



Consortium for  
Agroecological  
Transformations



# Landscape-Based Investment Plan for Mainstreaming Agroecology

AHWA



Gujarat

# Landscape-Based Investment Plan for Mainstreaming Agroecology

**Ahwa**

THE DANGS DISTRICT, GUJARAT



*Prepared by* **The Consortium for Agroecological Transformations**  
*hosted at* **The Centre for Sustainable Agriculture.**

Version 1, 2025

## Landscape-Based Investment Plan for Mainstreaming Agroecology - Ahwa

Prepared in collaboration with  
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# Introduction

This report is part of a broader initiative by the Consortium for Agroecological Transformations (CAT), which aims to design landscape-level investment plans for accelerating agroecological transformation in India. For more information on CAT, visit [www.agroecologyindia.org](http://www.agroecologyindia.org).

In CAT's framework, **a landscape is defined as an administrative block**—a governance and planning unit that enables systemic transformation by converging the efforts of farmers, institutions, markets, and governments. This definition goes beyond the conventional geographical notion of a landscape, emphasising coordination, governance, and collective action at the block level. By anchoring transformation in the block unit, CAT creates conditions for holistic and scalable impacts across food, farming, natural resources, and livelihoods.

The present study focuses on the **Ahwa block** and proposes an investment plan to accelerate agroecological transformation. CAT's six transformation goals guide the study:

1. Improving the quality of natural resources—soil, water, flora, and fauna.
2. Increasing farm incomes to make agriculture attractive to the younger generation.
3. Preserving and enhancing biodiversity.
4. Ensuring the well-being of smallholders, women, and landless labourers.
5. Improving food and nutrition security.
6. Addressing the climate crisis.

Agroecological transformation in this context means moving away from chemical fertilisers, pesticides, and GMOs, while strengthening sustainable, resilient, and inclusive local food systems. The interventions proposed in this report are also aligned with the 13 Agroecological Principles (HLPE, 2019) and the Sustainable Development Goals (SDGs).

The report follows the following structure:

- **Chapter 1** presents the findings of secondary research to capture the current status of the Ahwa landscape, drawing on available data across natural resources, agriculture, the economy, and social systems that influence agroecological pathways.
- **Chapter 2** provides a ten-year timeline of agroecology in the block, capturing both positive and negative movements. It highlights the role of Aga Khan Rural Support Programme (AKRSP) as the anchor organisation and synthesises its experiences in advancing agroecological practices in the landscape.
- **Chapter 3** draws insights from secondary research and a primary study of three villages: one relatively progressive in agroecology, one lagging, and one in between. This comparative lens helps identify the enabling and constraining factors that shape the adoption process.
- **Chapter 4** articulates the rationale for the proposed interventions, grounded in insights from the previous chapters and a systemic understanding of the landscape.
- **Chapter 5** outlines the proposed interventions, detailing their design, implementation modalities, and associated cost requirements.

- **Chapter 6** develops the investment plan, presenting the total cost of the initiative, contributions expected from the community, resources leveraged through government and convergence mechanisms, and the financing gap that requires external mobilisation.
- **Chapter 7** demonstrates how these interventions advance the six transformation goals, align with the 13 agroecological principles, and contribute to the SDGs.

Taken together, the report serves as both a strategic blueprint for Ahwa's agroecological transformation and a replicable framework for other blocks across India. Given the scale and complexity of the interventions, it is recommended that a Detailed Project Report (DPR) be developed as the next step for operational implementation.



## CHAPTER 1

# Landscape Profile

Ahwa is a block located in the Dang district of the Indian state of Gujarat. The following subsections detail its topographic, geographical, and climate characteristics.

## 1.1. Location and Area Coverage

Ahwa Block (*taluka*), located in the Dang District of Gujarat, India, is one of the three administrative divisions of the district, alongside *Waghai* and *Subir* talukas.

### 1.1.1. Geographical Extent of the Ahwa block:

- Latitude: Between 20°27' N and 21°5' N
- Longitude: Between 73°28' E and 73°59' E
- Area of Ahwa block: Approximately 560 sq. km.

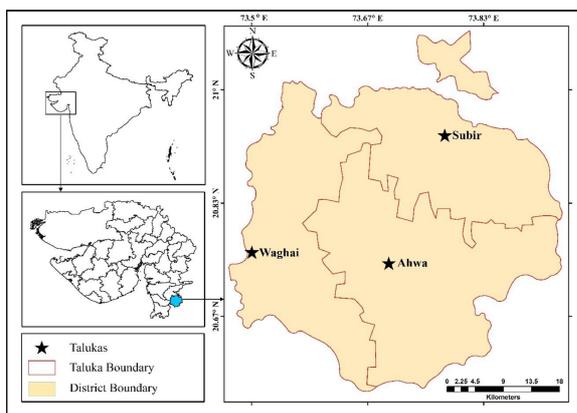


Fig. 1.1 – Dang District Map

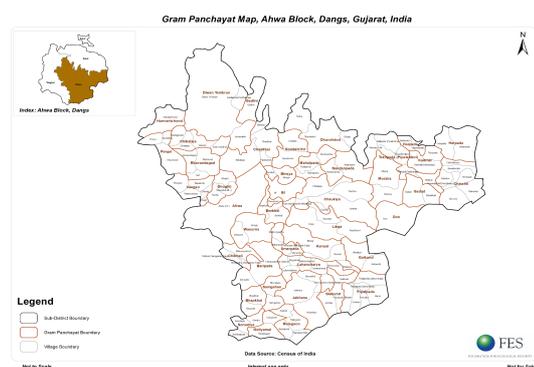


Fig. 1.2 – Gram Panchayat Map, Ahwa Block

The Ahwa block comprises 122 villages under 27 Gram Panchayats. It is located in the southern part of the state and shares borders with the following districts and states:

- North & Northwest: Tapi District, Gujarat
- East & Southeast: Nandurbar District, Maharashtra
- South & Southwest: Nashik District, Maharashtra

- West: Valsad District, Gujarat

### The Dang district

Dang district (1766 sq. km. area) is located in the southeastern part of Gujarat, India, and is the state's least populous district. Dang district in Gujarat has three main tehsils (also called talukas), which function as both administrative and revenue divisions: Ahwa, Waghai and Subir. These administrative divisions are further organised into 70 Gram Panchayats and encompass a total of 311 villages.

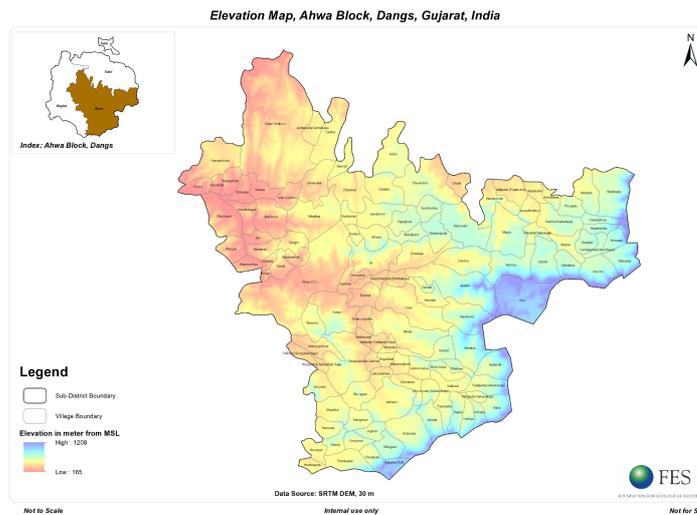
- Ahwa is the district headquarters and the most prominent tehsil, with a predominantly tribal population.
- Waghai is renowned for its forested regions, diverse tribal communities, and significant eco-tourism potential.
- Subir is characterised by hilly terrain and tribal settlements, with several development programs targeting remote villages.

Dang has a strategic position, sharing borders with both Gujarat and Maharashtra, and is known for its rich forest cover and tribal population.

## 1.2. Topography & Agroclimatic Features

### 1.2.1. Topography

Ahwa is situated in a forested, hilly region of the Western Ghats and is part of the Dangs Forest Division, contributing to its rich biodiversity and ecological importance. Its strategic location along the Gujarat–Maharashtra border makes it culturally and economically significant, especially for tribal and forest-based communities. A topographical map of the Ahwa block has been provided on the below.



**Fig. 1.3 – Elevation Map, Ahwa Block**

The Ahwa Taluka presents a striking topography dominated by hills, dense forests, and steep slopes. The region is characterised by undulating highlands, narrow valleys, and isolated plateaus, with elevations ranging from 150 to over 1,000 meters above sea level. The terrain is dissected by numerous hill ranges and seasonal streams, resulting in a complex physiography that is both scenic and ecologically significant. The slopes are generally steep, leading to rapid surface runoff during the monsoon, which in turn causes substantial soil erosion and limits the land's ability to retain water. The taluka is covered by thick tropical moist and dry deciduous forests, with over 90% of the area under forest cover, making it one of the most forested regions in Gujarat.

### 1.2.2. Influence of Neighbouring Landscapes on Ahwa Taluka

The Ahwa Taluka topography is primarily shaped by its surrounding landscapes, particularly the Western Ghats, Satpura Hills, and the Deccan Plateau, along with river basins and culturally contiguous tribal zones. These geographical and ecological continuities significantly influence its terrain, water systems, biodiversity, land use, and socio-cultural fabric.

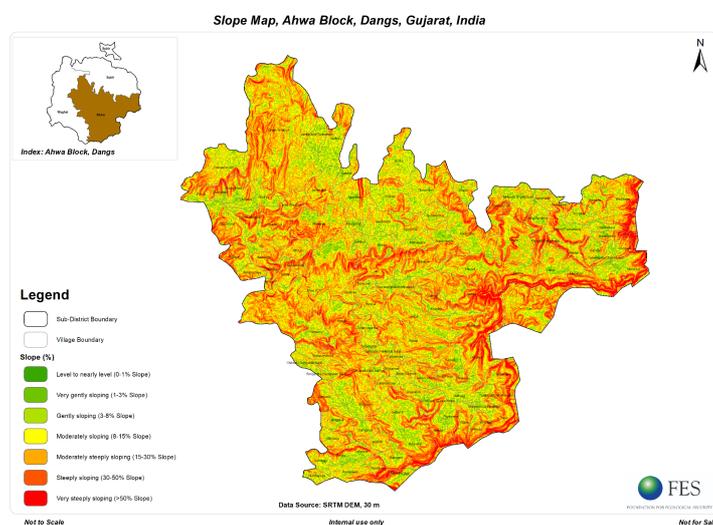


Fig. 1.4 – Slope Map, Ahwa Block

- Western Ghats and Satpura Hills (South and East):** Ahwa shares its southern and eastern borders with Maharashtra's Nandurbar and Nashik districts, where the Western Ghats extend as steep hill ranges. These hills form a continuous ecological zone, supporting similar forest types and a high level of biodiversity. The Purna Wildlife Sanctuary exemplifies this cross-border conservation landscape, enabling species migration and shared forest ecosystems. The high-altitude ridges receive heavy rainfall, and their hydrological flows feed rivers such as the Purna and Ambika, thereby sustaining Ahwa's water systems. Moreover, the continuity of slopes and hill formations impacts soil erosion, forest regeneration, and wildlife corridors across state lines.
- Forest Ecosystems and Tribal Cultural Zones:** Ahwa lies at the heart of a dense forest zone inhabited by tribal communities, extending into Maharashtra's Satpura ranges. The Bhil, Warli, and Kokna tribes, located on both sides of the border, share profound cultural and linguistic influences that influence their forest use, ecological knowledge, and shifting cultivation practices. The area also supports a thriving non-timber forest product (NTFP) economy. Seasonal cross-border migration of tribal labourers for agricultural and forest work affects local land use patterns and population dynamics in Ahwa, often adding pressure on natural resources.

- **Tapi River Basin (North and Northwest):** To the northwest, Ahwa forms part of the Tapi River Basin, while neighbouring plains like Valsad and Navsari are relatively flat and agriculturally prosperous. This stark contrast in topography and productivity influences local aspirations, as communities in Ahwa observe the economic advantages of the neighbouring plains. Additionally, water availability in Ahwa is impacted by downstream water management in the Tapi's tributaries, especially the Purna and Ambika rivers, which are vital during dry seasons.
- **Deccan Plateau Influence (East and Northeast):** Ahwa's eastern terrain gradually blends into the Deccan Plateau, extending into parts of Madhya Pradesh and Maharashtra. This geological connection introduces basaltic formations that influence local soil types, resulting in lateritic soils on slopes and black cotton soils in pockets. The hard basalt substrata typical of the plateau region also limit groundwater percolation, impacting water retention and availability in Ahwa.
- **Climatic Influence:** The orographic lift provided by the Western Ghats causes Ahwa to receive abundant rainfall, distinguishing its humid climate from the drier neighbouring zones in eastern Gujarat and central Maharashtra. These areas, situated in the rain-shadow belt, reinforce Ahwa's ecological uniqueness and contribute to its dense forest cover and rich biodiversity.

### 1.2.3. Type of the Landscape and Agroclimatic Features

The highlands of Dang district are primarily composed of layered lava flows, forming a thick sequence of nearly horizontal basaltic strata (Merh, 1995)<sup>1</sup>. The exposed Deccan basalt in the region contributes to the district's rugged and uneven terrain. These Deccan Trap formations rest atop Cretaceous sedimentary rocks, with fault lines dispersed throughout the district.

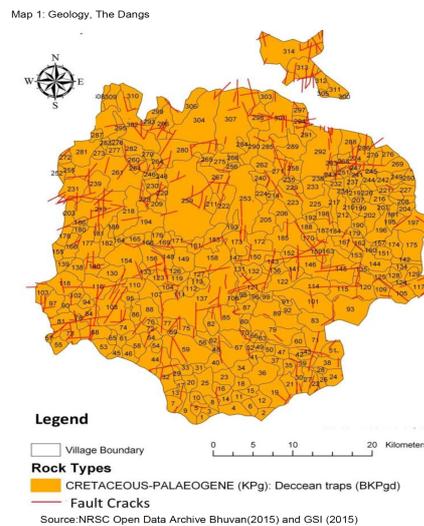


Fig. 1.5 – Geology, The Dangs

The Dangs watershed limits coincide with the administrative boundaries. There is hardly any rainfall runoff entering from any adjoining areas to the Dangs. Furthermore, there is no transfer of groundwater possible from one basin to another. The entire rainfall receipt from the district is drained out through two exit points: one near Waghai for the Ambika-Khapri rivers and one near Bhenskhatri for the Purna-Gira (CEE, 2005)<sup>2</sup>. The water contour maps (which connect the equal groundwater

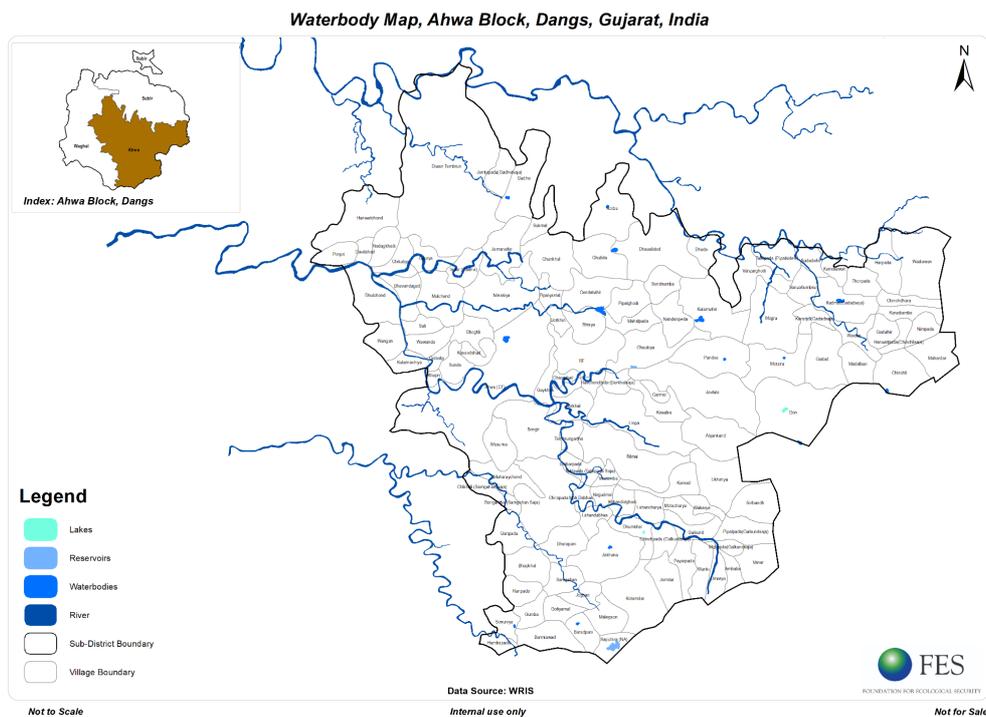
<sup>1</sup> Merh, S. S. (1995). Geology of Gujarat. Geological Society of India, Bengaluru.

<sup>2</sup> Centre for Environment Education (CEE). (2005). Environmental status report of Ahwa taluka, Dang District, Gujarat. Centre for Environment Education, Ahmedabad.

depth) of the area are drawn based on data gathered through observation wells, which indicate that the groundwater moves in the north-western direction as well as from higher elevation towards lower elevation. The Dangs district can be divided into two zone types: water recharge zones and discharge zones. Ahwa block comes under the recharge zone, and Waghai block comes under the discharge zone. Recharge zones experience comparatively higher rainfall during the monsoon season. Notwithstanding, the water retention is very low in these areas due to soil erosion and the absence of water conservation structures. On the other hand, discharge zones such as the Waghai block are comparatively better in terms of the area's water conservation capacity.

#### 1.2.4. Rivers, Groundwater, Rainfall, and Irrigation

The region is drained by four major rivers — Purna, Ambika, and Khapri — all of which originate in the northeastern part of the Dangs and flow towards the southwest. The rivers have a high drainage density and steep gradients, causing rapid runoff during monsoons, which results in severe soil erosion and high silt transportation. Ahwa experiences an annual average rainfall of 2,396 mm, making it one of the wettest regions in Gujarat. However, steep slopes cause quick surface runoff, resulting in limited groundwater recharge. During the summer, water scarcity is a critical challenge despite the high annual rainfall.



**Fig. 1.6 – Waterbody Map, Ahwa Block**

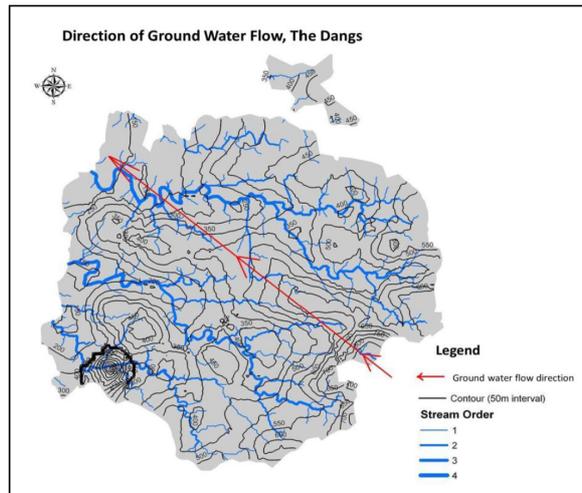


Fig. 1.7 – Direction of Ground Water Flow

Groundwater depth varies across the block:

- **Hand pump depth:** 60-120 meters.
- **Open well depth:** 18-20 meters with water levels ranging from 2-12 meters.
- **Borewell depth:** Average 90 meters.

The geology of the region consists primarily of Deccan Trap Basalt, a complex rock formation with minimal cracks and fissures, which acts as a poor aquifer, limiting groundwater storage.

### 1.2.5. The Main Soil Types of the Ahwa Block

- **Lateritic Soils:** These soils cover a significant portion of the district and are derived from the weathering of basaltic rocks. They are generally shallow, well-drained, and have low fertility.
- **Red Sandy Soils:** These are lighter soils with good drainage but lower nutrient content, requiring appropriate management for cultivation.

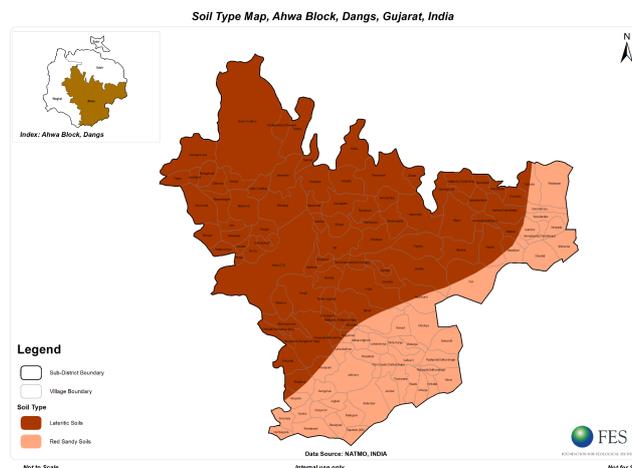


Fig. 1.8 – Soil Type Map, Ahwa Block

## 1.2.6. Irrigation Infrastructure and Challenges

The total net irrigated area in the entire Dang district is only 1,441 hectares (3% of the net sown area), as per the 2011 Census. In the Ahwa block, the primary sources of irrigation include dug wells, check dams, and storage tanks. However, many existing check-dams have been heavily silted due to heavy monsoon runoff and require urgent desilting and maintenance.

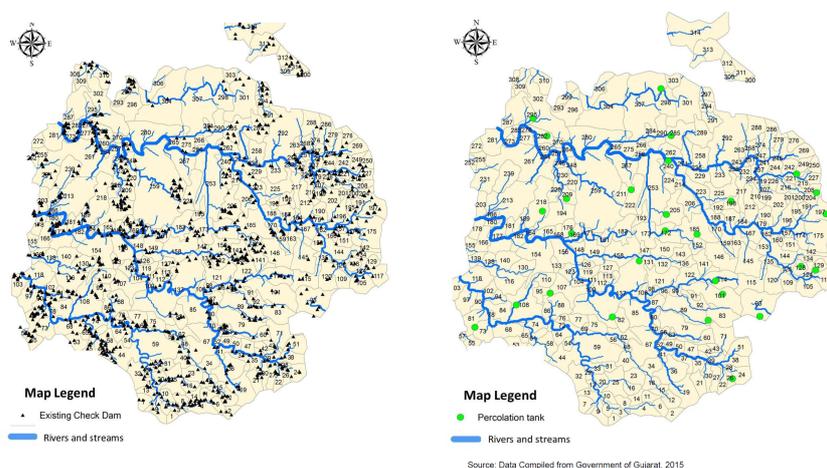


Fig. 1.9 – Dams, Tanks, Rivers and Streams

According to insights gathered from the irrigation department, approximately 300 check dams require repairs and desilting work; however, the department has only completed 125 repairs, leaving most dams non-functional. The irrigation department has the capacity to repair 25 check dams per year, but requires additional financial and technical support to restore all of them.

## 1.2.7. Groundwater Scenario

### Geological Formations

The geological formations in Dang district are primarily of Cretaceous-Eocene age, characterised by basaltic lava flows and basic intrusions. Along the Purna River, recent alluvium deposits of clay and sand are present. The general sequence of rock formations is as follows:

- **Quaternary:** Clay and sand (Alluvium)
- **Cretaceous to Eocene:** Deccan Trap (Basalts)

The Deccan lava flows, occurring between 700 and 1000 meters above mean sea level, are the dominant geological horizon. Within this range, 10 distinct flows have been identified. The thickness of these flows varies from 70 meters to less than 10 meters, particularly between the Saputara Ghat section and the Chinchili Grakhadi side Ghat section.

The basaltic lava flows can be divided into three distinct units:

- **Basal Unit:** Composed of chilled greyish basalt containing pipe amygdales filled with zeolites, chalcedony, and cherty minerals.
- **Middle Unit:** Fine to medium-grained basalt, characterised by its rugged and compact nature.
- **Upper Unit:** Vesicular basalt, medium to coarse-grained and soft in nature, with vesicles ranging from 1 to 5 mm in diameter, filled with zeolites and quartz.

### 1.2.8. Hydrogeology

The water-bearing properties of different lithological units influence the occurrence of groundwater. The primary aquifer system consists of various units of basaltic lava flows, where groundwater exists under phreatic conditions. The unconfined aquifer is composed of weathered and fractured volcanic rocks.

- **Weathered mantle thickness:** Ranges from less than 1 meter to approximately 8 meters.
- **Potential aquifers:** Weathered zones, jointed and fractured units in interflow junctions, and vesicular horizons.
- **Open well depth:** Ranges from 18 to 20 meters, with water levels between 2 and 12 meters below ground level (bgl).
- **Specific yield:** 0.0 – 26% in weathered basalt and 0.11 to 1.14% in semi-weathered to massive basalt.
- **Well yield:** 15 to 1200 litres per minute (lpm) in weathered and amygdaloidal/zeolitic basalt, and 20 to 165 lpm in semi-weathered to massive basalt.
- **Specific capacity:** Ranges from less than 25 lpm/m to 250 lpm/m.
- **Transmissivity of basalt:** 15 m<sup>2</sup>/day to 152 m<sup>2</sup>/day.

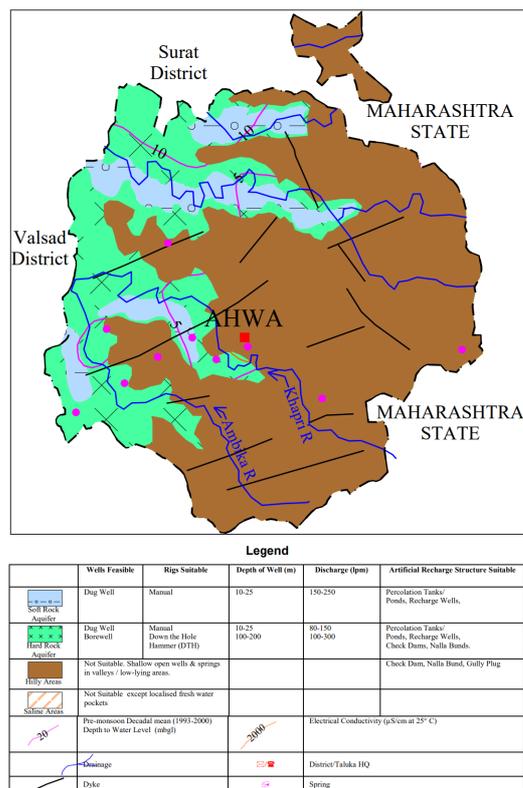


Fig. 1.10 – Hydrogeology

In 16 exploratory wells drilled in the district, depths ranged from 90 meters to 200 meters. Yields varied from negligible to 450 lpm for drawdowns ranging from 6 to 60 meters. Six wells yielded more than 100 litres per minute, while four were hydraulically unsuccessful. Electrical conductivity ranged from 350 to 800 µs/cm.

#### Depth of Water Levels

The Central Ground Water Board has monitored water levels in the district since 1969 through 1039 monitoring stations, including 21 open wells and three piezometers.

#### Pre-monsoon period:

- 47% of the area has water levels between 2 meters below ground level and 5 meters bgl, mainly in the eastern part.
- 42% of the area has water levels between 5 and 10 meters below ground level (bgl), localised in the central part.
- 11% of the area has water levels deeper than 10 meters below ground level (bgl) in the western part.
- Shallowest water level: 2.89 meters below ground level (bgl) at Jakhna.
- Deepest water level: 12.38 meters below ground level (bgl) at Mheskatri.

#### Post-monsoon period:

- 47% of the area has water levels at or below 2 meters below ground level (bgl).
- 53% of the area has water levels between 2 and 5 meters below ground level (bgl).
- Shallowest water level: 0.50 meters below ground level (bgl) at Jakhana/ChinchPada/Ghubita.

- Deepest water level: 9.55 meters below ground level (bgl) at Meshkatri.

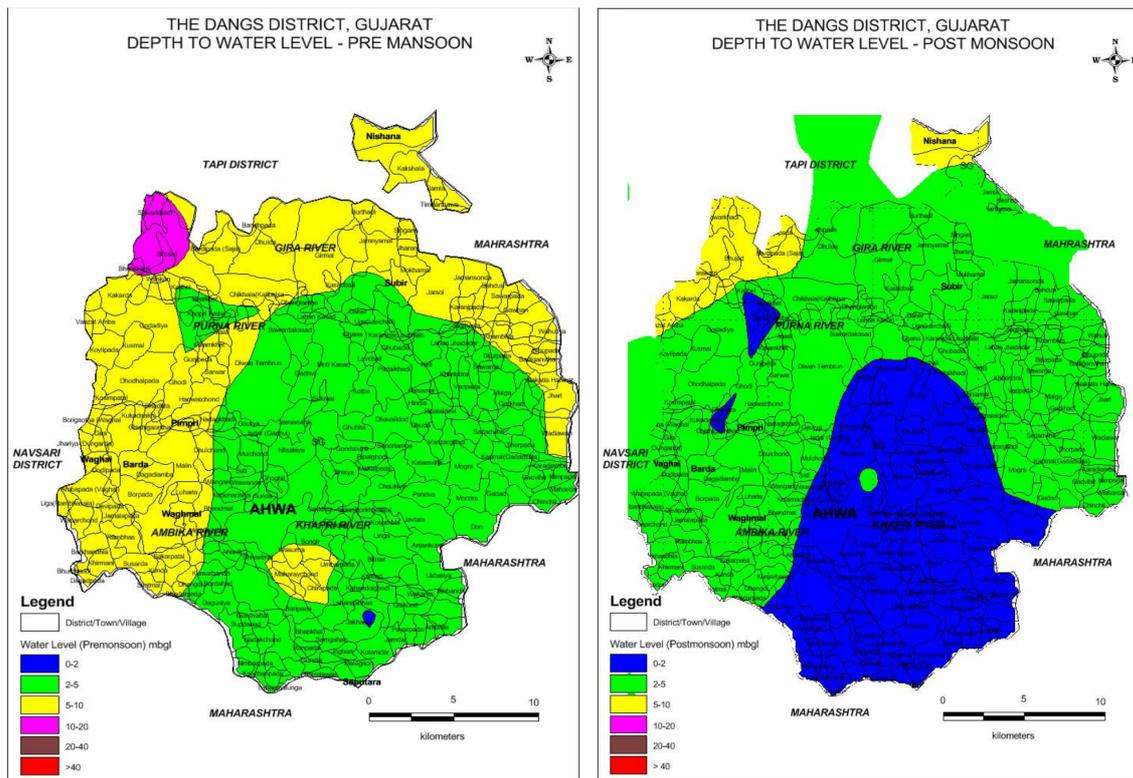


Fig. 1.11 – Depth of Water Level – Pre and Post Monsoon

### 1.2.9. Rainfall and Climate

The entire Dang district lies within the South Gujarat (Heavy Rainfall) Agro-Climatic Sub-Zone. It predominantly experiences a dry tropical climate, except during the monsoon season, which brings high precipitation, elevated humidity, and significant daily temperature fluctuations. The southwest monsoon extends from June to September, followed by the post-monsoon (or retreating monsoon) season from October to November. The cold season spans December to February, while the hot season lasts from March to May.

Occasionally, moisture incursions occur during the dry summer months, sometimes resulting in dry thunderstorms or dust storms. Additionally, hurricanes and depressions from the Arabian Sea, especially in the latter part of summer and post-monsoon periods, may impact the district with widespread rainfall and strong winds.

At Ahwa, the district headquarters, the average maximum temperature over recent decades has reached up to 45°C, while the minimum has dropped to around 10°C. Although the region receives substantial rainfall during the monsoon, precipitation outside this period is minimal. According to rainfall records (refer to Table 1a & 1b), the average annual rainfall is considerable, with approximately 77 rainy days (defined as days receiving at least 2.5 mm of rainfall) annually. This varies slightly across the district, ranging from 74 days in Waghai to 80 days in Ahwa.

Month	Waghai	Ahwa	The Dang
January	1.5	3.7	2.6
February	0.5	1.1	0.8
March	0.4	2.6	1.5
April	1	5.9	3.5
May	12.4	13.9	13.1
June	239.4	214.2	227.1
July	828.2	680	754.1
August	526.9	493.5	510.2
September	372.1	309.5	340.8
October	52.8	57.5	55.1
November	19.2	13.1	16.1
December	2.5	3.3	2.9
<b>Total</b>	<b>2057.4</b>	<b>1798.3</b>	<b>1927.8</b>

**Table 1.1 – Normals and Extreme of Rainfall (in mm) (1951-1980)**

The Dang district Ahwa Station	Month ->	June	July	Aug	Sept	Oct	Total
District-wise Monthly average rainfall	(in MM), 2011	62	1017	417	139		1635
Spread and range of rainfall	Spread of rainfall – 23rd June to 23rd Sept, 2001-2011	Maximum (Total) Rainfall(mm) in a year			Minimum (Total) Rainfall(mm) in a year		
		3825 (2005)			1316 (2009)		

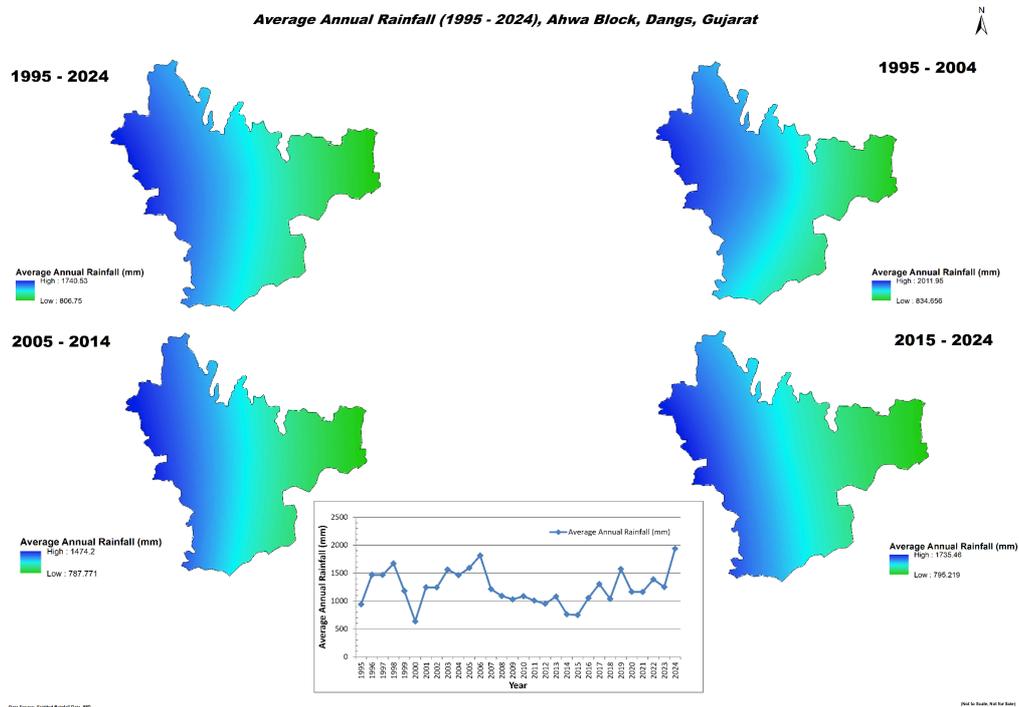
*Note: There was no rain during the months Jan to May, Oct to December—source Directorate of Agriculture, Gujarat State, Gandhinagar.*

**Table 1.2 – District wise Summary**

The rainfall map for the Ahwa block is provided ahead. Here are some of the key insights that we can draw from the rainfall pattern:

- **Overall Increasing Trend:** From 1995 to 2024, average annual rainfall shows an upward trajectory.
- **Low Phase (2000–2004):** This period experienced a sharp decline, with rainfall levels falling below 1000 mm in some years.
- **Recovery and Rise (Post-2005):** After 2005, there's a gradual recovery, with significant peaks around 2010, 2019, and 2023–24.
- **Highest Rainfall Years:** Close to or above 2000 mm in recent years (e.g., 2023–2024), indicating possible intensification of monsoon events.

- **Spatial Trends:** High Rainfall Zones: Western and central regions receive >2000 mm, Gradient: Sharp west-to-east decline; eastern fringe shows much lower rainfall (~835 mm).



**Fig. 1.12 – Average Annual Rainfall (1995-2024)**

### 1.2.10. Climate Risk Assessment of Ahwa Block

#### Key Local Observations

- **Unreliable Rainfall:** Despite historically high average rainfall (~2,475 mm/year), Ahwa is now experiencing significant reductions (~1,490 mm), with shorter monsoon pulses that are intense yet ineffective due to rapid runoff on hilly terrain. This leads to early-season (around January) water shortages, with villagers forced to access unsafe water sources.
- **Rain-Dependent Agriculture:** The block relies heavily on Kharif crops, with limited irrigation infrastructure, which reinforces its vulnerability to erratic rainfall and seasonal drought.
- **Heat Exposure:** Ahwa, located at a higher elevation (~550 m), remains in the moderate heat-risk category, whereas much of Gujarat falls into the "high" or "very high" risk bands.
- **Overall Climate Vulnerability:** According to CRIDA's agricultural risk index, Dang district ranks among the very highly climate-vulnerable districts in Gujarat, owing to its dependence on rainfed agriculture and weak water retention infrastructure.

#### SAPCC Alignment & Climate Risk Implications

While Ahwa's elevation offers some protection from extreme heat, the block is vulnerable across other climate dimensions:

- **Seasonal Water Stress:** SAPCC emphasises the need for water harvesting, groundwater recharge, and runoff control in rain-fed, hilly landscapes. Ahwa's rapid runoff and earlier water scarcity make this a critical adaptation priority.

- **Agricultural Resilience:** SAPCC stresses climate-resilient cropping, soil health, and diversified practices—essential for Ahwa’s farmers given declining rainfall and limited irrigation access.
- **Institutional Engagement:** Given its moderate heat-risk but high overall climate vulnerability (e.g., drought, rainfall), Ahwa could benefit from district-level climate cell interventions.

Climate Feature	Status in Ahwa Block
Rainfall Patterns	Erratic, reduced monsoon, high runoff, leading to water scarcity
Heat Risk	Moderate (better than surrounding districts)
Drought & Rainfall Dependence	High; heavily rain-fed agriculture, limited irrigation
Agroecological Vulnerability	Very high (per risk indices) due to High Dependence on Rainfed Farming, Steep Slopes & Fragile Soils, Limited Crop Diversity, Poor Water Retention Infrastructure, Low Access to Climate Services
SAPCC Priority Response	High need for water management and resilient agriculture

Table 1.3 – Status of Climate Features

### 1.2.11. Type of Forest

Ahwa block in Dang district, located in the southernmost part of Gujarat, is home to one of the most ecologically significant forest landscapes in the Western Ghats–Satpura transitional zone. The district is almost entirely forest-clad, with approximately 95.6% of its total area under forest cover. According to data from the Government of Gujarat (2022) and the Centre for Environment Education (2010), 822 km<sup>2</sup> falls under the Protected Forest category, and 866 km<sup>2</sup> under the Reserved Forest category. This makes the Dang forest the densest in Gujarat, both in terms of coverage and ecological value.

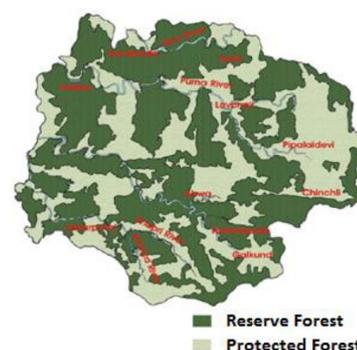
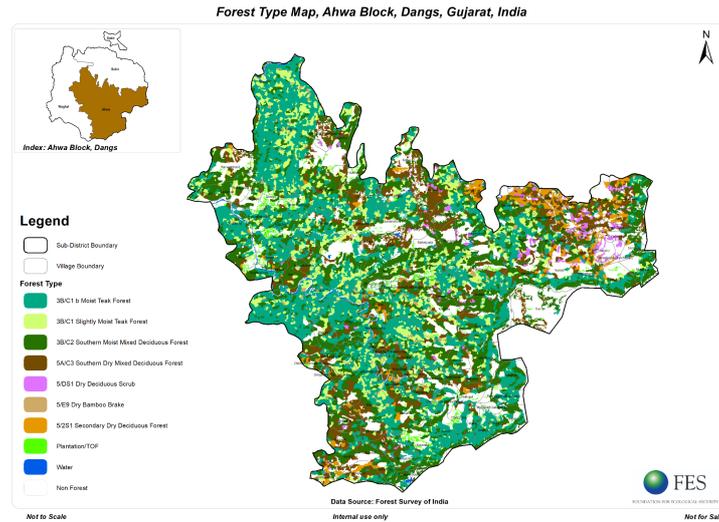


Fig. 1.13 – Type of Forest

The term ‘Dang’ in the local dialect translates to "hilly terrain with dense bamboo growth," reflecting the region’s rugged topography and forested hills. The terrain and geographic isolation preserved these forests for centuries, keeping them relatively inaccessible until the early 20th century. This isolation significantly contributed to the underdevelopment of the area, where the predominantly tribal communities heavily depended on forests for their livelihoods, particularly through the sale of Non-Timber Forest Products (NTFPs), such as bamboo, honey, tendu leaves, and medicinal plants.

Multiple legislative frameworks regulate forest governance in Dang. The Indian Forest Act of 1927 governs the movement and transit of forest produce within notified forest lands—Reserved, Protected, and Village Forests. Additionally, after the Saurashtra Prevention of Felling of Trees (Infliction of Punishment) Act, 1951, restrictions on tree felling were extended to privately held lands outside of notified forests. Following the formation of the Gujarat state in 1960, this Act was enforced across the state, including Dang. The law mandates written permission from government authorities before any tree felling, with penalties ranging from ₹50 to ₹1,000 for violations (Bare Acts Live, 2020)<sup>3</sup>.

<sup>3</sup> Bare Acts Live. (2020). The Indian Forest Act, 1927 (as accessed/compiled in 2020). Bare Acts Live. Retrieved from <https://www.bareactslive.com/> (accessed 2025)



**Fig. 1.14 – Forest Type Map**

Recognising the livelihood challenges of forest dwellers due to these restrictions, the Government of Gujarat took a significant step in 1970 by releasing 587.58 km<sup>2</sup> of land from the Protected Forest category and transferring it to the Revenue Department. This land was allocated to tribal forest dwellers with legal occupancy rights, although the government retained ownership of the standing trees. While this initiative allowed agricultural use and limited tree lopping, it did not yield the expected outcomes in either forest conservation or livelihood improvement.

In response, the state introduced the 'Malki Practice' in 1984. This model permitted landholders to fell trees for economic gain under strict conditions. Felling permissions were granted only after verifying that appropriate replantation efforts were undertaken. The Malki system aimed to balance environmental sustainability with economic development by incentivising responsible forest management by the forest-dependent communities.

Year	Plantation Guidelines	Economic Gain to the landholder
1984	To plant 05 times the trees which are to be cut. No cutting of trees would be allowed unless the age of the newly planted trees is minimum 01 year and that 80% of such trees should be in good health.	The land holder was allowed to keep the wood for burning for his own usage from such cut trees and the remaining timber and other wood would be disposed through auction by the forest department and after having deducted the expenses of the same, 20% of such cost would be paid to the land holder.
1991-1992	To plant 03 times the trees which are to be cut subject to the condition that permission of cutting would be given for 50% of the existing trees or number of trees demanded for cutting, whichever is lower, with a maximum limit up to 10 trees. The age of the newly planted trees should be minimum 03 years and that 80% of such trees should be in good health	The amount payable to the land holder was increased from the previous limit of 20% to 50%. However, the payment would be made in 2 instalments. 60% of the amount payable to the land holder would be paid only when the new trees attain the age of 01 year and remaining 40% would be paid only after such trees attain the age of 03 years.

1997	-	The percentage of payable amount to the land holders from selling of the five reserve trees (Sandalwood, Blackwood, Teak, Mahuva and Khair) increased from the existing 50 to 100% after having deducted the expenses.
2005	In addition to the previous guidelines of plantations, it was decided that there should be a gap of minimum 05 years between the two permissions issued to the land holder for the Malki cutting.	-
2007-2009	-	Few provisions were included for prioritizing the Forest produce sale based on the condition of the land holder like the need of medical treatment, pursuing higher education and primary teachers certificate studies

**Table 1.4 – Evolution of Malki Practice**

An analysis of various media articles sheds light on the following observations regarding the implementation of Community Forest Resource (CFR) and Individual Forest Rights (IFR) in the Ahwa block.

#### Status of CFR (Community Forest Resource) Implementation

- **Initiation & Coverage:** FRA implementation began in 2008–09 with Special Gram Sabhas to form Forest Rights Committees (FRCs). In Dangs, 273 out of 311 villages have FRCs; Ahwa block is part of this coverage.
- **Claims Filed & Recognition:** Approximately 137 CFR claims were filed in 2009 in the Dang district, but recognition was only granted from 2016 onwards. So far, only 76 villages across the district have received CFR rights; coverage in Ahwa remains partial.
- **Partial Recognition:** Granted rights cover only a fraction of claimed areas and exclude several entitlements (e.g., fisheries, medicinal plants). Some CFR deeds impose restrictive clauses—such as banning grazing for 7 years in plantation areas—which undermine community use.
- **Control Issues:** In practice, gram panchayats, rather than gram sabhas, have been given a role in management, diluting the FRA’s fundamental intent. The forest department retains significant control, limiting full ownership and sharing of benefits for the communities.

#### Status of IFR (Individual Forest Rights) Implementation

- **Claims & Approvals:** Between 2009 and 2020, 7,341 IFR claims were filed from 266 villages; of which 187 (43%) were approved. Many were rejected due to flawed BISAG satellite imagery and arbitrary verification processes.
- **Judicial Intervention:** In 2013, the Gujarat High Court ordered the reopening of rejected claims, requiring proper field verification. Despite this intervention, compliances have been patchy. Of the thousands of appeals, only 644 were heard, and just 10 new claims were approved.
- **Quantity & Tenure Issues:** In several cases, the area granted is much smaller than the land under occupation. Some claimants received titles only for one of multiple plots. Titles were

conferred largely by way of “secondary” rights—the forest department remains the legal owner, contravening FRA provisions.

- **Pending Cases:** 112 petitions from 21 villages, including in the Ahwa block, are still pending in the Gujarat High Court.

### Key Challenges in Ahwa Block

- **Historical injustice:** Long standing forest reservations have left limited cultivable land.
- **Bureaucratic resistance:** Considerable red tap with respect to both CFR and IFR have stood as resolute challenges.
- **Procedural flaws:** Rejection of claims due to inaccurate maps, inadequate verification, and restrictive deed conditions.
- **Delayed benefit realisation:** Even recognised rights for forests are realised without complete control, access to the area, or access to resources.

### Overall Assessment

CFR and IFR implementation in Ahwa block mirrors a district-wide pattern— it is partial, delayed, and diluted. While there has been some progress in recognising claims, both individual and community rights remain undermined by several conditions. This has resulted in a symbolic rather than substantive empowerment, leaving livelihood security and local governance over forest resources fragile.

## 1.3. Demographic and Social Profile

Provided below are key demographic details of the Ahwa block as per the Mission Antyodaya Survey of 2020<sup>4</sup>.

- **Total Population of Ahwa block of Dang district:** 123,471
- **Total male population:** 62,259
- **Total female population:** 61,007
- **Sex Ratio:** 980 females per 1,000 males
- **No. of households:** 21,809
- **Total Number of Villages:** 122
- **No of Towns:** 1 (Ahwa CT)

As per the Statistics Department Data<sup>5</sup>, here is a demographic breakdown for Ahwa based on the urban-rural divide.

- Total share of the **Rural Population:** 82.24%
- Total share of the **Urban Population:** 17.76%

Furthermore, additional data on the block’s demography as per the district census data of The Dangs (2011)<sup>6</sup> is provided below:

- **Population Density:** 129 persons per square kilometre
- Total share of the **ST population:** 94.65 % (Male: 94.48, Female: 94.81)
- Total share of the **SC population:** 0.43 % (Male: 0.43%, Female: 0.44%)

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<sup>4</sup> Block wise demographic data can be found on the website of the Mission Antyodaya 2020.

<sup>5</sup> DIRECTORATE OF CENSUS OPERATIONS. (2011). Census of India 2011: Gujarat Series-25 Part-XII-A Village and Town Directory: District Census Handbook: The Dangs. In Census of India 2011: Gujarat Series-25 Part XII-A District Census Handbook Village and Town Directory.

<sup>6</sup> Census of India 2011 - Gujarat - Series 25 - Part XII A - District Census Handbook, The Dangs.

- **Languages Spoken:** 68.50% of the population speaks Khandeshi, making it the most widely spoken language in the area. Konkani is spoken by 12.91% of the population, followed by Bhili/Bhilodi at 10.36%, and Gujarati at 4.31%.
- **Religion:** 89.2% of the population is Hindu. Muslims constitute 1.6% of the population. There is no reported population of Jains or Christians in the district.
- **Rural Literacy Rate:** 73.42% (Male: 81.80; Female: 65.12)
- **Urban Literacy Rate:** 88.32% (Male: 92.79; Female: 82.08)

The table below shows the distribution of workers by sex across four economic activity categories.

S. No.	Name of CD Block	Persons/ Males/ Females	Total Population	Total Workers (Main + Marginal Workers)	Category Of Workers			
					Cultivators	Agricultural Labourers	Household Industry Workers	Other Workers
					Number	%	Number	%
1	0200-The Dangs	Persons	203604	110886	64454	58.13	39508	35.63
		Males	101710	55758	36753	65.92	14904	26.73
		Females	101894	55128	27701	50.25	24604	44.63
	Total	Persons	203604	110886	64454	58.13	39508	35.63
		Males	101710	55758	36753	65.92	14904	26.73
		Females	101894	55128	27701	50.25	24604	44.63

Table 1.5 – Distribution of Workers by Sex across Economic Activities

## 1.4. Socio-Economic Conditions

### 1.4.1. Income

According to a baseline and impact assessment study conducted by Deloitte for the Aga Khan Rural Support Programme (AKRSP)<sup>7</sup> under the ABF project in June 2023, the income distribution of 154 participants (refer to the table below) provides significant insights into the socio-economic profile of the population.

Participants in the corresponding income range

Income range	No	%	Average income (Baseline data as per Deloitte study done in 2023)
0–12,000	20	13%	1,434
12,001–36,000	43	28%	23,309
36,001–60,000	57	37%	47,253

<sup>7</sup> Deloitte. (2023). Impact and baseline assessment report of Aga Khan Rural Support Programme (India). Project funded by Axis Bank Foundation.

60,001–84,000	18	12%	70,516
84,001–100,000	5	3%	88,610
Over 100,000	11	7%	1,81,614
<b>Total</b>	<b>154</b>	<b>100%</b>	<b>48,276</b>

**Table 1.6 – Socio-economic Profile of the Population**

### Key Findings on Income

- **The majority are in the 'Lower-Middle Income Bracket':** The most significant proportion of participants (37%) falls within the annual income range of ₹36,001–₹60,000, with an average yearly income of ₹47,253. This suggests that a significant portion of the target population earns a modest income, likely through semi-skilled or small-scale livelihood activities.
- **Prevalence of Low-Income Households:** A combined 41% of participants earn less than ₹36,000 per year—13% earning under ₹12,000 and 28% earning between ₹12,001 and ₹36,000. This indicates that a substantial portion of the population lives below or near the poverty line, with average incomes of ₹1,434 and ₹23,309, respectively, highlighting their vulnerability and the need for sustained livelihood support.
- **Emerging Middle and High-Income Segments:** Approximately 22% of participants fall into the higher income brackets—12% earning ₹60,001–₹84,000, 3% earning ₹84,001–₹1,00,000, and 7% earning above ₹1,00,000. The highest earners have an average income of ₹1,81,614, suggesting the presence of a small but notable segment of individuals with access to more stable or diversified income sources.
- **Overall Average Income:** The average income across all participants stands at ₹48,276, indicating a moderate livelihood status but also a notable disparity in earnings within the group.

Another study conducted by Think Through Consulting (TTC) for the AKRSP project area in 2019<sup>8</sup> shows source-wise distribution of annual income as follows:

Household Income	INR	(n)
Gross income from agriculture	30,353	437
Total cost of agriculture	17,749	437
Net income from agriculture	12,604	437
Gross income from livestock	59,370	145
Total cost of livestock	33,848	112
Net income from livestock	25,522	145
Gross income from bamboo	2,42,464	28
Total cost of bamboo	46,274	28
Net income bamboo	1,96,190	28
Other income	47,467	435

**Table 1.7 – Source-wise distribution of annual income**

<sup>8</sup> Think Through Consulting (TTC). (2019). Baseline study of "Dangi Vikas Programme – II". Study conducted for Axis Bank Foundation.

Gross income household	1,06,042	465
Total cost household	27,619	465
Net income household	78,423	465

The TTC 2019 study in the AKRSP project area reveals that households earn an average net income of ₹78,423, primarily from agriculture, livestock, bamboo, and other sources. Bamboo stands out with the highest net income (₹1,96,190), though fewer households access it. Livestock also provides a decent return (₹33,225), while agriculture yields modest net gains (₹12,603).

A further analysis of the income from the other sources provided in the TTC 2019 study is as follows: The average annual income from different sources is ₹47,467, with a median of ₹40,500 across 435 households, indicating its crucial role in sustaining rural livelihoods. Casual labour emerges as the most widespread and consistent source, while agricultural labour, though common, yields low returns, highlighting vulnerability. Salaried jobs, though rare, offer high income, hinting at migration and formal employment aspirations. Remittances support over a third of households but show wide disparity. Pensions, reported by a few, also vary widely. Overall, non-farm sources supplement income and reduce dependence on agriculture. However, enhancing skills and enabling mobility are crucial for improving earnings and resilience.

#### 1.4.2. Agriculture

Agriculture remains the primary livelihood for approximately 87–88% of households (Catalyst-SEIPL, 2021)<sup>9</sup>.

Provided below is a seasonal calendar of the Kharif crops in Ahwa.

Kharif crops	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May
Paddy	S1					H						
Sorghum	S1						H					
Finger millet	S2						H					
Barnyard millet	S2					H						
Maize	S1						H					
Black gram (Udad)	S					H						
Red gram (Tur)	S						H					
Bitter gourd	S		H	H	H	H						
Bottle gourd	S		H	H	H	H						
Okra	S		H	H	H	H						
Brinjal	S			H	H	H	H					
Tomato	S			H	H	H	H					

<sup>9</sup> Catalyst Management Services Pvt. Ltd. (2021). Impact evaluation of integrated development initiatives in Dang District (SEIPL), Gujarat. Study conducted for Integrated Development Initiatives funded by Hazira Port Private Limited and implemented by Aga Khan Rural Support Programme (India) and BAIF Institute for Sustainable Livelihoods and Development.

Colour legends

Sowing: S

Irrigation: I

Harvesting: H

Table 1.8 – Seasonal calendar of Kharif crops

The graphs below present a comparative analysis of crops grown, based on responses from the TTC 2019 study across the three blocks of Dang district. During the Kharif season, Paddy and Finger Millet emerge as the primary food crops. Among the other crops cultivated in this season, Red Gram, Green Gram, and Black Gram are prominent due to their higher market value. Vegetables are typically grown on a small scale in kitchen gardens, primarily for household consumption. However, a few farmers also engage in commercial cultivation of vegetables such as Okra, Brinjal, and Bitter Gourd.

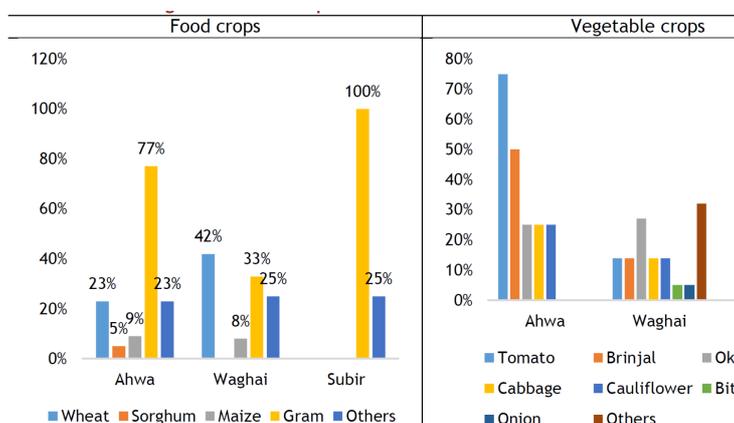
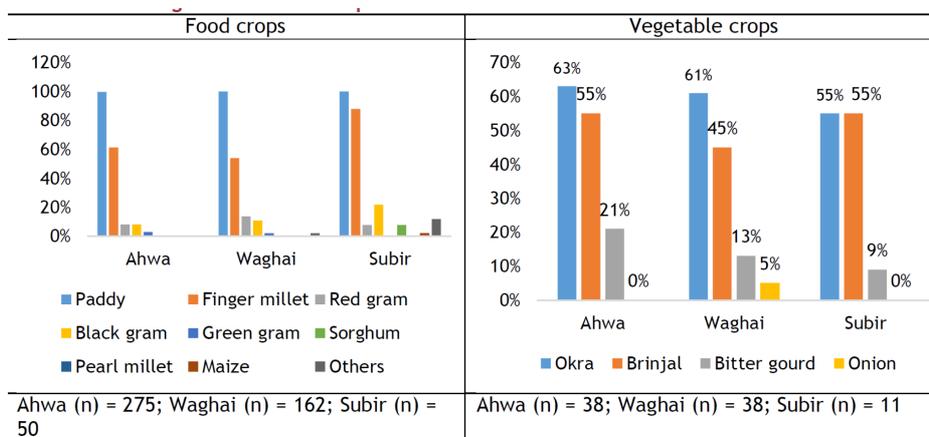


Fig. 1.15 – Comparative analysis of crops grown

Wheat and Gram are the two primary food crops cultivated during the Rabi season. In the Ahwa block, the TTC study revealed that 77% of respondents reported sowing Gram during this period. The three most commonly preferred vegetables grown are Tomato, Brinjal, and Okra.

The agricultural productivity (in Kg/Ha) of various crops in the Dangs district is presented below, based on the district-wise area, production, and yield report of food and non-food crops in Gujarat, prepared by the Directorate of Agriculture.

	2020-21	2021-22	2022-23	State Average
Rice irrigated	-	-	-	-
Rice unirrigated	1933.59	2849.61	1762.36	2182.48
Total kharif rice	1933.59	2849.61	1762.36	2182.48
Kharif jowar	1488.10	1433.02	1373.51	1428.68
Kharif bajra	-	-	-	-
Kharif maize	1520.85	1949.53	1905.83	1802.39
Kharif ragi	1327.20	945.47	842.24	1040.54
Kharif mung	412.04	-	-	412.04
Kharif moth	-	-	-	-
Kharif urad	1444.52	1143.87	818.67	1138.35
Kharif tur	914.22	399.03	492.24	604.01
Kharif groundnut	1456.17	1147.02	1071.67	1229.04
Soyabean	1355.76	1161.25	1076.00	1200.12
Other kharif cereals	670.00	-	670.00	670.00
Total kharif cereals	1747.18	2407.39	1515.81	1881.73
Total kharif pulses	1297.45	946.32	728.69	992.73
Total kharif foodgrains	1630.60	2019.92	1323.57	1654.08
Wheat irrigated	3270.67	3254.48	3224.48	3260.60
Wheat unirrigated	-	-	-	-
Total wheat	3270.67	3254.48	3224.48	3260.60
Rabi jowar	-	-	-	-
Rabi maize	2273.01	2529.81	2747.75	2434.53
Gram	1011.40	1035.59	895.26	981.58
Rapeseed & mustard	-	-	-	-
Sugarcane	68000.00	65650.00	65600.00	66125.75
Rabi onion	29557.57	27761.83	27547.20	28521.50
Garlic	8021.23	7239.82	6977.99	7493.98
Other rabi pulses	0.00	0.00	580.00	580.00
Total rabi cereals	2767.85	2928.90	2884.52	2847.25
Total rabi pulses	1011.40	1035.59	883.76	976.69
Total rabi foodgrains	1075.51	1098.31	898.56	1025.01
Summer rice	2999.01	2923.99	2898.55	2941.86
Summer maize	0.00	0.00	0.00	0.00
Summer bajra	0.00	0.00	0.00	0.00
Summer groundnut	2347.91	2162.12	2294.63	2270.70
Summer mung	1147.78	1324.79	1170.02	1222.11
Summer urad	0.00	760.00	900.00	881.94

Summer sesamum	0.00	0.00	0.00	0.00
Summer onion	0.00	0.00	0.00	0.00
Total summer cereals	2999.01	2923.99	2898.55	2941.86
Total summer pulses	1147.78	1300.41	1090.59	1181.79
Total summer foodgrains	1192.05	1334.71	1122.83	1218.39
Total jowar	1488.10	1433.02	1373.51	1428.68
Total bajra	0.00	0.00	0.00	0.00
Total rice	1934.27	2849.66	1762.96	2182.93
Total maize	1871.86	2170.93	2053.80	2028.15
Total mung	1137.33	1324.79	1170.02	1218.22
Total urad	1444.52	1142.45	820.78	1135.83
Total groundnut	1633.01	1307.76	1108.11	1370.93
Total sesamum	0.00	0.00	0.00	0.00
Total tobacco	0.00	0.00	0.00	0.00
Total onion	29557.57	27761.83	27547.20	28521.50
Total cereals	1764.72	2415.39	1520.61	1893.21
Total pulses	1137.30	1003.82	823.95	988.95
Total foodgrains	1485.57	1783.06	1219.36	1493.80
Total oil seeds	1583.60	1281.78	1101.28	1338.78

**Table 1.9 – Year-wise trends in crop production**

The crop productivity scenario provides both challenges and opportunities. The overall foodgrain productivity in the region remains below the state average, with notable underperformance in key Kharif crops, including unirrigated rice, finger millet (ragi), tur (pigeon pea), and groundnut. This indicates constraints related to rainfed farming, soil quality, and limited access to improved inputs. Kharif pulses, in particular, show a substantial productivity gap of over 25% compared to the state average. However, the district demonstrates strong potential in Rabi and high-value crops. Maize performs exceptionally well in both Kharif and Rabi seasons, exceeding the state average, and wheat productivity is nearly on par. High-value crops, such as sugarcane, onion, and garlic, also yield results close to or above state benchmarks, suggesting a favourable agroecological environment for selected commercial crops. With strategic investments in irrigation, improved seed systems, and farmer training, Dang district holds promise for enhancing agricultural productivity and income diversification, primarily through scaling up Rabi cultivation and market-linked value chains.

### Package of Practices

**Vegetables:** According to the TTC study, 88% of respondents engaged in vegetable cultivation reported using a combination of nursery development and direct sowing methods. Seed spacing practices have seen partial adoption in the treatment blocks, with 44% of respondents indicating they apply spacing techniques only for select vegetables. The practice of soil testing remains limited, with only 5% reporting that they had conducted soil tests on their agricultural land.

The use of Farmyard Manure (FYM) is widespread, although it is mainly dependent on its availability. A total of 97% of respondents reported applying FYM—with 50% using it for some vegetables and 47%

using it for most of their vegetable crops—highlighting the reliance on organic soil enrichment practices.

**Paddy:** In the lowland areas of Dang, farmers are increasingly cultivating hybrid paddy varieties, such as US 312, US 362, Savitri, and IR 64, alongside traditional varieties like Indrani. The TTC study indicates that 97% of farmers reported using conventional methods of paddy cultivation, while only 3% practised the System of Rice Intensification (SRI). A significant 88% of farmers reported practising Adar, a method involving controlled burning of the field before nursery plantation.

In terms of water management, 82% of farmers relied exclusively on flood irrigation, and 86% did not adopt wide spacing during transplantation. Interestingly, 51% of farmers mixed weeds in their paddy fields as a natural method of weed control. Regarding pest management, 21% of respondents reported using organic pesticides, either always (3%) or occasionally (18%), whereas a majority—79%—had never used organic pesticides in paddy cultivation.

In the TTC study, it was found that 13 per cent of the respondents have received training for Paddy cultivation, and 5 per cent of the respondents have received training on vegetable cultivation. The role of AKRSP (I) was found to be significant, as 84 per cent of the trainings under Paddy cultivation and 92 per cent of the trainings under vegetable cultivation were reported to be given by AKRSP (I)

**Millet:** In the Ahwa block, millet cultivation is integral to the agricultural landscape, particularly focusing on finger millet (*Eleusine coracana*) and little millet (*Panicum sumatrense*). Traditionally, farmers have employed broadcast sowing methods, resulting in suboptimal plant populations and increased weed competition. To enhance productivity, the Krishi Vigyan Kendra (KVK) in Waghai introduced line sowing techniques. Demonstrations revealed that sowing at a spacing of 22.5 x 7.5 cm significantly improved yields compared to random broadcasting. Additionally, the adoption of improved varieties, such as GN-8, has been promoted for their early maturity and higher yield potential. Despite these advancements, challenges such as limited access to quality seeds and inadequate weed management persist, necessitating ongoing extension efforts to support millet farmers in the region.

**Pulses:** Pulses, including pigeon pea (*Cajanus cajan*) and black gram (*Vigna mungo*), are cultivated in Ahwa block, often intercropped with cereals or millets to optimise land use and enhance soil fertility through nitrogen fixation. Farmers traditionally rely on rainfed conditions, making pulse production vulnerable to erratic rainfall patterns. The adoption of improved varieties and agronomic practices has been limited, partly due to constraints in extension services and access to inputs. Studies indicate that while Gujarat's overall pulse productivity is higher than the national average, districts like Dang have yet to realise their full potential. Addressing these challenges through targeted interventions, such as promoting drought-resistant varieties, improving access to quality seeds, and providing timely agronomic guidance, could significantly enhance pulse productivity and nutrition in the Ahwa block.

### Practice of Agroecological Farming

In Ahwa, traditional and agroecological farming practices are deeply rooted in the community's agricultural methods. A notable traditional technique is "Raab," a form of slash-and-burn agriculture where biomass is burned to enrich soil fertility. This practice is widespread in the upland or sloped fields and is often integrated with agroforestry. Farmers typically retain native trees, such as teak, bamboo, and khair, around or within cultivated plots, promoting soil conservation, biodiversity, and microclimatic balance.

Another widespread indigenous system is "Adar", a shifting cultivation practice observed in the forested and hilly areas of Ahwa. In this method, farmers selectively clear small patches of forest land, cultivate crops for a few seasons, and then let the land lie fallow to regenerate naturally. This rotational system helps maintain soil fertility, minimises pest build-up, and supports ecological recovery.

A total of 88 per cent of respondents, as part of the TTC study in the treatment blocks, reported that they always follow the practice of "Adar" before nursery plantation. Only 11 per cent of the respondents stated that they follow the practice of "Raab"-stubble burning (5 per cent) or burning sometimes (6 per cent), which may be attributed to the interventions of AKRSP (I) in the previous phase of the project.

Recognising the prevalence of chemical-free farming in the region, the Gujarat government declared Dang as the state's first 100% organic farming district in November 2021. This initiative, under the "Aapnu Dang, Prakrutik Dang" campaign, provided financial assistance to farmers adopting organic practices, with subsidies of ₹10,000 per hectare for up to two hectares. By that time, approximately 70% to 80% of the district's 58,000 hectares of cultivated land were already being managed using traditional, non-chemical methods.

With growing attention on natural farming, farmers in Ahwa have increasingly adopted the use of bio-inputs such as Jeevamrut, Beejamrut, and Ghanjeevamrut. These are locally prepared fermented microbial cultures made from cow dung, cow urine, jaggery, gram flour, and soil. They act as biofertilizers and plant growth promoters, enhancing soil microbial activity and significantly reducing input costs.

Green manuring, especially with legumes like sunhemp or dhaincha, is practised during fallow periods or before Kharif cropping to enrich soil organic matter. Farmers incorporate the green biomass into the soil, which decomposes and improves soil fertility, particularly in nutrient-deficient upland areas. Intercropping with nitrogen-fixing legumes is also practised to enhance soil health and productivity.

In the AKRSP intervention villages, we observed the benefits of bio inputs and improved techniques, such as crop rotation and trap crop practices.

In these villages, farmers practice crop rotation, particularly between cereals, pulses, and vegetables, as a way to:

- Maintain soil fertility,
- Break pest and disease cycles,
- Reduce dependency on external inputs.

Common crop rotation patterns observed in the region include:

- Maize – Chickpea – Groundnut
- Finger Millet – Green Gram – Mustard
- Paddy – Black Gram – Onion/Garlic
- Vegetable crops (e.g., Okra) – Fallow – Maize

These patterns not only diversify production and household nutrition but also promote nitrogen replenishment (through pulses), weed suppression, and improved soil structure.

In several areas, traditional crop sequences are maintained on terraced fields. At the same time, farmers with access to water also extend the crop cycle into the summer season by using short-duration legumes, such as mung beans, thereby enhancing year-round productivity.

The transition to natural farming has yielded positive outcomes for local farmers. For instance, Rajubhai Budhabhai Sahre from Galkund village in Ahwa taluka diversified his crops and employed techniques like drip irrigation and mulching. By 2023-24, he achieved earnings of ₹4.4 lakh from cultivating chillies, bitter gourd, tomatoes, and broccoli, showcasing the economic viability of sustainable farming practice<sup>10</sup>.

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<sup>10</sup> Ani. (2024, August 4). Dang declared as Gujarat's fully natural farming district, tribal youth plant 25000 strawberry saplings. [The Times of India](#).

Millet cultivation, particularly finger millet, is also prominent in Dang, with around 12,000 hectares dedicated to millet farming. The Hill Millet Research Station in Waghai has developed various millet varieties, supporting the district's role in millet research and production. These efforts have led to a thriving cottage industry where tribal women produce millet-based products, contributing to both nutritional security and economic empowerment<sup>11</sup>.

### 1.4.3. Fruit Trees and Agroforestry

The following table provides a description of the main fruit trees, their coverage area, and productivity data for the Ahwa block in Dang district, Gujarat as per the Horticulture Cultivation Area and Production Data from the Director of Horticulture, Gujarat.

**Fruit Crop Data – Dang District (2023–24)**

Fruit Crop	Area (ha)	Production (MT)	Productivity (MT/ha)
Mango	5,710	39,285	6.88
Banana	0	0	0.00
Papaya	36	373	10.35
Citrus	0	0	0.00
Pomegranate	20	143	7.14
Custard Apple	46	1,794	39.00
Guava	22	127	5.75
Jackfruit	134	830	6.19
Amla (Indian Gooseberry)	24	156	6.50

**Table 1.10 – Food crop data of Dang District (2023-24)**

### 1.4.4. Livestock

According to the Livestock Census 2020, the Ahwa block in Gujarat has the following livestock populations:

- **Cattle Population:** Cow 30,200; Buffalo 8,200
- **Goat Population:** Approximately 10,200 goats.
- **Poultry Population:** Approximately 86,000 poultry birds.

Insights from the 2019 TTC Baseline Study (AKRSP, 309 Respondents) for Ahwa block reveal the following data.

- 20% of families reported owning crossbred/exotic cows, including: Jersey, Holstein Friesian, Sahiwal, Gir
- 9% reported owning indigenous Dangi breed cows.
- 1% owned buffaloes.
- 3% kept goats.
- 73% reported owning poultry birds.

<sup>11</sup> Mehta, Y. B. (2023, February 5). [The cream of the crop? Dang it is!](#)

The following table depicts the herd size profile of the Livestock as per the TTC baseline study.

Heard Profile	Mean	Median
No. of dairy livestock	2	1
Number of female crossbreed cows	2	2
Number of female indigenous cows	2	1
No of male calves	3	2
No of male cattle	2	2
No of Doe	3	2
No of Bucks	3	3
No of goat kids	2	2
No of poultry birds	4	3
No of female birds	3	2

**Table 1.11 – Herd size profile of the Livestock**

### Productivity of Livestock

The TTC study also determined the following productivity for the dairy animals.

Dairy Livestock	Average Milking Period	Average milk yield per day
Cross-breed/exotic	258	7.6
Buffalo	203	6.3
Indigenous	201	2.4

**Table 1.12 – Productivity of livestock**

Most households do not plant exclusive fodder crops in the treatment blocks and rely on open grazing during the rainy season for green fodder. It was reported that green fodder is available only for a period of 4 months of the Kharif season, i.e., from June to September. After the Kharif season, dairy livestock are mainly fed on dry fodder, which reduces their milk productivity and quality to some extent. Those who rear cross-bred/exotic cows also purchase and provide cattle feed supplied through Vasudhara Dairy.

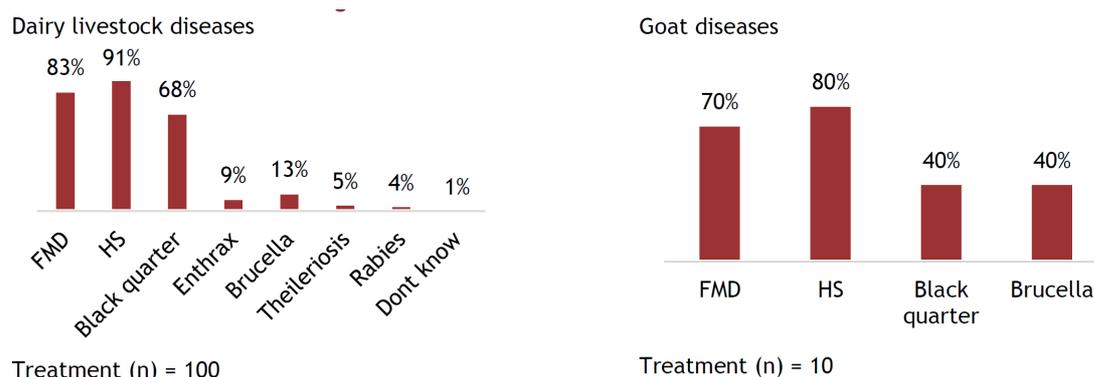
### Veterinary Services

The TTC study also reports that the status and access to veterinary services are poor in the Ahwa block. A disease outbreak among poultry and goats was prevalent in the area.

As per the study

- Only 21% respondents value AI services
- 26% respondents avail vaccination services
- 24% respondents avail deworming services

The following charts depict the incidence of diseases in dairy livestock and goats.



**Fig. 1.16 – Incidence of diseases in dairy livestock and goats**

It was observed that most households in the Ahwa block do not utilise veterinary services for their poultry and goats. As a result, the mortality rate of poultry birds remains alarmingly high, primarily due to frequent outbreaks of disease. While most villages reported the presence of veterinary services within a 5- to 10-km radius, accessibility remains a significant challenge.

According to the TTC baseline study, the Government Veterinary Department plays the most significant role in providing animal healthcare, with 87% of respondents identifying it as their primary service provider, followed by private veterinary practitioners. However, both government and private services are typically located at the block or district headquarters, limiting their regular accessibility for livestock rearers in remote villages.

Furthermore, the outreach of trained community-based animal health workers—certified para-vets or Pashu Sakhis—is notably low. Only 10% of respondents reported their presence in the area, highlighting a significant gap in last-mile veterinary service delivery.

#### 1.4.5. Non-Timber Forest Products

Non-Timber Forest Products (NTFPs) are critical to the socio-economic fabric of forest-dependent communities. In the Ahwa block of Dang District, Gujarat, tribal households heavily rely on NTFPs for both livelihood sustenance and supplemental income. The region's dense forest cover, biodiversity, and traditional knowledge base create a strong foundation for the sustainable harvesting and utilisation of these resources.

##### Key NTFPs in Ahwa Block

The major NTFPs collected in Ahwa include:

- Timru Leaves (*Diospyros melanoxylon*) – primarily used for bidi (hand-rolled cigarette) making.
- Mahua Flowers and Seeds (*Madhuca indica*) – utilised for food, oil extraction, and traditional beverages.
- Puwad Seeds – used in food and traditional medicine.
- Honey – gathered from wild bee colonies and used for both nutrition and medicinal purposes.
- Aritha (Soapnut/*Sapindus* spp.) – valued for its natural cleansing and medicinal properties.

A study by Chaudhari and Khunt (2024)<sup>12</sup> highlights that NTFP collection makes a significant contribution to the incomes of tribal households in Ahwa and Waghai blocks. In terms of quantity collected, an average of 369.64 kg of NTFPs was harvested per household annually. NTFPs not only served as an income source but were also widely consumed within households. Aritha had the highest average household consumption share at 46.21%, followed by Mahua flowers (37.26%), Mahua seeds (15.02%) and Honey (1.49%).

In terms of income generation, the findings further emphasise that the average annual NTFP income per household was ₹9,563.36. Other major contributors to income were:

- Timru Leaves – ₹2,901.90 (30.34%)
- Mahua Seeds – ₹1,958.50 (20.47%)
- Puwad Seeds – ₹1,769.00 (18.50%)
- Honey – ₹1,084.50 (11.34%)
- Mahua Flowers – ₹1,013.00 (10.59%)
- Aritha – ₹835.10 (8.37%)

The highest income was earned through the sale of Timru leaves, averaging ₹2,901.90 per household (30.34% of total NTFP income). This was followed by Mahua seeds at ₹1,958.50 (20.47%). The lowest income contributor was Aritha, bringing in ₹835.08 per household (8.37%).

NTFP collection also contributes significantly to rural employment:

- On average, households gained 72.26 person-days of employment annually from NTFP-related activities.
- Mahua flower collection, being particularly labour-intensive and time-consuming, accounted for the highest employment generation at 21.40 person-days per household.

These findings strongly reinforce the role of NTFPs as both a subsistence buffer and an essential source of seasonal cash income for tribal communities in the Ahwa block. The dual benefit of providing food security and generating employment makes NTFPs an integral component of the rural economy in forest-dependent regions, such as Dang.

The following are some of the key data tables from this study.

S. No.	Name of NTFPs	Quantity collected (kg)	Quantity consumed (kg)	Quantity sold (kg)
1	Mahuda seeds	83.38 (22.55)	5.04 (15.02)	78.34 (23.30)
2	Puwad seeds	126.42 (34.20)	0.00 (0)	126.42 (37.61)
3	Honey	2.67 (0.72)	0.50 (1.49)	2.17 (0.64)
4	Aritha	85.09 (23.01)	15.50 (46.21)	69.59 (20.70)
5	Mahuda flower	7208.00%	12.5	59.58
6	Timru leaves (in bunch)	265814.00%	20.05	2638.09
	Total	369.64 (100)	33.54 (100)	336.10 (100)

Note: Figures in parentheses indicates percentage to total

**Table 1.13 – Quantity and utilization pattern of major NTFPs**

<sup>12</sup> Chaudhari, A. S., & Khunt, K. A. (2024). Socio-Economic determinants of Non-Timber forest product income among tribal communities in the Dang region, Gujarat, India. *Asian Journal of Research and Review in Agriculture*. <https://doi.org/10.56557/ajrra/2024/v6i1148>

S. No.	Name of NTFPs	Selling price of NTFPs (Rs / kg)	Income generated through NTFPs (Rs /household)	Employment days/year involved in collection of NTFPs
1	Mahuda seeds	25	1958.50 (20.47)	15.55 (21.51)
2	Puwad seeds	14	1770.00 (18.50)	12.51 (17.31)
3	Honey	500	1085.00 (11.34)	8.11 (11.22)
4	Aritha	12	835.08 (8.37)	6.19 (8.56)
5	Mahuda flower	17	1012.86 (10.59)	21.40 (29.61)
6	Timru leaves (Rs./bunch)	1.1	2901.89 (30.34)	8.50 (11.76)
	Total	-	9563.34 (100)	72.26 (100)

Note: Figures in parentheses indicates percentage to total

**Table 1.14 – Income and employment generated through NTFPs**

### 1.4.6. Migration

The study "Understanding the Societal and Economic Impacts of Farmers' Labour Migration Patterns in Dang" by Ishan Mohammad (2023) provides a detailed examination of the labour migration dynamics in the Ahwa block of Dang district, Gujarat.

#### Reasons for Migration

In the Ahwa block, labour migration is essentially a coping mechanism for tribal households faced with chronic underemployment and seasonal livelihoods. The key reasons driving migration include:

- **Agricultural Seasonality:** The monsoon-dependent farming system in Dang provides limited employment opportunities outside the rainy season. Farmers are left with few options during the non-cropping months, prompting them to migrate to survive. They migrate after the monsoon, which is the primary cultivation season, and mostly return before the next monsoon.
- **Lack of Non-farm Employment:** The region lacks viable non-agricultural employment avenues, especially for the youth. This economic vacuum compels individuals to seek employment in urban centres. Primary destinations are nearby agricultural hubs — Surat/Bardoli (sugarcane) and Nashik (grape/vineyards). A large share of labour from Dang works as seasonal sugarcane harvesters around Bardoli/Surat and as vineyard/ grape labourers in Nashik and other locations in Maharashtra.
- **Who migrates:** Predominantly young adults and working-age men, though whole-family and child migration is reported in some cases (children accompanying parents or left behind with social consequences). Women sometimes migrate for specific labour tasks, but male labour migration is more prevalent.

#### Extent of Migration

- The study reports that over 70% of households in the Ahwa block engage in seasonal migration, predominantly during the post-harvest dry months (November to June).

- Migration is typically temporary and cyclical, with many families returning to resume farming duties during the monsoon.
- Migrant destinations are often urban and semi-urban areas in Gujarat and neighbouring states, where migrants work in construction, brick kilns, agriculture, and informal services.

### Income from Migration

- Migration contributes significantly to household income, with remittances accounting for 25–35% of the annual earnings for most migrating families.
- The average monthly income from migration ranges from ₹7,000 to ₹10,000 per worker, although this varies by location and the nature of work.
- While remittances help meet essential expenses (such as food, health, and education), they are generally insufficient to lift families out of poverty or ensure long-term financial stability.

### Effects of Migration

#### Positive Effects:

- **Economic Relief:** Migration provides much-needed cash income to meet daily needs and cope with agricultural uncertainty.
- **Skill Exposure:** Some migrants acquire new skills in masonry, carpentry, or mechanical work, though these are rarely formally certified.

#### Negative Effects:

- **Family Fragmentation:** Long absences of working-age members disrupt family life and increase the burden on women and older people at home.
- **Education Disruption:** Children who accompany their parents to work often drop out of school, creating intergenerational cycles of illiteracy.
- **Health Risks:** Migrants often live in substandard conditions with poor access to healthcare, making them vulnerable to disease and exploitation.
- **Community Impact:** High levels of migration lead to reduced community participation and erosion of traditional systems of cooperation and mutual aid.

### 1.4.7. Nutrition Profile

According to the National Family Health Survey (NFHS-5), the Dangs district in Gujarat exhibits significant nutritional challenges, particularly among children under five and women aged 15–49.

#### Nutritional Status of Children Under Five:

- **Underweight:** 53% of children are underweight, indicating a high prevalence of chronic undernutrition.
- **Wasting:** 41% of children are wasted, reflecting acute malnutrition.
- **Severe Wasting:** 22% of children are severely wasted, suggesting critical levels of acute undernutrition.
- **Stunting:** 37.6% of children are stunted, which, while slightly below the state average, still represents a significant concern.

#### Nutritional Status of Women (Aged 15–49):

- **Underweight (BMI <18.5):** 33.7% of women are underweight, highlighting widespread dietary deficiencies.

- **Overweight/Obese (BMI  $\geq 25$ ):** 8.1% of women are overweight or obese, indicating emerging issues related to overnutrition.

### Anaemia Prevalence

- **Children (6–59 months):** 82% are anaemic, pointing to severe iron deficiency among young children.
- **Non-Pregnant Women:** 77.6% are anaemic, reflecting widespread iron deficiency.
- **Pregnant Women:** 66.8% are anaemic, which can have adverse effects on both maternal and foetal health.
- **Adolescent Girls (15–19 years):** 77.1% anaemic, indicating a critical need for nutritional interventions in this age group.

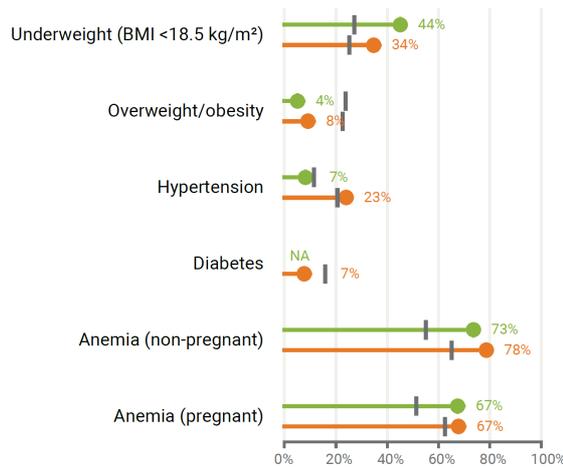


Fig. 1.17 – Comparison of key health indicators among women

A Comparison of the Immediate and Underlying Determinants of Nutrition is provided in the graphs below.

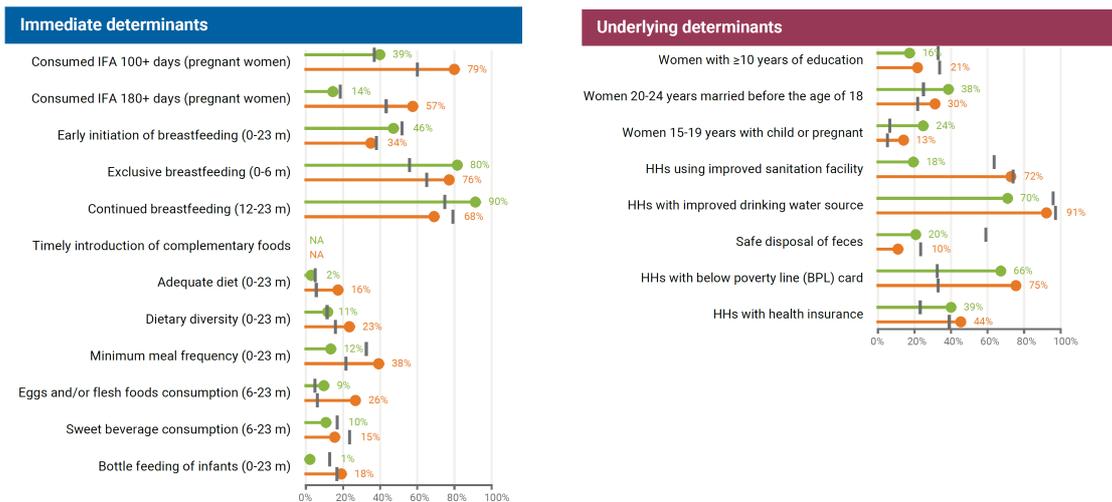


Fig. 1.18 – Comparison of immediate and underlying determinants of nutrition

### Some of the key concern areas are

- Adequate diet is available to only 16% of children aged 0-23 months
- Adequate Dietary diversity is attained by only 23% of children aged 0-23 months

- Minimum meal frequency is attained by only 38% of 0-23-month-old children

## 1.5. Land Use and Landholding Pattern

### 1.5.1. Land use

As described in the previous chapters, the region is predominantly characterised by extensive forest cover, which significantly influences its land use distribution. The following land use patterns are observed.

- **Forest Area:** A substantial portion of Ahwa Taluka is covered by dense forests, including the Purna Wildlife Sanctuary. These forests are integral to the local ecosystem and biodiversity.
- **Agricultural Land:** The rugged terrain and dense forests limit the extent of cultivable land in Ahwa Taluka. Farming activities are primarily conducted in cleared forest areas and valleys, where the soil is more fertile and suitable for cultivation.
- **Cultivable Waste Land:** This category includes lands that were previously used for agriculture but have been left fallow or are currently unsuitable for cultivation without significant reclamation efforts.
- **Barren and Uncultivable Land:** Areas that are unsuitable for any form of cultivation, such as rocky outcrops and steep slopes, are categorised here.
- **Pastoral Land:** There are designated grazing lands for livestock, but these are limited due to the emphasis on forest conservation. The local communities may utilise forest clearings and less densely wooded areas for grazing purposes.

Derived from satellite assessments, and state-level land use statistics for Dang district (which consists entirely of Ahwa block), the following data sets are approximate percentage estimates for major land use types

Land Use Type	Approximate % of Total Area	Notes
Forest Area	85–90%	Dominant land use. Includes reserved forests and wildlife sanctuaries, such as Purna.
Net Cultivable Land	5–7%	Mainly, valley areas and cleared forest patches are used for subsistence farming.
Cultivable Waste Land	1–2%	Includes fallow or degraded lands with potential for reclamation.
Barren & Uncultivable Land	2–3%	Rocky terrain, steep slopes, and uncultivable hilltops.
Pastures & Grazing Land	1–2%	Scattered community grazing patches often overlap with forest use.
Area under Non-Agri Use	0.5–1%	Settlements, roads, and small markets (like Ahwa town).

Table 1.15 – Land use pattern in study area

#### Land use data as per Mission Antyodaya Survey 2020

- Total Cultivable Area: 42,374.24 hectares
- Net Sown Area: 16,427.29 hectares

- Net sown area as a percentage of Cultivable Area: 38%
- Total Irrigated Area: 6539.12 hectares
- Irrigated area as a percentage of Cultivable Area: 15%
- Net sown area in Kharif: 12737.14 hectares
- Net sown area in Kharif as a percentage of total net sown area: 77.5%
- Net sown area in Rabi: 2114.77 hectares
- Net sown area in Rabi as a percentage of total net sown area: 12.9%

#### Forest Cover as per the Gujarat State Forest Statistics report 2023 - 2024

- Reserve Forest: 280.55 sq km or 28,055 ha
- Protected Forest: 62.5 sq km or 6,250 ha
- Total Forest: 343.05 sq km or 34,305 ha

#### Key Insights from the above land use data

- Over 62% of cultivable land remains fallow or unused annually, suggesting constraints such as terrain, irrigation, labour shortages, poor access to finances, low input support, and migration.
- Low Irrigation Coverage (15%): Indicates a heavy dependence on the monsoon, which limits the potential for irrigated agriculture.
- 77.5% of the sown area is during the Kharif season (monsoon)—only 12.9% in the Rabi season, indicating seasonal mono-cropping due to water shortage or input constraints.
- Dominance of Forest Cover: The block has 34,305 ha of forest, which is roughly 44% more than the total cultivable area (42,374 ha). Forests (both Reserve and Protected) form a significant part of the land base, indicating strong ecological significance but also limiting agricultural expansion.
- Reserve vs. Protected Forest: Reserve Forests (28,055 ha) account for 81.8% of the total forest cover, while Protected Forests (6,250 ha) make up 18.2%. This suggests stricter conservation measures apply to the majority of the forest land.
- Land Use Implication: The high forest cover, low proportion of irrigated land, and large share of rainfed Kharif agriculture suggest that interventions should focus on water harvesting, agroforestry, and climate-resilient cropping systems rather than large-scale expansion of cultivation into forest areas.

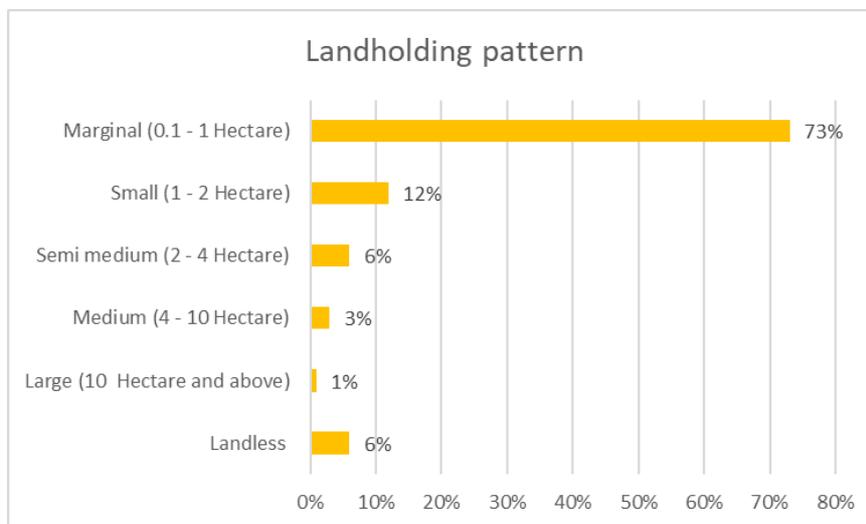
#### 1.5.2. Status of Degraded Common Land in Ahwa

- **High Erosion-Induced Degradation:** The Dangs district, including the Ahwa block, suffers significant land degradation driven primarily by water erosion, affecting approximately 84,000 hectares, including common lands and open forests. The Ahwa block is also impacted proportionately. This is primarily due to intense monsoon rainfall on steep, hilly terrain, which leads to rapid soil erosion.
- **High Soil Erodibility Across the Landscape:** Soil erodibility mapping reveals that nearly 44.5% of the district has soils highly susceptible to erosion (erodibility factor > 0.34), while 24.3% are less prone to erosion. This suggests that even forested commons are at risk of degradation, especially where vegetation cover is weak.
- **Widespread Severe Soil Erosion:** In the broader south Gujarat region, which includes Dang, erosion severity ranges from mild sheet erosion to very severe gully erosion, with an average soil loss of 22.41 t/ha/year in the Ambika watershed. This context reflects a significant potential for degradation, even in areas with high vegetation cover.

- **Vegetation Loss Trends:** Despite these challenges, forest cover in Dang has remained relatively stable, with only 25 hectares (0.29%) lost between 2001 and 2024, attributed largely to deforestation. While this indicates resilience in forest cover, it also masks the underlying degradation of common lands and soil, which canopy data have not been able to capture.
- **Desertification Risk in a High-Rainfall Area:** The combination of intense but short rainfall, rapid runoff, steep slopes, and deforestation has heightened risks of land degradation and localised desertification, even in this high-rainfall zone.

### 1.5.3. Landholding Pattern

The following graphic depicts the landholding pattern in the Ahwa block of Dang district across various categories of farmers. It shows that most landholders are predominantly marginal (72%), with less than 1 Ha of landholding, alongside small farmers (12%) with less than 2 ha of landholding.



Source: AKRSP baseline study of ABF project done by TTC, completed on July 3, 2019

Fig. 1.19 – Landholding pattern

#### Implications

- **Dominance of Marginal Farmers:** 73% of landholders own less than 1 hectare, indicating that agriculture is highly fragmented and largely subsistence-oriented. These households are vulnerable to climate shocks, market risks, and a lack of economies of scale.
- **Limited Land for Expansion:** Only 10% of holdings fall in the semi-medium to large category, limiting the scope for mechanised or large-scale farming.
- **Challenges in Productivity and Profitability:** Small plot sizes make it difficult for individual farmers to adopt irrigation, mechanisation, or diversification.
- **Landless Population:** This group is entirely dependent on wage labour, forest-based livelihoods, or migration. This indicates a need for diversification strategies in small ruminant-based livelihoods.



# History of Agroecology in the Landscape

## 2.1. Key Milestones that Influenced Agroecology Practice in the Landscape

Year	Milestone	Actors Involved
2006	Enactment of the Forest Rights Act (FRA), recognising the rights of forest-dwelling communities over land and resources.	Government of India
2008–2009	Implementation of the FRA begins in Dang district with the formation of Forest Rights Committees (FRCs) in villages.	Gujarat State Government, Tribal Development Department, Local Gram Sabhas
2016	Declaration of Dang as Gujarat's first 100% organic farming district during the 67th State Van Mahotsav.	Gujarat State Government, Chief Minister Anandiben Patel
2017	Launch of the 'Apnu Dang, Prakrutik Dang' initiative to promote chemical-free farming practices.	Gujarat State Government, Department of Agriculture
2021	Formal declaration of Dang as a completely chemical-free organic farming district; financial assistance of Rs 10,000 per hectare provided to farmers.	Gujarat State Government, Agriculture Minister Raghavji Patel, District Collector B K Pandya
2024	Reports of violations of tribal rights under the FRA resulting from forest department activities without prior consultations with the Gram Sabha.	Gujarat Forest Department, Local Tribals, Ministry of Tribal Affairs

Table 2.1 – Key milestones influencing agroecology practice

## 2.2. History of AKRSP in the Landscape

### 2.2.1. 2010–2012: Experimental Phase:

- AKRSP initiated its work in the Dangs region (Ahwa Block), focusing on community rapport building and contextual understanding. During this phase:
- Extensive baseline studies, research, and community dialogues were conducted to identify core challenges and explore feasible interventions.
- Emphasis was placed on understanding traditional practices, resource limitations, and aspirations of the local Adivasi communities.
- The learnings from this phase laid the groundwork for designing integrated and community-centric development interventions.

### 2.2.2. 2013–2017: Development Phase:

This phase focused on Water Resource Development, Soil and Water Conservation, Sustainable Agriculture, and the formation of grassroots institutions. Key highlights include:

#### Water Resource Development:

- Based on insights from the experimental phase, innovative models were piloted to enhance water availability for irrigation, particularly during periods of drought.
- Interventions included check dam renovation, desilting, and Group well rejuvenation to restore traditional water sources.
- Big and mini lift irrigation schemes, Solar-based irrigation schemes, Bori Bandh, Mobile diesel Engine

#### Natural Resource Management (NRM):

- Introduction of soil and water conservation practices aimed at reducing erosion and increasing the water retention capacity of the land.
- Community training and awareness drives on sustainable management of natural resources.

#### Agriculture:

- Recognising the shift of communities from traditional subsistence farming to surplus-oriented practices, training and knowledge-sharing on improved agricultural techniques were provided.
- Promotion of the System of Rice Intensification (SRI), vegetable cultivation, and the use of organic pesticides and weedicides.
- Emphasis on capacity-building through demonstrations, farmer exposure visits, and locally contextualised agronomic packages.

#### Non-Farm Livelihoods:

- Promotion of small-scale enterprises in farm and non-farm sectors, such as goat rearing and commercial poultry farming.
- Skill-building of youth and women for alternative income-generating activities.

#### Community Institutions:

- Formation of village-level community-based institutions like Gram Vikas Mandals (GVMs) to ensure participatory planning, implementation, and monitoring.
- These institutions played a critical role in anchoring development efforts and mobilising the community.

### 2.2.3. 2018–2022: Expansion Phase:

During this phase, the programme expanded to new thematic areas, incorporating Animal Husbandry, Skills and Enterprise Development, Local Governance, and Apex Institutions.

#### Water Resource Development:

- Intensification of earlier interventions and introduction of solar- and electric-based lift irrigation systems.
- Construction of farm ponds and continued renovation of check dams to improve water security.
- Soil and Water Conservation:
- Community-level campaigns promoting Natural Resource Management (NRM) were scaled through mass mobilisation and convergence with government schemes.

#### Agriculture:

- SRI practices were scaled through an intensive approach, supported by village-level Farmer Field Schools (FFS).
- Input distribution, initially handled by GVMs, was transitioned to Organisations (FPOs).
- Large-scale promotion of vegetable cultivation and the introduction of mango orchards for long-term horticultural gains.
- Introduction on oilseeds (Sunflower, Nizer), which are well adopted and scaled by the community.
- Introduction of new variety crops to support crop diversification.

#### Animal Husbandry:

- Introduced as an independent thematic area with focused interventions in poultry, goat rearing, and dairy development.
- Development of a cadre of Pashu Sakhis to provide doorstep animal healthcare services and preventive care.
- Introduction of Breed improvement among goats through the Surti buck.
- Promotion of improved practices for animal housing, fodder management, and nutritional supplementation (e.g., Azolla, Napier grass).

#### Skills and Enterprise:

- Launch of a dedicated Enterprise Development Programme to support rural youth in setting up local businesses.
- Enabled access to essential services within villages and reduced dependency on migration for livelihoods.

#### Governance:

- Formation of a Nagrik Mitra cadre to support villagers in accessing and availing government schemes.
- Capacity-building of Gram Panchayat representatives on GPDP, budget utilisation, and implementation of MGNREGA for watershed and conservation activities.

#### **Institutions:**

- Strengthening grassroots institutions, such as Self-Help Groups (SHGs) and GVMs.
- Establishment of apex-level organisations such as FPOs, Women's Federations, and Credit Cooperatives to anchor and scale interventions sustainably.
- These institutions ensured community ownership and enabled linkages with government and financial systems.

#### **2.2.4. 2023–2027: Sustainability Phase:**

This ongoing phase aims to ensure the long-term sustainability of interventions through promoted apex institutions, along with ongoing and existing programme activities initiated during the expansion phase of the project.

#### **Institutional Strengthening:**

- Focus on institution-led delivery of services with gradual handover of responsibilities to FPOs and Federations.
- Strengthening backwards and forward market linkages through FPOs for inputs, aggregation, and value addition.

#### **Thematic Expansion – Health & Nutrition:**

- Introduction of Health and Nutrition as a New Thematic Area.
- Deployment of Arogya Sakhis, a cadre of trained health workers supporting the community on preventive healthcare, maternal and child nutrition, and hygiene practices.

#### **Integration of Cadres:**

- Cadres under animal husbandry, health, and governance have been brought under the umbrella of Federations for better coordination and accountability.
- Federation leaders now oversee performance and planning across sectors.

#### **Scaling through Convergence:**

- Proven livelihood models from earlier phases are now being scaled up through government schemes, ensuring a wider reach and a more profound impact.
- Focus on institutional sustainability, capacity building, and the development of local leadership.



# Current State of Agroecology in the Landscape

## 3.1. Agriculture (field crops, vegetables, floriculture, fruit crops)

### 3.1.1. Village-level assessments and findings

The TAPE (Tool for Agroecology Performance Evaluation) assessment conducted across three villages in Ahwa block comparing their relative progression with respect to agroecology — Rawachod (progressive), Lahanchariya (moderate), and Vadiavan (low level of adoption) — highlights a transparent gradient in the adoption of agroecological principles, shaped not only by biophysical conditions but also by the strength of community institutions and exposure to training and facilitation. Rawachod, an early adopter of agroecology, demonstrates moderately higher alignment with 9–10 of FAO’s 13 agroecological principles. The community has embraced crop diversity (Score: 3), tree integration and agroforestry (Score: 3), soil fertility management through composting (Score: 3), and reduced use of chemical inputs (Score: 2), also improved livestock diversity (Score: 3). This progress has been strongly supported by training and continuous handholding from AKRSP(I), which has built the capacity of SHGs, CRPs, and local leaders. Rawachod also benefits from the comparatively higher water availability for irrigation, facilitated by decentralised solar-lift systems, which reduces farming risk and enables year-round cultivation. As a result, migration from the village is notably low, and strong village institutions—including SHGs, Gram Sabha participation, and active CRPs—have enabled a virtuous cycle of learning, adoption, and innovation.

In contrast, Lahanchariya reflects a medium stage of transition, with moderate alignment to 6–7 agroecological principles. It performs well on crop diversity (Score: 3) and shows emerging practices in agroforestry (Score: 2), livestock integration (Score: 2), and reduced external input use (Score: 2). Training exposure exists but is less consistent than in Rawachod, and water availability for irrigation is moderate (lower than Rawachod), limiting second-season crops and diversification potential. Institutional development in Lahanchariya is underway, with some SHG and CRP activities, but participation in Gram Sabhas and convergence with government schemes remains limited. As a result, the village shows potential for accelerated agroecological transformation with targeted investment in water infrastructure, nursery development, and structured capacity building.

Vadiavan, identified as a village lagging, aligns weakly with only 3–4 agroecological principles. While there is some natural tree cover (Score: 3) and basic crop diversity (Score: 2), there is minimal

evidence of composting, livestock integration, or collective farming. The village has received the least exposure to external training or institutional support, and water availability is lowest for irrigation, making agriculture highly vulnerable to climate variability. Consequently, seasonal migration is highest in Vadiavan, as farming fails to offer year-round sustenance. SHGs and local governance platforms are either weak or non-functional, and community mobilisation around agroecology remains absent.

These patterns underscore that agroecological transformation in Ahwa block is not only an agronomic issue but also a deeply institutional and infrastructural one. The performance across the three villages is shaped by the presence or absence of enabling conditions, including training and extension, water infrastructure, and active community institutions. Rawachod illustrates what is possible when all three factors converge, while Vadiavan highlights the need for foundational interventions. Lahanchariya offers a window of opportunity to scale change if supported with the right investments. However, across all three villages, there remains significant scope for strengthening ridge-to-valley treatment to improve soil and water conservation. Additionally, enhancing access to government schemes and programmes through integrated planning under the Gram Panchayat Development Plan (GPDP)—led by the Gram Sabha and Gram Panchayats—can play a vital role in accelerating agroecological transformation.

### **3.1.2. Ambitions and Aspirations of Farmers in Ahwa Block**

During the village-level interactions in Ahwa block, it became evident that farmers across all three villages—Rawachod, Lahanchariya, and Vadiavan—do not migrate by choice. Migration is often a compulsion, undertaken only when local livelihoods are deemed unsustainable. Farmers expressed a deep-rooted desire to remain in their villages, preserve their farmlands, conserve traditional seeds, and continue age-old agricultural and forest-based practices. There is a profound emotional and cultural connection to nature, land, and forests. However, increasing pressure on natural resources—due to degraded forest cover, soil erosion, rising temperatures, irregular rainfall, and shrinking landholdings driven by population growth—has forced many to seek work outside their villages, particularly during lean agricultural seasons.

Most farmers are not engaged in commercial farming, except in areas with access to irrigation. Even in these plots, while there is an effort to retain traditional knowledge and techniques, many feel compelled to use synthetic fertilisers and pesticides—especially DAP, Urea and market-grade pesticides—when growing paddy and vegetables for market sale. These practices are not preferred but are viewed as a necessity to meet urgent cash needs. Many farmers interviewed expressed an apparent willingness to adopt bio-inputs, compost, and natural formulations, such as Jeevamrut, Neemastra, and fermented plant extracts—if these were available, accessible, and affordable. Currently, the lack of timely, high-quality bio-inputs at the village level remains a significant constraint. The aspirations of these farmers clearly align with ecological, sustainable, and self-reliant farming. Still, there is an urgent need for enabling systems, robust extension services, and input delivery mechanisms to help them realise this vision.

Importantly, women in Ahwa block play a central and transformative role in shaping the future of agriculture and rural development. They are at the forefront of the 'Self-Help Group' (SHG) and Farmer Producer Organisation (FPO) movements, actively participate in work stipulated under the National Rural Employment Guarantee Act (NREGA), and take leadership in agriculture, agroforestry, livestock, and NTFP collection and management. During the interactions, women expressed strong aspirations to contribute more meaningfully to household incomes, with a special focus on improving the food and nutritional security of their children. Many shared their desire to invest in their children's education, seeing it as a path toward a better future. Their leadership, resilience, and aspirations are key drivers of change, and investing in women's capacities and entrepreneurship will be essential for building a more sustainable and equitable development pathway for the region.

### 3.1.3. Yield

The following data indicates a significant difference in yield in the Ahwa region compared to the State and National Averages.

#### Food Crops

Crop	Dang Yield (kg/ha)	State Avg (kg/ha)	National Avg (kg/ha)	% Gap w.r.t. State	% Gap w.r.t. National
Rice (Total)	1,762.96	2,182.93	2,882	↓19%	↓39%
Maize (Total)	2,053.80	2,028.15	3,351	▲1%	↓39%
Jowar (Total)	1,373.51	1,428.68	1,162	↓4%	▲18%
Ragi	842.24	1,040.54	1,375	↓19%	↓39%
Other Millets	No recent data	NA	2,283	-	-
Groundnut	1,108.11	1,370.93	2,163	↓19%	↓49%
Gram (Chickpea)	895.26	981.58	1,151	↓9%	↓22%
Pulses (Total)	823.95	988.95	881	↓17%	↓6%
Foodgrains (Total)	1,219.36	1,493.80	2,515	↓18%	↓52%

Table 3.1 – Comparison of crop yields in Dang with State and National averages

#### Vegetables

Vegetable	Dangs Yield (MT/Ha)	Gujarat Avg. (MT/Ha)	India Avg. (MT/Ha)	% Diff: Dangs vs. Gujarat	% Diff: Dangs vs. India
Onion	18.88	20	17.5	-5.60%	7.90%
Tomato	21.92	25	26.5	-12.30%	-17.30%
Brinjal	17.39	22	20.2	-21.00%	-13.90%
Cabbage	17.92	24	25	-25.30%	-28.30%
Cauliflower	20.14	23	24.2	-12.40%	-16.80%
Okra	14.72	13	12.5	13.20%	17.80%
Bitter Gourd	13.89	15	15.5	-7.40%	-10.40%
Bottle Gourd	13.92	17	19	-18.10%	-26.70%
Pumpkin	18.25	19.5	20	-6.40%	-8.80%

Cucumber	16.11	18	19.2	-10.50%	-16.10%
Cluster Bean	15.48	10	9	54.80%	72.00%
Cowpea	5.63	8	9.5	-29.60%	-40.70%
Green Chilli	13.11	12.5	12.8	4.90%	2.40%

Source: District-wise area, production and yield of important food and non-food crops in Gujarat State, published by the Directorate of Agriculture, State Horticulture Data published by the Department of Horticulture and Agricultural Statistics, published by the Ministry of Agriculture and Farmers Welfare, Department of Agriculture

**Table 3.2 – Comparison of vegetable yields in Dang with State and National**

### Key Factors Contributing to Low Crop Yields in Ahwa Block:

During focus group discussions with farmers from Ravachod, Lahanchariya and Vadiavan villages, several interrelated factors were identified as key contributors to the lower levels of agricultural productivity around food crops and vegetables in the region:

- Limited Use of External Inputs:** Most farmers reported low or negligible use of chemical-based inputs such as fertilisers and pesticides. This is primarily due to two factors: the reliance on traditional farming practices and Ahwa's designation as a natural farming block, where the use of chemical inputs is restricted or not permitted. However, in villages like Ravachod and Mahalpada, where the Aga Khan Rural Support Programme (AKRSP) has been actively involved, around 40% of farmers have adopted improved natural farming practices. Through targeted training, they learned to prepare and utilise inputs such as Jivamrita, compost, sunhemp for green manure, trap crops, and other relevant materials. These interventions have helped improve crop yields and reduce losses by enhancing soil health and pest management. In contrast, in villages like Vadiawan, which adopted the training interventions at a later stage, the positive effects of these practices are yet to be fully realised.
- Water Scarcity for Irrigation:** Inadequate irrigation coverage remains a significant challenge across the region. Farmers identified poor maintenance and heavy siltation of existing check dams and irrigation structures as major bottlenecks limiting water availability. Even during the monsoon, extended dry spells often coincide with critical stages of crop growth. In the absence of functional irrigation systems, farmers are unable to provide timely protective irrigation, leading to substantial yield losses. As a result, only a small portion of land is cultivated during the rabi season, and summer cropping is nearly non-existent. Vadiavan village was reported to have the lowest agricultural productivity, primarily due to inferior irrigation infrastructure. Alarming, farmers in the town struggle to access sufficient water even during the kharif season. This chronic water scarcity has contributed to high levels of seasonal migration, as farming is no longer a viable livelihood option for many households.
- Degraded Soil Health:** Soil quality is deteriorating, primarily due to high surface runoff and erosion, especially in sloped and upland areas. Farmers observed a lack of attention to integrated soil and water conservation measures, such as ridge-to-valley watershed treatment. Additionally, the rocky terrain in upland zones impedes groundwater recharge, further compounding soil moisture stress.
- Limited Access to Quality Extension Services:** The lack of regular and high-quality agricultural training and extension services limits farmers' exposure to improved practices. However, in villages like Ravachod and Mahalpada, where NGOs such as AKRSP have

provided targeted training and support, farmers have successfully adopted improved agronomic practices, resulting in notable yield improvements.

- **Declining Seed Quality:** Farmers expressed concern over the declining quality and productivity of traditional seed varieties of paddy, millets, and pulses. Over time, these varieties have lost vigour due to continued recycling without proper seed selection or renewal, resulting in reduced germination rates, increased pest vulnerability, and overall lower productivity.

### 3.1.4. Institutions

The Gujarat Livelihood Promotion Company (GLPC) serves as the key implementing agency for the State Rural Livelihood Mission (SRLM) initiatives across the state. As the primary driver of community institution building, GLPC has facilitated the formation of over 1,000 women-led Self-Help Groups (SHGs) in collaboration with local NGOs. These SHGs are further federated at the village level into Village Organisations (VOs)—typically, 10 SHGs form one VO, and 10 VOs are collectively organised into one Cluster Level Federation (CLF). Currently, three active CLFs are operational in the Ahwa block, effectively supporting grassroots women’s institutions in governance, livelihoods, and financial inclusion.

In addition to GLPC’s efforts, the Aga Khan Rural Support Programme (AKRSP) has promoted the Pragati Mahila Manch, a women-led federation comprising 73 SHGs across 21 villages in Ahwa block. This federation plays a pivotal role in supporting agricultural activities by facilitating timely access to finances through group savings and internal credit—particularly critical during peak farming seasons.

#### Subsidised Financing Available under SRLM for Agricultural Support

SHGs and their federations in Ahwa block can access various subsidised financing mechanisms under the State Rural Livelihood Mission to strengthen agriculture and allied livelihoods:

- **Revolving Fund (RF):** Eligible SHGs receive a start-up corpus ranging from ₹10,000 to ₹15,000 to build their internal lending capacity and provide credit to members for livelihood activities. (Source: SLBC Gujarat)
- **Community Investment Fund (CIF):** Provided in intensive blocks, the CIF (₹15 lakhs per CLF, ₹1.5 lakhs per VO) is routed through VOs or CLFs and maintained as a long-term community resource. It is used to offer larger loans to SHGs or finance common socio-economic ventures such as collective farming or small-scale enterprises. (Source: SLBC Gujarat)
- **Interest Subvention:** The mission offers interest subvention to reduce the cost of credit for SHG members. SHGs can avail of loans from banks/financial institutions at subsidised rates, with the government covering the gap above a 7% interest rate, for loans up to a maximum of ₹3 lakh per SHG. (Source: SLBC Gujarat)

These financial instruments, when effectively accessed and managed, can significantly enhance the promotion of agriculture and horticulture, as well as the economic resilience of SHG members in Ahwa block.

#### Women-led Farmer Producer Organisations (FPOs) in Ahwa Block

There are five Farmer Producer Organisations (FPOs) currently operational in the Ahwa block of Dang District. Among these, two of the more active FPOs have been promoted by the Aga Khan Rural Support Programme (AKRSP). These are the Dangji Adivasi Mahila Khedut Utpadak Producer Company Ltd. and the Galkund Agro Farmers Producer Company Ltd. The Dangji Adivasi Mahila Khedut Utpadak

Producer Company Ltd. is an all-women FPO with a strong base of 1,946 shareholder members, playing a significant role in empowering women farmers in the region. In contrast, the Galkund Agro Farmers Producer Company Ltd. is a mixed-membership FPO comprising both male and female farmers, with a total of 306 shareholders.

Both FPOs are playing a pivotal role in supporting local farmers, particularly women, by strengthening agricultural value chains, improving access to markets, inputs, and services, and fostering collective entrepreneurship in the tribal communities of Ahwa.

The FPO currently offers the following services:

- Output marketing, branding, and packaging of agricultural produce
- Improvement of supply and value chains through better aggregation and logistics
- Access to primary processing facilities to enhance value addition
- Provision of high-quality agroecological inputs for key crops such as vegetables, paddy, millets, oilseeds, and pulses

The Dangi Adivasi Mahila Khedut Utpadak Producer Company Ltd FPO has mobilised significant investment—₹50 lakhs through the Tribal Sub Plan and an additional ₹15 lakhs through support from Axis Bank Foundation (ABF). It is envisioned to establish a Common Facility Centre (CFC) to further enhance its operations in processing, storage, and packaging.

### Future Scope of Cluster-Based Model for Scaling FPO Operations

For the FPO to function effectively at the block level, there is a need to develop a decentralised cluster-based model. Each cluster can be formed around 10 GPs, so typically, four cluster-level FPOs can be promoted across the Ahwa block. These Cluster FPOs would be responsible for:

- Local-level aggregation, sorting, and grading of produce
- Basic processing and storage, reducing post-harvest losses
- Facilitating direct linkages with the block-level FPO for advanced processing, value addition, and marketing

This hub-and-spoke model would not only enhance efficiency and scale but also deepen grassroots participation, improve access to markets, and enable better price realisation for tribal women farmers. The block-level FPO, led by AKRSP, would serve as the apex institution, coordinating higher-order processing, branding, and bulk marketing, both within and beyond the district.

### Role of Gram Sabhas and Gram Panchayats in Agricultural Development

In Ahwa which comprises 40 Gram Panchayats, the Gram Sabhas and Gram Panchayats (GPs) play a critical role in planning and implementing agricultural development at the grassroots level. Their most important function is the preparation and execution of the Gram Panchayat Development Plan (GPDP). This decentralised planning mechanism allows communities to identify local priorities and access funds through convergence from schemes. Through this process, GPs can prioritise and mobilise resources for interventions like irrigation development, soil and water conservation, and agroecological farming models. In the context of agriculture, these institutions can drive transformation by facilitating ridge-to-valley watershed development, bunding, check dam construction, farm pond creation, and the development of farm-level infrastructure. Labour budgets under MGNREGA, combined with technical support from the Agriculture, Forest, and Irrigation Departments, can help operationalise these plans and improve water-holding capacity, soil health, and year-round farm productivity.

Field insights from the three study villages highlight the varying effectiveness of Gram Sabhas in local governance and agricultural planning. In Rawachod, the Gram Sabha was found to be highly organised

and participatory, with strong community engagement in decision-making and convergence planning. This has resulted in improved coordination with line departments and more efficient implementation of schemes. In Lahanchariya, while a Gram Sabha structure exists, it often struggles to mobilise participation and take collective action—leading to missed opportunities in planning and execution. In Vadiavan, the situation is more critical: Gram Sabhas are rarely convened, and when they are, community participation is minimal, reflecting weak institutional functioning and a lack of community ownership.

### **Role of Women in Institutions**

In the Ahwa block of Dang district, women are playing a central role in agriculture through self-help groups (SHGs), village organisations (VOs), and cluster-level federations (CLFs), which are supported by the Gujarat Livelihood Promotion Company (GLPC) and NGOs, such as the Aga Khan Rural Support Programme (AKRSP). They are actively involved in managing SHG federations, such as the Pragati Mahila Manch, and leading Farmer Producer Organisations (FPOs), including the Dang Adivasi Mahila Khedut Utpadak Producer Company Ltd., which has nearly 2,000 women shareholders. These institutions support women in farming by enhancing access to credit, inputs, and markets, as well as promoting collective efforts to improve their livelihoods. Women have already taken on leadership roles in these FPOs, but many still lack the knowledge, skills, and experience necessary to establish strong systems, structures, and governance processes. This limits their ability to lead and grow these institutions effectively. While progress has been made through subsidised loans and government schemes, challenges remain—especially in villages where Gram Sabhas are inactive or lack women’s participation.

Furthermore, many extension roles at the grassroots level are also envisioned for women, such as Prakrutik Krishi Sakhis (natural farming facilitators), Pashu Sakhis (community animal care workers), and NREGA mates for natural resource management (NRM) work. However, these women often do not receive adequate training in soft skills, leadership, or communication, which are critical for building their confidence and effectiveness in these roles. Additionally, the Gram Sabha and Panchayati Raj (PRI) system remains male-dominated, mainly creating a significant barrier to women’s meaningful participation. This exclusion not only undermines women’s voices but also weakens the quality of governance. Increasing the involvement of women in Gram Sabhas can significantly improve the quality of decision-making, making local governance more inclusive, responsive, and effective. To truly empower women in agriculture and rural development, it is essential to invest in their leadership capacity, ensure their representation in local institutions, and create an environment that enables them to actively engage in planning and implementation processes.

### **3.1.5. Indigenous Knowledge and Practices**

In the tribal regions of Ahwa block, indigenous agricultural practices have been central to sustainable farming for generations. Traditional methods, such as Raab and Adar, exemplify the community’s deep-rooted knowledge and adaptation to the local environment.

#### **Raab-Traditional Slash-and-Burn Agriculture**

Raab is a traditional slash-and-burn agricultural practice prevalent among the tribal communities of Dang district. This method involves clearing forested land by burning vegetation to enrich the soil with ash, thereby enhancing its fertility for crop cultivation. While Raab has historically supported subsistence farming, concerns have arisen regarding its environmental impact, particularly deforestation and soil degradation.

#### **Adar-Indigenous Farming Technique**

Adar is another indigenous farming technique practised in the region, though detailed documentation is limited. It typically involves traditional methods of land preparation and crop cultivation, tailored to the local topography and climate. These practices are integral to the community's agricultural heritage and have been passed down through generations.

### Benefits of the Indigenous Practices

#### Raab (Slash-and-burn shifting cultivation):

- **Soil Enrichment:** The controlled burning of forest biomass releases nutrients, particularly potassium (potash), into the soil, temporarily enhancing soil fertility and promoting healthy crop growth.
- **Low External Input:** Raab relies entirely on locally available natural resources, requiring no chemical fertilisers or synthetic inputs.
- **Climate Resilience:** Because it's typically done on hill slopes with natural rainwater management, Raab fields are less prone to waterlogging, making them suitable during erratic monsoons.
- **Crop Diversity:** Tribal communities often cultivate millets, pulses, and mixed cropping systems, thereby enhancing both nutritional security and ecological balance.

Adar (Traditional permanent cultivation on hill terraces or plots):

- **Soil and Water Conservation:** Adar involves farming on gently sloped or terraced land, which naturally controls erosion and improves rainwater retention.
- **Use of Indigenous Seeds:** Farmers utilise traditional seed varieties that are adapted to local soil and climate, which are drought-tolerant and pest-resistant.
- **Cultural Continuity:** These practices are closely tied to local festivals, rituals, and community labour systems, reinforcing social cohesion and traditional ecological knowledge.

However, Raab today faces several critical challenges:

- **Escalating fire risk:** Reports near Purna Wildlife Sanctuary show that Raab zones have increased incidences of accidental or uncontrolled forest fires compared to areas where the risk is declining.
- **Soil nutrient volatility:** While Raab generates a short-term spike in fertility—raising soil pH and potassium levels—these gains are transient and can exacerbate long-term soil degradation if the fields are repeatedly reused.

The tradition of Adar, involving permanent hill-slope cultivation—often on terraced lands—relies on indigenous seed varieties and procedures adapted to the local topography and rainfall patterns. Although less documented, Adar enhances water retention and erosion control under relatively stable conditions.

Yet, Adar too has weakened due to:

- **Loss of community labour systems:** Shifting demographics and reduced reliance on collective land preparation threaten its continuity.
- **Climate unpredictability:** Even terraces struggle with maintaining moisture in the face of erratic wet seasons and dry spells.

### Current Status in Ahwa Block

In recent years, both Raab and Adar practices have been declining in the Ahwa block due to multiple factors:

- **Forest Regulation & Land Use Restrictions:** Forest conservation laws have limited access to shifting cultivation lands, making Raab increasingly difficult to practice legally.
- **Introduction of Market-led Crops:** There has been a shift toward high-input commercial crops (like maize and hybrid vegetables), promoted by government schemes and market demand, which displaces traditional low-input practices.
- **Younger Generation Shifts:** Younger farmers are often less inclined to continue traditional methods, opting instead for quicker-return cash crops.
- **Environmental Concerns:** Although Raab temporarily enriches soil, repeated use can lead to deforestation, soil depletion, and biodiversity loss, resulting in pressure to phase it out.

### What Needs to Be Done

- **Blended Approaches:** Encourage “knowledge hybridity”—blending indigenous practices with modern agroecological techniques to create sustainable models of tribal agriculture.
- **Documentation and Validation of Traditional Knowledge:** Institutions like KVK Waghai and Navsari Agricultural University should systematically document practices like Raab and Adar, assessing their ecological value and integrating functional elements into sustainable farming models.
- **Promotion of Modified Eco-Friendly Versions:** Instead of banning Raab outright, promote eco-adapted versions that minimise burning and integrate agroforestry or mulching with forest litter.
- **Support for Adar Revival:** Programs should support terracing, organic composting, and water harvesting on Adar lands to increase productivity while conserving the essence of the practice.
- **Cultural Recognition and Incentives:** Recognise traditional farming as part of tribal heritage and provide incentives for preserving and practising it in environmentally sustainable ways.

### 3.1.6. Digital Technology

The use of digital technology in agriculture in Ahwa is still nascent, constrained by limited connectivity and low digital literacy. While Gujarat has an overall internet penetration rate of 72%, many villages in Dang, particularly those in remote, forested areas, lack reliable mobile and internet access. Over 90 villages in the district reportedly have zero mobile connectivity, severely restricting the scope of full-scale digital interventions for farmers and extension workers.

To address these disparities, the adoption of hybrid models for digital agricultural extension offers a promising and inclusive solution.

Offline Access to Digital Content:

- Extension workers can carry pre-downloaded video advisories, audio files, digital manuals, and market updates on mobile devices or tablets for use during farmer training sessions in offline mode.
- Farmers can access curated content in local languages during group meetings or one-on-one sessions, without needing mobile data.

Online Upload & Monitoring Facilities:

- Once workers return to connected areas, they can upload photos, geo-tagged field data, farmer queries, and feedback reports to central databases or agroecological advisory platforms.
- Real-time data enables district- or state-level experts to monitor trends and provide timely remote support.

## Interactive Voice Response Systems (IVRS)

- These tools allow even low-literate farmers to call a toll-free number and get voice-based guidance in their local dialects.

### 3.1.7. Enablers and Constraints - Inputs

#### Seed

**Indigenous Varieties and Seed Conservation:** Farmers in Ahwa predominantly use traditional seed varieties for staple crops, including millets, pulses, vegetables, and paddy. Notable local paddy varieties include Ambamore, Indrani, Bwariya, Dudhmalai, and Laxmi 70, which are well-adapted to local agroclimatic conditions and are integral to the community's food and nutritional security. Seed preservation remains a communal activity, with farmers exchanging or purchasing seeds as per seasonal requirements. Traditional storage methods—such as bamboo containers known as kabla, coated with clay and cow dung and layered with neem leaves—are commonly used to protect seeds from pests and maintain viability across planting cycles.

**High-Quality Seed and Seed Treatment as Productivity Drivers:** Access to high-quality traditional seeds and appropriate seed treatment are two major drivers of farm productivity. However, smallholder farmers often face challenges in accessing timely and quality conventional seeds. Initiatives such as the Seed Village Programme and the promotion of seed entrepreneurs, particularly those focused on producing and conserving traditional seed varieties, can significantly enhance both the quality and accessibility of seeds. Furthermore, integrating these efforts with SHG-based seed bank programmes can create decentralised and resilient seed systems at the community level.

**Pilot Collaborations and Institutional Support:** Promising pilot initiatives, in collaboration with the Krishi Vigyan Kendra (KVK) in Waghai, the Navsari Agricultural University (NAU), and the Hill Millet Research Station, can further enhance the availability of high-quality traditional seeds. These collaborations can focus on community-level seed production of millets, paddy, and pulses, ensuring that traditional varieties are not only conserved but also improved for better yield and climate resilience.

**Use of High-Yielding and Hybrid Varieties:** While traditional seed varieties continue to dominate subsistence farming in the region, farmers also adopt high-yielding and hybrid seeds, particularly for commercial cultivation. During the Kharif season, hybrid paddy varieties such as US312 and US362 are widely used for market-oriented farming, while traditional paddy varieties are primarily cultivated for household consumption.

In the instance of vegetables, farmers often retain and use traditional seeds for small-scale cultivation during the Kharif season, primarily to meet their household's dietary needs. However, during the Rabi season, especially in irrigated areas, farmers shift to commercial vegetable production and procure open-pollinated (OP) or high-yielding varieties (HYVs) to meet market demands. This dual seed strategy reflects both economic pragmatism and cultural continuity in local farming practices.

**Millet Cultivation in Dang District:** Dang district is a leading hub for millet cultivation in Gujarat, with approximately 12,000 hectares under cultivation. Finger millet (ragi) alone occupies around 8,500 hectares, supplemented by varieties such as little, foxtail, proso, barnyard, and kodo millets. The Hill Millet Research Station in Waghai, under NAU, has played a critical role in developing and disseminating improved sub-types of these millets, contributing to the agrobiodiversity and climate resilience of the region's farming systems.

#### Bio-Inputs

During field visits to the villages of Rawachod, Mahalpada, Lahanchariya, and Vadiawan in Ahwa block of Dang district, farmers expressed a growing inclination to adopt bio-inputs and reduce their dependence on chemical fertilisers and pesticides—primarily to preserve soil fertility and maintain ecological balance. This transition toward agroecological practices is uneven, however, and closely tied to several contextual factors such as livestock ownership, water availability, financial capacity, and knowledge systems.

The extent of bio-input use varied across villages, reflecting their progression on the agroecology adoption scale:

Village	Agroecological Status	Bio-Input Use
Rawachod	Progressive	High
Mahalpada	Progressive	High
Lahanchariya	Semi-progressive	Moderate
Vadiawan	Low-progressive	Low

**Table 3.3 – Agroecological status and bio-input use across villages**

The extent of bio-input usage is also an indicator of progress in agroecology. We observed that in the more progressive villages, such as Rawachod and Mahalpada, the use of bio-inputs was higher; in semi-progressive villages, like Lahanchariya, it was moderate; and in low-progressive villages, like Vadiawan, the use was significantly lower. This gradient in usage is primarily influenced by the availability of livestock, such as cows and buffaloes, as well as access to water and financial resources, both of which are essential for maintaining livestock and producing bio-inputs. Another significant factor is the level of knowledge and skills related to the processing and utilisation of bio-resources, such as cow dung, farm waste, and cow urine, to prepare various bio-growth promoters.

While bio-inputs like Jeevamitra have been popularised and are being used—more extensively in progressive villages and less so in others—a broader range of inputs is still underutilised. Bio-fertilisers such as nitrogen-fixing bacteria (*Rhizobium*), phosphate-solubilising bacteria, and mycorrhizal fungi enhance soil fertility by making nutrients more readily available to plants. Bio-nutrients, such as vermicompost, Panchagavya, and biochar, enhance soil structure, improve moisture retention, and stimulate microbial activity. However, many of these, along with bio-pesticides and fungicides such as Brahmastra, Neemastra, and Agniastra, are still largely absent from farmers’ practices, with only a couple of farmers in progressive villages using them partially. Moreover, farmers lack knowledge of and access to mechanical pest control tools, such as sticky traps, yellow traps, and pheromone traps, which KVK and NAU actively promote. Good practices, such as the use of green manures like sunhemp and intercropping with pigeonpea, are found in progressive villages and are gaining popularity due to AKRSP’s interventions. More farmers, however, need to be supported through training and extension services to scale up the use of bio-inputs across all villages and to expand the range of available bio-inputs for different purposes.

This transition will be feasible only if farmers have local access to high-quality bio-inputs, apply them based on soil analysis reports, and can see their benefits demonstrated through well-managed field sites. Community resource persons—such as SHGs, Pashusakhis, and Krishi Sakhis—can be trained to establish and operate Bio-Resource Centres (BRCs) for microbial biofertilisers and biocontrol agents. Sustained training and extension services across Ahwa block, paired with a dependable supply of quality bio-inputs, can help shift farmers away from chemical fertilisers like DAP and synthetic pesticides and fungicides—still used covertly in hybrid paddy and vegetable cultivation despite official discouragement.

### 3.1.8. Enablers and Constraints- Processes

#### Extension Services

Agricultural extension services from the government were found to be mostly absent or weak across the landscape. The Prakrutik Krishi Sakhis employed under GLPC (Gujarat Livelihood Promotion Company) as part of the state's rural livelihoods mission—30 of whom have been trained for the Ahwa block under the ATMA programme—are yet to begin active field-level extension services. These Sakhis are expected to play a critical role in developing Intensive Farming Clusters, with each cluster slated to receive a grant of ₹7 lakhs from the GLPC.

However, during discussions with villagers, it was evident that such government-led extension services are currently lacking on the ground. Most of the existing training and extension support is being provided by AKRSP(I).

Extension workers from AKRSP, along with some of the newly trained Krishi Sakhis, expressed a strong need for continuous learning, exposure visits, and opportunities to interact with Krishi Vigyan Kendra (KVK), Navsari Agricultural University (NAU), and progressive farmers and scientists to enhance their technical knowledge and confidence.

They also emphasised the importance of higher incentives to ensure that they can remain productive and deliver quality extension services to a larger number of farming families. One extension worker confidently shared that she was capable of covering one entire Gram Panchayat effectively, provided she received the necessary support and recognition. The extension workers also expressed that they lack a platform where they can come together, exchange their learnings and challenges with each other and find solutions to the problems under expert guidance. The selection of extension workers, preferably from progressive women farmers in SHGs, followed by continuous training, exposure, and mentoring, along with a sound incentive system to reward their good performance, is key to developing a successful extension system.

#### Access to Agricultural Implements and Equipment

Access to agricultural implements and post-harvest infrastructure in the Ahwa block of Dang district, Gujarat, remains limited, impacting productivity and market readiness for local farmers. Farmers in the Ahwa block primarily engage in small-scale, rain-fed agriculture, relying on traditional tools due to limited access to modern machinery. The 2016–17 Potential Linked Credit Plan (PLP) by NABARD for Dang district highlighted the need to promote farm mechanization by encouraging the use of implements such as mould board ploughs, trailers, cultivators, cage wheels, disc harrows, seed drills, portable pump sets, power threshers, winnowers, self-propelled reapers, sprayers, pruners, weeders, and grass cutters. Despite these recommendations, the adoption of modern agricultural equipment remains low, primarily due to small field sizes, mono-cropping practices, financial constraints, lack of awareness, and inadequate infrastructure to support mechanisation.

The Department of Agriculture, Government of Gujarat, under various schemes, including the Subsidy Scheme on Agricultural Mechanisation, provides financial support to farmers for procuring farm equipment such as:

- Power tillers, rotavators, seed drills
- Multi-crop threshers, reapers, mini tractors
- Power weeders, sprayers, and pump sets

Farmers can receive subsidies ranging from 40% to 80%, depending on their (SC/ST/women beneficiaries receive higher support). The aim is to increase mechanisation, especially in hilly and tribal areas like Dang, to improve efficiency and reduce manual labour.

However, field interactions in villages such as Rawachod, Mahalpada, Lahanchariya, and Vadiawan reveal that access to these schemes is limited due to a lack of awareness, complicated application processes, and low digital literacy, especially in remote forest villages. Some farmers reported receiving implements through group-based schemes, but widespread individual adoption remains a challenge.

### Post-Harvest Infrastructure: Gaps in Cleaning, Grading, and Sorting

Despite being an agricultural zone with significant horticulture and grain production, Ahwa block lacks dedicated spaces for cleaning, grading, and sorting of produce. The absence of such infrastructure results in:

- Post-harvest losses
- Inability to meet quality standards for institutional or urban markets
- Low price realisation for farmers

There are no functional cluster-level aggregation or processing centres for vegetables and grains, which limits opportunities for value addition and branding.

To enhance agricultural productivity and market access in the Ahwa block, the following measures can be taken up:

- **Establish Cluster Level Agro-Service Centres:** Set up centres equipped with modern agricultural implements available for hire, making mechanisation accessible to small and marginal farmers.
- **Develop Cluster-Level Post-Harvest Infrastructure:** Invest in facilities for cleaning, grading, and sorting of agricultural produce to reduce post-harvest losses and enhance marketability.
- **Financial Support and Training:** Provide knowledge, awareness, and application filing support to individual farmers and groups of farmers receiving financial assistance, as well as subsidies to access agricultural machinery and tools.
- **Collaborate with Financial Institutions:** Encourage banks to offer tailored financial products that support the purchase of agricultural machinery and the development of post-harvest facilities.

### Organic Certification

In the Ahwa block, traditional low-input farming practices aligned with organic and natural farming principles are still prevalent, particularly among tribal communities. However, formal organic certification remains limited, and the Participatory Guarantee System (PGS)—despite being recognised under the National Mission on Natural Farming (NMNF)—is not currently practised. Some initial awareness-building and capacity development on natural farming methods, such as the use of Jeevamrut, Neemastra, and mulching, have been introduced through state-supported NMNF interventions and facilitated by Krishi Vigyan Kendras (KVKs), Agriculture Technology Management Agencies (ATMAs), and civil society organisations like AKRSP(I).

Between 2017 and 2020, around 10,000 farmers in Dang district were certified in organic farming through third-party agencies accredited by APEDA and GOCA, under the Sampurna Rasayanmukt Dang Yojana. However, due to resource and institutional constraints, the renewal of these certifications could not be pursued after 2021. This presents a significant opportunity to revitalise the organic farming ecosystem in the region by transitioning to a more sustainable and accessible model.

In this context, PGS offers high potential as a scalable, cost-effective, and community-owned alternative. Its peer-review-based, participatory approach aligns well with the tribal culture and the existing social infrastructure, as represented by Self-Help Groups (SHGs), Farmer Producer

Organisations (FPOs), and Community Resource Persons (CRPs). By leveraging this existing base and past certification experience, PGS can be rapidly scaled to renew organic recognition for farmers in a more sustainable manner.

While Gujarat currently relies on central government-accredited agencies under the National Programme for Organic Production (NPOP) for certification, there have been steps toward institutional reform. The Gujarat State Organic Certification Agency (GSOPA) is under development as a state-level body to streamline and localise the certification process. This institutional momentum further strengthens the case for integrating PGS into the broader natural farming strategy.

To unlock this potential, it is essential to embed PGS promotion within NMNF interventions supported by investments in bio-input production, internal control systems, and market development. With proper facilitation and institutional backing—including from the forthcoming GSOPA—Ahwa block could emerge as a model for community-led, certified natural farming, building on traditional wisdom and a renewed certification framework.

### Overgrazing

Government forest statistics and the India State of Forest Reports indicate that The Dangs retains substantial forest cover and that, at the district level, there has not been massive tree-cover loss in recent decadal summaries — tree-cover loss in the district has been small in Global Forest Watch analyses.

District planning / PMKSY documents and local administrative reports include livestock population and land-use tables for Ahwa, acknowledging livestock and grazing as part of the local land-use mosaic. District studies and the District Human Development Report (DHDR) show that livestock numbers in The Dangs have fluctuated (and in some census periods declined), rather than exhibiting a runaway increase.

Independent reporting and studies about the Dangs point to historical forest governance issues (tenure, access, and degraded commons) and note that forest rights and management have been contested — these governance stresses can concentrate grazing pressure close to settlements and on common lands.

Synthesis & Inference: Available government and remote-sensing sources do not show clear, district-wide catastrophic forest loss or runaway livestock increases that would prove severe, uniform overgrazing across However, multiple lines of evidence point to localized overgrazing and pasture degradation risks, especially near villages, roads, and shrinking common grazing patches, driven by governance issues (tenure, access to commons), seasonal fodder shortages, and livelihood pressures.

Overgrazing in Ahwa is a localized and manageable problem, not an across-the-board catastrophic driver of landscape collapse. That said, local hotspots of grazing pressure and degradation do exist and are likely to worsen without interventions addressing common-land management, fodder development, rotational grazing, and alternative livelihoods.

### Man–Animal Conflict

In Ahwa block, incidents of man–animal conflict do occur but are infrequent and largely confined to villages situated close to forest fringes. Occasional crop raiding by wild boar or nilgai is reported during the kharif season. However, such incidents remain rare and do not represent a widespread or chronic challenge across the block. For most farming households in Ahwa, agriculture continues without significant disruption from wildlife. With community vigilance and support from the Forest Department, these isolated incidents can be effectively managed, ensuring that man–animal conflict remains a minor, contained issue rather than a major livelihood threat for Ahwa block.

## Insurance

Following the Gujarat government's decision to withdraw from the Pradhan Mantri Fasal Bima Yojana (PMFBY) in 2020, the primary crop risk coverage in Dang district—particularly Ahwa block—is through the Mukhya Mantri Kisan Sahay Yojana (MMKSY). This is a zero-premium, universal coverage scheme that automatically includes all eligible farmers and does not include any enrolment fees or formal applications. Under MMKSY, compensation is provided for crop losses caused by drought, unseasonal rains, heavy rainfall, or cyclones during the Kharif season.

- **Eligibility:** All farmers (land-owning and sharecroppers) in Gujarat.
- **Payouts:**
  - 25–33% crop loss → ₹20,000/ha (up to 4 ha)
  - 33% crop loss → ₹25,000/ha (up to 4 ha)
  - Funding Mechanism: State Disaster Response Fund (SDRF) norms, topped up by the Gujarat state government.

Additionally, during extreme natural calamities, State Calamity Relief Assistance can be activated for both Kharif and Rabi crops, although this is event-specific and contingent upon government notifications.

### 3.1.9. Enablers in the Current Context

- Universal Access: No exclusion based on premiums or enrolment hurdles.
- Simplified Process: No upfront cost or documentation required from farmers for enrolment.
- State Backing: Fully funded by the state government, ensuring continuity for Kharif crops.
- Quick Eligibility Identification: Based on official crop cutting experiments (CCEs) and satellite data.

### Key Constraints and Challenges

- Reduced Coverage after PMFBY Withdrawal: PMFBY offered coverage for both Kharif and Rabi, as well as additional risks (such as pest/disease outbreaks), which MMKSY does not fully address.
- Limited Per-Hectare Compensation: The fixed payout cap may not adequately cover the actual value of crop loss, particularly for high-value horticultural or cash crops.
- Seasonal Limitation: Primarily designed for Kharif crops; Rabi and perennial crops have minimal structured insurance coverage.
- Assessment Delays: Damage verification can be slow due to remote, hilly terrain and poor connectivity in the Ahwa block.
- Awareness Gaps: Many small and marginal farmers remain unaware of claim timelines, documentation needs, or appeal procedures.
- No Voluntary Top-Up: Farmers cannot opt for higher premium-based coverage for additional protection.

### Way Forward for Ahwa

- For a tribal, rainfed, and ecologically fragile region like, integrating crop insurance with climate-resilient agriculture is key. This would involve:
- Blending MMKSY with Local Adaptation Plans of Action (LAPAs) so that payouts are coupled with advisories for better future preparedness.
- Exploring Weather Index-Based Insurance Pilots for high-risk crops like paddy and vegetables, with ATMA as a nodal implementing agency.

- Digitising Claim Processes to shorten the lag between damage occurrence and farmer compensation.
- Strengthening Farmer-Producer Organisations (FPOs) to negotiate better group coverage packages for members.

## Market

The list of major markets in the Ahwa block is given on the right side. In the Ahwa block of Dang district, Gujarat, farmers rely primarily on traditional local haat (weekly) markets for selling their produce. These markets, although essential for regional trade, offer limited opportunities for farmers to access competitive prices or link directly with larger markets. Small weekly markets operate across various villages, such as Chinchali, Mahalpada, Bhavandagad, Morzhira, Jamlapada, and others, on specific days, usually covering a cluster of villages within a 5–10 km radius. These markets primarily cater to the needs of local consumers and small-scale vendors, characterised by informal trade, limited infrastructure, and the absence of standardised pricing or weighing systems.

Bigger markets in the block are located in Ahwa (Monday), Galkund (Tuesday), and Samgahan (Sunday), where more volume-based transactions occur. These markets serve as local aggregation hubs, attracting buyers from nearby regions. However, they still lack basic post-harvest infrastructure, including facilities for cleaning, grading, sorting, and storage. Most produce is traded unprocessed, leading to lower price realisation for farmers.

Although the Ahwa block is geographically well-positioned with access to urban markets such as Surat (~130 km), Nashik (~150 km), and Mumbai (~300 km), direct linkages are largely absent. Traders from these urban centres do not regularly source directly from Ahwa; instead, local intermediaries dominate the trade, often buying produce at low farmgate prices. This absence of direct market access limits farmers' bargaining power and their ability to earn fair returns.

S. No	Name Of Village	Day	Big & Small	Time of Market
1	Chinchali	Tuesday	Small Market	Morning Time
2	Morzhira	Sunday	small Market	Morning Time
3	Mahalpada	Friday	small Market	Morning Time
4	Jamlapada	Thursday	small Market	Morning Time
5	Bhavandadag	Saturday	small Market	Morning Time
6	Lashkariya	Tuesday	Small Market	Evening Time
7	Dhavalidod	Monday	small Market	Morning Time
8	Chikatiya	Wednesday	small Market	Morning Time
9	Borkhal	Friday	small Market	Morning Time
10	Galkund	Tuesday	Big Market	Morning Time
11	Samgahan	Sunday	Big Market	Morning Time
12	Gadhavi	Monday	small Market	Evening Time
13	Ahwa	Monday	Big Market	Morning Time

**Table 3.4 – Village-wise weekly market schedule**

To bridge these gaps, it is essential to develop community-level collection and sorting centres in strategic market villages, such as Ahwa, Galkund, and Samgahan. Strengthening existing FPOs, promoting direct linkages with institutional buyers in Surat and Nashik, and facilitating access to digital market platforms such as eNAM would enhance market integration. The promotion of shared transport systems, exposure visits, and buyer-seller meets can further improve the visibility and competitiveness of Ahwa's agri-produce.

### **3.1.10. Connection with other Domains**

In the Ahwa block, agriculture is intricately linked with other domains, including livestock, natural resource management (NRM), and agroforestry. Strengthening these linkages is essential for fostering sustainable and resilient rural livelihoods. The TAPE assessment across Rawachod, Lahanchariya, and Vadiavan reveals that villages progressing in agroecology have integrated livestock diversity, agroforestry practices, and soil fertility management, with strong institutional support and water infrastructure playing a catalytic role. Livestock not only complements crop-based farming through manure and nutrition security but also serves as a livelihood buffer during lean seasons. Agroforestry enriches biodiversity, enhances soil moisture, and provides additional income through timber, fruits, and NTFPs. At the same time, ridge-to-valley NRM treatments improve water retention and soil conservation, directly benefiting both farming and livestock rearing. Strengthening these interlinkages requires a holistic approach—building decentralised irrigation systems, developing nurseries, improving access to bio-inputs, and aligning NRM activities with GPDP plans. Equally important is investing in women's leadership and entrepreneurship across agriculture, livestock, and forest produce value chains, as they are pivotal actors in community institutions. By enabling integrated planning, institutional capacity building, and inclusive extension services, Ahwa block can accelerate its transition toward climate-resilient and self-reliant farming systems.

### **3.1.11. Current Programmes of the State and Central Governments and Fund Availability**

Promoting agroecological landscape development requires the strategic convergence of central and state government schemes. One of the most significant national-level interventions is the National Mission on Natural Farming (NMNF), launched in 2023, which provides ₹15,000 per hectare over three years to farmers adopting chemical-free, natural farming practices. With appropriate planning, this mission alone could unlock ₹4.5 crore for 1,000 hectares in Ahwa. This can be complemented by the Paramparagat Krishi Vikas Yojana (PKVY), which supports organic farming clusters with input kits, certification, and training, allocating ₹50,000 per farmer over three years. To address water scarcity and enhance soil productivity, the National Mission on Sustainable Agriculture (NMSA)—especially the Rainfed Area Development (RAD) component—offers support for Integrated Farming Systems (IFS), water harvesting, and agroecological inputs. This aligns perfectly with Ahwa's need for ridge-to-valley water and soil conservation models, especially on sloping and degraded lands. For long-term ecological resilience, the Sub-Mission on Agroforestry (SMAF) is crucial. SMAF supports tree plantation efforts (₹20,000–₹30,000 per hectare). Additionally, the RKVY-RAFTAAR scheme offers flexible funds for innovation and infrastructure, which can be mobilised for pilot agroecology clusters or demonstration sites.

At the state level, Gujarat's Department of Agriculture provides subsidies of 40%–80% on agricultural equipment, which is ideal for creating Custom Hiring Centres (CHCs) or FPO-led machinery pools. The Vanbandhu Kalyan Yojana under the Tribal Development Department can fund land development,

orchard establishment, and irrigation for tribal farmers. Similarly, Gujarat Green Revolution Company Ltd. (GGRC) supports micro-irrigation systems with a subsidy of up to 90%. At the same time, the Mukhya Mantri Pak Sangrah Yojana promotes post-harvest storage to reduce losses.

Bringing these schemes together under a unified agroecology plan can transform farming systems in the Ahwa block. The following table outlines the potential convergence:

Component	Scheme(s)	Indicative Funding Potential
Natural farming clusters (1000 ha)	NMNF, PKVY	₹4.5 crore (3 years)
Ridge-to-valley conservation (500 ha)	NMSA-RAD, Vanbandhu	₹3-4 crore
Integrated farming units (300 HHs)	PKVY, NMSA, RKVY	₹1.5-2 crore
Farm machinery (FPO/CHC level)	Agri Mechanization Scheme, RKVY	₹50 lakh-₹1 crore
Agroforestry & pollinators	SMAF, NBH	₹50 lakh-₹70 lakh
Micro irrigation systems	GGRC	₹1-2 crore
Post-harvest infrastructure	MIDH, Pak Sangrah Yojana, RKVY	₹1-2 crore

**Table 3.5 – Potential convergence of schemes**

To enable this convergence, it is essential to prepare village-level and Gram Panchayat-level plans integrated with the GPDP planning, leading to a block-level agroecology action plan that involves the Departments of Agriculture, Tribal Affairs, Horticulture, and Forests. This plan should also facilitate planning through platforms such as FPOs, SHGs, and Village Watershed Committees. Demonstration plots, decentralised input production units, and targeted capacity building, with extension support, can accelerate uptake. Ultimately, such an integrated approach will not only improve the health of soil, water, and biodiversity but also enhance the incomes and resilience of the tribal communities in Ahwa.

### 3.1.12. Climate Change

Here is a brief summary of the climate profile for Ahwa, that details the temperature range, rainfall and extreme heat frequency and risks relating to land erosion, all of which impact agriculture in the region quite directly.

#### Climate status

Rising temperatures & climatic shifts: Gujarat has warmed by roughly ~1°C over the last century; Dang shows a notable warming trend increasing the heat-stress risk for crops and livestock.

- **High vulnerability despite relief from extreme heat:** Dang ranks among the very highly climate-vulnerable districts in agricultural and socio-economic indices (high exposure due to rain-fed agriculture, poverty, and weak infrastructure). SAPCC and vulnerability assessments flag Dang as a priority for adaptation.
- **Erratic rainfall with poor retention:** Although the district historically receives high rainfall, the hilly terrain causes rapid runoff and poor groundwater recharge. Local monitoring and groundwater assessments cite an urgent need for recharge and runoff management.

- **Land-use and erosion risks:** Intense short-duration rains on steep slopes drive soil erosion and siltation, degrading commons and reducing productive topsoil, magnifying agricultural vulnerability. This is consistent with the observed climate impacts in southern Gujarat, as reported by SAPCC.

#### Selected data sources from the Gujarat State Action Plan on Climate Change (SAPCC) that inform Ahwa priorities

- Gujarat SAPCC identifies water resource management, climate-resilient agriculture, and ecosystem restoration as core adaptation themes for vulnerable districts. SAPCC recommends on-ground measures such as water harvesting, watershed management, and agroforestry<sup>13</sup>.
- District profiles (Gujarat Climate Tracker)<sup>14</sup> reveal Dang's high rainfall variability and socio-economic vulnerability indicators, underscoring the need for a focus on community water systems and livelihood diversification.
- CRIDA/ICAR<sup>15</sup> vulnerability assessments classify Dang among high agricultural-risk districts, reinforcing the need for climate-smart cropping and extension services.
- The CGWB district brochure<sup>16</sup> highlights groundwater scarcity driven by a lack of recharge in hilly catchments and recommends the installation of check dams and recharge structures.

#### SAPCC-aligned interventions recommended for Ahwa

Based on the SAPCC combined with the findings of this report, the following interventions are recommended for Ahwa

- **Runoff reduction & soil-water conservation (top priority)**
  - Build contour trenches, staggered trenches, check dams, percolation tanks, farm bunding and vegetative filters to slow runoff, trap silt, and enhance recharge (SAPCC emphasis: water resource management + catchment treatment).
- **Groundwater recharge & Bhungroo/managed aquifer storage pilots**
  - Pilot Bhungroo and subsurface recharge, where geology permits (proven in Gujarat contexts), to store monsoon runoff for Rabi/lean seasons. Link pilots to the community maintenance plan
- **Scale Farmer Field Schools (FFS) for climate-resilient agroecology**
  - Use FFS to teach mulching, soil organic matter, water-saving methods, intercropping, drought-tolerant millets/tubers and integrated crop-livestock systems (IFS) — matching SAPCC's agriculture adaptation goals.
- **Agroforestry & catchment restoration**
  - Combine reforestation with on-farm agroforestry to reduce erosion, sequester carbon and stabilise slopes (SAPCC / forest-land use synergy). Target degraded common lands and gullied catchments first.
- **Climate Advisory Services (CAS) + last-mile delivery**
  - Institutionalise CAS through KVKs / NAU and train Krishi Sakhis/CRPs to deliver seasonal forecasts, pest alerts and advisories to farmers — a core SAPCC recommendation to increase adaptive capacity.
- **Ecosystem-aware livelihood diversification & LAPA planning**

<sup>13</sup> GUJARAT STATE ACTION PLAN ON CLIMATE CHANGE GOVERNMENT OF GUJARAT CLIMATE CHANGE DEPARTMENT. (n.d.). Retrieved October 16, 2025.

<sup>14</sup> Sourced from the Gujarat Climate Tracker

<sup>15</sup> Sourced from ICAR- Central Research Institute for Dryland Agriculture

<sup>16</sup> Gupta, B. K. & Government of India Ministry of Water Resources Central Ground Water Board West Central Region Ahmedabad. (2014). GROUNDWATER BROCHURE THE DANG DISTRICT GUJARAT.

- Promote IFS, value chains for climate-resilient crops, and Local Adaptation Plans of Action (LAPAs) developed via Gram Sabhas to secure community ownership (SAPCC governance alignment).
- **Monitoring, mapping & institutional convergence**
  - Create a local dashboard (district/climate tracker style) for rainfall, groundwater, erosion hotspots, and canopy health; convene quarterly convergence cells (Agriculture, Water, Forest, and Tribal Welfare) as prescribed by the SAPCC.

## 3.2. Agroforestry, Forestry and NTFP

### 3.2.1. Agroforestry

To reiterate, agroforestry is an important practice in Ahwa and the larger Dang district of Gujarat, where most of the population is tribal and agrarian. Agroforestry systems in this high-rainfall region often combine field crops, fruit trees, and forest trees, providing food security and alternative income for small and landless farmers

#### Village-level Assessments

Focused Group Discussions (FGDs) conducted in the villages of Rawachod, Lahanchariya, and Vadiavan have revealed strong community interest and potential for promoting mixed horticultural interventions, particularly through planting fruit trees along agricultural field bunds. While this practice is already evident in several pockets, its adoption varies significantly across the three villages. Rawachod leads in the uptake of agroforestry due to lower migration, which allows farmers to invest time in the maintenance and watering required during the establishment phase. Lahanchariya exhibits moderate adoption, whereas in Vadiavan, where migration is high and household labour availability and water resources are scarce, such practices are almost absent.

#### Community Aspirations on Agroforestry

Tribal farmers in the Ahwa block of Dang district are increasingly aspiring to adopt agroforestry as a means to enhance their livelihoods and secure long-term benefits. Encouraged by the success of fellow farmers in nearby areas who have raised fruit-bearing trees and improved their incomes, many farmers are now keen to plant fruit trees such as mango, cashew, and custard apple on their own lands. They recognise the potential of agroforestry not only for income generation but also for improving soil health and environmental sustainability. However, they require support in practical areas, such as pit digging, the timely supply of quality plant material, and skill building in plantation and maintenance techniques. While they are aware that irrigation could be a significant challenge—especially during the dry summer months—they remain hopeful that with proper planning, support, and selective identification of suitable plots, agroforestry can become a viable and impactful option for their communities.

Through village discussions, a set of priority fruit species has been identified for integration into bund-based agroforestry systems: mango, custard apple, cashew, moringa (also known as drumstick), amla, and ber. These species are locally suitable, culturally familiar, and offer both nutritional and market value. Additionally, planting on bunds not only adds value through fruit production but also strengthens bund stability, which helps reduce surface runoff and soil erosion—aligning with the ridge-to-valley conservation approach.

#### Yield

The following table shows a comparative yield analysis of Dang district with Gujarat state and the country.<sup>17</sup>

Crop	Dang District (MT/Ha)	Gujarat Average (MT/Ha)	India Average (MT/Ha)
Mango	6.88	8.2	7.5
Custard Apple	7.01	9.3	7.8
Cashew Nut	1.06	1.4	1.2
Drumstick (Moringa)	0.00	12.0	9.0
Amla	5.75	7.1	6.4
Ber	7.14	10.2	8.0

**Table 3.6 – Comparative yield analysis of Dang with State and Country**

### Insights for each crop

#### Mango

- The yield in Dang (6.88 MT/ha) is below the state average in Gujarat (8.2 MT/ha) and slightly below the national average (7.5 MT/ha).
- This suggests opportunities for improving orchard management, improving pest control, and utilising superior planting material to increase mango productivity.

#### Custard Apple

- Productivity in Dang (7.01 MT/ha) is also lower than the Gujarat average (9.3 MT/ha) and the national average (7.8 MT/ha).
- There is potential to enhance yield through improved cultivation practices and farmer training, especially since custard apple can thrive well in the region's agro-climatic conditions.

#### Cashew Nut

- The yield in Dang (1.06 MT/ha) lags behind both Gujarat (1.4 MT/ha) and India (1.2 MT/ha).
- Cashew productivity can benefit from improved nut quality inputs, enhanced harvesting methods, and upgraded processing facilities.

#### Amla (Gooseberry)

- Yield in Dang (5.75 MT/ha) is lower than the Gujarat (7.1 MT/ha) and India (6.4 MT/ha) averages.
- Amla cultivation can be enhanced by implementing improved orchard care, adequate irrigation, and protection against pests and diseases.

#### Ber (Indian Jujube)

- Dang's productivity (7.14 MT/ha) is again lower than the averages for Gujarat (10.2 MT/ha) and India (8.0 MT/ha).
- There is an opportunity for yield improvement by adopting improved varieties and better farm management techniques.

<sup>17</sup> (Source: Director of Horticulture Data 2025)

## Analysis of Major Constraints Affecting Yields

The following challenges provide considerable challenges for yields.

- **Unavailability of Quality Saplings:** Access to good-quality, disease-free planting material remains a significant challenge for farmers in Ahwa.
- **Over-reliance on nurseries:** Many farmers rely on local nurseries, which often produce lower-quality saplings with poor survival and productivity rates.
- **Management Practices:** Lack of timely pruning, fertilisation, pest management, and nutrient management reduces the productivity of orchards and plantations. Further, knowledge gaps about modern agroforestry techniques and integrated pest management (IPM) contribute to suboptimal crop performance.
- **Unavailability of Water for Irrigation:** Ahwa's terrain is predominantly hilly and rain-dependent, leading to water scarcity during the dry and summer months. Limited access to irrigation infrastructure means that crops suffer water stress, particularly during critical growth stages, negatively impacting yields. Farmers have expressed concerns about the sustainability of irrigation options, as groundwater availability is low and surface water sources are limited.
- **Lack of an organised market:** Due to low fruit production, marketing channels and distribution networks remain underdeveloped, creating significant challenges for cultivating fruits, which are highly perishable commodities.

## Institutions

The institutional framework supporting agroforestry in Ahwa block largely overlaps with that of agriculture, as previously explained. However, each institution can play a distinct and strategic role in advancing agroforestry initiatives.

Self-Help Groups (SHGs) can be mobilised to take the lead in setting up and managing decentralised nurseries for fruit and multipurpose tree species. This not only ensures local availability of quality planting material but also creates livelihood opportunities for women.

Village Organisations (VOs) and Cluster Level Federations (CLFs) can play a vital role in facilitating access to credit, mobilising community contributions, and channelling financial subsidies for agroforestry activities. These platforms can also enable the coordination of collective planning and implementation of agroforestry on both individual and community lands.

Gram Sabhas and Gram Panchayats (GPs) have a critical role in integrating agroforestry promotion into the Gram Panchayat Development Plan (GPDP). They can identify suitable lands—both private and community-owned—for plantation and mobilise resources for essential activities such as pit digging, fencing, water harvesting, and maintenance. Inclusion of agroforestry in the GPDP ensures convergence with schemes such as MGNREGA, horticulture, and forest programs.

Farmer-Producer Organisations (FPOs) can contribute significantly to the post-harvest value chain by supporting the cleaning, grading, packaging, and marketing of fruits and other agroforestry products. Their aggregation capacity can help farmers realise better prices and connect to formal markets.

The Horticulture and Forest Departments play key roles in providing technical guidance and supplying high-quality planting materials, including saplings and seeds. They can also support capacity building and provide convergence support through their respective schemes.

By strengthening coordination across these institutions and building their capacities for agroforestry planning and implementation, a robust ecosystem can be created to scale agroforestry as a viable livelihood and ecological strategy in the region.

## Indigenous traditional knowledge in Livestock rearing

Tribal communities in the Ahwa block and the broader Dang district possess a rich heritage of traditional agroforestry practices. The 'Wadi' model, pioneered by the BAIF Development Research Foundation, has played a crucial role in promoting agroforestry among tribal farmers. This approach integrates fruit and multipurpose trees with annual crops, enhancing biodiversity and providing sustainable livelihoods.

Tribal farmers traditionally plant species like mango, custard apple, and cashew along field bunds, a practice that not only yields fruits but also aids in soil conservation and water retention. These indigenous methods align well with modern agroecological principles, emphasising biodiversity, sustainability, and resilience.

By blending these time-tested traditional practices with contemporary agroecological techniques—such as improved pit design, organic soil amendments, and efficient water management—there's significant potential to enhance agroforestry outcomes in the region. Such integration can lead to improved yields, environmental conservation, and strengthened livelihoods for the tribal communities of Ahwa block.

### Technology

In the Ahwa block of Dang district, agroforestry practices on farm bunds are primarily rooted in traditional, low-input methods. Most tribal farmers engage in bund planting using locally available tools and indigenous knowledge passed down through generations. Common species, such as mango, custard apple, amla, and ber, are planted manually on bunds without formal spacing or pit design. The use of farmyard manure is prevalent, but the systematic application of compost, biofertilizers, or mulching techniques is rare. There is minimal adoption of improved tools, irrigation systems, or soil enhancement practices. Farmers typically rely on seasonal rainfall, and irrigation support (such as drip or sprinkler systems) is largely absent, especially on upland plots.

Protection measures for young saplings—such as fencing or tree guards—are also limited, leading to frequent damage from grazing animals and wild fauna. Post-plantation care, such as pruning, pest management, or monitoring survival rates, is performed regularly due to limited technical knowledge and labour availability.

To enhance the impact and productivity of agroforestry on farm bunds, there is a clear need for:

- Training in scientific bund planting techniques (e.g., spacing, pit preparation, moisture conservation)
- Access to simple tools for digging, weeding, and pruning
- Water management solutions, including low-cost drip irrigation or gravity-based systems
- Affordable fencing or community-led protection systems
- Use of organic inputs like compost, mulching, and biopesticides to improve soil fertility and plant health
- Regular extension support and demonstrations to introduce agroecological practices and build confidence among tribal farmers

Blending these technological needs with the existing traditional systems can significantly improve survival rates, yields, and the long-term sustainability of agroforestry in Ahwa block.

### Prevalent Issues of Enterprises

In the Ahwa block of Dang district, several traditional and small-scale enterprises are centred on the collection, sale, and marketing of agroforestry-based fruits, including mango, custard apple, amla, cashew, and ber. These fruits are typically harvested by individual farmers and sold to local traders or in nearby markets. However, most farmers operate in isolation, with limited bargaining power and a

heavy dependence on intermediaries, resulting in low and unstable prices. Post-harvest handling is a significant constraint due to the lack of infrastructure for proper grading, sorting, packaging, and storage. Perishable fruits like custard apple and amla often suffer quality loss due to poor transportation and the absence of cold chain facilities. In terms of value addition, very few efforts exist, and those that do are usually informal, such as sun drying or basic home-level processing, without adequate hygiene or shelf-life management. These enterprises face additional challenges, including irregular yields due to climate variability and a lack of irrigation, frequent crop losses resulting from pest attacks and animal damage, and limited access to technical expertise. The absence of structured market linkages, poor awareness of government schemes, and weak convergence with departments like horticulture and tribal development further constrain the growth of these local enterprises.

## Enablers and Constraints

### Inputs

In the Ahwa block of Dang district, the availability and accessibility of quality inputs remain a critical factor influencing the success of agroforestry interventions. On the enabler side, there is a growing institutional focus from government departments such as horticulture and forest, which occasionally support the distribution of fruit saplings and agroforestry species through seasonal plantation drives. Schemes under MGNREGA and the Integrated Watershed Management Programme (IWMP) also provide scope for input-related support, such as pit digging and limited fencing. Farmers also benefit from traditional knowledge about selecting local species and enriching soil using farmyard manure.

However, several constraints persist. There is a severe shortage of locally available high-quality saplings, and farmers often rely on government nurseries located far from villages, which are limited in both quantity and species diversity. Seed availability for nursery-raising is poor, and most villages lack access to certified seed sources or community seed banks. Nursery materials such as grow bags, shade nets, and potting mixtures are either unavailable or unaffordable for individual farmers or SHGs interested in local propagation. Moreover, the use of organic fertilisers, compost, or bio-inputs remains minimal due to a lack of awareness, supply channels, and demonstration. Chemical fertilisers are also used sporadically, and rarely in appropriate doses due to knowledge gaps. The situation is worsened by the lack of regular extension support, meaning that farmers are often left to manage plantations without guidance on input application, pest and disease management, or spacing techniques.

### Extension

The extension services for agroforestry are gradually evolving, with the emergence of grassroots-level workers such as Prakruti Krishi Sakhis and NREGA mates playing essential roles. These women extension agents have been identified under various schemes to promote natural farming practices and coordinate MGNREGA activities related to land development and soil conservation. Their proximity to the community, familiarity with local languages and customs, and presence at the village level make them ideal enablers for disseminating knowledge, motivating, and monitoring agroforestry interventions. However, their role remains largely untapped and under-resourced. Most Prakruti Krishi Sakhis have limited exposure to agroforestry-specific knowledge—particularly on topics like species selection, planting techniques, bund stabilisation, and post-plantation care. Similarly, NREGA workers focus mainly on wage and attendance management, with little involvement in planning or quality monitoring of plantation works, such as pit digging or fencing. Both cadres often lack structured training in soft skills, technical competencies, and leadership, which limits their ability to inspire and guide farmers effectively. Strengthening these extension actors through regular capacity-building, practical exposure visits, and equipping them with field tools and visual aids could significantly enhance their effectiveness. Creating clear roles, accountability mechanisms, and linkages with

horticulture and forest departments will further institutionalise their contribution to agroforestry promotion in the block.

### **Market**

Market access for agroforestry-based produce in the Ahwa block remains a significant bottleneck, despite growing interest in fruit tree cultivation among tribal farmers. One of the key constraints is the perishable nature and short shelf life of many fruits grown under agroforestry systems—such as custard apple, amla, and ber—which require rapid post-harvest handling and transportation. However, the region lacks cold storage, grading, and basic processing facilities, leading to high post-harvest losses. Farmers also face transportation challenges due to the hilly terrain, scattered villages, and poor rural road infrastructure, especially during the monsoon season. The local markets in Ahwa are small and offer limited demand or price differentiation, which forces farmers to sell their produce in unorganised ways, often at low prices.

The dependence on intermediaries is widespread. These traders often purchase in bulk directly from farm gates or village-level aggregators but offer poor price realisation, taking advantage of farmers' limited bargaining power and lack of collective marketing mechanisms. There are very few structured market linkages with urban mandis or institutional buyers (e.g., schools, government nutrition schemes), and no operational farmer-run collection or aggregation centres. Additionally, value-added opportunities, such as drying, pulping, or packaging, are absent in the area, which limits income from lower-grade produce that could otherwise be processed.

On the enabler side, there is growing interest among Farmer-Producer Organisations (FPOs) and NGOs in linking producers to better markets. The proximity of Ahwa to towns like Vyara, Songadh, and Nashik also presents potential for establishing regional supply chains, if supported by logistics and aggregation infrastructure. Traditional knowledge of storage techniques, such as sun-drying amla or using mud-based storage for fruits, can also be harnessed and improved with scientific methods. Furthermore, the increased focus on promoting tribal produce through government and CSR initiatives can open up market opportunities if branding, certification (e.g., organic, tribal), and institutional support are provided.

To overcome these challenges, there is a need for investments in rural aggregation centres, decentralised processing units, cold storage, and farmer-level training in grading and packaging. Equally important is to strengthen producer institutions, such as SHGs and FPOs, for collective marketing and enable them to negotiate better prices through direct linkages with wholesale buyers or e-commerce platforms. With the right mix of infrastructure, institutional support, and skill development, market access for agroforestry in Ahwa can be significantly improved.

### **Connection with other domains**

Ahwa block, with its hilly terrain, rainfed agriculture, and traditional knowledge systems, offers significant potential for promoting mixed cropping systems that integrate fruit trees, seasonal crops, and fodder species. This approach aligns with agroecological principles, helping to diversify income, improve soil health, and enhance climate resilience for tribal farmers.

**Fruit Trees and Seasonal Crops:** The practice of planting fruit trees such as mango, custard apple, amla, ber, and cashew along field bunds or in alley formations allows farmers to continue cultivating short-duration crops in the interspaces. During the initial 3–5 years, when the fruit trees are still establishing, there is ample sunlight and space to grow millets, pulses, maize, or vegetables like okra and brinjal. This combination not only optimises land use but also provides regular seasonal income while the trees mature. Intercropping also helps with weed suppression, improves the microclimate, and supports soil organic matter through the diversity of its root systems and biomass.

**Fruit Trees and Fodder Cultivation:** Agroforestry plots can be effectively integrated with fodder grasses or tree fodder species, such as moringa (also known as drumstick) and subabul, which are nutritious and well-suited for small livestock. Cultivating grasses such as Napier or Stylosanthes in the interspaces of orchards can support stall-fed goat and cattle rearing, a common practice among tribal households. The combination of fruit trees and fodder supports year-round biomass availability, reduces dependence on forest grazing, and strengthens livestock-based livelihoods.

**Ecological and Livelihood Benefits:** Mixed cropping systems enhance nutrient cycling, mitigate the risk of total crop failure under erratic rainfall, and establish ecological buffers against pests and diseases. For small and marginal farmers in Ahwa, they offer a low-risk, sustainable model that builds on existing practices while adding new livelihood streams. In addition, fodder integration can reduce women's drudgery by minimising the time spent on collecting grass from forests.

### Current Government Schemes

Several ongoing government schemes in Gujarat offer strong opportunities to support and scale agroforestry initiatives in Ahwa block, notably when strategically converged at the village level. Under the State Horticulture Mission and the centrally sponsored MIDH (Mission for Integrated Development of Horticulture), farmers can access subsidies for fruit saplings, plantation material, and orchard development. The Gujarat Forest Department, through its Joint Forest Management (JFM) programs and Vanbandhu Kalyan Yojana, also promotes tree-based livelihoods and can provide technical and planting support for indigenous species. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) remains a powerful tool for financing labour-intensive activities essential to agroforestry, such as pit digging, fencing, and soil and water conservation structures, particularly when aligned with the Gram Panchayat Development Plan (GPDP). Additionally, the Krushi Mahotsav initiative and Natural Farming promotion campaigns provide platforms for awareness-building and capacity development. The Gujarat Livelihood Promotion Company (GLPC), under the National Rural Livelihoods Mission (NRLM), can mobilise SHGs and federations to manage nurseries, distribute inputs, and offer credit support. When effectively converged, these schemes can collectively address key input, labour and institutional gaps and catalyse agroforestry adoption across the Ahwa block.

### Climate Challenges

Agroforestry holds significant promise as a nature-based solution to address the growing climate-related challenges. The region, part of the Western Ghats, is increasingly experiencing erratic rainfall patterns, prolonged dry spells, delayed monsoons, and intensified soil erosion, all of which affect the productivity of rainfed agriculture and the availability of water and fodder. Additionally, heat stress, declining groundwater levels, and increased pest incidence have made traditional farming systems more vulnerable and less predictable.

Agroforestry systems—especially those involving fruit trees integrated with crops and fodder species—can act as a climate buffer by improving microclimates, stabilising soils, and increasing water retention in the landscape. Tree canopies reduce surface temperature, limit evapotranspiration, and create shade that protects understory crops and reduces moisture stress. Their deep root systems enhance groundwater recharge and drought resilience, especially when combined with soil and water conservation measures, such as bunding and farm ponds, under the MGNREGA.

By diversifying income sources—through fruits, fodder, and intercrops—agroforestry mitigates economic risks associated with crop failure due to weather variability. It also provides year-round biomass for composting and mulching, improving soil fertility and water-holding capacity, which are essential for adaptive farming. Additionally, the inclusion of climate-resilient species, such as amla, custard apple, ber, and moringa, enhances system stability and nutritional security.

To make agroforestry models in Ahwa truly climate-resilient, the following elements should be built into the design:

- Selection of drought-tolerant, native, and multi-purpose tree species
- Micro-catchment-based water harvesting and irrigation solutions (e.g., pitcher irrigation, drip, trench bunds)
- Integration of agroecological principles, such as intercropping, organic soil amendments, and local seed diversity
- Community-based monitoring to track survival, water use, and climate impacts
- Capacity building and local climate literacy to help farmers adapt practices based on seasonal forecasts and variability

Incorporating agroforestry into broader village-level climate adaptation and GPDP plans can help transition Ahwa's farming systems from vulnerability to resilience—ensuring sustainable livelihoods, ecological regeneration, and improved adaptive capacity in the face of a changing climate among tribal communities.

### 3.2.2. Forests and NTFP

Provided the dense forest coverage in Ahwa and considerable scope for NTFP, this section details various practices, the scope and challenges for NTFP and the involvement as well as aspirations of community groups in the region.

#### Assessment of current practices and aspirations

Field visits across the three study villages—Rawachod, Lahanchariya, and Vadiavan—revealed that "Malki" practices dominate the forest landscape, with a heavy emphasis on teak monoculture plantations. While these plantations offer regulated access to timber—allowing households to harvest five teak trees every five years in exchange for planting three to five times more—the overwhelming focus on teak has led to a gradual decline in the availability of Non-Timber Forest Products (NTFPs). The loss of native species diversity not only threatens traditional livelihoods but also reduces the ecological resilience of the forest ecosystem. Discussions with local communities and the AKRSP(I) team highlighted a strong interest in restoring forest biodiversity through community-led plantation drives, utilising native and economically valuable species such as bamboo, Mahua, Sadar, Harda, Baheda, and Timru.

#### Aspirations and Ambitions of the Community

In all three villages, there is a growing aspiration among community members to move beyond teak monocultures and foster more ecologically diverse and economically beneficial landscapes. People expressed a strong desire to see a variety of native trees, fruit-bearing species, and plants with medicinal or NTFP value planted across village common lands, including degraded forest patches, school premises, and community spaces. This ambition reflects a collective vision for regenerating biodiversity, enhancing climate resilience, and revitalising traditional livelihoods tied to forest products, while also creating a greener, more vibrant environment for future generations

#### Institutions- Challenges and Prospects

An analysis of secondary documents reveals that the implementation of the Forest Rights Act (FRA) in Gujarat's Dang district, particularly in Ahwa block and the Saputara Hills, continues to face significant challenges. Although Forest Rights Committees (FRCs) have been formed in 273 out of 311 villages, a large number of Individual Forest Rights (IFR) claims have been rejected by the District Level

Committee (DLC) due to alleged “insufficient evidence.” These rejections have triggered widespread protests by tribal communities, citing Section 4(5) of the FRA, which clearly prohibits evictions until all claims are thoroughly verified and resolved.

The implementation of Community Forest Rights (CFRs) has also been limited, undermining the spirit of collective forest governance. Despite the provisions of the Panchayats (Extension to Scheduled Areas) Act (PESA), which mandate local self-governance and natural resource management by Gram Sabhas, the actual decision-making authority often remains with external agencies. For example, the Gujarat State Forest Development Corporation (GSFDC) retains monopoly control over the collection and sale of Minor Forest Produce (MFP), thereby limiting both the autonomy and economic agency of Gram Sabhas. Additionally, schemes like the Green Credit Programme have resulted in the appropriation of community forest lands without prior consultation, further eroding the rights and trust of tribal communities.

Amid these institutional and governance gaps, villagers across Ahwa block express a strong aspiration to revitalise their Forest Protection Committees (FPCs) and reclaim their rightful authority under the FRA and PESA. They envision a future of community-led forest management, rooted in traditional knowledge, sustainable harvesting practices, and biodiversity conservation. Community-driven plantation drives featuring native, multi-use species such as bamboo, Mahua, Baheda, and Timru are seen as a pathway to regenerate degraded lands and secure both ecological and livelihood benefits.

### Women’s Current Role and Emerging Leadership in Forest Governance

While women in these forest-dependent communities are primary collectors and users of NTFPs, their participation in formal forest governance structures—such as FRCs, FPCs, or Gram Sabha decision-making—remains limited. Social norms, time poverty, and lack of capacity-building opportunities have historically kept women on the margins of institutional processes. However, field insights and conversations with village groups indicate a shifting mindset. Women are increasingly vocal about their dependence on forest produce for household income, nutrition, and traditional medicine. They are also showing greater interest in participating in plantation drives, MFP value addition, and conservation efforts.

A growing number of women’s Self-Help Groups (SHGs) have shown interest in establishing village-level forest nurseries, managing, and cultivating saplings of native and economically valuable species. These SHG-led nurseries not only provide planting material for community plantation drives but also offer women new livelihood opportunities and leadership roles. In some villages, SHG members are already taking the lead in organising climate-resilient plantation campaigns, ensuring the inclusion of diverse and locally beneficial species.

Going forward, women can and must play a more empowered role in forest governance. This includes:

- Ensuring 50% representation of women in FRCs and CSS.
- Organising women-led forest user groups for species-specific MFP collection and management (e.g., Mahua flowers, bamboo, timru leaves).
- Facilitating capacity-building on FRA, CFRs, biodiversity, and climate resilience for women leaders through targeted training and peer learning platforms.
- Supporting value chain development and market linkages for NTFPs managed by women-led SHGs and FPOs.
- Encouraging women’s leadership in Gram Sabha and forest planning processes to ensure their voices shape decisions around land use, plantation, and harvesting norms.
- Promoting SHG-led forest nurseries and plantation drives as a scalable model for ecological restoration, income generation, and gender empowerment.

## Enablers and Constraints

### Input- Forest species planting material

Currently, over 90% of the saplings provided by forest department nurseries are teak, primarily to support malki-based harvesting, which has resulted in the limited availability of other native species. This mono-cropping approach has contributed to declining forest diversity and ecological imbalance. However, there is strong potential to establish community-level nurseries that focus on a broader variety of forest and native species, in alignment with the horticulture nurseries referenced earlier. These nurseries can be designed and managed by communities to raise a diverse mix of trees, shrubs, and grasses that help restore the natural biodiversity and ecological richness of both village commons and forest areas.

To encourage widespread adoption, communities across the Ahwa block can be mobilised to participate in seasonal plantation drives on key days such as Van Mahotsav, World Environment Day, and other local festivals. These efforts can be further strengthened through collaborative planning with the Forest Department, which can provide technical support and help supply high-quality seeds of native species.

### Processing and Marketing of NTFPs

Currently, the processing of Non-Timber Forest Products (NTFPs) in the Ahwa block is minimal, with most products being sold in their raw and unprocessed form to local intermediaries at village haats. This lack of value addition severely limits the income potential of tribal collectors, who have no control over pricing and often receive a fraction of the market value. The absence of proper cleaning, grading, or packaging facilities, combined with an unstructured market system, leaves collectors vulnerable to exploitation and market volatility.

To address this, the envisioned Farmer-Producer Organisation (FPO) system, structured at both cluster and block levels, offers a transformative solution. At the cluster level, FPOs can be equipped to carry out basic processing tasks, such as cleaning, sorting, grading, and primary drying, thereby adding immediate value to the collected NTFPs. At the block level, more advanced infrastructure and technical support can enable secondary processing, packaging, labelling, and bulk storage, significantly improving product shelf life, quality, and market appeal. This two-tiered model not only enhances price realisation for producers but also opens pathways for direct marketing, aggregation, and collective bargaining, reducing dependency on intermediaries.

### Ongoing Initiatives that can be leveraged

To enhance forest biodiversity and increase the availability of Non-Timber Forest Products (NTFPs) in Dang district, Gujarat, several government and other programs and schemes can be leveraged. The following are a few key programmes.

**Gujarat Forestry Development Project (GFDP):** Implemented in collaboration with GIZ, this project focuses on restoring degraded forests and improving livelihoods in tribal areas, including Dang. It emphasises sustainable forest management and biodiversity conservation.

**Pradhan Mantri Van Dhan Yojana (PMVDY):** This scheme aims to enhance the income of tribal communities by establishing Van Dhan Kendras for value addition, branding, and marketing of NTFPs. It provides skill training and capacity building to tribal gatherers.

**Global Centre for Bamboo and NTFP Promotion (GCBNTP):** GCBNTP focuses on the sustainable development of NTFPs, particularly bamboo and medicinal plants, by providing knowledge, research, training, and collaboration opportunities to empower communities and enhance conservation efforts.

## Climate Challenges

Climate change poses significant threats to forest ecosystems in Dang district, including increased temperatures, erratic rainfall patterns, prolonged dry spells, and heightened vulnerability to pests and diseases. These changes not only degrade forest health but also undermine the ecosystem services that local communities rely on—such as water regulation, soil fertility, carbon sequestration, and biodiversity.

### **Role of Forest Species Plantation in Climate Change Mitigation**

Rejuvenating degraded forest landscapes through the plantation of diverse native tree species is a powerful strategy to arrest climate change locally and contribute to broader climate goals. Forests act as significant carbon sinks, absorbing atmospheric carbon dioxide through photosynthesis and storing it in biomass and soils. The restoration of forest cover, especially with multipurpose native species like bamboo, Mahua, Baheda, Harda, and Timru, enhances this carbon sequestration potential while improving biodiversity and ecosystem resilience.

In addition to carbon storage, healthy forests regulate local microclimates by maintaining humidity levels, reducing soil erosion, supporting water cycles, and buffering communities against extreme weather events such as floods and droughts. Thus, forest restoration serves as both a climate mitigation and adaptation strategy, providing ecological stability and safeguarding the livelihoods of communities dependent on forest resources.

### **Climate-Resilient Approaches to Plantation Interventions**

To maximise the climate resilience of forest plantation efforts in Ahwa block, interventions must be carefully designed with the following principles:

- **Species Diversity and Native Selection** Prioritise a mix of native tree and shrub species that are adapted to local climatic and soil conditions, ensuring varied root depths and canopy structures to improve overall ecosystem stability and pest resistance.
- **Community-Led Nursery Development:** Support SHGs and village nurseries in growing healthy saplings, including drought-tolerant and fast-growing species, to ensure a steady supply of planting material suited to changing climate patterns.
- **Water Conservation Measures:** Integrate water harvesting techniques, such as contour trenches, check dams, and mulching, into plantation sites to retain soil moisture and improve seedling survival during dry periods.
- **Adaptive Planting Calendars:** Align planting activities with seasonal rainfall forecasts to enhance seedling establishment and reduce mortality from unexpected weather shocks.
- **Participatory Monitoring and Adaptive Management:** Engage local communities, especially women's groups, in monitoring growth, pest outbreaks, and survival rates, using this data to adapt species choice, planting density, or maintenance practices over time.
- **Awareness and Capacity Building:** Train community members on the impacts of climate change, sustainable harvesting practices, and forest conservation to foster long-term stewardship and resilience.

## **3.3. Animal Husbandry**

### **3.3.1. Village-level Assessments- Species, Socioeconomic Role, and Farmer Aspirations**

In the forested and hilly landscape of Ahwa block in Dang district, livestock rearing plays a vital role in the livelihoods of tribal farming households, complementing rainfed agriculture. While agriculture is primarily a source of food security, livestock serves as a critical source of cash income, used to meet everyday household expenses, social obligations, and emergencies. However, the emphasis on

income generation sometimes overshadows the nutritional value of livestock products, particularly their contribution to protein intake in the diets of tribal populations.

Farmers in Ahwa rear a diverse range of livestock, including indigenous cattle (Kankrej, Dangi), goats, buffaloes, and desi poultry, such as Kadaknath chickens, as well as exotic breeds like Rhode Island Reds (RIR), which are promoted through the veterinary department. Goats and poultry are primarily raised using traditional methods, with minimal veterinary or extension support. These species are valued for their low maintenance, adaptability to local conditions, and their cultural and economic relevance. In dairy, however, farmers are increasingly aspiring to shift from indigenous breeds to high-yielding breeds such as Jersey, Sahiwal, Gir, or HF cross-breeds, especially where infrastructure and market linkages are improving.

A transparent village-level gradient in livestock ownership was observed. In Rawachod, a progressive village with lower migration rates, livestock holding per household is relatively high, including cows, buffaloes, goats, and poultry. This is enabled by better water availability and household labour, as more family members stay back in the village. In Lahanchariya, livestock ownership is moderate, correlating with seasonal migration patterns and water stress. In Vadiavan, however, where migration is significantly high and water availability is scarce, livestock numbers are extremely low. The absence of family members at home limits the ability to manage and maintain animals.

A significant enabler in the region has been the entry of Vasudhara Dairy, which has established local milk collection routes and provided structured support for dairy development. This includes feed supply, extension services, training, and financial linkages to facilitate the purchase of improved dairy animals. The dairy's presence has catalysed the shift towards commercial dairy farming, particularly in villages like Rawachod, where several households have already adopted this livelihood model. Farmers view these interventions as game-changers and aspire to access market-linked, technically supported livestock-based livelihoods.

### **Aspirations and Ambitions of Villagers on Livestock Rearing**

In the Ahwa block of Dang district, livestock rearing is viewed not only as a traditional activity but also as a key pathway for enhancing livelihoods and ensuring economic stability among tribal households. Villagers aspire to move beyond subsistence practices and develop livestock-based enterprises that are market-linked and technically supported. There is growing interest in upgrading from local breeds to high-yielding dairy animals such as Jersey, Sahiwal, or HF crosses, particularly in areas with improved infrastructure and access to services. The success of Vasudhara Dairy in establishing milk collection systems and providing training, inputs, and financial linkages has inspired many farmers—especially in Rawachod—to envision livestock rearing as a primary source of income. Additionally, the continued preference for small ruminants and indigenous poultry reflects both cultural attachment and the practicality of low-input systems suited to the terrain. However, villagers also recognise the challenges posed by seasonal migration, water scarcity, and limited veterinary support. Their aspirations clearly point toward a future where livestock plays a central role in resilient, diversified, and sustainable rural livelihoods—provided that enabling support systems are expanded and aligned with their evolving needs.

### **Perspective of the Government on Promoting Livestock Rearing**

At the state level, the Department of Animal Husbandry and Dairying promotes livestock development through schemes that support breed improvement, veterinary services, fodder development, insurance, and dairy infrastructure. Key schemes such as the Kisan Kalpataru Yojana, Cattle Insurance Scheme, and subsidies under the Vanbandhu Kalyan Yojana are tailored to meet the needs of Scheduled Tribe (ST) populations in districts like Dang.

One of the most innovative grassroots-level strategies has been the deployment of Pashu Sakhis—women para-veterinary workers selected and supported under the Gujarat Livelihood Promotion Company (GLPC) and trained in collaboration with the District Veterinary Department. These community-based animal health workers are trained in basic veterinary care, vaccination, first aid, deworming, and livestock management. Their proximity to and trust within the community enable them to provide timely, gender-sensitive livestock extension services, especially in remote and underserved areas where access to formal veterinary infrastructure is limited. |

In parallel, institutions like Vasudhara Dairy, supported by the Gujarat Cooperative Milk Marketing Federation (GCMMF), have established milk collection routes and provide technical and market support for dairy farmers. These interventions have also increased farmers' aspirations to shift from traditional cattle breeds to higher-yielding exotic varieties, such as Jersey, as well as high-yielding indigenous breeds like Sahiwal and Gir, particularly for commercial dairy enterprises. Through these linkages, farmers also receive access to animal feed, training, and credit support, facilitating the gradual transition from subsistence to semi-commercial livestock farming.

The government is also converging schemes, such as the Rashtriya Krishi Vikas Yojana (RKVY), the National Livestock Mission (NLM), and the National Dairy Development Programme, to support infrastructure development, fodder cultivation, and credit-based livestock enterprises through SHGs and FPOs. Increasingly, there is also a focus on climate-smart livestock practices, such as stall feeding, pasture development, and integration with biogas and compost systems.

### 3.3.2. Productivity of Livestock

During our field visit, we observed the variation in livestock ownership and productivity across villages, with livestock contributing as much as 60-70% of net cash income in better-off households—particularly in Rawachod, where migration is low, water availability is better, and Vasudhara Dairy services are accessible. In contrast, this contribution is moderate in Lahanchariya and negligible in Vadiavan, where high migration and lack of local caretakers and water resources limit livestock rearing. This correlation illustrates that livestock income is a strong indicator of household prosperity, and focused interventions in this sector have the potential to significantly reduce distress migration by increasing year-round cash flow.

Livestock productivity in Ahwa block, particularly in terms of milk and meat yield, varies significantly depending on the breed, availability of feed and fodder, and access to animal health services. The indigenous Dangi breed of cows, though well-adapted to the local terrain, has very low productivity, yielding around 2 litres of milk per day, and only under optimal conditions—typically during the Kharif season when green fodder is available. The milk is mainly used for consumption purposes. In contrast, crossbred and exotic cattle breeds, such as Jersey and Holstein Friesian (HF), and indigenous high-yielding varieties, such as Sahiwal and Gir, which have undergone gradual naturalisation through successive hybridisation, have proven to be more productive under current conditions. The average milk yield for crossbred cows is around 7.6 litres/day, while buffaloes yield approximately 6.3 litres/day. However, even these yields are constrained by the seasonal availability of fodder, particularly during the post-Kharif and summer months. Farmers typically cultivate fodder during the Kharif season and, where irrigation is available, continue to do so during the Rabi season. Commercial dairy farmers also rely on cattle feed from Vasudhara Dairy; however, this is not uniformly accessible to all households.

Improving livestock productivity requires addressing the fodder scarcity that undercuts yields, alongside addressing health (mastitis), false/ missed heat cycles, protein and micronutrient deficiencies, etc. Enhancing pastureland development in forest fringes and commons, promoting

integrated fodder cultivation, and expanding irrigation coverage help ensure year-round availability of quality feed. The dry fodder is, anyway, accessed through the Vasudhara Dairy. Equally important is the evolving role of Pashu Sakhis, who, when effectively trained and supported, can provide critical services such as vaccination, disease management, and animal health advisory. Currently, this support system is still in its early stages of development. Still, collaboration between Pashu Sakhis, veterinary clinics, and mobile veterinary units has the potential to transform livestock management and reduce preventable losses.

Regarding goat rearing, the government's 10+1 goat distribution programme has generated interest among smallholders. However, the ideal Suratiya breed, known for its suitability in crossbreeding, is rarely available in the region. This calls for identifying and promoting healthy Dangi goats for breeding purposes. A significant challenge is the restriction on free-ranging due to forest regulations, which limit feeding opportunities for animals. This makes the case for exploring community-based goat rearing systems where shared, grazing and feeding arrangements can be organised. Currently, goat-related extension and veterinary support is minimal, leading to frequent disease outbreaks and high mortality rates—issues that can be mitigated through better coordination between government services and trained Pashu Sakhis.

Poultry rearing, predominantly indigenous or desi chicken, holds significant untapped potential in the Ahwa block. There is strong market demand in local areas and nearby urban centres such as Saputara, Nashik, and Mumbai, where non-vegetarian consumption is high. However, the absence of local hatcheries for desi birds and the lack of brooding facilities have resulted in a poor availability of good-quality, healthy chicks. As a result, most households maintain tiny flocks (typically under 10-20 birds), which are highly vulnerable to disease and mortality. The situation is further exacerbated by the lack of extension services, timely vaccination, and veterinary care, resulting in frequent disease outbreaks and discouraging farmers from scaling up their operations. Despite these challenges, there is a clear aspiration among tribal households to expand poultry rearing as a reliable source of income. Scaling up to flock sizes of 50–100 birds per household could make the enterprise economically viable and encourage better investment in housing, preventive healthcare, and feed management. With proper veterinary support, vaccination drives, and practical training, desi poultry farming can evolve into a low-input, high-return livelihood option that is especially suitable for women and landless families.

## Institutions

In the Ahwa block, institutional support in the dairy sector is relatively well-established, primarily through the efforts of *Vasudhara Dairy*, which has successfully institutionalised the dairy value chain by promoting Dudh Mandalis—village-level milk cooperative societies registered under cooperative norms. Women play a central role in these Mandalis as primary caregivers and managers of livestock, as well as active members of the cooperative societies. They organise themselves through regular meetings, taking leadership in milk collection, quality monitoring, and collective decision-making. This involvement not only empowers women economically but also strengthens the overall dairy value chain. *Vasudhara Dairy* further supports farmers by providing access to fodder, feed, veterinary services, and financial linkages at the village level, enabling even small and marginal farmers, particularly women, to engage confidently in the formal dairy economy.

In contrast, goat rearing and poultry lack similarly structured institutional frameworks in the region. However, women remain the primary managers and caregivers of poultry stock, and they play an equally important role in goat rearing. Their involvement through Self-Help Groups (SHGs) positions them well to access credit and financial services, which are critical for scaling up these livelihood activities. Strengthening women's participation in SHGs and linking these groups to formal financial

institutions can enhance access to government subsidies and loans under schemes targeting small ruminants and backyard poultry.

To bridge the existing gaps, AKRSP(I)-promoted Farmer-Producer Organisations (FPOs) offer a promising platform to develop dedicated goat and poultry verticals, with women's leadership embedded at all levels. These verticals can focus on aggregation, input supply, healthcare services, and market linkages, creating a comprehensive support system. Demonstration units for both dairy and poultry at the cluster level can serve as practical learning hubs, building farmer confidence and showcasing successful models. Promoting women's capacity-building through targeted training on animal health, management, and entrepreneurial skills—delivered via SHGs, FPOs, and youth-led initiatives—will be crucial to scaling these enterprises.

Furthermore, enhancing women's institutional involvement can be achieved by fostering their representation in the governance bodies of VOs (Village Organisations), CLFs (Cluster Level Federations), and FPOs, thereby ensuring their voices influence planning and resource allocation.

### Indigenous traditional knowledge in Livestock rearing

In the tribal landscape of Ahwa block, Dang district, indigenous and traditional knowledge (ITK) plays a vital role in livestock, goat, and poultry rearing. These practices are deeply rooted in generations of experience and ecological wisdom, offering low-cost, sustainable solutions adapted to the region's terrain and resource limitations. Farmers traditionally rear the Dangi and Kankrej cattle breeds, which are valued for their hardiness and ability to survive on minimal feed. Herbal remedies, including those made from neem, turmeric, garlic, and tulsi, are commonly used to treat wounds and illnesses. Additionally, smoke from dried leaves is employed to repel pests. Feeding practices rely on crop residues and forest grasses, with homemade supplements such as jaggery and sesame cake provided during lactation. For goat rearing, free-range grazing in forest fringes remains a common practice, with indigenous Dangi goats being preferred for their resilience. Ethnoveterinary treatments, such as turmeric paste and dung-smoke enclosures, are used to prevent infections. Traditional bamboo sheds offer safe and dry housing, especially during monsoons. Poultry rearing follows a scavenging model, with desi chickens raised freely around homesteads, feeding on grains, insects, and kitchen waste. Broody hens are used for natural hatching, and ash or charcoal is used for deworming and disease prevention. These systems, although low-input and sustainable, also significantly contribute to household nutrition and income. However, these practices are increasingly under pressure due to shrinking grazing areas and a lack of institutional support. Recognising the value of this knowledge and integrating it with modern veterinary care, breed improvement, and extension services—particularly through trained Pashu Sakhis and FPOs—can enhance productivity while preserving the ecological and cultural richness of traditional animal husbandry practices.

### Prevalence and Issues of Enterprises

In the Ahwa block, livestock rearing is primarily practised at the individual household level, often in a subsistence-oriented and low-scale manner. The activity is rarely viewed as an enterprise, and the enterprising spirit among livestock owners remains low due to limited volumes, weak market access, and minimal aggregation. Most households rear animals to meet their immediate and emergency cash needs, rather than as a planned livelihood strategy. The exception to this is dairy farming, which has begun to evolve into a micro-enterprise model, particularly among farmers linked to Vasudhara Dairy. These farmers supply milk regularly through established milk routes and benefit from structured input and veterinary support—making dairy the only form of livestock-based enterprise currently functional at a commercial scale.

However, there is significant untapped potential to develop micro-enterprise models in goat and poultry rearing as well. With the proper training, veterinary extension, feed and input services, and market linkages, these traditional activities can be transitioned into viable, income-generating enterprises. Importantly, institutional structures such as Farmer-Producer Organisations (FPOs) at the cluster or block level can play a catalytic role by aggregating producers, facilitating input supply, and enabling collective marketing, as well as facilitating linkages with market aggregators. While such structures exist in the dairy sector, they are currently absent in goat and poultry value chains. Strengthening FPOs or developing dedicated livestock verticals within them can unlock economies of scale and entrepreneurial pathways for tribal farmers, especially women and youth.

## Enablers and Constraints

### Inputs

At the level of inputs, the most prominent enabler for commercial dairy in Ahwa block is the Vasudhara Dairy, which offers a well-established market linkage through dedicated milk routes, doorstep payments, and an integrated package of services including veterinary care, AI support, fodder and feed supply, and facilitation of financial access. This bundled support system has made dairy farming relatively more viable and attractive, especially for those already part of the cooperative network.

However, scaling dairy operations still poses a significant challenge due to high upfront investment requirements. While many farmers aspire to enter dairy farming, they lack the financial capital to purchase even a single cow. Although the District Veterinary Department, under the Tribal Sub Plan (TSP), provides a 50% subsidy (up to ₹47,500 for a unit cost of ₹95,000), this is a reimbursable subsidy. Farmers are required to make the initial investment, submit bills and vouchers, and then claim the subsidy—a process that excludes the poorest households who cannot afford to invest upfront. The district plans to support 4,000 dairy units under the TSP, including 1,000 units in Ahwa block; however, many of these subsidies remain underutilised due to inaccessible financing. A potential solution would be to establish a revolving fund mechanism that can front-load the investment for the purchase of livestock and related infrastructure. Once the subsidy is reimbursed, the fund can be replenished, unlocking both the capital and the benefits of government schemes for scaling dairy operations.

In the case of goat rearing, input challenges are even more complex. The government offers support for establishing 10+1 goat units (10 female goats + 1 buck) with a subsidy ranging from ₹45,000 per unit to ₹90,000, costing again on a reimbursable basis. However, quality breeding stock—such as the Surati or a healthy Dangi goat—is rarely available, making herd quality a significant bottleneck. As with dairy, the requirement to first invest in animals, shed construction, and feed before accessing the subsidy prevents most smallholders from participating. A revolving fund, as proposed above, could facilitate initial investment and attract more farmers to goat-based livelihoods.

For poultry, a significant constraint is the limited availability of quality Day-Old Chicks (DoCs). Many tribal households wish to expand their flocks from the usual 5–10 birds to 20, 50, or even 100, but face challenges in accessing healthy, vaccinated chicks. A viable solution is to establish cluster- or Gram Panchayat-level breeding and brooding units managed by trained *Pashu Sakhis* and trained poultry rearers. These units would maintain breeding flocks at an optimal ratio of 1 male to 8–10 females, enabling natural hatching. The resulting chicks would be brooded for 14–21 days under proper vaccination and care before being sold to poultry growers. By supplying stronger, semi-mature chicks, this model would significantly reduce early-stage mortality, support flock expansion in line with available grazing resources, and encourage sustainable backyard poultry development. Over time, such community-managed units can ensure a consistent supply of high-quality birds, improving both income and nutritional security in tribal areas.

## **Extension and Management Process**

Currently, veterinary care services in Ahwa block are primarily focused on large ruminants, especially cattle. The block is supported by approximately 10 Artificial Insemination (AI) centres and veterinary dispensaries, which provide AI services, first aid, and emergency support. In addition, 10 Mobile Veterinary Vehicles (MVVs) operated by GVK extend reach to more remote areas. However, despite the presence of this infrastructure, feedback from village-level interactions in Rawachod, Lahanchariya, and Vadiavan suggests that access to timely and consistent veterinary advisory and support remains inadequate—particularly for small ruminants and backyard poultry.

The recently recruited and trained Pashu Sakhis, though promising as community-based animal health workers, are yet to be fully integrated into the local veterinary extension system. Their roles within villages and Gram Panchayats are often loosely defined, resulting in limited engagement. Nonetheless, they hold great potential to offer doorstep advisory services for cattle, goats, and poultry—particularly under the technical supervision of veterinary doctors and dispensary-based staff. In AKRSP-supported villages, where Pashu Sakhis have received basic training, their presence has filled critical gaps in livestock care. However, these instances are isolated and not yet institutionalised across the block.

To unlock their full potential, Pashu Sakhis require regular technical training, ongoing mentoring, and clearly defined roles and responsibilities. Currently, they work in isolation, often with unclear payment arrangements, limited recognition, and a lack of a structured support system. Providing performance-based incentives, professional development opportunities, and a block-level platform for peer learning and support would strengthen their motivation and expertise. Such a platform should include regular review meetings, exposure visits, and knowledge-sharing sessions facilitated by veterinary experts. It should also serve as a forum where Pashu Sakhis can raise field-level challenges and receive practical guidance from the technical team.

Institutionalising the role of Pashu Sakhis through better coordination with the Veterinary Department, clear supervision frameworks, and formal recognition within livestock development programs will be essential to ensuring last-mile service delivery—particularly for underserved and remote tribal communities in Ahwa block.

## **Market**

The milk marketing system in Ahwa block is relatively well-developed, primarily facilitated through the Vasudhara Dairy's structured collection network. Most villages are connected to the milk routes, and road connectivity is generally good, which supports regular milk pickup and timely payments. However, a few interior villages located farther from main roads are still not part of the collection loop. With strategic coordination and discussions involving block and district authorities, the inclusion of these villages could be achieved by improving last-mile road infrastructure and extending existing milk routes.

As dairy expansion continues, accessing quality cow breeds becomes increasingly critical. Procuring high-yielding, disease-resistant cattle can be challenging, especially if demand scales rapidly. In this context, organisations like BAIF, which operate in neighbouring blocks and have deep experience in livestock development, could be valuable partners. BAIF also organises cattle fairs, where farmers can interact directly with sellers, examine livestock, and make informed purchases. Organising similar livestock trade events within Dang district could provide safe, transparent, and cost-effective avenues for expanding dairy herds.

In contrast, marketing systems for goats and poultry remain largely unorganised and fragmented. As these sectors begin to scale, Farmer Producer Organisations (FPOs)—both at cluster and block levels—will need to play a central coordinating role. For poultry, challenges lie not only in marketing the final product but also in sourcing inputs, such as quality day-old chicks, feed for mother units, and fertile eggs for hatcheries. These require centralised planning and logistical coordination, which the FPOs are well-positioned to manage. Additionally, the marketing of desi birds—which are in high demand in nearby markets such as Saputara, Nashik, and Mumbai—should be handled collectively to ensure fair prices, a steady supply, and efficient transportation.

Similarly, the marketing and procurement of goats for setting up enterprises needs a coordinated system. This includes identifying reliable breeders, facilitating bulk purchases, and ensuring transparent pricing. The FPOs can also act as aggregators, enabling collective sales of goats in regional livestock markets and organising platforms for breed selection and veterinary screening. To ensure success, these institutions must be supported with technical assistance, market intelligence, and infrastructure—such as holding sheds, transport services, and weighing and grading facilities.

In conclusion, while dairy marketing is well-established, the goat and poultry sectors require institutional strengthening, input coordination, and market access planning to fully realise their potential. Empowering FPOs to play a central role in marketing, both upstream (inputs) and downstream (sales), will be key to unlocking the full potential of livestock-based enterprises in Ahwa block.

## **Insurance**

Gujarat provides livestock risk coverage through centrally sponsored mechanisms under the National Livestock Mission (NLM) and state-level animal husbandry programmes, implemented locally by the Directorate of Animal Husbandry and the Gujarat Livestock Development Board (GLDB). The NLM's Risk Management & Insurance component subsidises premiums so smallholders can insure cattle and buffaloes (with centrally funded premium support and state facilitation), and Gujarat now also offers state compensation/assistance channels that complement central schemes; applications are processed online through portals such as i-Khedut and the DOAH web portal.

On the ground in Ahwa block, practical delivery has two promising features: (a) recent app-based enrolment and claims pilots in Gujarat (which cut claim settlement times from weeks to days) demonstrate that mobile enrolment linked to community-level mandlis/FPOs can be effective; and (b) local agencies (ATMA, GLDB, Pashu Sakhis) can act as last-mile facilitators to register animals, verify ownership and assist with documentation. These approaches are particularly suited to Dang's dispersed tribal settlements.

However, several implementation challenges constrain meaningful coverage in Ahwa: limited farmer awareness of insurance products and benefits; tenure and documentation gaps (many tribal households rear animals on common or forest lands and lack formal records required for enrolment); rugged terrain and poor connectivity that slow field verification and veterinary inspection; limited veterinary infrastructure and staffing for timely mortality diagnosis; and product design gaps (low coverage for small ruminants, backyard poultry and draft/working animals which are essential in tribal livelihoods). Premium affordability and reach remain issues despite subsidies, especially for mixed or high-value animals. These operational realities have been repeatedly flagged in state implementation reviews and independent evaluations.

To improve uptake and effectiveness in Ahwa, state and district actors should scale the app-based model, task ATMA / Pashu Sakhis / CRPs to run door-to-door enrolment drives, and use FPOs/mandlis

to aggregate members for group policies (reduces transaction costs). Where ownership records are weak, the programme should accept locally certified ownership (Gram Sabha/Panchayat certificates) and utilise community verification to expedite claims. Strengthening veterinary outposts (for rapid post-mortem / cause-of-death certification) and piloting index-based or parametric products for small ruminants/ backyard poultry can broaden protection. Finally, transparent grievance redressal and prompt payouts—enabled by digital claim workflows and regular public reporting—are essential to build trust among tribal livestock rearers.

### Connections with Other Domains

In the forested, hilly terrain of Ahwa block in Dang District, livestock rearing is integral to the tribal livelihoods, complementing rain-fed agriculture. Livestock primarily provides cash income for daily expenses, social needs, and emergencies, while agriculture focuses on food security. Farmers rear indigenous cattle (Kankrej, Dangi), goats, buffaloes, and desi poultry with minimal veterinary support, relying on traditional methods adapted to local ecological conditions. Crossbreeding with high-yielding dairy breeds is increasing, especially where infrastructure and market access improve, as exemplified by villages like Rawachod, which have better water availability and lower migration rates.

Livestock productivity and ownership are strongly correlated with the availability of natural resources, such as water and fodder, which are influenced by irrigation and forest resources. Water scarcity and seasonal migration limit livestock rearing in villages like Vadiavan. The fodder shortage, particularly in dry seasons, constrains milk yields from both indigenous and crossbred cattle. Current feed sources include crop residues and forest grasses; however, limited irrigation restricts fodder cultivation to the monsoon periods. Expanding irrigation and promoting integrated fodder production through agroforestry and pastureland development could provide year-round feed, boosting productivity.

Traditional knowledge plays a crucial role in livestock management, utilising herbal remedies and sustainable feeding practices closely tied to local forest resources. However, shrinking grazing lands due to forest regulations pose a challenge to free-ranging goats, calling for community-based grazing systems that integrate natural resource management with livestock needs.

Institutions such as Vasudhara Dairy support dairy farming through milk collection routes, veterinary services, feed supply, and market linkages, helping transition subsistence farmers toward commercial dairy enterprises. In contrast, goat and poultry rearing lack similar institutional support, despite strong potential. Strengthening Farmer-Producer Organisations (FPOs) and Self-Help Groups (SHGs) to focus on these species could improve access to inputs, veterinary care, and markets.

Government schemes and local para-veterinary workers (Pashu Sakhis) provide crucial veterinary support, but these services remain limited and uneven. Enhancing integration of veterinary care with natural resource management and agriculture—such as promoting stall feeding, fodder cultivation linked to agroforestry, and water-efficient irrigation—will improve livestock health and productivity.

### Climate-Related Changes

Climate variability and change are increasingly impacting livestock rearing in Ahwa block, affecting dairy, poultry, and goat farming systems in several critical ways. Rising temperatures, altered rainfall patterns, and increased frequency of droughts and erratic monsoons challenge traditional livestock management, threatening productivity and farmer livelihoods.

Impact on Dairy: Heat stress reduces milk yield and fertility in dairy cattle, particularly affecting crossbred and exotic breeds that are less adapted to the local climate. Seasonal fodder scarcity

worsens with unpredictable rainfall, reducing feed quality and availability, especially during summer and post-Kharif periods. Water shortages further constrain livestock watering needs, impacting animal health and milk production. These climatic stresses increase vulnerability to diseases, further undermining dairy productivity.

**Impact on Poultry:** Poultry, predominantly indigenous desi breeds, are sensitive to temperature extremes and humidity fluctuations. Heat stress can reduce egg production, growth rates, and increase mortality from diseases. Inadequate shelter and lack of brooding facilities make poultry flocks more vulnerable during extreme weather events such as heavy rains and heatwaves.

**Impact on Goat Rearing:** Goats, though relatively resilient, face challenges from shrinking grazing lands due to forest conservation and climate-induced vegetation changes. Drought and erratic rainfall affect the availability of browse and fodder in forest fringes, limiting feed resources. Water scarcity also impacts goat health and productivity. Disease outbreaks can increase under stressed climatic conditions, particularly when veterinary support is limited.

**Promoting Climate-Resilient Livestock Practices in Ahwa:** To sustain and improve livestock livelihoods under changing climatic conditions, a combination of adaptation and mitigation strategies tailored to the local context is essential:

- **Breed Selection and Improvement:** Promote improved indigenous and locally adapted breeds known for heat tolerance, disease resistance, and low input requirements, alongside improved breeds that are already naturalised for the area.
- **Water and Fodder Management:** Expand irrigation infrastructure and promote climate-smart fodder cultivation (drought-resistant fodder species, agroforestry integration) to ensure year-round feed availability. Develop pastureland management on forest fringes with community-based grazing systems that balance conservation and livestock needs.
- **Shelter and Housing:** Enhance livestock housing with climate-adaptive designs that offer protection from heat, cold, and heavy rainfall—such as ventilated sheds for dairy cattle and poultry—to mitigate heat stress and reduce disease risks.
- **Veterinary and Extension Services:** Strengthen local veterinary networks, including Pashu Sakhis, to provide timely disease surveillance, vaccination, and health management, particularly for climate-related disease risks.
- **Integrated Farming Systems:** Encourage integration of livestock with agriculture and natural resource management—using livestock manure for compost, biogas for energy, and crop residues for feed—to enhance resilience, reduce waste, and improve resource efficiency.
- **Capacity Building and Institutional Support:** Empower farmers, especially women and youth, through training on climate-smart livestock practices, improved animal husbandry, and entrepreneurial skills via SHGs and Farmer-Producer Organisations.

## Government and Other Programmes Supporting Livestock

### Subsidy for Establishing Dairy Units

- Under the Veterinary Department, a 50% subsidy is available for establishing dairy units, with a maximum subsidy of ₹47,500 for a unit costing up to ₹95,000.

### Support from Vasudhara Dairy

Vasudhara Dairy facilitates milk collection through established routes, ensuring timely payments based on the quality of milk.

- Additional support includes access to veterinary care, fodder, feed, and financial services, streamlining the dairy farming process.

#### **Subsidy for Goat Units**

- A 50% subsidy is provided for establishing a goat unit comprising 10 females and one male, with a maximum subsidy of ₹45,000.

#### **Subsidy for Poultry Units**

- Scheduled Tribe beneficiaries can avail subsidies for establishing poultry units with 25 RIR/Kadaknath birds or 1,000 broiler birds.
- The scheme also includes stipends for poultry farming training, encouraging skill development among tribal communities.

### **3.4. Fisheries**

Fish farming has not proven to be a viable livelihood option in the Ahwa block of Dang district, Gujarat, and is therefore omitted from the proposed landscape interventions. AKRSP(I) piloted freshwater aquaculture in the Dangs for three years, but it failed to scale due to persistent challenges. The region faces acute summer water scarcity, with ponds and streams drying up, making year-round aquaculture unfeasible. The activity also demands high capital investment, which most tribal farmers are unwilling or unable to risk. Additionally, there is a poor local availability of fish feed and quality fingerlings—previous pilots had to source them from Andhra Pradesh and Kolkata, which increased costs and logistical complexity. Farmers also lack traditional expertise in fisheries management, and there is no significant local market for fresh fish, making the economics even less attractive. Considering these environmental, infrastructural, and market constraints, fish farming offers limited potential compared to other suitable livelihood options, such as agroecological vegetable cultivation, livestock development, and horticulture, which are better aligned with the region's resources, skills, and climate resilience needs.

### **3.5. Natural Resource Management**

#### **3.5.1. Integrated Natural Resource Management**

As mentioned in the previous sections, water and soil are two critical drivers of agriculture, livestock, and forest-based livelihoods, including Non-Timber Forest Produce (NTFP) activities. Improvements in water availability for irrigation and enhanced soil health significantly boost productivity, reduce migration, and help farmers remain invested in agriculture over the long term.

#### **Assessment of Current Situation**

These improvements, however, can only be achieved through an integrated natural resource management (INRM) approach that encompasses ridge-to-valley management. In Ahwa, when tribal communities first established agricultural land, their forefathers invested considerable effort and resources in land terracing and bunding to make the land cultivable. Over time, however, rising population pressure, shrinking landholdings, and increasing livelihood stress have led to the erosion of these cultural practices. This has resulted in the deterioration of terracing and bunding in upper

catchment areas, reduced water recharge capacity, and damaged or neglected water harvesting infrastructure.

During our meetings in Rawachod, Lahanchariya, and Vadiavan, it became evident that the long-term sustainability of the landscape's ecosystem requires a revival of the ridge-to-valley planning approach. Unfortunately, current planning efforts, particularly those related to irrigation, are largely extractive and lack a holistic perspective.

The Gram Sabhas and Gram Panchayats are currently not leveraging their traditional ecological knowledge or collective decision-making capacity to design micro-plans based on natural resource management principles under the Gram Panchayat Development Plan (GPDP). If adopted, such an approach could unlock significant financial resources through MGNREGA, the Tribal Sub-Plan, the 15th Finance Commission, and funds available with the Irrigation Department.

### Assessment of Government Initiatives

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) remains the largest source of funding for water and soil conservation infrastructure in Ahwa block. In the 2023–24 financial year, there were 25,103 active workers enrolled in the scheme within the block. However, only 367 households managed to complete the full 100 days of wage employment, indicating a significant gap in work availability and absorption. The average number of employment days per household stood at 56.98 days, suggesting that while the scheme reaches a broad base, its intensity and continuity of engagement need to be strengthened.

During this period, the total financial outlay under MGNREGA was ₹1,927.26 lakhs, supporting the implementation of 7,864 different worksites across the block. This work is primarily focused on land development, water harvesting, bunding, and plantation activities, which are vital for enhancing soil productivity and climate resilience.

In terms of participation, Scheduled Tribe (ST) communities, who make up the majority in Ahwa block, accounted for a substantial 96.25% of the total person-days generated, reflecting strong tribal engagement with the scheme. However, women's participation was slightly lower than that of men, with female person-days comprising 45.69% of the total. This gender gap in participation highlights the need for targeted strategies to make MGNREGA more accessible and inclusive for women, particularly through the provision of childcare support, closer worksite allocation, and the inclusion of tasks aligned with women's interests and time availability.

Currently, the implementation of MGNREGA in Ahwa block follows a largely schematic and fragmented approach, rather than adopting a comprehensive ridge-to-valley Integrated Natural Resource Management (INRM) strategy. While various types of works are undertaken—such as land levelling, check dam desiltation, construction of irrigation and community wells, and creation of farm ponds—these interventions are often executed in isolation, without being part of a coordinated, long-term watershed or landscape-level plan. As a result, the overall impact on soil and water conservation across the broader ecosystem remains limited, with only partial and short-term benefits.

A key challenge is the limited technical vision and planning capacity within the implementing departments, which hinders the formulation and execution of holistic natural resource management strategies. Additionally, while parallel funding streams, such as the 15th Finance Commission grants, the Tribal Sub-Plan (TSP), and Irrigation Department schemes, are available and utilised for similar purposes, inter-departmental convergence and collaboration remain weak. There is currently no

integrated framework for developing village-wise and Panchayat-level plans for soil and water conservation to align the efforts and investments of multiple departments over an extended period.

To maximise the ecological and livelihood outcomes of these public investments, it is essential to shift from activity-based planning to integrated, area-based planning, backed by technical expertise and participatory processes. Developing long-term, coordinated plans across departments would enable the systematic creation and maintenance of water harvesting and soil regeneration assets, ensuring more sustainable and resilient outcomes for tribal communities in the Ahwa block.

<b>Total No. of GPs</b>							40
<b>I. Job Card</b>							
<b>Total No. of Job Cards Issued</b>							21,259
<b>Total No. of Workers</b>							37,333
<b>Total No. of Active Job Cards</b>							16,000
<b>Total No. of Active Workers</b>							25,103
<b>()SC worker against active workers(%)</b>							0.26
<b>()ST worker against active workers(%)</b>							96.93
<b>II. Progress</b>	<b>FY 2024-2025</b>	<b>FY 2023-2024</b>	<b>FY 2022-2023</b>	<b>FY 2021-2022</b>	<b>FY 2020-2021</b>	<b>FY 2019-2020</b>	
<b>Approved Labour Budget</b>	0	0	0	0	0	0	
<b>Person days of Central Liability so far</b>	5,27,087	6,73,680	7,48,509	8,92,732	5,90,569	5,33,986	
<b>% of Total LB</b>	0	0	0	0	0	0	
<b>% as per Proportionate LB</b>	0	-	-	-	-	-	
<b>SC person days % as of total person days</b>	0.33	0.34	0.31	0.34	0.2	0.12	
<b>ST person days % as of total person days</b>	96.21	96.25	95.91	96.35	96.8	97.42	
<b>Women Person days out of Total (%)</b>	45.99	45.69	45.75	45.33	45.23	44.83	
<b>Average days of employment provided per Household</b>	51.54	56.98	58.32	66.94	59.87	54.37	
<b>Average Wage rate per day per person (Rs.)</b>	277.58	253.17	238.39	228.8	221.29	197.51	
<b>Total No. of HHs completed 100 Days of Wage Employment</b>	174	367	542	1,195	445	214	
<b>Total Households worked</b>	10,227	11,824	12,834	13,337	9,864	9,821	
<b>Total Individuals Worked</b>	15,559	18,556	20,347	21,522	15,361	15,066	
<b>Differently abled persons worked</b>	25	33	30	31	28	20	
<b>III. Works</b>	<b>FY 2024-2025</b>	<b>FY 2023-2024</b>	<b>FY 2022-2023</b>	<b>FY 2021-2022</b>	<b>FY 2020-2021</b>	<b>FY 2019-2020</b>	
<b>Number of GPs with NIL exp</b>	0	0	13	13	13	13	

<b>Total No. of Works Taken up (New + Spill Over)</b>	6,164	7,864	8,255	6,392	2,744	2,691
<b>Number of Ongoing Works</b>	1,625	4,568	5,345	6,285	2,058	1,318
<b>Number of Completed Works</b>	4,539	3,296	2,910	107	686	1,373
<b>% of NRM Exp. in MWC Blocks</b>	NaN	NaN	NaN	NaN	NaN	NaN
<b>% of Category B Works</b>	44.58	50.24	37.8	35.53	24.42	26.35
<b>% of expenditure on Agriculture &amp; Agriculture Allied Works</b>	53.69	47.26	87.37	91.49	0	0
<b>IV. Financial Progress</b>	<b>FY 2024-2025</b>	<b>FY 2023-2024</b>	<b>FY 2022-2023</b>	<b>FY 2021-2022</b>	<b>FY 2020-2021</b>	<b>FY 2019-2020</b>
<b>Total Exp (Rs. In Lakhs.)</b>	1,659.26	1,927.26	1,877.66	2,080.19	1,408.24	1,254.82
<b>Wages (Rs. In Lakhs)</b>	1,481.53	1,675.66	1,726.20	1,990.55	1,302.94	1,086.90
<b>Material and Skilled Wages (Rs. In Lakhs)</b>	106.93	185.02	107.49	46.91	65.99	129.67
<b>Material (%)</b>	6.73	9.94	5.86	2.3	4.82	10.67
<b>Total Adm Expenditure (Rs. In Lakhs.)</b>	70.8	66.58	43.97	42.73	39.32	39.32
<b>Admin Exp (%)</b>	4.27	3.45	2.34	2.05	2.79	3.03
<b>Average Cost Per Day Per Person (In Rs.)</b>	317.21	295.17	258.04	235.66	232.16	225.37
<b>% of Total Expenditure through EFMS</b>	100	100	100	100	100	99.74
<b>% payments generated within 15 days</b>	100	100	99.34	99.9	99.98	98.43

### Role of Institutions

Rural institutions, such as the Gram Sabha and Gram Panchayat, are intended to play a central role in the planning, design, and implementation of Integrated Natural Resource Management (INRM), particularly through the use of the ridge-to-valley approach. These institutions are best positioned to harness local knowledge, mobilise community action, and enable the convergence of diverse government schemes for sustainable resource management. However, during our field visits and Focus Group Discussions (FGDs) in Ahwa block, several gaps in institutional functioning were identified—most notably, the limited and exclusionary nature of planning processes, especially in relation to women's participation.

Although Gram Sabha meetings are conducted, they are often symbolic, with decisions primarily taken by a few male leaders—typically the Gram Pradhan and the Rojgar Sevak—who prepare the plans in advance and then retrospectively secure community endorsement through signature collection. This practice runs contrary to the very principles of participatory governance and bottom-up planning enshrined in the Gram Panchayat Development Planning (GPDP) and Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) frameworks.

**Table 3.7 – MGNREGS Performance Summary for Dang District**

One of the most concerning findings was the systematic exclusion of women from these planning spaces. In most cases, women are not recognised as key stakeholders in natural resource management. Because they have been excluded from these spaces for generations, their absence has become normalised—even though women often possess rich experiential knowledge on water, forests, soil conservation, and seasonal resource patterns, acquired through their roles in agriculture, firewood and fodder collection, and domestic water management. Their insights are invaluable for creating locally appropriate, sustainable INRM plans.

Moreover, the selection and empowerment of MGNREGA Mates—those responsible for facilitating participatory planning at the village level—are currently inadequate. In many villages, mates are either not selected at all or they are appointed without training or orientation on INRM planning. Where mates are appointed, they are usually male and are not equipped to facilitate inclusive processes, especially those that actively involve women and marginalised groups.

To address these structural gaps, the following measures are urgently needed:

- Empower women and Self-Help Groups (SHGs) to participate actively in the Gram Sabha and GPDP planning processes. SHG leaders, in particular, can serve as effective community mobilizers, ensuring that women’s priorities are heard and integrated into official plans.
- Encourage and support women to contest and be elected as Gram Sabha Presidents and Gram Panchayat Pradhans. Increasing women’s leadership in these institutions will help shift the culture of exclusion and bring more gender-responsive governance into INRM planning.
- Ensure that MGNREGA Mates are selected from among trained SHG members or women leaders, with dedicated capacity building support. These women mates can serve as inclusive facilitators of participatory rural appraisal (PRA) tools such as social/resource mapping, seasonal calendars, and transect walks—ensuring that diverse voices inform the planning process.
- Institutionalise capacity building programs for Panchayat members and village-level staff on participatory planning techniques, data interpretation (soil types, land use, water availability), and convergence strategies. Visual aids and tools should be simplified for community understanding and use.
- Establish monitoring mechanisms to ensure compliance with participatory norms—tracking gender participation in Gram Sabha meetings, the quality of community facilitation, and the use of participatory planning tools in GPDP and INRM exercises.

### Role of Technology in INRM Planning

GIS-based applications can play a vital role in collecting accurate data and supporting the Gram Sabha, Gram Panchayat, and village communities in making informed decisions regarding planning and implementation. Proper layering of information—such as satellite imagery, village maps, and GIS-level data—enables better visualisation and understanding of the natural resource management (NRM) status of the village. Additionally, government initiatives have introduced digital tools, such as the JanMNREGS application and NMMS (National Mobile Monitoring Software), which aid in planning, monitoring, and ensuring timely payments under the MGNREGA scheme, thereby enhancing transparency and accountability.

### Enablers and Constraints

#### Collection and Use of Data for INRM Planning

One of the key enablers for effective Integrated Natural Resource Management (INRM) planning is the systematic collection and analysis of relevant data and information before the planning process. Tools

such as GIS-based applications, transect walks, social and resource mapping, revenue maps, toposheets, and satellite imagery can significantly enhance the accuracy, relevance, and responsiveness of the Gram Panchayat Development Plan (GPDP). When used effectively, these tools enable communities and planners to make informed decisions based on a holistic understanding of the local landscape, natural resources, and vulnerabilities.

However, a significant constraint is the lack of adequate preparation and technical support before the commencement of the planning process. Often, this leads to planning exercises being conducted without access to critical baseline information. Additionally, the availability of trained technical experts who can interpret the data and support communities in identifying and prioritising interventions is severely limited at the block and Panchayat levels. This limits the potential of data-driven and participatory planning.

To overcome these challenges, there is a need to institutionalise a well-defined methodology for INRM-based GPDP planning that mandates the use of spatial and participatory data tools. Further, dedicated investment in technical facilitation, capacity building, and data generation must be ensured in convergence with line departments, NGOs, and resource organisations. Only by integrating appropriate data with community knowledge through a structured and well-supported process can truly inclusive, sustainable, and climate-resilient development plans be created at the Panchayat level.

### **The Missing Troop of Barefoot Planners**

NREGA Mates and Rozgar Sewaks are expected to function as barefoot planners, playing a crucial role in facilitating Gram Sabhas and Gram Panchayats in the preparation of Gram Panchayat Development Plans (GPDPs). However, in practice, they often lack the necessary training and capacity to perform this role effectively. Most are not equipped to gather, process, and analyse information from diverse sources—including participatory tools, geospatial data, and government records. As a result, they are unable to translate complex data into simple, actionable insights for the community, nor can they effectively present this information in formats that are understandable and useful to Gram Sabhas, Panchayat members, and villagers.

This critical gap in local facilitation capacity limits the quality of participatory planning and weakens the overall implementation of GPDPs, especially those based on Integrated Natural Resource Management (INRM). To address this, there is an urgent need to build a dedicated cadre of well-trained, community-rooted barefoot planners—individuals who can bridge the technical and social dimensions of planning. Strengthening the capacities of Rozgar Sewaks and Mates through structured training modules, mentoring support, and practical exposure is essential to empower Gram Panchayats in leading evidence-based, inclusive, and context-specific development planning.

### **Lack of District-Level Planning and Coordination**

While the District Level Coordination Committee (DLCC) provides a formal platform for inter-departmental dialogue and decision-making, it is currently underutilised for integrated natural resource management (INRM) planning. The platform does not actively facilitate convergence-oriented planning aligned with the vision of *“Apnu Dang – Prakrutik Dang”*, which emphasises ecological restoration and sustainable development.

There is a pressing need to transform the DLCC into a dynamic, multi-stakeholder convergence forum that can pool resources, share expertise, and implement district-level initiatives in a time-bound and target-driven manner. Such a coordinated mechanism would enable systematic alignment across departments, schemes, and NGOs, driving integrated and sustainable outcomes for the region.

## Connection with Other Domains

Integrated Natural Resource Management (INRM) is fundamentally interconnected with key rural development sectors, including agriculture, livestock, agroforestry, and non-timber forest product (NTFP) collection. In the Ahwa block context, these domains not only share the same resource base of soil, water, and forests but also contribute synergistically to enhancing livelihoods, food security, and climate resilience among tribal communities. However, current approaches to planning and implementation in these sectors remain mainly siloed and fragmented, weakening the full potential of integrated landscape management.

**Agriculture and INRM:** Agriculture is the most direct and significant beneficiary of INRM interventions. Water availability and soil health, two primary targets of INRM efforts, are foundational for enhancing agricultural productivity, especially in rainfed tribal regions like Ahwa. Yet, without coordinated planning, agricultural schemes often overlook upstream catchment degradation, resulting in poor water retention, nutrient loss, and reduced yields. Strengthening the connection between agriculture and INRM involves:

- Aligning watershed-based soil and water conservation activities with crop planning and input support programs under the agriculture department schemes.
- Promoting agroecological practices—such as intercropping, mulching, organic manure application, and cover cropping—through INRM-linked capacity-building and demonstration plots.
- Enhancing convergence between MGNREGA and agriculture schemes to support land improvement works and farm pond construction, especially for smallholder and marginal farmers.

**Livestock and INRM:** Livestock rearing is a critical pillar of livelihoods, especially for landless and marginal families. However, fodder scarcity and limited access to water significantly constrain productivity. Strengthening the livestock-INRM link requires:

- Developing fodder plantations and silvipasture systems as part of the ridge-to-valley approach, especially in degraded commons and fallow lands.
- Ensuring water security for livestock through the strategic placement of drinking water points and check dams that serve both irrigation and livestock needs.
- Integrating livestock development with GPDP-INRM planning, ensuring that animal health camps, breeding services, and feed interventions are part of a broader ecosystem strategy.

**Agroforestry and NTFP-Based Livelihoods:** Agroforestry and NTFP-based livelihoods depend heavily on the health of forest and fringe ecosystems. The deterioration of bunding, slope management, and water recharge structures reduces the productivity of both cultivated and forest areas. A stronger INRM-agroforestry linkage would involve:

- Encouraging multi-tier agroforestry systems that integrate fruit trees, timber species, and understory crops to improve soil stability, biodiversity, and income.
- Conserving and regenerating forest patches through community-led protection and water conservation efforts under MGNREGA or Forest Rights Act (FRA)-related plans.
- Strengthening NTFP value chains by integrating storage, processing, and marketing infrastructure within GPDP and INRM planning efforts.

**Institutional and Planning Reforms Needed:** The above interlinkages can only be realised through institutional reforms and improved convergence mechanisms:

- Multi-sectoral GPDP planning must replace the current single-sector, schematic approach. The GPDP process should be anchored in a landscape-based INRM framework, with clear articulation of cross-sectoral priorities and resource pooling.
- Departmental silos must be broken, with joint planning mandates issued at the block and district levels across agriculture, animal husbandry, forest, and rural development departments.
- The capacities of barefoot planners, mates, and Panchayat functionaries should be built on how to integrate agriculture, livestock, agroforestry, and NTFP into INRM micro-plans—using tools such as livelihood zoning, water budgeting, and seasonal calendars.
- Monitoring frameworks must include cross-sectoral indicators—for example, an increase in crop yields due to water harvesting, a rise in fodder availability, or improved NTFP collection linked to forest soil moisture levels.

### Leveraging Government Schemes for INRM Implementation in Ahwa Block

Implementation of Integrated Natural Resource Management (INRM) in Ahwa block can be significantly strengthened by converging ongoing government schemes through the Gram Panchayat Development Plan (GPDP). Key schemes and their convergence potential are summarised below:

**MGNREGA:** Provides wage employment and funds for land and water conservation works like farm bunds, trenches, ponds, and plantations. Aligning INRM micro-plans with MGNREGA can help create climate-resilient assets and enhance local employment opportunities.

**Tribal Sub-Plan (TSP):** Targets the development of tribal livelihoods. Funds can support agroforestry, fencing, water harvesting, and NTFP-based livelihoods in tribal-dominated villages of Ahwa block.

**15th Finance Commission (FFC) Grants:** United funds available with Gram Panchayats can complement INRM activities not covered under other schemes, including asset maintenance and hiring local technical support for planning.

**Horticulture Schemes:** Support the development of orchards (mango, cashew, custard apple), backyard gardens, and the implementation of drip irrigation. It can be integrated with INRM works on treated lands and slopes.

**Agriculture Department Schemes:** Provide subsidies for climate-resilient crops, organic inputs, and mechanisation. These can improve soil health and productivity in INRM-planned watersheds.

**Irrigation Department Schemes:** Support minor and lift irrigation. Can be aligned with upstream water harvesting works under INRM to enhance water availability in valley areas.

**Watershed Development (WDC-PMKSY):** Promotes ridge-to-valley planning and land restoration. These funds can anchor the INRM plan and attract convergence from MGNREGA, FFC, and others.

By integrating these schemes through GPDP and INRM micro-plans, Ahwa block can ensure ecological restoration, improved livelihoods, and efficient public investment. Active convergence platforms, community participation, and capacity building at the Panchayat level are essential for success.

### Building Climate-Resilient Communities through INRM and Climate-Smart GPDP Planning

Integrated Natural Resource Management (INRM) is crucial for building climate-resilient rural communities, particularly in ecologically sensitive and tribal-dominated regions, such as the Ahwa

block of Dang district. INRM focuses on managing land, water, forest, and biodiversity resources in a coordinated manner, leading to long-term sustainability and improved livelihoods.

#### **Making GPDP Plans Climate-Smart:**

- Incorporate Local Climate Risks: Use community-level vulnerability assessments to identify key risks (e.g., drought, land degradation) and prioritise adaptive measures in GPDP.
- Use INRM Microplans as Technical Input: Base GPDP resource allocations on detailed watershed-level INRM plans to ensure landscape-based planning.
- Convergence of Schemes for Resilience: Strategically leverage MGNREGA, TSP, Horticulture, and Watershed programmes for investments in soil-water-forest restoration.
- Promote Climate-Resilient Practices: Support organic farming, climate-resilient crops, water-saving irrigation, and eco-restoration activities through GPDP planning.
- Capacity Building and Awareness: Train Panchayat members and community volunteers on climate change, INRM, and resilient planning to strengthen local ownership and decision-making.

### **3.5.2. Irrigation Systems**

The following subsections provide insight into the irrigation systems in Ahwa, including the significant challenges and the scope and current status of technological interventions.

#### **Current Status**

Ahwa block in Dang district has one of the lowest irrigation coverage rates in Gujarat, with net irrigated area constituting only ~15% of total cultivable land. Most agriculture is rain-fed, relying on monsoon streams that dry up by January, resulting in acute water scarcity during the Rabi and summer seasons. The hilly terrain, high runoff, and fragmented holdings exacerbate the challenge. The District Irrigation Plan (DIP) notes significant untapped potential for micro-irrigation, lift irrigation (solar/electric), and diversion-based systems to expand vegetable cultivation.

#### **Technology**

##### **Four main irrigation technologies are relevant for intensive vegetable farming in Ahwa:**

- Drip Irrigation Systems – Ideal for vegetables like bitter melon, okra, ridge melon, and chilli. These systems deliver water directly to the root zone, reducing wastage and enhancing yields. Unit cost for 0.4 ha: ₹1.0–1.2 lakh; subsidy up to 85% (₹85,000–₹1.02 lakh) for SC/ST farmers under the *Gujarat Green Revolution Company (GGRC)* scheme.
- Solar-based Lift Irrigation – Utilising solar pumps (3–5 HP) suitable for villages with perennial/semi-perennial streams, this system eliminates dependency on erratic grid supply. The unit cost for a 3 HP system is approximately ₹3.5–4 lakh; the subsidy under *PM-KUSUM Component-B* is up to 70% (central + state), reducing the farmer's contribution to approximately ₹1–1.2 lakh.
- Electricity-based Lift Irrigation – Electric pumps (3–5 HP) are used where 3-phase power is available. Unit cost: ₹50,000–₹80,000. Subsidies (40–60%) under *Mukhyamantri Kisan Sahay Yojana* and *Gujarat Micro Irrigation Scheme*.
- Diversion-based Irrigation Systems – Weirs, intake wells, and gravity-fed channels divert stream flow for cluster irrigation. Unit cost varies from ₹10 to ₹25 lakh, depending on the size; it can be fully financed through *MGNREGA* for labour components and the *Tribal Area Sub-Plan* for materials.

## Enablers and Constraints

### Inputs

- Water Source Access: Reliable springs, catchments, and small streams exist, but they require improved storage and uplift mechanisms to ensure their sustainability.
- Technology Availability & Cost
- Drip kits (₹30,000–₹50,000/ha) have high installation costs.
- Gujarat's Suryashakti Kisan Yojana subsidises solar lift pumps—farmers pay about ₹15,000 post-subsidy for units that cost ₹1 lakh.
- Electric pumps require grid reliability and a sufficient power supply in remote areas, such as Ahwa.

### Financial Constraints

- Affordability remains a barrier. Farmers rely on PMKSY and MIDH subsidies to meet capital costs. Institutional convergence and SHG/FPO-based revolving funds can help bridge gaps.

### Extension Services

- Training is limited—Krishi Sakhis and Community Resource Persons need guidance on design, maintenance, and scheduling. Demonstration plots and local technical support are essential.

### Institutional Support

- Access to subsidies under Gujarat's Irrigation Scheme and Suryashakti Kisan Yojana requires proactive facilitation and linkage by ATMA and FPOs.

## Payment for Ecosystem Services (PES)

Micro-irrigation and solar pumping systems reduce groundwater extraction and energy use, generating climate benefits that could be monetised in emerging carbon credit frameworks for water conservation and renewable energy adoption.

## Integration with Other Domains

Irrigation systems complement broader agroecological strategies by enabling *Rabi* vegetable cultivation, reducing dependence on erratic rainfall, and promoting crop diversification. Solar irrigation also contributes to carbon-light farming, aligning with Gujarat's climate goals. Additionally, improved water access boosts livelihood resilience and supports sustainable agriculture pathways in Ahwa.

## Convergence Opportunities for Irrigation Systems in Ahwa Block

The promotion of drip irrigation, solar-based lift irrigation, electricity-based lift irrigation, and diversion-based irrigation systems in Ahwa block can be significantly scaled through convergence with ongoing government schemes. The following are key opportunities with indicative unit costs and subsidy norms:

### Drip Irrigation Systems

- Implementing Agency: Gujarat Green Revolution Company Ltd. (GGRC)
- Unit Cost: Approx. ₹1.0 lakh per hectare for a standard drip system (inclusive of pipes, emitters, filtration unit, and fittings).

- Subsidy:
  - SC/ST farmers: 85% subsidy (beneficiary contribution ~₹15,000 per ha).
  - Other small/marginal farmers: 70% subsidy (beneficiary contribution ~₹30,000 per ha).
- Convergence Scope for Ahwa: Given that only ~15% of the cultivable area is irrigated and vegetable production is increasing, convergence with GGRC will make drip adoption viable for smallholders. Linking with FPO-led procurement of drip components can further reduce costs.

### Solar-based Lift Irrigation Systems

- Implementing Agency: Gujarat Energy Development Agency (GEDA), MNRE Solar Pumping Programme.
- Unit Cost: ₹3.5–4.0 lakh for a 5 HP solar pump with panel, motor, and pipeline distribution.
- Subsidy:
  - Central + State Combined Subsidy: Up to 90% for tribal farmers in notified areas; beneficiary share ~₹35,000–₹40,000.
  - Special Component for ST Areas: A 95% subsidy is possible under the tribal sub-plan.
- Convergence Scope for Ahwa: High potential for vegetable and millet cultivation in off-monsoon seasons using solar-powered lifts from perennial streams or check dams, reducing dependency on grid electricity.

### Electricity-based Lift Irrigation

- Implementing Agency: Gujarat Water Resources Department & State Electricity Board.
- Unit Cost: ₹2.5–3.0 lakh per group-based lift system (including pump, motor, rising main, and distribution).
- Subsidy:
  - Up to 75% under group irrigation schemes; balance cost to be shared among beneficiaries.
  - An additional 10% support is possible under MGNREGA for civil works (pump house, delivery chamber).
- Convergence Scope for Ahwa: Electrification of lift points from small reservoirs and check dams can ensure year-round irrigation for clustered villages.

### Diversion-based Irrigation Systems

- Implementing Agency: State Irrigation Department, Tribal Sub-Plan (TSP) funds, MGNREGA.
- Unit Cost: ₹15–20 lakh per diversion structure (including weir, canal excavation, and lining).
- Subsidy: 100% funding possible for tribal-majority habitations under TSP or MGNREGA convergence.
- Convergence Scope for Ahwa: Streams in hilly terrain can be diverted to community tanks or small canals, ensuring protective irrigation during the Rabi and Summer Seasons. These systems also support aquaculture and livestock farming.

### Role of Institutions

- Gram Panchayat Role: Identification of sites and preparation of micro-irrigation plans, ensuring equitable access for women and marginal farmers.
- FPO Role: Bulk procurement of drip kits, pumps, and pipes to reduce unit costs, combined with aggregation of produce to increase profitability from irrigated crops.
- MGNREGA Linkages: Use of MGNREGA for land levelling, field channels, and water harvesting structures, reducing the capital burden on farmers.
- Financial Linkages: NABARD's RIDF for larger lift/diversion projects; Kisan Credit Card loans for beneficiary contributions.

## 3.6. Biodiversity

Ahwa block sits within a largely forested, high-rainfall landscape with a long history of tribal land use and diverse agroecosystems. Traditionally, the area has supported a mosaic of rainfed smallholdings, upland millets and rice landraces, forest commons, and scattered grass–shrub patches that together sustain local food systems and livelihoods. Recent assessments and regional reports, however, flag accelerating land degradation pressures (mainly water-driven soil erosion on steep slopes), small but measurable tree cover loss, and changing rainfall patterns that are already affecting ecosystem services and household resilience.

### Native Habitats and Plant Communities

The block retains patches of native grasslands, shrubs, and herbaceous plants that provide forage for pollinators and habitat for natural pest predators. Upland slopes and field margins host a mix of native species, including *Cymbopogon* grasses, *Cassia tora*, and *Tridax procumbens*, which also contribute to soil stabilisation. Farmers have historically cultivated indigenous crops, including nagli (finger millet), varai (barnyard millet), kodo, foxtail millet, pigeon pea, cowpea, black gram, local maize landraces, and aromatic rice varieties, along with a diverse range of vegetables adapted to rainfed and mixed-cropping systems.

### Small Ecosystems — Wetlands, Ponds, and Vegetation Patches

Scattered ponds, seasonal wetlands, and check-dam pockets in micro-valleys provide crucial dry-season refuges for fauna, recharge minor aquifers, and sustain wetland flora. These waterbodies, although limited and increasingly stressed during prolonged dry periods, contribute disproportionately to pollination, pest regulation, and local water regulation.

### Fauna and Locally Significant Species

Although a systematic species inventory is lacking, the block's dense forest matrix and mosaic of agricultural lands support a typical Western Ghats-fringe fauna, as well as numerous locally crucial non-timber forest products relied upon by tribal communities. There are concerns about restricted access to community forest rights (CFR/IFR) and the gradual erosion of traditional ecological knowledge tied to local flora and fauna.

### Observed Changes and Emerging Threats

- Soil erosion and fertility decline in sloping farmland lead to habitat degradation.
- Loss of native crop varieties as farmers shift to high-yield commercial seeds.
- Reduced pollinator populations due to habitat fragmentation and pesticide use.
- Water scarcity during the dry season is impacting agriculture and the survival of wild species.
- Weak institutional mechanisms for biodiversity monitoring and protection.

These trends threaten pollinators, natural pest regulators, and soil-building communities, increasing the risk of biodiversity loss if left unaddressed.

### Challenges

- Habitat fragmentation resulting from the expansion of market-oriented cropping and infrastructure.
- Decline in on-farm crop and varietal diversity due to seed system erosion.
- Climate variability is impacting crop resilience, pollination, and pest control services.

- Overuse of commons leads to depletion of grasslands, shrubs, and NTFPs.
- Low awareness and a lack of systematic biodiversity documentation.

#### **Opportunities**

- Reviving traditional seed systems through community seed banks and crop diversity plots.
- Embedding pollinator-friendly practices in farming, such as hedgerows and flowering intercrops.
- Leveraging MGNREGS and watershed programs for grassland and wetland restoration.
- Integrating biodiversity documentation with agroecology and market-linkage plans.
- Establishing People's Biodiversity Registers at the Gram Panchayat level to institutionalise knowledge and guide interventions.

### **3.6.1. People's Biodiversity Register (PBR) – A Strategic Tool for Ahwa**

The PBR, mandated under the Biological Diversity Act (2002), can serve as both a biodiversity conservation tool and a planning framework for agroecological transformation. In Ahwa, it would:

- Document local crop varieties, wild edible plants, medicinal herbs, native trees, livestock breeds, and associated fauna.
- Capture traditional ecological knowledge held by tribal elders, seed custodians, and healers.
- Identify priority species and habitats for conservation and sustainable use.
- Integrate biodiversity data into Gram Panchayat and block-level development plans.
- Support benefit-sharing mechanisms for community intellectual property rights.

The process would be led by Biodiversity Management Committees (BMCs) at the GP level, with facilitation from AKRSP, Farmer-Producer Organisations (FPOs), and the Gujarat Biodiversity Board. Capacity-building workshops will ensure that communities are equipped to monitor biodiversity changes and link the PBR to resource management, seed conservation, and livelihood planning.

## **3.7. Renewable Energy - Bio Gas**

### **3.7.1. Current Status**

In the Ahwa block of Dang District, the potential for cow dung-based biogas generation is steadily increasing, driven by growing interest in dairy farming and the development of improved infrastructure. Currently, most tribal households rely on firewood collected from nearby forests for cooking—a task that causes significant drudgery for women and contributes to deforestation and indoor air pollution. The adoption of clean biogas energy offers a transformative alternative, reducing women's workload and improving their health, while promoting climate-friendly practices. With the support of Vasudhara Dairy, more households are adopting dairy farming, thereby increasing the availability of cattle dung. This momentum is expected to grow further with the upcoming Tapi River Water Project, which will address water scarcity—another key barrier to biogas viability. AKRSP has already established pilot dairy-linked biogas demonstration units in the block, which have yielded highly encouraging results in terms of energy output, community uptake, and the use of slurry as an organic fertiliser.

### **3.7.2. Technology**

Modular, prefabricated biodigester technology that transforms organic waste—such as cattle dung—into renewable biogas for clean cooking and nutrient-rich slurry for use as an organic fertiliser has

gained considerable popularity. These biodigesters are designed for easy installation and operation, making them suitable for smallholder farmers. The system includes biogas appliances and connections, enabling households to utilise the produced biogas efficiently. The slurry byproduct serves as a potent organic fertiliser, enhancing soil fertility and reducing reliance on chemical inputs.

### 3.7.3. Enablers and Constraints

#### Inputs

A reliable and continuous supply of cattle dung is the most critical input for the successful functioning of bio-digesters. Each unit requires dung from at least 2 to 3 cows to generate sufficient biogas for daily cooking needs and organic slurry for use in farming. In the Ahwa block, this input constraint is being systematically addressed through the ongoing dairy development interventions supported by Vasudhara Dairy. These efforts are yielding increased livestock ownership and improved animal husbandry, laying a solid foundation for scaling biogas units.

The availability and supply of high-quality bio-digester units are another critical input. Collaborations with specialised companies such as *Sistema.bio*, which manufactures and installs modular biodigesters, can ensure both technical robustness and ease of operation. These systems are durable, low-maintenance, and designed specifically for smallholder settings, providing both biogas and nutrient-rich slurry for agricultural use.

From a financial perspective, each biogas unit costs around ₹37,000. A substantial portion—approximately ₹22,000—can be covered through carbon financing subsidies, significantly reducing the upfront financial burden on tribal households. However, the remaining ₹15,000 still poses a capital challenge for many marginal farmers. This gap can be bridged through innovative financing mechanisms, such as accessing loans from Self-Help Groups (SHGs), linking with bank credit lines, or leveraging CSR and dairy cooperative support. SHG-based revolving funds or community savings models can further ease affordability and encourage collective investment.

In summary, the key enablers for the success of the dairy-linked bio-digester model include integration with existing dairy promotion efforts, partnerships with quality technology providers like *Sistema.bio*, access to carbon subsidies, and facilitation of affordable financing. Constraints around cattle ownership, upfront costs, and technical know-how are being proactively addressed through convergence, demonstration units, and targeted capacity building.

#### Extension Services

Effective extension services are critical for the successful adoption and long-term sustainability of bio-digester units. While installation and initial technical support will be provided by *Sistema.bio*, a cadre of trained extension service providers, such as *Pashu Sakhis* (PS) and *Prakrutik Krishi Sakhis* (PKS), will be required to offer decentralised maintenance and troubleshooting support. These community-based resource persons require hands-on training in bio-digester operations, minor repairs, and slurry utilisation. A few model biodigester units within villages are also required to be set up as live demonstration sites. These models are needed for farmer exposure visits, capacity building, and awareness generation, creating community confidence and facilitating scale-up.

### 3.7.4. Payment for Ecosystem Services (PES) through Carbon Credits

A significant enabler of the dairy-linked bio-digester intervention is the existing Payment for Ecosystem Services (PES) mechanism in the form of carbon credit subsidies. Under this system, farmers who install and use bio-digesters contribute to reducing greenhouse gas emissions by replacing firewood and fossil fuels with clean biogas. These measurable climate benefits qualify for carbon financing, which provides a subsidy of approximately ₹22,000 per unit, reducing the capital cost burden for tribal households. This PES mechanism not only incentivises climate-friendly practices but also makes the intervention financially viable and scalable for marginal farmers.

### 3.7.5. Connection with other Domains

The dairy-linked bio-digester intervention creates strong synergies across multiple domains. In agriculture, the nutrient-rich slurry produced from the bio-digester serves as an organic bio-input, improving soil fertility, enhancing crop yields, and reducing dependence on chemical fertilisers—supporting the shift toward agroecological farming. From an environmental perspective, the intervention significantly reduces the use of firewood for cooking, which not only.

### 3.7.6. Current Schemes

The bio-digester initiative can be effectively financed and scaled through convergence with several government schemes and subsidies. Key among these is the Gobar-Dhan Yojana under the Swachh Bharat Mission, which promotes the management of cattle dung and organic waste for biogas production and provides capital subsidies for rural households. In Gujarat, the Gujarat Energy Development Agency (GEDA) offers additional support for biogas units, particularly those associated with dairy operations. Furthermore, carbon credit financing presents a significant opportunity, as households can receive up to ₹22,000 per unit as a carbon subsidy for reducing greenhouse gas emissions and transitioning to clean energy.

### 3.7.7. Climate

The Bio Gas Unit plays a vital role in strengthening climate resilience, adaptation, and mitigation at the household and community levels. By converting cow dung into clean cooking gas, it reduces dependence on firewood, thereby lowering deforestation and indoor air pollution—both key climate and health concerns. The slurry byproduct serves as an organic fertiliser, enhancing soil health, moisture retention, and crop productivity, which is crucial for adapting to erratic rainfall and degraded soils. Additionally, the shift from firewood and fossil fuels to biogas helps reduce greenhouse gas emissions, contributing directly to climate change mitigation. Overall, the intervention promotes a circular and sustainable farming-energy system, making rural households more self-reliant and climate-smart.

## 3.8. Nutrition

The Diet Quality Assessment in Ahwa block was undertaken to understand the dietary diversity, adequacy, and nutrition-related risks among tribal households using the India Diet Quality Questionnaire (DQQ). The objective was to generate evidence on the quality of diets in this tribal agroecological setting, identify gaps in nutrient intake, and highlight emerging risks associated with dietary transition, such as increased sugar consumption and the consumption of processed foods.

Dietary diversity is widely used as a proxy for nutritional status because it reflects the likelihood of meeting nutrient requirements, is strongly associated with health outcomes, and can be measured

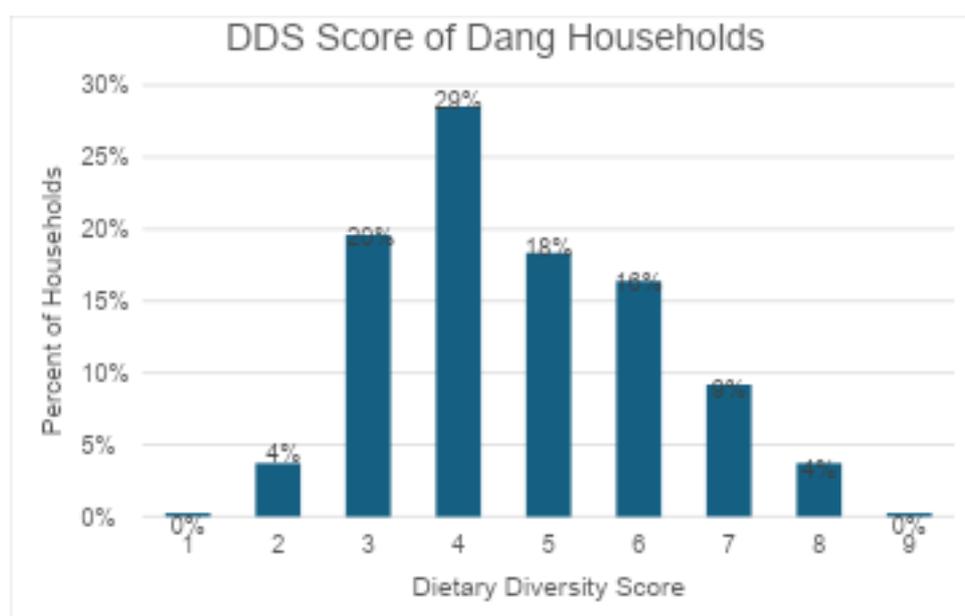
quickly and cost-effectively in diverse populations. However, existing indicators such as the Minimum Dietary Diversity for Women (MDD-W) focus primarily on micronutrient adequacy and overlook important components related to NCD risk, including the consumption of ultra-processed foods and sugar-sweetened beverages. The Diet Quality Questionnaire (DQQ), developed by the Global Diet Quality Project, addresses this gap.

Indicators analysed include Dietary Diversity Score (DDS), protective and risky food consumption, Global Dietary Recommendation (GDR) score, and food source (own production vs. market). Definitions of these indicators, methodology and ensuing recommendations are provided in the main report.

### 3.8.1. Dietary Diversity

Minimum Dietary Diversity: Nearly half of respondents (46%) in Dang achieved a Minimum Dietary Diversity (MDD)<sup>18</sup> of five or more food groups (Figure 1). MDD was slightly higher among men (50%) than women (45%). The MDD for women (MDD-W) of 45% was higher than the national average for rural women (33%), but dietary gaps remain. The mean dietary diversity score in surveyed households was 4.6, matching the national average (4.6).

Fig. 3.1 – Dietary diversity score of households in Dang



### 3.8.2. Consumption of Healthy and Unhealthy Foods

Only a quarter of households (26%) in Dang consumed all five essential healthy food groups (All-5; cereals/starchy foods, pulses, vegetables, fruits, and animal-source foods), which is comparable to the

<sup>18</sup> The DDS was calculated based on reported consumption of the following 10 food groups: whole grains and starchy staples; pulses and legumes; nuts and seeds; dairy products; meat, poultry, and fish; eggs; dark green leafy vegetables; vitamin A-rich fruits and vegetables; other vegetables; and other fruits. A score of one is assigned for each food group consumed and a DDS of five or more was considered an indicator of minimum dietary adequacy, as per FAO guidelines.

national average of 28%. Nearly nine in ten households (89%) consumed at least one fruit or vegetable in the past 24 hours, though 11% reported zero fruit or vegetable intake, compared to 22% nationally (Figure 2). Dairy product consumption was moderate (46%) but still lower than the national average of 70%, while intake of meat, poultry, and fish was lower in Dang (34% versus 78% nationally). This reflects dietary reliance on staples and pulses, with relatively less integration of animal-source foods compared to other regions.

Along with the moderate consumption of healthy and protective foods, households in Dang also reported the intake of unhealthy foods. About 37% of respondents consumed more than one sugary food or beverage in the past 24 hours, which is similar to the national rural average of 34% (Table 1). Consumption of fried or salty snacks was reported by 28% of households, lower than the national figure of 38%.

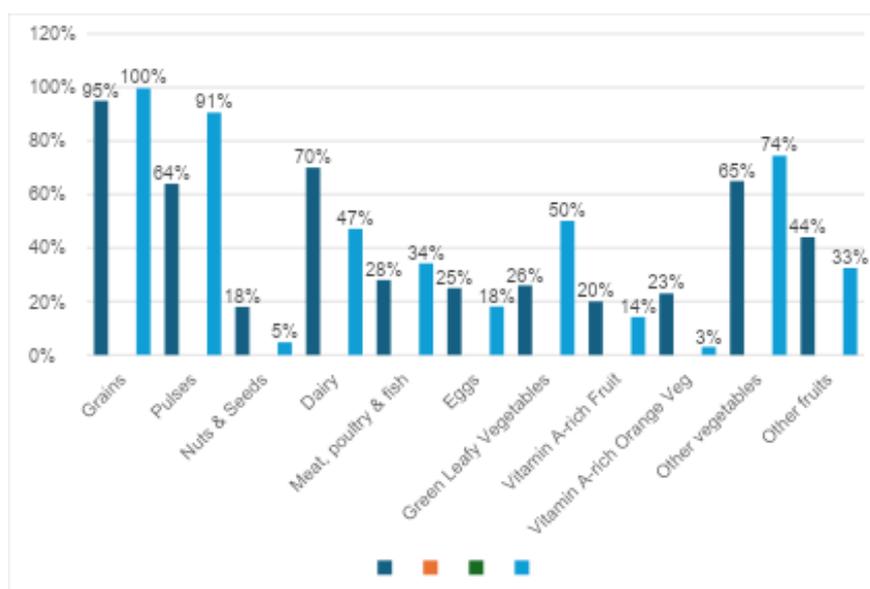


Fig. 3.2 – Consumption of 10 food groups in India and in Dang

Indicator	India Score	India Score for Rural Households	Total (n=403)	Female (n=187)	Male (n=216)
All-5	28%	24%	26%	25%	27%
At least one vegetable	71%	69%	85%	86%	83%
At least one fruit	44%	39%	38%	37%	39%
At least one pulse, nut or seed	67%	64%	91%	93%	89%
At least one animal-source food	78%	72%	65%	60%	68%
At least one starchy staple	95%	94%	100%	100%	100%
MDD-W	41%	33%	46%	46%	NA*
Dietary Diversity Score (DDS)	4.64	4.33	4.61	4.48	4.71
Zero vegetable or fruit consumption	22%	25%	11%	10%	13%
At least one vegetable or fruit	78%	75%	89%	90%	88%
Pulse consumption	64%	62%	91%	93%	89%
Nuts or seeds consumption	18%	17%	5%	5%	5%
Whole grain consumption	67%	69%	35%	34%	37%
Processed meat consumption	6%	5%	0%	0%	0%
Salty or fried snack consumption	38%	36%	28%	20%	34%
Deep-fried food	23%	22%	6%	4%	7%
Sweet food consumption	39%	35%	37%	34%	39%
Soft drinks (sodas, energy drinks, sports drinks)	13%	11%	8%	2%	13%
NCD-Protect <sup>19</sup>	3.35	3.23	2.99	2.99	2.99
NCD-Risk <sup>20</sup>	1.49	1.37	0.86	0.64	1.05

<sup>19</sup> *Protective food consumption*: The NCD-protect score reflects the consumption of healthy foods, which are whole grains, pulses, nuts and seeds, fruits and vegetables and is calculated on a scale of 0-9, with a higher score reflecting higher consumption of healthy foods. These foods are considered to have a protective effect against malnutrition, infectious diseases, as well as non-communicable diseases.

<sup>20</sup> *Unhealthy food consumption*: The NCD-Risk score reflects the consumption of unhealthy foods, which are soft drinks, sugary foods, sugar-sweetened beverages, salty and fried foods, ultra-processed foods, instant noodles, and processed meats (like sausages). They are considered to be unhealthy foods that the global dietary recommendations recommend limiting or avoiding. The NCD-Risk score is also calculated on a scale of 0 to 9, with a higher score reflecting a higher consumption of unhealthy foods.

GDR Score <sup>21</sup>	10.86	10.86	11.13	11.35	10.94
At least one whole grain, pulse, nut or seed	87%	86%	91%	93%	89%
More than one sugary food or beverage	39%	34%	37%	33%	41%
More than one salty ultra-processed food	19%	17%	6%	4%	8%
Fast food or instant noodles	13%	11%	8%	5%	11%

\*NA-Not Applicable

**Table 3.8 – Nutrition indicators calculated for India, rural India, and Dang, disaggregated by gender**

The consumption of sugary beverages in Dang was primarily due to sugar-sweetened tea or coffee, which were consumed by the vast majority of households (86%), along with the intake of sugary foods such as cakes or mithai (Table 3.9).

Food group	India	Dang
Sweet foods	39%	37%
Sugary tea, coffee, or milk	64%	86%
Fruit or packet juice	14%	2%
Soft drinks	13%	8%

**Table 3.9 – Consumption of sweet foods, beverages, and traditional drinks in Dang**

### 3.8.3. Further Discussion

The results from Dang present a mixed picture of diet diversity and quality among households. Cereal and pulse consumption was near universal, reflecting continued reliance on traditional staples and legume-based foods. However, overall diet quality and diversity were low, with less than half the population achieving a dietary diversity score of five or more, and only a quarter of households consuming all five recommended food groups. This indicates limited access to and use of nutrient-dense groups such as dairy, nuts and seeds, and vitamin A-rich fruits and vegetables, which remain below national averages. These gaps matter for essential micronutrients such as calcium, zinc, and vitamin A in everyday diets.

Further inquiry is necessary, especially given the low household intake of dairy, nuts, seeds, and vitamin A-rich produce. While traditional food systems show strengths in plant-based staples, context-appropriate supplementation strategies (e.g., backyard poultry for eggs, groundnuts, sesame seeds) may be needed depending on child nutrition status and micronutrient adequacy.

<sup>21</sup> *Global Dietary Recommendations (GDR) score*: The GDR score is reported on a scale of 0 to 18, reflecting adherence to global dietary recommendations. The higher the GDR score, the better the adherence. GDR is calculated as:  $GDR = NCD\text{-Protect} - NCD\text{-Risk} + 9$

The data also points to signs of dietary transition. While the intake of ultra-processed foods like instant noodles and packaged snacks remains lower than national levels, sweetened beverage consumption was widespread, with 86% of households reporting daily use of sugar-sweetened tea, coffee, or milk. This relatively low penetration of other market-processed foods offers an opportunity to reinforce healthier choices before exposure rises, especially among youth, while specifically addressing the high consumption of sugary beverages.

Data on self-production across food groups was most insightful. High consumption of cereals, pulses, and green leafy vegetables highlights continued reliance on plant-based staples, likely supported by local production. However, low intake of nuts, seeds, dairy, and vitamin A-rich fruits and vegetables indicates areas of micronutrient inadequacy, likely linked to low production or access to these foods. Both consumption and self-production were high only for pulses and cereals. Further enquiry is needed to understand the quantity of healthy foods consumed, as market dependence could lead to the consumption of insufficient quantities.

Overall, Dang's diet quality shows insufficient diversity and a prominent emerging risk from sugar-sweetened beverages. Programming should prioritise increasing regular access to and intake of fruits, vegetables (especially vitamin A-rich crops like pumpkin, papaya, carrots, and orange-fleshed sweet potato), eggs, dairy or fermented dairy alternatives, nuts, and seeds. This should be coupled with targeted awareness campaigns on the risks of excess sugar consumption and promoting alternatives such as unsweetened milk, herbal teas, or fruit-infused water, while protecting and promoting local production of pulses, cereals, and vegetables.



## CHAPTER 4

# Rationale for the interventions

The proposed interventions have been deliberately curated to meet the intertwined livelihood, ecological, and equity needs of Ahwa block in the Dang district of Gujarat—a predominantly tribal region where agriculture, livestock, forest produce, and wage labour form the core of rural life. The area's smallholder-dominated farming systems, rainfed cultivation, fragile hilly terrain, and high poverty levels necessitate an approach that not only enhances incomes but also builds climate resilience, protects biodiversity, and strengthens social inclusion.

The overarching rationale rests on five principles:

- Inclusivity across segments – designing interventions so that both landed and landless households have tangible, equitable benefits.
- Women and youth leadership – embedding them as decision-makers, entrepreneurs, and technical leaders, not just beneficiaries.
- Income diversification and stability – creating multiple, year-round livelihood streams.
- Climate responsiveness – adopting agroecological and water-efficient systems that reduce vulnerability to weather extremes.
- Biodiversity and equity – conserving indigenous species, restoring ecosystems, and ensuring benefits reach across caste, gender, and socio-economic lines.

## 4.1. Strengthening Knowledge Systems and Human Capital

Interventions such as the **Knowledge Exchange and Learning Platform (A1)** and **Farmer Field Schools (A2)** form the backbone of local capacity building. Deploying trained Community Resource persons (CRPs), Prakruti Krishi Sakhis (PKSs) and Pashu Sakhis as extension agents bridges the last-mile delivery gap for sustainable crop and livestock practices. For smallholders, this means better yields and reduced costs; for landless households, these roles become direct livelihood opportunities in service provision, bio-input supply, and livestock care. Women are positioned in leadership, managing training platforms and demonstration sites, while youth are engaged as facilitators and technical specialists. These knowledge systems accelerate the adoption of practices that restore soil fertility, conserve water, and sustain agro-biodiversity.

## 4.2. Diversifying and Intensifying Production Systems

The promotion of **intensive vegetable cultivation** (A3), **traditional seed conservation** (A4), and **bio-resource centres** (A5) addresses both productivity and resilience. Vegetables offer quick, high-value returns for farmers with access to irrigation, while home gardens and nurseries create income for landless and women-headed households. Seed conservation revitalises indigenous varieties—vital for climate adaptation and biodiversity—through community-managed seed banks led by SHGs. Bio-resource centres ensure timely, affordable access to organic inputs, reducing chemical dependence and production costs. Youth play entrepreneurial roles in managing nurseries, input supply chains, and marketing.

## 4.3. Restoring Natural Capital

A **one-time soil health rejuvenation programme** (A6) anchors ecological regeneration by enhancing soil organic carbon, improving nutrient balance, and increasing moisture retention. The **ridge-to-valley natural resource management** approach (D1), **irrigation systems** (D2), and **land levelling** (D3) collectively address water scarcity, erosion, and uneven land productivity. These measures benefit landed farmers by enabling higher cropping intensity and diversified production, and landless households by generating wage employment and service roles in water user committees. Women's involvement in planning ensures equitable resource allocation; youth gain skills in GIS mapping, water management, and soil testing.

## 4.4. Building Market Power and Institutional Strength

Forming **Farmer-Producer Organisations (FPOs)** (E) federated at the block level provides collective bargaining power, aggregation capacity, and value addition for agricultural, livestock, and NTFP products. This structure opens premium markets in Surat, Nashik, and Mumbai, while mandating women's leadership in governance. Landless households benefit through wage labour and shared returns from processing enterprises. PGS certification (A7) complements this by ensuring market recognition for agroecologically produced goods, which enables premium prices and fosters consumer trust.

## 4.5. Livestock and Allied Enterprises for Inclusive Growth

The **livestock extension platform for Pashu Sakhis** (C1), **dairy-based enterprises** (C2), **backyard poultry** (C3), and **goat rearing** (C4) interventions offer high-return, low-land livelihood options, particularly for women and landless families. These enterprises integrate with cropping systems through nutrient recycling, while promoting ethnoveterinary care, breed improvement, and fodder cultivation. Youth are trained as vaccinators, dairy technicians, and market agents, fostering rural entrepreneurship. Dairy-linked **biogas units** (F) close nutrient and energy loops, cutting firewood use, improving soil fertility, and reducing greenhouse gas emissions.

## 4.6. Integrated Crop Development and Value Chain Support

The **integrated crop and value chain development** intervention (A8) combines climate-resilient production, infrastructure for storage and processing, and structured market access. It directly supports landed farmers through irrigation and land improvements, as well as landless households through roles in nurseries, processing, and marketing. Women lead seed banks, bio-input centres, and certification committees; youth drive branding, logistics, and digital marketing. This intervention positions Ahwa's produce in premium urban and health-conscious markets, linking biodiversity conservation with tangible income gains.

## 4.7. Nutrition and Food Systems Transformation

The **community-based nutrition education** programme (G) addresses the emerging challenge of dietary shifts towards ultra-processed foods. By embedding nutrition awareness in schools, women-led campaigns, and frontline worker training, it promotes the consumption of local, diverse, agroecological foods. This reinforces demand for indigenous crops, supporting biodiversity and improving household health outcomes, particularly for women and children.

## 4.8. Strategic Integration for Equity and Resilience

Across all interventions, equity is ensured by prioritising Scheduled Tribe households, women-headed households, and youth. Landless households are included through wage labour, service provision, and asset-light enterprises. Women and youth are systematically positioned in governance, technical, and entrepreneurial roles, ensuring voice and agency. Climate resilience is achieved by integrating water conservation, soil health, seed diversity, and low-input farming practices. Biodiversity is protected through seed conservation, agroforestry, rotational grazing, and reduced chemical loads.

The rationale for this integrated programme is therefore to create a **self-reinforcing system** where ecological restoration supports economic advancement, institutional structures sustain gains, and women and youth leadership ensure intergenerational continuity. This positions Ahwa block as a model for climate-resilient, inclusive, and biodiverse rural transformation in Gujarat.



# Intervention Planning for Agroecological Transformation

## PART 1 - DETAILS OF INTERVENTIONS

### 5.1. Agriculture

#### 5.1.1. Improving Agroecological extension services through incentives, Capacity Building, and developing a Knowledge Exchange, Learning Platform for CRP/Prakrutik Krishi Sakhis

To support a smooth transition to agroecology, this intervention will strengthen localised extension systems through a trained cadre of Community Resource Persons (CRPs), Prakrutik Krishi Sakhis (PKSs), and Pashu Sakhis (PSs), acting as frontline facilitators across crops, horticulture, and livestock.

Although these cadres are initially trained under government schemes (e.g., GLPC, ATMA, KVK, NAU), they often lack continued mentoring, structured peer learning, or career support. To address this, AKRSP, in collaboration with the GLPC, will deploy 100 CRPs/PKSs and 100 PSs over five years (50% women). Each CRP/PKS will support 200-250 farmers, whereas each PS will support ~100 livestock rearers, to improve outreach, handholding, and knowledge transfer.

Dedicated learning platforms at the block level will be established—one for agriculture (CRPs/PKSs) and one for animal husbandry (PSs)—offering technical training, monthly peer meetings, and mentoring with support from institutions such as KVK, NAU, and ATMA.

#### Key activities include

- **Training of 100 CRPs/PKSs and 100 PSs** in on agroecological practices such as soil health, bio-inputs (e.g., Jeevamrut, Beejamrut), crop rotation, seed treatment, integrated pest management, ethno-veterinary and indigenous techniques. Training will combine expert-led sessions and hands-on learning at model farms.

- **Monthly Cluster Meetings** of CRPs/PKSs and PSs for peer sharing, technical troubleshooting, planning seasonal outreach, and reviewing Farmer Field School progress—fostering a strong community of practice.
- **Annual Exposure Visits** for CRPs/PKSs and PSs to learn from successful agroecological models, innovative farmers, and institutions—enhancing vision and practical understanding.
- **Performance-Based Incentives** will be paid monthly to CRPs, PKSs, and PSs based on clear deliverables—e.g., organising FFS, facilitating group trainings, supporting composting and bio-inputs, and linking with local institutions. This ensures motivation, retention, and quality delivery during the critical transition period.

This multi-tiered support system aims to build local capacity, ensure continuity in advisory services, and sustainably scale context-specific agroecological innovations.

### How does the intervention contribute towards the different elements of the Agroecological Value Chain?

Value Chain Element	Improvements
<b>1. Seed equivalent</b>	Trained CRPs/Prakrutik Krishi Sakhis (PKSs) and Pashu Sakhis (PSs) will play a vital role in strengthening agroecological practices and seed systems at the village level. They will support the setup of Farmer Field Schools and Model Farms for hands-on learning on seed treatment, bio-inputs, crop rotation, soil health, and sustainable livestock practices. CRPs/PKSs will also help establish Community Seed Banks, and some will serve as Community Seed Champions to conserve and promote local seed varieties. To reinforce experiential learning, 30 agroecological demonstration plots and 30 livestock demonstration farms will be established, showcasing best practices and facilitating peer learning. Through peer platforms and guided sessions, these cadres will promote context-specific, climate-resilient practices, enhancing productivity, seed sovereignty, and self-reliance among farming communities.
<b>2. Inputs</b>	CRPs/PKS and PSs trained in agroecological farming play a pivotal role in enhancing access to and adoption of high-quality bio-inputs among smallholder farmers. By imparting hands-on training on the preparation/ application of biofertilizers, such as Azotobacter, Rhizobium, and Phosphate Solubilising Bacteria (PSB), as well as traditional formulations like Jivamrita, Bijamrita, and compost, they promote sustainable soil health, microbial activity, and nutrient cycling. In pest and disease management, they demonstrate the use of indigenous plant-based bio-pesticides and fungicides, such as Brahmastra, Agneyastra, and Neemastra, which are effective, affordable, and environmentally safe alternatives to chemical inputs. Their own farms serve as Farmer Field Schools, where these techniques are showcased through season-long demonstrations, encouraging peer learning and replication. Additionally, they facilitate access to improved saplings, green fodder varieties, and balanced livestock feed, as well as chicks and goat/ dairy breeds. They also collaborate with Bio Resource Centres to ensure the timely supply of certified and quality bio-inputs. Through this integrated approach, they not only improve productivity and reduce input costs but also strengthen local agroecological value chains and resilience to climate variability
<b>3. Agri-advisory training and extension</b>	Agro-Advisory Training and Extension Services delivered by Prakrutik Krishi Sakhis (PKSs) and Pashu Sakhis (PSs) can significantly enhance farmers' decision-making and resilience by providing localized, need-based guidance grounded in agroecological principles. Building on their training and experience with bio-inputs, model farms, and farmer field schools, these grassroots resource persons can offer real-time advice on crop planning integrated with climate advisories, soil health management, integrated pest and nutrient management, seasonal practices, animal health, and fodder planning. Using

	<p>participatory methods, they help farmers interpret weather data, manage risks, and adopt context-specific practices that are both sustainable and cost-effective.</p> <p>A key component of this advisory system will be water budgeting and the promotion of water-efficient irrigation practices. PKSs will guide farmers in assessing the availability of water resources at the household and village level, planning crop choices and acreage accordingly, and scheduling irrigation based on soil moisture and crop requirements. Farmers will be introduced to efficient irrigation technologies such as drip, sprinkler, and low-cost micro-irrigation systems that optimize water use while maintaining productivity. Community-level water-sharing norms, supported by watershed and INRM structures, will be promoted to ensure equitable access and avoid over-extraction.</p> <p>Their close proximity to farming communities allows for regular field visits, group meetings, and demonstrations, making the advisory services more accessible and trusted. By linking with Krishi Vigyan Kendras (KVKs), Bio-Resource Centres, and irrigation departments, they can also disseminate scientific knowledge and innovations—such as mulching, crop selection based on water availability, and use of solar pumps—ensuring that smallholders benefit from both traditional wisdom and emerging best practices. In doing so, PKSs and PSs will not only strengthen crop and livestock management but also help build a culture of water stewardship, which is central to sustaining agroecological farming in Ahwa’s fragile landscape.</p>
<b>4. Method of growing</b>	<p>CRPs/Prakrutik Krishi Sakhis and Pashu Sakhis play a crucial role in imparting diverse agroecological methods across agriculture, horticulture, and livestock rearing by blending traditional knowledge with ecologically sound practices. In agriculture, farmers are trained in crop diversification, intercropping, and the use of indigenous seed varieties that are adapted to local conditions. This promotes methods such as mulching, cover cropping, and low-tillage practices to enhance soil health and moisture retention. For horticulture, they demonstrate techniques such as mixed cropping of vegetables and fruits, use of bio-pesticides for pest control, and preparation of nursery saplings using organic compost and neem-based treatments. In livestock rearing, Pashu Sakhis guide farmers on ethnoveterinary practices, natural fodder cultivation such as Napier grass or Stylo, and the preparation of herbal tonics and dewormers to improve animal health. By using their own farms as live demonstration sites and conducting farmer field schools, these grassroots leaders help communities adopt climate-resilient, cost-effective, and ecologically sustainable farming practices across sectors.</p>
<b>5. Pest and Disease Management</b>	<p>CRPs/ Prakrutik Krishi Sakhis and Pashu Sakhis play a critical role in strengthening agroecological approaches to pest and disease management across crops, horticulture, and animal husbandry. In agriculture and horticulture, they train farmers in preparing and using plant-based bio-pesticides, such as Neemastra, Brahmastra, and Agneyastra, which are effective against common pests while preserving beneficial insects and soil microorganisms. They also promote preventive practices, such as intercropping, crop rotation, the use of pest-repelling companion plants, and pheromone traps, to naturally reduce pest incidence. In animal husbandry, Pashu Sakhis encourage the use of ethno-veterinary medicine and herbal treatments for common diseases, and promote improved hygiene, regular deworming, and vaccination schedules to enhance animal immunity. They also emphasise the importance of stress-free housing and access to clean water to prevent infections.</p>
<b>6. On-farm mechanisation</b>	<p>Prakrutik Krishi Sakhis and Pashu Sakhis can actively promote on-farm mechanisation by demonstrating the use of appropriate, small-scale tools and equipment—such as weeders, seeders, chaff cutters, and mini threshers—on their model farms to showcase labour-saving and efficiency-enhancing benefits. They also play a key role in creating awareness about government schemes and subsidies for farm mechanisation, supporting farmers in navigating application processes and accessing these benefits, especially for women and smallholder farmers.</p>

<b>7. Harvesting and post-harvesting processing (including value addition)</b>	<p>CRPs, Prakrutik Krishi Sakhis (PKSs), and Pashu Sakhis (PSs) will provide crucial advisories on timely harvesting and post-harvest practices to reduce losses and maintain product quality. This includes proper drying and storage of grains, sorting and grading of horticultural produce, and hygienic handling of milk and meat in livestock systems. They will also guide farmers on simple value addition techniques, such as cleaning, sorting, grading, and basic processing. Importantly, these frontline cadres are closely linked to Cluster-level and Block-level Farmer Producer Organisations (FPOs). They facilitate farmers' collective access to shared infrastructure for cleaning, grading, and basic processing at the cluster level, while also enabling them to benefit from advanced processing facilities and market linkages available at the block-level FPOs. This integrated support system helps farmers improve product quality, reduce post-harvest losses, and enhance market value.</p>
<b>8. Storage and logistics</b>	<p>CRPs/Prakrutik Krishi Sakhis and Pashu Sakhis will serve as key links between Cluster-level and Block-level Farmer-Producer Organisations (FPOs), facilitating smooth communication and coordination. They will assist in connecting farmers with appropriate storage and logistics facilities available under the FPOs at both the Cluster and Block levels, ensuring that produce is stored correctly and efficiently, reducing losses and improving market access for smallholder farmers.</p>
<b>9. Market Linkages - Local</b>	<p>Prakrutik Krishi Sakhis and Pashu Sakhis strengthen local market linkages by actively collaborating with Cluster-level and Block-level Farmer-Producer Organisations (FPOs). They can identify and aggregate marketable surplus from farmers in their villages and coordinate with FPOs to ensure collective marketing, better price negotiation, and direct linkages with local buyers, wholesalers, and institutional markets. By working under the guidance of FPOs, they can also support planning of crop cycles based on market demand, facilitate grading and packaging at the FPO level, and ensure timely transport and logistics, ultimately enhancing farmers' income and market access</p>
<b>10. Market Linkages - Distant</b>	<p>For distant market linkages, CRPs/ Prakrutik Krishi Sakhis and Pashu Sakhis will collaborate directly with the Block-level FPO to channel bulk produce and livestock products to larger markets, processors, and institutional buyers beyond the local area.</p>

### Feasibility (Technical Feasibility and Financial Viability Issues)

- Fragmented and Isolated Extension Support:** Despite being initially recruited and trained under government programs such as GLPC, ATMA, KVK, and NAU, Prakrutik Krishi Sakhis (PKSs) and Pashu Sakhis (PSs) often function in isolation. The absence of ongoing mentoring, refresher trainings, and structured peer learning platforms limits their effectiveness, innovation capacity, and long-term motivation.
- High Initial Demand for Extension Support:** During the early stages of the agroecological transition, farmers require intensive, personalised training and advice. This necessitates greater investment in expanding the number of trained extension workers and ensuring they receive adequate and regular compensation to sustain their engagement and performance.
- Domain-Specific Knowledge Gaps:** Both agriculture and livestock systems require specialised technical knowledge. The lack of ongoing access to domain-specific guidance—such as updates on bio-input formulations, ethno-veterinary practices, or climate-resilient techniques—can limit the capacity of PKSs and PSs to address context-specific challenges effectively.
- Risk to Quality and Continuity:** Without regular support and technical backstopping, Model Farms and Farmer Field Schools (FFSs) risk becoming inactive or outdated. This can erode farmers' trust and diminish interest in adopting agroecological practices.

- **Weak Convergence with Technical Institutions:** Limited or irregular collaboration with key institutions, such as KVKs, NAU, and ATMA, constrains timely problem-solving, access to innovations, and the effective dissemination of improved agroecological solutions. Strengthening these linkages is critical for technical credibility and long-term sustainability.

### Financial Feasibility Challenges

- **Low and Unstable Incentive Structures:** Sakhis often work on a voluntary or semi-voluntary basis. A lack of precise incentive mechanisms or delayed payments can reduce motivation, increase attrition, and negatively impact continuity in field-level advisory services.
- **Limited Government Budget Absorption:** Even if the pilot phase is successful, government departments may not allocate dedicated budgets to scale or institutionalise the platform due to competing priorities or administrative inertia.
- **Dependence on External Facilitation:** Without a sustainable funding model in place after the 4th year, the knowledge exchange platform risks discontinuation when donor or project-based support ends.
- **Weak Career Pathways:** Absence of professional growth trajectories or service monetisation limits Sakhis' long-term interest and retention, especially among skilled or high-performing individuals.

### Mitigation Strategies

To address the challenges of sustaining institutional support, extension worker motivation, and long-term platform viability, the following key features have been integrated into the design of the knowledge exchange and learning platform:

- **Monthly Learning Exchanges** at the block level will be hosted and facilitated by experts from Krishi Vigyan Kendras (KVK), Navsari Agricultural University (NAU), and the Veterinary Department. These sessions ensure continuous technical upskilling, real-time problem-solving, and direct interaction between Sakhis and formal extension systems.
- **Yearly Exposure Visits** to model farms, agricultural universities, and innovative field sites will provide Sakhis with hands-on experiences, broaden their perspectives, and inspire locally adaptable innovations in agroecology and livestock care.
- **Dedicated Mentorship Support** from experienced resource professionals will provide regular, one-on-one guidance to Sakhis, ensuring their continued motivation, skill advancement, and confidence as community-based extension agents.
- **Structured Peer Learning Platforms** will promote collaborative learning, encourage problem-solving in local contexts, and foster solidarity among *Pashu Sakhis* and *Prakritik Krishi Sakhis*. These platforms will document and disseminate grassroots innovations, fostering leadership.
- **An incentivised payment system**, combining, will support motivation and professionalisation.
- **Ensuring Stakeholder Ownership and Continuous Engagement:** Active participation and commitment of all key stakeholders—local authorities, line departments, Panchayats, and community institutions—will be institutionalised through dedicated agenda points and review sessions in DLCC (District Level Coordination Committee) meetings, chaired by the District Collector. These sessions will serve as a formal forum to address challenges, ensure accountability, and strengthen convergence with departmental programs.
- **Sustainable Income Streams** will be promoted by enabling Sakhis to evolve into semi-independent rural service providers. As they gain trust and credibility, they will be encouraged to diversify their income through fee-based services (e.g., veterinary care, natural input production), training delivery, data collection, and partnerships with Farmer-Producer Organisations (FPOs).

### Implementation Design and HR

## Milestones of the Initiative

AKRSP, in partnership with KVK, NAU, GLPC, and ATMA, will lead the development and phased implementation of the learning and extension platform through the following key milestones:

- Year 1: Selection and induction of CRPs/ *Prakrutik Krishi Sakhis* (PKSs) and *Pashu Sakhis* (PSs) will be carried out jointly by AKRSP, GLPC and ATMA based on merit, demonstrated agroecological leadership, and representation across all Gram Panchayats.
- Years 1–3: Monthly knowledge-sharing and learning sessions will be organised in collaboration with KVK, NAU, and other expert institutions to ensure continuous capacity strengthening and timely problem-solving support.
- Years 1–3: Annual exposure visits and specialised thematic trainings will be conducted to enhance field-level innovation, technical depth, and peer learning among the Sakhis.
- Years 1–5: An incentive-based payment system will be designed and piloted to motivate performance and professionalisation.
- Year 4 onwards: Based on evidence of effectiveness, the government (GLPC/ATMA) and relevant Farmer-Producer Organisations (FPOs) will take full ownership of the learning platform and the incentive mechanism, ensuring long-term institutionalisation and scale-up.

## Key Cost Components

- **Training of CRPs/PKSs**
  - **Unit Cost:** ₹1,00,000 per training cohort (10 participants each)
  - **Year 1 & Year 2:** 5 cohorts trained each year (₹5,00,000 per year).
  - This is a **one-time upfront investment** to ensure CRPs are trained in agroecology.
- **Monthly Cluster-Level Sharing Meetings**
  - **Unit Cost:** ₹10,000 per meeting.
  - **36 meetings/year** (3 per month across clusters) = ₹3,60,000 per year.
  - This recurring cost supports peer learning and ongoing knowledge transfer.
- **Yearly Exposure Visits**
  - **Unit Cost:** ₹1,50,000 per visit.
  - **5 visits/year** = ₹7,50,000 annually in Year 1, Year 2, and Year 3.
  - Facilitates cross-learning from successful agroecological models.
- **Monthly Incentives to CRPs/PKSs**
  - **Unit Cost:** ₹12,500 per CRP/PKS per month.
  - **Number of CRPs/PKSs:** 100
  - **Annual Cost:** ₹1,50,00,000, which is covered through investment for the first five years. In the 6th and 7th years, 50% of this amount is mobilised through convergences. From the 8th year onwards, they become self-sustaining/ integrated into FPOs or fully onboarded into the government-led extension system.

## Additional human resources required

One Agroecology Expert at the AKRSP level will be required to coordinate the entire programme and provide ongoing support to the CRPs/ PKSs. In addition, three Cluster-level Master Trainers in Agroecology will mentor and support the Krishi Sakhis during the initial five years of implementation. Similarly, two Veterinary Experts at the AKRSP level will be needed for five years to coordinate the livestock component of the programme and provide regular technical support to the Pashu Sakhis. They will be supported by three Livestock Master Trainers who will offer field-level mentoring and handholding to the Pashu Sakhis.

The platform will function informally, managed by AKRSP for the first three years. From the fourth year onwards, management will transition to local authorities such as GLPC or ATMA, in collaboration with the FPO.

### Ecological, Economic and Social Benefits

#### Ecological Benefits:

- Promote natural farming techniques (e.g., jeevamrit, crop rotation, mulching) that restore soil health and reduce chemical input use.
- Enhance biodiversity through intercropping, agroforestry, and preservation of traditional seeds.
- Support water conservation and improved soil moisture via organic practices and mulching.
- Reduce carbon emissions by minimising synthetic input use and encouraging organic waste recycling.
- Pashu Sakhis promote stall feeding, fodder cultivation, and indigenous livestock practices that protect commons and lower methane emissions.

#### Economic Benefits:

- Lower input costs for farmers through bio-inputs and natural pest management.
- Enhance income through improved animal health, reduced mortality, and increased yields.
- Generate livelihoods for women Sakhis via training, veterinary services, and the sale of inputs.
- Help farmers access government schemes (e.g., livestock insurance, PM-Kisan) through institutional convergence.
- Diversify income through integrated farming systems, improving household resilience.

#### Social Benefits:

- Empower rural women as knowledge leaders and service providers, enhancing their social status and confidence.
- Strengthen local institutions (e.g., SHGs, producer groups) through Sakhi engagement.
- Improve household nutrition via diversified crop and livestock-based food systems.
- Foster social cohesion and peer learning across gender, caste, and class boundaries.
- Build community resilience through collective action, knowledge sharing, and participatory approaches.

#### Results of the Intervention

- One hundred CRP/PKSs and one hundred PSs have been trained in agroecology and livestock extension services, and are now successfully supporting 90% of the farming households in Ahwa block.
- At least 70% of the farming households in Ahwa block have adopted 3 to 5 recommended best practices in agroecological farming and livestock rearing.

### 5.1.2. Farmer Field Schools and Demonstration Models for Agroecological Learning

Community Resource Persons (CRPs), along with Prakrutik Krishi Sakhis (PKSs), will play a pivotal role in establishing Farmer Field Schools (FFSs) in each village. These FFSs will function as interactive learning hubs where farmers will participate in modular, hands-on training sessions on key agroecological practices. The sessions will cover essential topics such as:

- Seed selection and seed treatment

- Use of bio-inputs like *Jeevamrut* and *Beejamrut*
- Intercropping and crop rotation
- Mulching and moisture retention techniques
- Soil health management and other context-specific, climate-resilient practices
- Identify appropriate local innovations and integrate them in the curriculum and field demonstrations for scaling

These FFSs will be active for the first five years of the project, ensuring that agroecological knowledge is deeply embedded and internalised within farming communities.

To strengthen practical learning, the following demonstration models will be integrated:

**Agroecological Demonstration Plots (30 units):** Established by CRPs and PKs, each demonstration plot will showcase a comprehensive package of agroecological practices. With a project investment of ₹50,000 per unit, these plots will serve as live classrooms for peer learning, exposure visits, and farmer-to-farmer extension.

**Tools and Materials to Support FFS Learning:**

- IEC materials for each session to support structured discussions on agroecological and climate-smart practices — ₹5,000 per FFS
- Hand-held moisture meters to demonstrate real-time soil moisture monitoring — ₹3,000 per FFS
- Basic soil testing kits for on-site analysis of pH and nutrient levels — ₹4,000 per FFS
- Gram Panchayat-level demonstration farms to serve as participatory learning and experimentation spaces — ₹50,000 per unit. A total of 30 demonstration farms will be established, with 15 in each of the first two years.

Value Chain Element	Improvements
<b>1. Seed equivalent</b>	FFSs, facilitated by trained CRPs, PKs, and PSs, will be central to strengthening community-based seed systems. Through hands-on sessions, farmers will learn about seed selection, preservation of indigenous varieties, and bio-based seed treatments such as <i>Beejamrut</i> . Community Seed Banks will be established and managed by CRPs/PKs, with some trained as "Seed Champions." Demonstration plots under FFSs will showcase locally adapted, climate-resilient seed practices, fostering seed sovereignty and self-reliance.
<b>2. Inputs</b>	FFSs will promote on-farm production and use of sustainable bio-inputs. Farmers will be trained in making and applying inputs like <i>Jivamrut</i> , <i>Rhizobium</i> , and herbal biopesticides (e.g., <i>Neemastra</i> , <i>Brahmastra</i> ). Model farms will serve as season-long demonstration labs, and CRPs will connect farmers to Bio Resource Centres for certified inputs, improved saplings, and green fodder, reducing external dependency.
<b>3. Agri-advisory training and extension</b>	FFSs will be the primary platform for delivering localised agro-advisories. CRPs, PKs, and PSs will provide guidance aligned with seasonal and climate information, covering soil health, pest and nutrient management, and animal husbandry. Their continuous engagement ensures accessible and responsive extension services, which are strengthened through collaboration with KVKs and Bio-Resource Centres.
<b>4. Method of growing</b>	FFSs will demonstrate a range of diverse ecological farming techniques, including intercropping, crop rotation, mulching, and low-tillage practices. In horticulture, practices like mixed cropping and neem-based pest management will be showcased. PSs will integrate livestock practices such

	as ethno-veterinary care and natural fodder cultivation. FFSs serve as learning hubs for these adaptable, climate-resilient practices.
<b>5. Pest and Disease Management</b>	FFS sessions will focus on ecological pest and disease control using plant-based biopesticides and cultural practices such as crop rotation and trap cropping. PSs will offer livestock health sessions on herbal remedies, vaccinations, and hygiene. The FFS platform ensures participatory learning and adoption of non-chemical, holistic health practices across farm systems.
<b>6. On-farm mechanisation</b>	FFSs will introduce small-scale, gender-inclusive mechanisation tools through the demonstration sites, such as weeders, seeders, and chaff cutters. CRPs/PKSs will conduct demonstrations on model farms and support access to government schemes and subsidies for equipment procurement, mainly benefiting women and smallholders.
<b>7. Harvesting and post-harvesting processing (including value addition)</b>	FFS advisories will cover optimal harvest timing and basic post-harvest techniques, including drying, sorting, and grading. Farmers will also be trained in value-added practices. Through linkage with Cluster- and Block-level FPOs, FFSs will help ensure that farmers have access to collective infrastructure for processing and packaging, thereby improving product quality and marketability.
<b>8. Storage and logistics</b>	FFSs will support farmers in improving on-farm storage through demonstrations and training on moisture control, pest prevention, and inventory practices. CRPs/PKSs will facilitate access to FPO-managed storage and logistics, especially for perishable goods, improving supply chain efficiency.
<b>9. Market Linkages - Local</b>	FFS-trained CRPs, PKSs, and PSs will help aggregate produce, align production with local market demands, and facilitate linkages with Cluster-level FPOs. They will coordinate packaging, transport, and collective marketing to ensure fair pricing and market access.
<b>10. Market Linkages - Distant</b>	For regional and urban markets, FFSs will enable farmers to meet quality standards and packaging norms. CRPs and PKSs will coordinate with Block-level FPOs for bulk aggregation and logistics to reach institutional buyers and processors, enhancing income opportunities.

## Feasibility (Technical Feasibility and Financial Viability Issues)

### Technical Feasibility Challenges

- **Modular, Practical Delivery at Scale:** Covering diverse areas of agroecology—such as seed systems, bio-inputs, soil health, and climate-resilient cropping—in a structured, modular, and hands-on format for thousands of farmers is logistically demanding.
- **Ensuring Quality Across Multiple FFS Sites:** Maintaining consistent training quality across villages, especially in field-based demonstrations, requires strong coordination and monitoring systems.
- **Limited Engagement from Knowledge Institutions:** While collaboration with KVKs and NAU is essential for technical rigour, these institutions may have limited capacity or resources for direct involvement in every FFS.
- **Dependency on Government Support:** Sustained technical guidance and resources from government agencies are crucial, but engagement levels can vary.

## Financial Feasibility Challenges

- **Post-project Sustainability:** Without external funding, FFS operations—such as trainer honorariums, demonstration plot maintenance, and material costs—may be challenging to sustain.

## Mitigation Strategies

- **Structured Curriculum & Training-of-Trainers:** Develop standardised agroecology modules with practical exercises; train CRPs/PKSs as master trainers to ensure consistent delivery across all FFS sites.
- **Layered Learning Approach:** Blend in-person demonstration with visual aids, farmer manuals, and mobile-based refresher content to reinforce modular training.
- **Institutional Linkage Mechanisms:** Establish MoUs or working groups with KVKs and NAU, for periodic expert sessions in the knowledge exchange platform, technical vetting of training content, and seasonal advisories.
- **Government Engagement Plans:** Involve agriculture department officials in FFS review meetings, field days, and planning cycles; align FFS activities with ongoing schemes to ensure mutual ownership and support.
- **Integration with Farmer Institutions:** Transition FFS ownership to FPOs, SHGs, and Gram Panchayats to manage as community-led learning forums.
- **Service Fee Models:** CRPs/PKSs can offer paid services (such as soil testing, input preparation, and training) to generate revenue for FFS upkeep.

## Ecological, Economic and Social Benefits

### Ecological Benefits

- **Soil Health Regeneration:** Regular sessions on composting, green manuring, and bio-input use improve soil fertility and structure.
- **Water Conservation:** Training on mulching, moisture sensors, and low-water farming techniques helps reduce water usage and improve irrigation efficiency.
- **Reduction in Chemical Use:** Promotes bio-inputs like Jeevamrut and Beejamrut, leading to reduced reliance on chemical fertilisers and pesticides.
- **Agrobiodiversity Conservation:** Encourages the use of indigenous seeds, crop rotation, and intercropping, helping preserve local biodiversity.
- **Climate Resilience:** Enhances adaptive capacity among farmers through techniques such as mixed cropping and the use of drought-resistant seeds.

### Economic Benefits

- **Reduced Input Costs:** Lower dependence on expensive chemical inputs due to the use of on-farm bio-inputs and traditional seed systems.
- **Higher and Stable Yields:** Better soil health and resilient cropping patterns contribute to more consistent production.
- **Livelihood Diversification:** Livestock FFS and mixed farming systems provide alternative income streams for farming households.
- **Market Readiness:** Exposure to collective marketing and quality produce improves income through better price realisation.
- **Entrepreneurial Opportunities:** CRPs, PKSs, and Pashu Sakhis gain additional income as resource persons and demonstration plot managers.

## Social Benefits

- Empowered Local Leadership: CRPs, PKs, and PSs emerge as knowledge leaders and trusted advisors in their communities.
- Inclusive Learning Spaces: FFS encourages participation from women, youth, and marginalised farmers, fostering equity.
- Knowledge Democratization: Promotes peer-to-peer learning and collective problem-solving among farmers.
- Community Ownership: Builds solidarity and collective action for natural resource management at the Gram Panchayat level.
- Improved Gender Roles: Women's leadership through PKs and PSs increases recognition of their contributions to farming and livestock rearing.

## Implementation Design

- All 122 Farmer Field Schools (FFS) will be established in Year 1 to serve as the central platform for training farmers in agroecological practices. This early setup ensures that FFSs can provide season-long, modular, and practical learning from the outset, creating a strong knowledge base that supports and reinforces agroecology-related actions in subsequent years.
- CRPs and PKs will play an active role in setting up these FFSs along with the lead farmers and using them as their primary space for training and extension work with farming communities. Their close engagement will ensure that each FFS is context-specific, farmer-friendly, and responsive to local agroecological needs.
- In parallel, 15 Panchayat-level demonstration farms will be established in Year 1 to serve as live classrooms for showcasing integrated agroecological practices. The remaining 15 demonstration farms will be established in Year 2, ensuring a geographic spread and phased reinforcement of learning. These demonstration farms will complement the FFS curriculum, providing continuous, practical exposure to climate-resilient and low-input farming techniques.

## Results of the Intervention

- **Strengthened Agroecological Farming Systems at Scale:** Through season-long FFS cycles offered through 122 village-based FFS, 90% of all 22,000 farming households, i.e., 20,000 households, are trained in agroecological practices—covering local seed systems, bio-inputs, soil health, water conservation, mixed cropping, and pest management. This resulted in widespread adoption of climate-resilient, low-input farming practices in over 70% of village-level farming households.
- **Decentralised Extension and Demonstration Infrastructure Established:** Thirty panchayat-level demonstration farms will be set up and managed by CRPs and PKs to provide ongoing practical training and extension support. These hubs became permanent centres for learning, peer exchange, and innovation, increasing access to field-level knowledge, tools (like soil testing kits and moisture sensors), and agrobiodiversity.
- **Enhanced Livelihood Security and Community Leadership in Agriculture:** The FFS model would enhance the capacities of CRPs, PKs, and PSs as agroecological leaders and service providers, creating local livelihood opportunities and improving service outreach. Communities experienced a reduction in cultivation costs, diversification of farm income (including livestock), and stronger local leadership—especially women—in agricultural decision-making.

**Additional Human Resources (HR):** No additional human resources will be required for the FFS implementation, as the existing cadre of Community Resource Persons (CRPs), Prakrutik Krishi Sakhis (PKSs), and Pashu Sakhis (PSs) supported by the lead farmers will drive the initiative.

These frontline facilitators would already be trained in agroecology by AKRSP's Agroecology Experts and Master Trainers, as proposed in the action plan. This trained cadre is capable of delivering high-quality, modular training, managing demonstration farms, and ensuring continuous farmer engagement without creating new staffing requirements.

### Institutions Required

The success and sustainability of FFSs will depend on strong institutional linkages and community ownership. Three key institutional connections will be established:

- **Farmer Producer Organisations (FPOs):**
  - Serve as the bridge between FFS learnings and market linkages, collective input procurement, and post-harvest handling.
  - Provide operational support for demonstration farms and help mobilise resources for scaling.
- **Knowledge Institutions – KVK & NAU:**
  - While these institutions may have capacity limitations for direct involvement in all FFSs, their technical expertise is invaluable.
  - Formal linkages will be developed for seasonal expert visits, technical validation of training content, and dissemination of agro-climatic advisories.
- **Gram Sabha Engagement:**
  - Host periodic FFS knowledge-sharing sessions to embed the FFS as a village-level institution.
  - Involving the Gram Sabha ensures broader community participation, transparency, and the long-term institutionalisation of the FFS in local governance systems.

### 5.1.3. Promotion of Intensive Vegetable Cultivation in Ahwa Landscape

The Ahwa block and wider Dang district possess highly favourable agro-climatic conditions for vegetable cultivation, particularly in the Rabi season and in limited areas during the summer season. Among the most promising crops are bitter melon, ridge melon, okra, and chilli, which have strong market demand in nearby urban centres such as Surat, Pune, Nashik, and Mumbai. Given the region's increasing connectivity and tribal communities' growing interest in horticulture, a structured intervention to promote intensive vegetable cultivation will enable small and marginal farmers to diversify their income, improve nutrition, and build resilience.

#### Key Components of the Intervention

##### Infrastructure for Trellis-Based Cultivation

To improve yield, reduce pest incidence, and enhance fruit quality and harvesting efficiency, the intervention will support two types of trellis structures:

- **Kachcha Trellis Mandaps for Non-Creeper Vegetables:** For crops such as okra and chilli, low-cost kachcha trellis mandaps (utilising bamboo or wooden poles with metal wire or nylon rope) will be promoted.
  - Coverage: 3,500 farmers

- Unit size: 05 Gunthas (~0.125 acres) per farmer
- Unit cost: ₹18,500
- These structures will support plant staking, improve ventilation and light penetration, and enhance quality grading for marketability.
- Semi-Permanent Trellis for Creeper Vegetables: For crops like bitter gourd and ridge gourd, which require climbing support, more durable semi-permanent trellis structures will be promoted using bamboo/wooden poles, galvanised wires, and nylon netting.
  - Coverage: 2,000 farmers
  - Unit size: 05 Gunthas (~0.125 acres) per farmer
  - Unit cost: ₹20,000
  - These will ensure higher yields, reduce fruit rotting, and enable staggered harvesting to meet market demand.

### Drip Irrigation Promotion

To address water use efficiency and enhance crop productivity, especially in summer, the intervention will expand the adoption of drip irrigation systems:

- Existing Adoption: 5,000 progressive farmers in villages with reliable water sources have already adopted drip systems via GGRC or private vendors.
- Gaps: Farmers in lagging or remote villages often lack awareness or access to resources for installing drip systems, despite a high demand.
- Proposed Action:
  - Promote drip irrigation among additional tribal farmers, with technical guidance and support for GGRC linkage.
  - Cost per system (GGRC-approved): ₹1,00,000
  - Subsidy (for SC/ST farmers): 85%
  - Investment required (post-subsidy): ₹15,000

Value Chain Element	Improvements
<b>1. Seed equivalent</b>	FFS trains farmers on the selection, treatment, and saving of high-quality seeds. CRPs/PKSs ensure timely access and local multiplication—FPOs aggregate demand and supply quality seeds at scale.
<b>2. Inputs</b>	FFS demonstrates the use of organic and biologically based inputs. CRPs/PKSs support preparation and application at the farm level. FPOs ensure bulk procurement and distribution of inputs at fair prices through BRCs. The restoration of defunct irrigation sites like check dams under the GPDP led actions will also contribute to enhanced availability of water for irrigation.
<b>3. Agri-advisory training and extension</b>	FFS serves as the primary platform for knowledge dissemination. CRPs/PKSs offer follow-up handholding. FPOs coordinate expert visits and digital advisory services.
<b>4. Method of growing</b>	FFS promotes improved methods, such as raised beds, mulching, and trellis systems. CRPs/PKSs support implementation. AKRSP and FPOs mobilise resources for group infrastructure (e.g. drip sets, trellis kits).
<b>5. Pest and Disease Management</b>	FFS builds capacity on non-chemical pest control methods. CRPs/PKSs facilitate field-level adoption. FPOs, in collaboration with the BRCs, may supply bio-control agents and promote integrated pest management.

<b>6. On-farm mechanisation</b>	FFS introduces small tools and mechanised solutions. CRPs/PKSs guide the use and availability of government subsidies for procurement. FPOs enable tool banks.
<b>7. Harvesting and post-harvesting processing (including value addition)</b>	FFS teaches appropriate harvesting time and techniques. CRPs/PKSs support grading, sorting, and safe handling through cluster-level FPOs. Block-level FPO provides market linkage and farm-to-pickup services.
<b>8. Storage and logistics</b>	FFS focuses on crop-specific storage practices. CRPs/PKSs coordinate collection. FPOs establish aggregation centres, cold storage (if required), and organise transportation.
<b>9. Market Linkages - Local</b>	FFS helps identify local markets and pricing trends. CRPs/PKSs support aggregation. FPOs engage with local buyers, negotiate rates, and facilitate collective selling.
<b>10. Market Linkages - Distant</b>	FFS organises exposure to external markets. CRPs/PKSs prepare quality produce. FPOs negotiate contracts, handle logistics, and ensure payment to farmers.

## Feasibility (Technical Feasibility and Financial Viability Issues)

### Technical Feasibility Issues

- **Soil and Water Suitability:** Intensive vegetable farming requires fertile soil with good drainage and a consistent water supply. In tribal and hilly areas like Ahwa, soil depth and fertility vary, and irrigation sources are often seasonal or inadequate.
- **Pest and Disease Vulnerability:** Vegetables are highly susceptible to pest and disease attacks, mainly when grown intensively. A lack of timely pest management can result in total crop loss.
- **Lack of Technical Know-How:** Many smallholder farmers, especially women, often lack prior experience in intensive vegetable cultivation, which can result in improper spacing, nutrient mismanagement, or inappropriate crop combinations.
- **Climate Sensitivity:** Vegetables are climate-sensitive. Unseasonal rains, temperature fluctuations, or dry spells—common in the Ahwa landscape—can drastically affect yield and quality.
- **Storage and Shelf-Life Challenges:** Most vegetables are perishable and have a short shelf life. Without access to cold storage or quick market linkages, farmers face post-harvest losses.
- **Quality Assurance and Grading:** Absence of proper grading, sorting, and quality control systems limits the ability of farmers to meet market standards, especially for distant buyers.

### Financial Feasibility Issues

- **High Initial Investment:** Intensive vegetable farming requires significant investment in inputs (quality seeds, organic manure, bio-inputs), irrigation systems (drip lines, pipes), fencing, and protective infrastructure.
- **Cash Flow Risks:** Vegetables offer high returns but are also high-risk investments. Farmers need working capital for every season, and any crop failure due to weather or pests can push them into debt.
- **Lack of Access to Credit:** Many farmers, especially women, lack formal documentation or collateral, which limits their access to institutional credit and insurance.
- **High Market Dependence:** Returns are dependent on market price fluctuations. Overproduction, poor demand, or price crashes can wipe out expected profits.

- Inadequate Collective Mechanisms: Individual marketing results in low margins. Without collective aggregation and transport, farmers struggle to reach high-value markets.

### Mitigation Strategies

- Strengthening Farmer Field Schools (FFS) for Climate-Resilient Practices: FFS can promote diversified cropping, organic methods, and soil and water conservation techniques that enhance sustainability and reduce environmental impacts.
- Mobilising and Incentivising CRPs/PKSs: CRPs and PKSs can provide last-mile handholding on pest management, soil health, and post-harvest care, thereby preventing significant losses. Incentive mechanisms (e.g., per demo plot or output) can improve performance.
- Investment through FPOs: Farmer-Producer Organisations aggregate demand and invest in shared infrastructure, such as nurseries, cold storages, drip systems, and tool banks, thereby reducing the individual burden.
- Access to Working Capital and Credit: Linking farmers and FPOs with revolving funds, SHG savings, and institutional credit sources (e.g., NABARD, cooperative banks) can help manage seasonal cash flow fluctuations.
- Market Assurance through Tie-Ups: Establishing MoUs with local traders, retailers, and distant market actors (e.g., Surat, Pune) can offer assured procurement. FPOs can play a vital role in negotiating contracts and handling logistics.
- Real-Time Market Intelligence: Use of ICT tools and CRPs/PKSs to share real-time pricing and market trends can help farmers make informed selling decisions.
- Increased Convergence with Government Schemes: Leveraging existing schemes, such as MIDH, PMKSY, PKVY, and NRLM, can reduce the investment burden and scale up technical support.

### Implementation Design

- In each of the first and second years, Kachha Trellis Mandaps will be promoted, increasing to 1,500 units in the third year, resulting in a total of 3,500 units. These Mandaps will be constructed using locally available bamboo or wooden poles and ropes or wires, making them affordable and replicable.
- In parallel, semi-permanent trellis structures for creepers will be introduced to 500 farmers each in the first two years, scaling up to 1,000 units in the third year. These structures will utilise stronger materials and netting, suitable for supporting heavier creepers and providing more extended durability.
- To ensure optimal moisture management and nutrient uptake, **drip irrigation systems** will be installed for 1,500 farmers in Year 1 and 2,000 farmers in Year 3, reaching a total of 3,500 farmers. These systems will be aligned with the trellis units to promote water-use efficiency and reduce dependency on erratic monsoon rains—a key issue in this tribal, rain-fed landscape. Drip systems will also facilitate fertigation, leading to reduced input costs and increased yields.
- Implementation will be community-led, with Farmer Field Schools (FFS) serving as the leading learning platform. Community Resource Persons (CRPs), Prakrutik Krishi Sakhis (PKS), and FPOs will facilitate technical support, farmer mobilisation, and access to inputs. CRPs and PKSs will lead on-the-ground capacity building and field demonstrations, while FPOs will support bulk procurement of materials and establish linkages to drip irrigation and market channels. The implementation will prioritise progressive villages in the early years and provide intensive handholding support to lagging areas. This phased, locally embedded approach ensures ownership, skill-building, and effective scaling of intensive vegetable cultivation across the region.

**Additional HR:** Not required; the previously specified HR requirements shall suffice.

### Institutions required

The success of intensive vegetable cultivation in the Ahwa landscape depends on strong coordination between community-level institutions and support organisations. **Farmer Producer Organisations (FPOs)** will anchor input aggregation (seeds, trellises, and drip kits), produce marketing, and convergence with government schemes (such as Horticulture, ATMA, and MGNREGS), while also linking farmers to distant markets and managing shared assets, including cold storage. **Farmer Field Schools (FFS)** will serve as practical learning platforms for season-long training on trellis-based cultivation, drip irrigation, soil health, organic inputs, and pest management. **Community Resource Persons (CRPs)** and **Prakrutik Krishi Sakhis (PKSs)** will provide last-mile support by offering timely, field-level advisory services, promoting agroecological practices, and troubleshooting irrigation, pest, and disease issues.

**Self-Help Groups (SHGs)** will mobilise women farmers, facilitate access to training, and manage collective activities such as community nurseries or group marketing. They will also contribute to financial inclusion and resilience through savings and credit for inputs or equipment. **Panchayati Raj Institutions (PRIs)** will play a critical enabling role by facilitating convergence with government schemes and supporting access to infrastructure, including water sources and land for everyday activities. AKRSP will lead implementation, training, monitoring, and adaptive planning, ensuring continuous learning and scale-up.

#### 5.1.4. Traditional seed conservation, propagation and diversity

The Ahwa block of Dang district, with its rich tribal farming heritage, holds significant potential for revitalising traditional seed systems as a cornerstone of climate-resilient agriculture. For generations, local farmers—predominantly from tribal communities—have cultivated and conserved a diverse array of indigenous varieties, finely adapted to the hilly terrain, high monsoon rainfall, and rain-fed conditions of the Western Ghats. These include staple millets such as nagli (finger millet), varai (barnyard millet), kodo, and foxtail millet; pulses like black gram (urad), green gram (moong), horse gram (kulthi), pigeon pea (tur), cowpea (chawli), and moth bean (matki); local maize landraces suited for both food and fodder; aromatic and pigmented rice varieties such as jeera samba, kali kakri, and waav moti; as well as diverse vegetable landraces of brinjal, okra, gourds, beans, chillies, and tuber crops that form part of the traditional diet. However, this wealth of agrobiodiversity is under increasing threat from market-driven monocultures, hybrid seed dependence, and the gradual erosion of conventional custodianship.

Structured interventions are therefore essential to reverse this trend. Community Seed Banks (CSBs) managed by women's Self-Help Groups will act as decentralised repositories for storing, processing, and distributing traditional seeds. At the same time, Crop Diversity Blocks will serve as living field laboratories for conserving rare varieties and showcasing their agronomic and nutritional value. Champion seed farmers will be identified and supported with training on seed selection, isolation practices, treatment, and storage to ensure the genetic purity and viability of their seeds. Farmer-Producer Organisations (FPOs) will coordinate the aggregation, quality assurance, certification, and marketing of seeds.

In contrast, seasonal seed fairs and exchange events will revive the traditional seed-sharing culture and foster collective ownership of genetic resources. By integrating seed conservation with agroecological practices—such as mixed cropping, border planting of pest-repellent species, organic nutrient management, and in-situ moisture conservation—this approach will not only safeguard the region's crop diversity but also enhance resilience to erratic rainfall, pests, and climate shocks. In

doing so, it will secure seed sovereignty, strengthen local food systems, and ensure that future generations in Ahwa inherit a rich and living repository of climate-adapted, culturally significant crop varieties.

Value Chain Element	Improvements
<b>1. Seed equivalent</b>	<p>Ten community seed banks have been established, covering 10-15 villages each, and are managed by women’s SHGs or farmer groups. They are equipped with storage racks, seed treatment tools, and moisture meters.</p> <p>Twenty champion seed farmers have been identified for priority crops (nagli, varai, aromatic rice, pulses, and vegetables) to multiply and maintain varietal purity.</p> <p>Participatory varietal selection (PVS) is used to identify climate-resilient strains; Seasonal seed fairs and exchanges are also organised.</p> <p>FPOs aggregate, package, certify (PGS), and buy back seeds for redistribution.</p>
<b>2. Inputs</b>	<p>Bio-inputs are promoted for seed treatment and field management through Bio-Input Resource Centres (BRCs).</p> <p>BRCs/FPOs also provide access to vermicompost, microbial culture kits, and natural pest repellents to maintain the organic integrity of seed crops.</p>
<b>3. Agri-advisory training and extension</b>	<p>Farmer Field Schools (FFS) provide season-long training on seed selection, storage, germination testing, and varietal preservation.</p> <p>CRPs and PKs provide field-level support and facilitate technical linkages with research institutions, including Millet Research Institutions, KVK, and Navsari Agricultural University.</p>
<b>4. Method of growing</b>	<p>Agroecological seed production is encouraged through mixed cropping, in-situ moisture conservation, and raised beds, which help maintain soil fertility and promote sustainable agriculture.</p> <p>Isolation distances and staggered sowing are adopted to prevent cross-pollination and maintain varietal integrity.</p>
<b>5. Pest and Disease Management</b>	<p>Integrated pest management (IPM) is promoted through the use of botanical extracts, trap crops, and biological control agents.</p> <p>CRPs/ PKs monitor seed plots and coordinate pest scouting to protect seed crops.</p>
<b>6. On-farm mechanisation</b>	<p>Small-scale seed processing equipment (threshers, graders, tarpaulins, sieves) is provided to the CSBs. FPOs manage advanced tool banks.</p>
<b>7. Harvesting and post-harvesting processing (including value addition)</b>	<p>Farmers are trained in the correct harvesting time to ensure seed maturity and viability.</p> <p>Cluster-level FPOs support facilities for drying, cleaning, grading, and packing seed in moisture-proof bags.</p>
<b>8. Storage and logistics</b>	<p>CSBs are equipped with racks, airtight containers, and hermetic storage bags for long-term seed viability.</p> <p>FPO-manage storage hubs for bulk seed and coordinate transport for redistribution.</p>

<b>9. Market Linkages - Local</b>	Local seed exchange networks are strengthened through seed fairs and SHG-led seed retailing.
<b>10. Market Linkages - Distant</b>	Block-level FPO may deal with external buyers, organic/natural farming clusters, and institutional seed programs and develop branded indigenous seed lines for niche organic markets.

## Feasibility (Technical Feasibility and Financial Viability Issues)

### Technical Feasibility Issues

- Maintaining varietal purity requires training and monitoring.
- Seed drying and storage infrastructure must address the region's high humidity.
- Risk of pest and disease outbreaks in stored seeds without proper treatment.
- Limited access to certified seed testing facilities within the block.

### Financial Feasibility Issues

- Initial capital costs for CSBs, BRCs, and CDBs are high.
- Champion seed farmer support and training require sustained funding over 2–3 years.
- Revenue depends on seed demand; low adoption may delay cost recovery.

### Mitigation Strategies

- Integrate seed conservation with ongoing agroecology and natural farming programs to share infrastructure and training resources, thereby enhancing the effectiveness of both initiatives.
- Use revolving funds managed by FPOs for seed procurement and operational costs.
- Partner with government schemes (MIDH, PKVY, NFSM) to subsidise equipment and certification costs.
- Promote climate-resilient varieties to increase adoption and marketability.

## Ecological, Economic and Social Benefits

### Ecological Benefits

- Conserves agrobiodiversity and protects genetic resources.
- Reduces dependency on external hybrid seeds, lowering carbon footprint.
- Improves ecosystem resilience through diverse cropping patterns.

### Economic Benefits

- Enhances farmer income through premium prices for indigenous seeds.
- Reduces annual seed purchase costs for farmers.
- Creates rural enterprises (seed production, processing, retailing).

### Social Benefits

- Strengthens women's leadership via SHG-managed seed banks.
- Preserves traditional knowledge and cultural heritage.
- Increases community self-reliance and food security.

### Implementation Design

- Year 1: Establish 5 CSBs, 5CDBs, and train 20 champion seed farmers;

- Year 2–3: Expand to 10 CSBs, continue supporting 5 CDBs, 20 champion seed farmers; link all to FPO for aggregation and branding.
- Year 4–5: Integrate certified seed production systems, expand markets, and ensure full cost recovery for operations.

#### HR Required

- 1 CRP per 100 farmers for field-level advisory.
- 1 Seed System Coordinator at the FPO to oversee quality assurance and marketing.
- 1-2 trainers per cluster for technical training and capacity building.

#### Institutions Required

- **FPOs:** Aggregate, certify, market seeds, and manage buy-back systems.
- **SHGs/Women’s Seed Custodian Groups:** Operate CSBs and manage local seed distribution.
- **Research Institutes (e.g., NAU):** Provide breeder seeds and technical guidance.
- **CRPs/PKSs:** Offer extension services and promote farmer participation.
- **Panchayati Raj Institutions:** Facilitate convergence with government schemes and provide community spaces for seed banks.

The following table provides capital expenses for a Community Seed Bank.

S. No	Details	Description	Unit (NO)	Unit cost (Rs)
1	Seed containers	Shelving and racks for seed containers	1	30,000
2	Moisture meters		1	5000
3	Weighing machine		1	8000
4	Tarpaulins and sieves		1	7000
5	3-layered seed storage bags	200 bags	200	20000
		<b>Total</b>		<b>70,000</b>

**Table 5.1 – CAPEX for a Community Seed Bank**

The following table provides the cost estimates of 1 Crop Diversity Block of 2 acres.

**Table 5.2 – Cost estimates of 1 Crop Diversity Block of 2 acres**

S. No	Details	Description	Unit (NO)	Unit cost (Rs)	Yr1 Budget (Rs)
<b>Note: The details are for 1 Crop Diversity Block with 2 Acres</b>					
1	Diversity mapping	Mapping the local germplasm from farmers, seed banks, local NGOs, and NBPGR	1	20000	20000
2	Seed melas	50 members @Rs. 300/- for one member; 2 melas will be done each year	2	15000	30000

3	Crop Diversity Block	Support to farmers on Land preparation, seed sowing, pest management, irrigation, separate manual harvest, threshing, seed cost, etc. per year per two acres	1	60000	60000
4	Community Resource Person cost	One CRP per month @8000/- including travel	12	8000	96000
5	Need-based Experienced farmers' time	Lumpsum	1	10000	10000
6	Field days at CDB and Participatory Variety Selection (PVS)	Lumpsum	3	15000	45000
7	Recipe trainings / competitions	Ingredients, utensils, etc.; resource person fee Rs. 2000, including travel (once in a year)	1	5000	5000
8	Food festivals	40 persons for one food festival - @200 per person per year, two food festivals per year	2	8000	16000
9	Expert time for the local organisation	5,000 per month	12	5000	60000
10	Miscellaneous	Lumpsum	1	10000	10000
		<b>Total Amount (INR)</b>			<b>352000</b>

### 5.1.5. Promoting Bio-Resource Centres

As highlighted in Chapter 3, one of the critical constraints to agroecological transition is the lack of access to high-quality and diverse bio-inputs. While a wide range of bio-inputs, such as bio-fertilisers, growth promoters, and bio-pesticides, have proven effective for various agricultural needs, most farmers currently rely on only one or two inputs—such as *Jeevamrit*—and even those are used inconsistently. This limited and sporadic use often leaves them vulnerable during emergencies, such as pest outbreaks or crop failures, prompting a return to chemical-based solutions.

This issue can be effectively addressed through the establishment of **cluster-based Bio-Resource Centres (BRCs)** as envisioned under the **National Mission on Natural Farming (NMNF)**. However, during our interactions with the ATMA team in Ahwa block, we observed several limitations in the current BRC model. The Sakhi Mandal-based BRCs, supported with ₹60,000, are primarily equipped with a 5,000-litre tank and a 200 sq. ft. drying yard to produce *Jeevamrit*, whereas FPO-based BRCs are supported with ₹120,000 for a 10,000-litre tank and 400 sq. ft of drying yard. The focus remains narrow, lacking both product diversity and entrepreneurial development. There is minimal support for identifying and training entrepreneurs in the full range of possible bio-inputs, nor is there adequate guidance in business planning, packaging, and marketing.

#### Proposed Model for BRC Revamp

Under the proposed intervention, **three cluster-level model BRCs** will be established, one in the first year and the remaining two in the **second year**—approximately one for every 9–10 Gram Panchayats (GPs), covering all 27 GPs in Ahwa block. These BRCs will be managed by trained SHGs or local entrepreneurs and developed as comprehensive, self-sustaining enterprises with technical support from **AKRSP-promoted Farmer-Producer Organisations (FPOs)**. The cluster-level BRCs will be **fully**

integrated with the cluster-level FPOs being established in the same year under the project, ensuring institutional convergence and long-term sustainability.

### How does the intervention contribute towards the different elements of the Agroecological Value Chain?

Value Chain Element	Improvements
<b>1. Seed equivalent</b>	<p>BRCs can serve as local hubs for <b>organic seed treatment</b> (e.g., Trichoderma, Pseudomonas fluorescens, bio-priming) to improve germination, protect against seed-borne diseases, and reduce early pest damage.</p> <p>Provide <b>pre-sowing inputs</b>, such as Rhizobium cultures for pulses, Azospirillum for cereals, and phosphate-solubilising bacteria for maize and millets, to ensure higher nutrient uptake and healthier crop establishment.</p> <p>Provide <b>bio-based anti-pest treatments</b> (neem seed powder, herbal fumigants) to protect stored seeds from weevils, beetles, and fungal infestation.</p> <p>Supply CSBs with <b>customised bio-input kits</b> for millets, pulses, maize, rice, and vegetables conserved in Ahwa, ensuring each variety receives context-specific nutrition and pest protection.</p>
<b>2. Inputs</b>	<p>These BRCs will produce and sell a range of high-quality bio-inputs, including i) Bio-fertilisers (Rhizobium, Azotobacter, Phosphate Solubilising Bacteria), ii) Compost and soil enhancers, iii) Bio-growth promoters (Jeevamrit, Beejamrit), iv) Bio-pesticides (Brahmastra, Neemastra, Agniastra), etc.</p>
<b>3. Agri-advisory training and extension</b>	<p>Bio Resource Centre (BRC) entrepreneurs can collaborate closely with the CRPs/Prakritik Krishi Sakhis Pashu to provide integrated advisory services to farmers on the benefits and applications of bio-inputs. By combining their technical knowledge and local networks, they can raise awareness among farmers about the full range of bio-products available and guide them on appropriate usage.</p>
<b>4. Method of growing</b>	<p>CRPs/Prakrutik Krishi Sakhis and BRC entrepreneurs can play a key role in training farmers to grow and produce basic bio-inputs—such as compost, jeevamrut, and botanical extracts—that can be easily processed at the household or farm level. For more advanced or commercially formulated products, farmers can procure them directly from the Bio Resource Centres.</p>
<b>5. Pest and Disease Management</b>	<p>The products developed and supplied by Bio Resource Centres (BRCs) will play a crucial role in managing pests and diseases through agroecological methods. These include bio-pesticides, botanical extracts, neem-based formulations, and other natural solutions that are environmentally friendly and safe for crops, livestock, and humans. This will help farmers transition to chemical-free products without incurring substantial productivity losses.</p>
<b>6. On-farm mechanisation</b>	<p>BRCs will supply eco-friendly mechanical pest control tools such as pheromone traps, light traps, and yellow sticky plates, offering farmers effective, non-chemical solutions for pest management and reinforcing the transition to natural and agroecological farming.</p>
<b>7. Harvesting and post-harvesting processing</b>	<p>This will not be handled directly by the BRCs but will be addressed by the FPOs</p>

<b>8. Storage and logistics</b>	The BRCs will take responsibility for managing the storage and logistics related to the procurement of raw materials required for the preparation of bio-inputs. In close collaboration with FPOs, CRPs and Prakrutik Krishi Sakhis, they will ensure efficient storage, timely processing, and systematic distribution of bio-inputs to farmers.
<b>9. Market Linkages - Local</b>	The marketing of bio-inputs will be carried out under the brand name of the FPO, ensuring a unified identity and greater market recognition. This will be supported through coordinated marketing efforts led by Cluster-level BRCs, in collaboration with the network of CRPs/Prakrutik Krishi Sakhis and Pashu Sakhis. Together, they will promote the products within the local farming community, leveraging their grassroots presence and trust to create awareness, generate demand, and establish a reliable customer base for high-quality, locally produced bio-inputs.
<b>10. Market Linkages - Distant</b>	The primary objective of the BRCs is to support local farmers by ensuring easy access to high-quality bio-inputs. Therefore, the focus will remain on meeting local demand rather than expanding marketing efforts to distant markets.

## Feasibility (Technical Feasibility and Financial Viability Issues)

### Technical Feasibility Challenges

- Limited Technical Capacity of Entrepreneurs: SHGs or local entrepreneurs currently lack the necessary skills in multi-product bio-input production, quality control, packaging, and business planning. Existing BRCs focus narrowly on producing Jeevamrit, with minimal diversification.
- Inadequate Infrastructure: Current BRC models have limited infrastructure (small tanks and drying yards) that restrict production scale and input variety.
- Quality Assurance Gaps: Lack of standardised protocols and testing facilities can result in inconsistent product quality, undermining farmer trust.
- Knowledge Gaps in Agroecology: Farmers primarily use 1–2 bio-inputs (e.g., Jeevamrit) irregularly. In emergencies such as pest outbreaks, a lack of awareness or access to a broader range of inputs can lead to a reversion to chemical use.
- Extension Support Gaps: Limited convergence between BRCs, Krishi Sakhis, and government extension services may hinder the practical application of farmer training and product adoption.

### Financial Feasibility Challenges

- High Initial Investment Requirements: Each cluster-level BRC requires an initial investment of ₹15 lakh.
- Low Initial Demand: Due to low awareness or perceived ineffectiveness of natural inputs, there's a risk of poor uptake and unsold inventory in the early years.
- Operational Sustainability Risks: If sales are insufficient to cover operating costs, BRCs may struggle to operate sustainably beyond the project support phase.
- Market Saturation: Without expanding the customer base or product range, multiple BRCs may face revenue pressure due to overlapping markets and price competition.

## Mitigation Strategies

To address the technical and financial feasibility challenges, an FPO-led institutional support model will be central to the success of the Bio Resource Centres (BRCs). The cluster-level FPOs will anchor each BRC and provide end-to-end support, ensuring:

- Regular and timely supply of raw materials to avoid production gaps.
- Technical training and mentorship for SHG/entrepreneur-led BRCs on production, packaging, and enterprise management.
- Business planning, branding, and marketing to build product credibility and demand.
- Quality control systems and brand visibility under a standard FPO label to maintain trust and market consistency.

Under the proposed model, three **cluster-level Bio-Resource Centres (BRCs)** will be established—one in Year 1 and the remaining two in Year 2—each with an investment of ₹15 lakhs. This cost will cover commercial mixer machines, vermi beds, raw materials, microbial culture kits, storage drums, bottles, and other essential infrastructure. In addition, each BRC will have a one-time operational and replenishment budget of ₹3 lakhs and ₹50,000 for training and capacity building of the SHG or the entrepreneur managing it. These BRCs will serve approximately 9–10 Gram Panchayats each, functioning as comprehensive production and distribution hubs for diverse bio-inputs linked to seed and seed-equivalent needs. By phasing the establishment—starting with a single model unit in Year 1 to demonstrate viability and refine systems—the approach reduces operational risk, ensures quality control, and enables learning before full roll-out. Integration with Farmer-Producer Organisations will anchor technical support, market linkages, and institutional sustainability, ensuring that each BRC becomes a reliable node for last-mile delivery and community-owned agroecological transition.

The BRCs will also operate on a revenue model. A projected business plan for the Cluster-Level BRC is provided below.

#### Cluster-Level BRC Revenue Model

- Coverage: ~9 Gram Panchayats (3,000–4,000 farmers) per BRC
- Ownership & Management: Women's SHG or trained local entrepreneur, integrated with AKRSP-promoted FPO for technical backstopping, market linkages, and quality assurance.

#### Setup & Initial Operations

- Capital Investment: ₹15,00,000 per BRC (infrastructure, commercial mixer machines, vermi beds, microbial culture kits, storage drums, bottles, drying facilities, etc.)
- One-Time Operational & Replenishment Cost: ₹3,00,000 (raw materials – cow dung, cow urine, jaggery, neem, herbs, microbial cultures, etc.)
- Training & Capacity Building: ₹50,000 (entrepreneur/SHG-level training in production, quality management, packaging, and business operations)
- Total Year-1/2 Setup Cost: ₹18,50,000 per BRC

#### Revenue Streams

##### Bio-Input Sales

- Production capacity: ~10,000 litres/month of Jeevamrit, vermi wash, botanical pesticides, bio-fertilisers, and bio-stimulants.
- Average selling price: ₹20/litre
- Monthly bio-input sales: ₹2,00,000
- Annual bio-input revenue: ₹24,00,000

### Seed & Seed-Equivalent Sales

- Bundled seed-care kits for millets, pulses, maize, rice, and vegetables, including bio-seed treatments.
- Direct sales of indigenous seeds in partnership with CSBs and FPOs.
- Annual additional income: ₹2,80,000

### Custom Services & Rental

- Rental of small equipment (tarpaulins, sprayers, seed graders).
- Paid drying, cleaning, and packaging services for farmer groups.
- Estimated annual service income: ₹75,000–₹1,00,000

### Projected Annual Turnover

- Bio-input sales: ₹24,00,000
- Seed & seed-equivalent sales: ₹2,80,000
- Services: ₹0.75–₹1.00 lakhs
- Total annual turnover: ₹27.55–₹27.80 lakhs per BRC

### Financial Sustainability Timeline

- Breakeven Point: Achievable within 1–1.5 years, assuming 70–80% utilisation of production capacity in Year 1, scaling to full capacity in Year 2.
- Profitability Drivers: Strong seasonal demand for bio-inputs, integration with FPO bulk procurement, product diversification, and value-added seed treatment kits.
- Risk Mitigation: Maintain a diversified product portfolio to manage seasonal fluctuations; secure institutional buyers (FPOs, organic farming groups) for consistent off-take.

## Implementation Design and HR

### Milestones of the Initiative

#### Year 1 – Foundation and Pilot Launch

- Identification and Training of Cluster-Level Entrepreneurs: Select and onboard one entrepreneur for the first cluster-level BRC (covering ~9 Gram Panchayats, 3,000–4,000 farmers). Intensive training provided on large-scale bio-input production (10,000 litres/month capacity), quality standards, storage, packaging, record keeping, and business planning.
- Entrepreneur Development: Business plan prepared with AKRSP's support, including market analysis, product portfolio design, and pricing strategy. An entrepreneur accesses infrastructure, commercial mixer machines, vermi beds, microbial culture kits, and raw materials for initial operations.
- Institutional Linkages: Establish partnerships with AKRSP-promoted FPOs for aggregation and marketing, and initiate collaboration with ATMA, KVK, and NAU for technical backstopping.

#### Year 2 – Full Cluster-Level BRC Coverage

- Launch of Remaining Two Cluster-Level BRCs: All three cluster-level Bio-Resource Centres are operational, each serving ~9 Gram Panchayats (covering all 27 GPs in Ahwa block).
- Integration with FPO Ecosystem: FPOs provide back-end support (training, bulk procurement of raw materials, logistics) and front-end services (quality control, branding, marketing, bulk sales).

- Revenue Model Roll-Out: Each BRC targets an annual turnover of ~₹27.5 lakhs through bio-input sales (10,000 litres/month at ₹20/litre), seed and seed-equivalent sales, and custom services.

#### Years 3–5 – Consolidation and Scaling of Operations

- Operational Optimisation: Continuous improvement in production efficiency, quality assurance systems, and product diversification (bio-fertilisers, bio-pesticides, bio-stimulants, seed-treatment solutions).
- Market Expansion: Secure institutional buyers (organic farming clusters, farmer collectives, government programs) and expand distribution beyond the immediate 9 GP coverage area for each BRC.
- Technology Integration: Introduce production monitoring, inventory tracking, and quality testing protocols to ensure consistency and compliance with organic standards.
- Entrepreneurial Capacity Growth: Ongoing business mentoring, exposure visits, and market linkage facilitation to ensure strong leadership and financial sustainability of each BRC.

#### Additional Human Resources Required

- At AKRSP Level: One dedicated Bio-Resource Expert for five years to coordinate training, technical guidance, quality control, and market linkages across all three BRCs.
- At FPO Level: One BRC Coordinator per cluster-level FPO for operational oversight, business development, and integration with seed system value chains.

#### Institutions Required

- FPOs: Act as the central institutional anchors for BRC operations, providing procurement, marketing, and governance oversight.
- SHGs/Entrepreneurs: Directly own and operate BRCs, ensuring local leadership and financial sustainability.
- Technical Partners (ATMA, KVK, NAU): Provide training, product development support, and innovation inputs.

### Ecological, Economic, Social, and Institutional Outcomes

#### Ecological Benefits

- The large-scale production and adoption of biofertilizers, biopesticides, and bio-stimulants reduce dependency on chemical inputs, leading to improved soil health, increased biodiversity, and cleaner water sources.
- Supports agroecological transitions by strengthening organic seed systems and integrating seed-care products with conservation efforts.

#### Economic Benefits

- Each cluster-level BRC generates ~₹27.5 lakhs/year in turnover, creating viable rural enterprises and new income streams for entrepreneurs and SHGs.
- Farmers benefit from affordable, locally produced, high-quality bio-inputs, which reduce cultivation costs and enhance productivity.
- Stimulates local economies through input supply chains, equipment rentals, and service provision.

### **Social Benefits**

- Strengthens women's leadership and entrepreneurship through SHG-based ownership.
- Promotes community collaboration between farmers, entrepreneurs, and FPOs.
- Improves food and seed security by integrating bio-inputs with traditional seed conservation and multiplication systems.

### **Institutional Benefits**

- Embeds BRC operations within FPO governance frameworks, ensuring professional management and accountability.
- Builds strong linkages between village-level institutions (SHGs) and higher-level farmer collectives (FPOs).

### **Results of the Intervention**

By the end of Year 5:

- Seventy per cent of households regularly use high-quality bio-inputs from BRCs.
- 40% of households transition from minimal to zero chemical use.
- 30% of households currently dependent on moderate to high chemical inputs shift to very low usage.
- All three cluster-level BRCs operate as financially self-sustaining enterprises, achieving breakeven within 1 to 1.5 years.

## **5.1.6. Soil Health Rejuvenation – One-Time Intervention**

The Ahwa block of Dang district, characterised by its hilly terrain, high monsoon rainfall, and predominantly smallholder, tribal farmers, is experiencing declining soil fertility due to erosion, nutrient depletion, and low organic matter content. To restore productivity and lay the foundation for sustainable agroecological practices, a large-scale, one-time soil rejuvenation program is proposed, combining soil testing, green manuring, and composting. The intervention will cover 15,000 farmers, each cultivating an average of 0.5 hectares, at a cost of ₹22,500 per hectare.

### **Feasibility (Technical Feasibility and Financial Viability Issues)**

#### **Technical Feasibility Challenges**

- Farmer Awareness: Limited knowledge of the benefits of green manuring may hinder adoption.
- Soil Testing Logistics: Ensuring timely collection, analysis, and distribution of soil health cards across remote villages.
- Composting Constraints: Lack of initial raw materials (manure, biomass) during lean seasons.

#### **Financial Feasibility Challenges**

- High Initial Cost: ₹22,500 per hectare may be unaffordable for farmers without project support.
- Sustainability Post-Project: Risk of discontinuation if farmers cannot finance inputs in later years.

#### **Mitigation Strategies:**

- Use Farmer Field Schools to demonstrate productivity gains from soil rejuvenation.
- Deploy mobile soil testing kits for faster results and immediate advisory.
- Establish collective composting units where individual resources are scarce.

- Initial 2-year cost covered by project, followed by farmer-led continuation through FPO input supply chains, SHG credit, and MGNREGS convergence for green manure seed sowing and compost pit construction.
- Encourage value addition through the sale of surplus compost within the community.

## Ecological, Economic and Social Benefits

### Ecological Benefits

- Increased soil organic carbon and nutrient availability.
- Improved soil structure, aeration, and water retention.
- Enhanced biodiversity in soil microbiota, reducing dependency on synthetic fertilisers.

### Economic Benefits

- Reduction in chemical fertiliser purchases by 30–40% over 3 years.
- Yield improvements of 10–20% in subsequent seasons. Creation of local micro-enterprises for compost and green manure seed supply.

### Social Benefits

- Strengthened community awareness of sustainable soil management.
- Enhanced food security through improved farm productivity.
- Women's SHGs engaged in compost preparation and seed multiplication, fostering local leadership.

## Implementation Design

- Year 1: Soil rejuvenation on 3,000 hectares through soil testing, green manuring, and composting.
- Year 2: Scale-up to 4,500 hectares, completing the 7,500 hectares targeted under the project.
- Investment Flow: In the initial two years, all costs will be supported by the project. From Year 3 onwards, farmers will be empowered to sustain these practices independently, using compost pits, locally sourced green manure seeds, and their own savings or SHG/FPO revolving funds.
- Execution:
  - Soil Testing: Comprehensive analysis to generate soil health cards with nutrient recommendations.
  - Green Manuring: Sowing of sunhemp, dhaincha, and other nitrogen-fixing legumes before the primary cropping season.
  - On-Farm Composting: Construction of compost pits using crop residues, farmyard manure, and bio-decomposers to replenish soil organic matter.
- Institutional Anchors: CRPs and PKs to provide field guidance; FPOs to handle procurement of inputs and bio-decomposer cultures; ATMA, KVK, and NAU to provide technical backstopping and quality monitoring

## Additional Human Resources Required

At the AKRSP level, **one Soil Health and Organic Inputs Expert** will be engaged for a period of five years to oversee the planning, training, quality assurance, and monitoring of the soil rejuvenation initiative. At the block level, **three Field Facilitators** (one per 2,500–3,000 farmers) will be required in the first two years to coordinate soil testing logistics, green manure seed distribution, composting demonstrations, and farmer record-keeping.

### Results of the Intervention:

By the end of Year 2, 7,500 hectares in the Ahwa block will have undergone soil rejuvenation. From Year 3 onwards, the practice will be fully farmer-driven, ensuring that the ecological and economic benefits continue for generations while reducing dependency on external inputs.

### 5.1.7. PGS Certification of Agroecological Products

The Participatory Guarantee System (PGS) is a community-based, low-cost certification approach that is particularly suitable for small and marginal farmers, especially in tribal and remote regions, such as the Ahwa block in the Dang district. PGS-India, under the National Centre for Organic and Natural Farming (NCONF), offers PGS-Organic for fully organic systems and PGS-Green for farmers in transition from chemical to organic farming.

#### Cost Structure for Ahwa Implementation

- PGS Administration Cost: ₹700 per hectare per year.
- Year 2: Certification for 3,750 farmers for 0.25 ha per farmer – fully funded by project investment.
- Year 3: Certification for an additional 3,750 farmers for 0.25 ha per farmer– fully funded by project investment.
- Year 4: Certification for 3,750 farmers for 0.25 ha per farmer– costs paid directly by farmers.
- Year 5: Certification for 3,750 farmers for 0.25 ha per farmer– costs paid directly by farmers.

This phased approach ensures that farmers gain a complete understanding of the PGS process. At the same time, market linkages are strengthened, making it financially viable for them to sustain certification without project subsidies after Year 3.

#### Step-by-Step Implementation Plan

##### Year 1 – Preparation and Capacity Building

- Training of Facilitators: Train CRPs and Prakrutik Krishi Sakhis (PKS) in PGS standards, certification procedures, peer review methods, record keeping, and digital documentation.
- Awareness Campaigns: Conduct sensitisation workshops in all target villages.
- Farmer Mobilisation: Identify and group interested farmers into PGS Local Groups (5–7 members each).
- System Setup: Develop documentation formats and digital templates for monitoring and compliance.

##### Year 2 – First Certification Cycle (Project-Funded)

- Certify 3750 farmers, each covering 0.25 ha on average under PGS (PGS-Green or PGS-Organic, depending on readiness).
- The project fully covers facilitation, administration, and ₹700/ha certification costs.
- Begin building local organic brand presence (e.g., "Dang Naturals").
- Start establishing organic market linkages.

##### Year 3 – Second Certification Cycle (Project-Funded)

- Certify an additional 3,750 farmers (each covering 0.25 Ha) under PGS with full project funding.

- Consolidate peer-review systems, train additional internal inspectors, and strengthen record-keeping compliance.
- Expand branding and engage with larger buyers, processors, and institutional markets.

#### Year 4 – Third Certification Cycle (Farmer-Funded)

- Certify 3,750 farmers covering 937.5 ha (0.25 ha per farmer), now paid directly by farmers.
- Farmers, motivated by price premiums and market security, invest in certification.
- FPOs facilitate payment collection, registration, and compliance monitoring.

#### Year 5 – Fourth Certification Cycle (Farmer-Funded)

- Certify 3,750 farmers across 937.5 ha, fully farmer-funded.
- PGS becomes self-sustaining, with operational oversight by FPOs and trained PS/PKS.
- Full integration with organic market channels, both local and distant.

### Technical & Financial Feasibility Challenges

#### Challenges:

- Limited farmer awareness of certification benefits.
- Need for continuous compliance monitoring.
- Digital literacy gaps for online PGS-India portal registration.
- Risk of slow market premium realisation delaying farmer motivation.
- Farmers may hesitate to pay certification costs in Year 4 without a clear price advantage.

#### Mitigation Strategies:

- Strong early-stage capacity building for CRP/PKS to ensure quality facilitation.
- Secure advance purchase agreements or MoUs with organic buyers by Year 3 to guarantee market demand.
- Use digital tools for simplified data collection and compliance tracking.
- Showcase early success stories and price benefits to encourage Year 4 farmers to invest.

### Ecological, Economic, Social & Institutional Benefits

#### Ecological

- Reduction in chemical input use improves soil and water quality.
- Enhanced biodiversity through crop diversification and habitat-friendly farming practices.

#### Economic

- 15–30% market premium for certified products.
- Lower production costs from reduced chemical dependency.

#### Social

- Stronger farmer groups with peer-based trust systems.
- Empowerment of women facilitators (PKS/PS) in leadership roles.

#### Institutional

- Strengthened FPOs as certification facilitators and market enablers.
- Local ownership of certification through active Peer Review Groups and Biodiversity Management Committees.

### Additional HR Requirement

- At AKRSP Level: 1 Block-level PGS Coordinator.
- Cluster Level: 3 Master Trainers (1 per cluster) for ongoing technical support.
- Field Level: 100 CRP/PKS as farmer trainers, record-keepers, and certification facilitators.

### Key Results of the PGS Certification Intervention

- **15,000 farmers are certified under PGS by Year 5-** Through a phased, area-based certification process—3,750 farmers each covering 0.25 Ha, total land of 937.5 Ha certified each year from Year 2 to Year 5—a total of 15,000 farmers, covering 3750 Ha of farmland, are brought under PGS certification by the end of the project. This results in a robust network of certified agroecological producers across the Ahwa block, ensuring both scale and sustainability.
- **15,000 Farmers Certified and Market-Linked** - By Year 5, 15,000 small and marginal farmers will have been successfully mobilised, trained, and certified under PGS (PGS-Organic or PGS-Green), with market linkages established to urban organic markets and institutional buyers.
- **15–30% Price Premium Secured for Certified Produce.** Certified farmers consistently achieve a 15–30% price premium for their produce—particularly millets, pulses, honey, and NTFPs—through branding initiatives like “Dang Naturals” and dedicated organic market channels, leading to significantly higher net farm incomes.
- **100+ Peer Review Groups Established-** Over 100 PGS Peer Review Groups (PRGs) are formed, each conducting regular peer appraisals, maintaining compliance, and ensuring quality standards at the grassroots level.
- **100 Active CRP/PKS Facilitators Anchoring the System-** A cadre of more than 100 trained Prakrutik Krishi Sakhis (PKS) provide ongoing technical assistance, record-keeping support, and certification facilitation—ensuring that the PGS system remains functional, credible, and community-owned.
- **Sustainable Farmer-Funded Certification Model by Year 4-** From Year 4 onwards, farmers bear the ₹700/ha certification cost themselves, demonstrating financial commitment and ownership. This transition to farmer-funded certification stabilises the PGS system beyond project support.

### 5.1.8. Integrated Crop Development and Value Chain Support in Ahwa Landscape

The proposed interventions in Ahwa block combine improved extension systems, infrastructure development, resource management, and institutional marketing support to ensure higher and stabilised yields across major food crops—paddy, millets, pulses, and vegetables—while creating a surplus for processing, packaging, and marketing through Cluster-Level and Block-Level FPOs. The strategy simultaneously addresses production, productivity, quality, and market positioning, enabling farmers to transition to agroecological farming without compromising income or yield.

#### Strengthened Extension and Knowledge Systems

An **improved extension system** will diversify and enhance production across all targeted crops. This includes:

- **Demonstration Plots and Farmer Field Schools (FFS):** Practical on-field demonstrations for improved agronomic practices, varietal performance, and agroecological techniques.
- **Mentorship Support:** Continuous guidance through Community Resource Persons (CRPs) and Para Krishi Sevaks (PKSs) to handhold farmers in adopting improved methods.

- **Crop Diversification Support:** Technical advice to integrate paddy, millets, pulses, oilseeds, and vegetables into a balanced, profitable cropping system

#### **Infrastructure for Productivity Enhancement**

- **Vegetable Cultivation:** Kaccha and semi-pakka trellis structures, along with drip irrigation systems, will help expand vegetable production (brinjal, okra, cluster bean, and tomato) to more land, enable better crop management, and improve quality.
- **Community Seed Banks:** Ensure year-round access to high-quality traditional and improved seed varieties for all crops, enabling farmers to adopt agroecological practices without yield loss.
- **Bio-Resource Centres:** Supply locally produced, high-quality bio-inputs (compost, bio-pesticides, and bio-fertilisers) as viable alternatives to chemicals, helping to maintain or improve yields during the agroecological transition.

#### **Soil Health and Nutrient Management**

- **Soil Rejuvenation Programme:** Immediate restoration of soil fertility through organic amendments, micronutrient enrichment, and soil biology revival to fast-track the agroecology transition while improving yields.
- **Livestock Integration:** Promotion of dairy, goat, and poultry rearing to increase access to farmyard manure (FYM), which will be composted and applied to enhance soil productivity.

#### **Water Management and Land Development**

- **Soil and Water Conservation:** Ridge-to-valley watershed interventions will reclaim cultivable land lost to erosion, increasing the net sown area and improving cropping intensity.
- **Land Levelling:** Will make more land cultivable, improve soil structure, and allow for efficient irrigation and uniform crop establishment.
- **Irrigation Systems:** Solar-based, electric-based lift irrigation, and diversion-based irrigation systems will provide reliable water for critical crop stages, ensuring yield stability and enabling higher cropping intensity.

#### **Certification and Market Positioning**

- **PGS Certification:** Establishing both PGS-Green (transition) and PGS-Organic certification systems will position farmers' produce in niche organic markets, enabling premium pricing.
- **Brand Development:** Attractive branding under a unified PGS-certified FPO brand will create market differentiation, especially for Ahwa's unique crops.

#### **Crop-Specific Strategies and Surplus Management**

- **Millets:** A **special initiative** will boost millet production using improved varieties, enhanced agronomy, and improved processing facilities. Cluster and Block-Level FPOs will handle cleaning, dehulling, grading, and flour milling, as well as the development of millet-based products, followed by branding and marketing to premium, health-conscious markets.
- **Paddy, Black Gram, and Groundnut:** Adoption of high-quality improved seed varieties, integrated pest and nutrient management practices, and supplemental irrigation to stabilise and enhance yields. Surplus produce will be aggregated and processed—cleaned, graded, sorted, packed, and PGS-certified—through FPOs for bulk sales to premium markets.
- **Vegetables:** Large-scale production of brinjal, okra, cluster bean, and tomato supported by trellising, drip irrigation, IPM, and quality seed. Surplus will be graded, sorted, and packed alongside PGS certification at Cluster-Level FPOs, then transported to potential markets for higher returns.

### **FPO-Led Value Addition and Marketing**

Cluster-Level FPOs will handle the primary processing of **paddy, black gram, groundnut, millets (finger millet, little millet), and vegetables (brinjal, okra, cluster bean, tomato)** through cleaning, sorting, grading, drying, and short-term storage. The Block-Level Apex FPO will undertake advanced processing, including milling (paddy, millets), pulse milling (black gram), packaging for fresh vegetables, cold storage, branding, and marketing. Surplus produce will be aggregated and processed—cleaned, graded, sorted, packed, and PGS-certified—through these FPO structures, enabling bulk sales to local, regional, and premium niche markets, including urban health-conscious consumers and institutional buyers. Special branding for millets will position **“Ahwa Millets”** as a signature product line, building strong market recognition and consumer trust.

### **Promoting Local Consumption of Processed Crops**

Alongside external marketing, the FPO model will actively promote local consumption of processed crops to strengthen food security and dietary diversity within the Ahwa block. Cluster-level FPOs will provide basic processing services—cleaning, grading, drying, milling, and packaging—at a low service fee, allowing farmers to bring their produce, have it processed, and take it home for household use. For example, a millet farmer can bring finger millet to the Cluster FPO, have it dehulled or milled into flour at an affordable per kg or per quintal rate, and carry back ready-to-use flour for home consumption. This arrangement makes nutritious local crops such as millets, pulses, and oilseeds easier to consume in daily diets, reduces dependence on market-purchased refined foods, and reinforces cultural food practices. By balancing surplus marketing with local use, the FPO system will strengthen community nutrition, ensure steady demand for local crops, and build resilience in both household food systems and the local economy. At the same time, perishable surplus produce such as okra, brinjal, and bitter gourd will be aggregated, graded, and marketed by FPOs to external markets in nearby urban centres such as Surat, Pune, and other demand hubs, ensuring farmers secure higher returns from their excess production while retaining sufficient quantities for household consumption.

### **Organic and Agroecological Pathway for Ahwa**

The transition of the Ahwa block towards a resilient, sustainable, and nutrition-sensitive food system will be anchored in a stepwise organic and agroecological pathway. Currently, many tribal households already grow food crops such as millets, pulses, and paddy with minimal or no chemical inputs, reflecting deeply embedded traditional practices. These systems provide a strong foundation to amplify organic cultivation for household consumption and local markets. However, in the case of cash crops such as vegetables, farmers often resort to partial chemical input use due to weak market incentives, lack of a supportive ecosystem, and poor availability of high-quality bio-inputs. The pathway will therefore focus on removing these barriers by creating an enabling ecosystem through Integrated Natural Resource Management (INRM) interventions, land levelling, soil rejuvenation programmes, improved irrigation support, access to community-managed bio-inputs & seeds, and crop-specific extension support. The promotion of Participatory Guarantee System (PGS) certification will further build farmer confidence and create assured market differentiation. Cluster and block-level FPOs will provide essential back-end services such as processing, packaging, branding, and marketing, ensuring that organically produced crops secure premium price realisation in regional and urban markets. This organic and agroecological pathway is envisioned as a gradual, adaptive transition—strengthening existing organic practices in food crops first, and progressively expanding to vegetables and other cash crops. In doing so, Ahwa can emerge as a model landscape where farmers benefit from higher incomes, consumers access healthier food, and the ecosystem itself is restored through sustainable, chemical-free practices.

## 5.2. Agroforestry, Forestry and NTFP

### 5.2.1. Modified Wadi Model with Plantation on Farm Bunds

#### Overview

The Modified Wadi Model involves the plantation of fruit-bearing trees such as mango, custard apple, cashew, drumstick (moringa), amla, and ber along farm bunds, integrated into existing cropping systems. This model integrates ecological restoration with income generation for small and marginal farmers in the Ahwa block of Dang District. It ensures the dual benefits of perennial tree cover and diversified farm produce, contributing to climate resilience, biodiversity enhancement, and livelihood security.

#### Demonstration & Scaling Plan

In the first three years, the model will be established through 1,000 demonstration units (0.2 ha each) funded by the project:

- Year 1: 100 units (₹15,000 per unit)
- Year 2: 400 units
- Year 3: 500 units

From Year 4 onwards, scaling will be achieved entirely through convergence with government schemes such as NABARD Wadi Programme, MGNREGA, 14th Finance Commission, and Tribal Sub-Plan (TSP) funding:

- Year 4: 1,500 units
- Year 5: 1,500 units
- Year 6: 2,000 units

By Year 6, a total of 6,000 units (each 0.2 ha) will be established, covering an area of 1,200 ha.

#### How does the intervention contribute towards the different elements of the Agroecological Value Chain?

Value Chain Element	Improvements
<b>1. Seed equivalent</b>	The intervention promotes seed or seed-equivalent systems by supporting the establishment of SHG-led nurseries to raise saplings of fruit-bearing trees, such as mango, custard apple, cashew, drumstick, amla, and ber. In the first two years, demonstration nurseries will be set up in two Gram Panchayats, showcasing community-led sapling production. From the third year onward, SHG-run nurseries will be scaled across 20 GPs, gradually replacing external procurement with locally produced saplings. Initially, saplings will be sourced through the Horticulture Department's certified nurseries, but later on, procurement will increasingly prioritise SHG nurseries.
<b>2. Inputs</b>	The necessary bio-inputs for promoting the aforementioned nurseries—such as organic compost, vermicompost, Jeevamrut, biofertilizers (Azospirillum, PSB), and natural pest repellents like neem-based formulations—can be effectively supplied through the Bio Resource Centres (BRCs). BRCs, in collaboration with SHG-run nurseries, will ensure

	<p>a consistent supply of high-quality inputs essential for healthy sapling growth. For example, BRCs can provide Jeevamrut and compost for pit filling and sapling nutrition. At the same time, neem oil or Agniastra can be used to manage common nursery pests without the need for chemical inputs.</p>
<b>3. Agri-advisory training and extension</b>	<p>Agri-advisory services for the agroforestry initiative can be delivered through trained Prakrutik Krishi Sakhis (PKSs), who will serve as community-based resource persons. These PKSs will provide hands-on guidance to farmers on site selection, pit preparation, sapling care, organic input application, watering schedules, and pest and disease management using natural methods. They will also support farmers in integrating fruit trees with existing cropping systems, ensuring optimal space utilisation and ecological balance. To enhance learning, PKSs will set up demonstration plots within Farmer Field Schools (FFS), facilitating experiential learning and popularising these agroforestry models across the community through practical exposure and peer learning.</p>
<b>4. Method of growing</b>	<p>Already covered above under Agro advisory services to be provided through the Prakrutik Krishi Sakhis</p>
<b>5. Pest and Disease Management</b>	<p>Prakrutik Krishi Sakhis (PKSs) can facilitate agroecological pest and disease management for the agroforestry initiative by promoting the use of natural pest repellents and biological control solutions sourced from Bio Resource Centres (BRCs). Through Farmer Field School demonstrations, PKSs will showcase the practical application of eco-friendly tools, such as pheromone traps, neem-based formulations, and intercropping techniques, enabling farmers to adopt sustainable practices that promote healthy tree growth and development.</p>
<b>6. On-farm mechanisation</b>	<p>On-farm mechanisation to support agroforestry can be facilitated through equipment rental services provided by the Bio Resource Centres (BRCs). Farmers can access essential tools, such as augers for digging pits, water pumps for irrigation, and weeders for maintenance, at affordable rates, thereby reducing manual labour and speeding up planting activities. This ensures the timely and efficient implementation of agroforestry interventions, especially during peak planting seasons, while also lowering the cost burden on small and marginal farmers.</p>
<b>7. Harvesting and post-harvesting processing</b>	<p>Harvesting and post-harvest processing of agroforestry produce, such as fruits, can be efficiently supported through Farmer-Producer Organisations (FPOs). FPOs can facilitate collective harvesting, grading, sorting, and value addition, like drying, pulping, or packaging, thereby improving the shelf life and marketability of the produce.</p>
<b>8. Storage and logistics</b>	<p>Cluster and block-level FPOs will play a key role in facilitating storage and logistics for agroforestry produce such as mango, cashew, amla, and drumstick. They will establish or link with decentralised storage facilities for temporary holding and aggregation, ensuring the preservation of quality</p>

	post-harvest. Additionally, FPOs will coordinate transportation and logistics to collection centres or markets, reducing delays and spoilage.
<b>9. Market Linkages - Local</b>	FPOs will facilitate local marketing linkages by leveraging SHG institutions and existing networks of smaller weekly haats and larger market hubs, including the tourist-driven Saputara market. They will collaborate with SHGs to aggregate, package, sort, and grade agroforestry products at the cluster-level FPOs before transporting them to local markets. Additionally, FPOs will tap into the demand from local hotels and tourists, particularly in the Saputara region, to promote the sale of agroforestry produce and value-added products, thereby expanding market access and increasing income opportunities for farmers.
<b>10. Market Linkages - Distant</b>	The block-level FPO can play a leading role in facilitating market linkages for surplus agroforestry produce by collaborating with cluster-level FPOs. By coordinating the transportation and aggregation of fruits and other agroforestry products, the block-level FPO can help connect local producers to larger markets in Surat, Nashik, and Mumbai.

## Feasibility Technical Feasibility and Financial Viability Issues

### Technical Challenges:

- **Water Availability:** Limited access to water for plant irrigation, particularly in dry months, may hamper the survival and growth of fruit trees.
- **Site Suitability:** Selecting appropriate sites for plantation with adequate bund space and water access can be challenging in scattered or fragmented landholdings.
- **Nursery and Sapling Quality:** Ensuring quality and timely availability of saplings from local SHG-run nurseries may face initial capacity and skill limitations.
- **Adoption & Maintenance:** Farmers may be reluctant to adopt or may neglect maintenance without visible short-term returns.
- **Pest/Disease Management:** Lack of agroecological knowledge for tree pest and disease control may affect tree survival rates.

### Financial Challenges:

- **Initial Investment Needs:** High initial costs for pit digging, sapling procurement, fencing, and care.
- **Sustained Funding:** Ensuring a consistent flow of financial resources over 5 years, especially for scaling up from the demonstration phase.
- **Material Component under MGNREGA:** Possible shortfalls in MGNREGA's material budget for saplings and other inputs.
- **SHG Nursery Sustainability:** Ensuring SHG-run nurseries become financially viable and do not rely on continuous external support.

### Mitigation Strategies

- **Mainstreaming in GPDP:** Institutionalising the agroforestry model within the Gram Panchayat Development Plan (GPDP) ensures long-term commitment and convergence with government schemes.

- **Convergence with Schemes:** Pooling resources from NABARD Wadi programme, MGNREGA (for labour/pit digging), Horticulture Department (for saplings and technical support), Tribal Sub-Plan (TSP), and 15th Finance Commission (for infrastructure and material costs).
- **Efficient Irrigation Techniques:** Promoting water-saving irrigation systems like pitcher irrigation and mulching to increase plant survival and reduce water stress.
- **Community Site Selection:** Encouraging communities to select sites with assured water availability and bund space during participatory planning processes.
- **Capacity Building:** Ongoing training for SHGs and PKSs in nursery management, plant care, and pest/disease control using agroecological methods.
- **Local Entrepreneurship Support:** Enabling SHG-run nurseries to generate income from sapling sales, creating local business models for sustainability.
- **Phased Demonstration and Scaling:** Starting with a demonstration of 1,000 units in the first 3 years and then upscaling to an additional 5,000 units in the next three years through convergences.

## Implementation Design and HR

### Milestones of the Initiative

- Year 1: 100 demo units, one nursery, 10 SHGs trained.
- Year 2: 400 demo units, one more nursery, 10 more SHGs trained.
- Year 3: 500 demo units, six new nurseries.
- Year 4: 1,500 units via convergence, six more nurseries.
- Year 5: 1,500 units via convergence, six more nurseries.
- Year 6: 2,000 units via convergence.

**Additional human resources required:** AKRSP will require two horticulture experts to drive this initiative

**Institutions required, if any:** The implementation of the MGNREGA-supported agroforestry initiative will require coordinated efforts of Gram Panchayats, SHGs, Cluster and Block-level FPOs, Village Organisations (VOs), and Community Resource Persons such as Prakruti Krishi Sakhis.

## Ecological, Economic and Social Benefits

### Ecological Impact

- 6000 wadi units covering 1200 hectares of farmland brought under agroforestry
- Improved soil health, microclimate, and biodiversity along field bunds due to tree plantation.
- Reduction in land degradation and enhanced carbon sequestration through perennial vegetation.

### Economic Outcomes

- Supplementary and long-term income for farming households through the sale of fruits such as mango, cashew, amla, and moringa.
- At least 20 community nurseries established and managed by SHGs, creating local employment and entrepreneurship opportunities.
- Sustained livelihood diversification through nursery management and plantation-based microenterprises.

## Social and Institutional Outcomes

- Twenty Gram Panchayats actively integrate agroforestry promotion into their GPDPs, thereby strengthening decentralised planning.
- Over 200 SHG members (all women) from 20 SHGs are trained in nursery development and plantation techniques.
- The availability of fruits increases dietary diversity, resulting in improved nutrition.
- Demonstration models of 1000 wadi units set up over the first three years catalyse wider community adoption and enable convergence with MGNREGA, TSP, and 15th Finance Commission schemes.
- Enhanced institutional coordination between AKRSP, Gram Panchayats, MGNREGA, Horticulture Department, and other schemes ensures long-term sustainability and replication.

## Results of the intervention

- **6,000 Wadi units** (1,200 ha) established on farm bunds.
- **Twenty-twenty functional SHG nurseries** producing 100% of saplings locally.
- **Supplementary income** from fruit sales within 3–5 years of planting.
- **Enhanced biodiversity** and soil health through agroforestry.
- **Empowered women SHGs** managing nurseries and leading local agroforestry expansion.

### 5.2.2. Community-Led Forest Species Plantation Drive facilitated through MGNREGA Planning to Improve Biodiversity and promote NTFP

A community-driven **Forest Species Plantation Drive** will be launched to restore lost biodiversity across forest and common lands. The initiative aims to enhance ecological resilience by planting native forest species that not only provide a dense canopy cover, helping protect and enrich the soil, but also offer valuable **wood and non-timber forest products (NTFPs)** to local communities.

There is immense potential for reintroducing a diverse range of indigenous tree species. During village-level consultations, communities identified **Bamboo, Teak, Sadar, mahua, harad, Baheda, Timru, and Amla** as priority species for plantation, given their ecological and livelihood significance.

These plantations will contribute to:

- **Biodiversity conservation**
- **Climate change mitigation**
- **Sustained access to NTFPs for traditional and economic use**

The plantation drive will be carried out in close coordination with the **Forest Department and MGNREGA**. However, recognising that the department's nursery stock may not include a wide diversity of native species, the project will promote **village-based nurseries managed by Self-Help Groups (SHGs)**. Seeds of indigenous species will be collected in collaboration with forest officials, and SHG women will be trained to raise saplings locally.

As part of the plantation drive, each Gram Panchayat will mobilise the community to plant approximately **12,000 saplings of forest species** in designated common and forest land areas. In the initial two years, the project will invest in establishing community nurseries in two selected Gram Panchayats, along with providing training, inputs, and logistical support for plantation and maintenance.

From the third year onward, the initiative will be scaled and sustained through **convergence with the Forest Department, MGNREGA, and the Tribal Sub-Plan (TSP)**. This convergence strategy will ensure long-term viability, local ownership, and institutionalisation of the plantation efforts.

Over six years, the initiative aims to plant **240,000 saplings of forest species across 20 Gram Panchayats**. Once the nurseries are established, they will continue to function beyond the project period, supplying saplings for future plantation drives.

By integrating this initiative into the **Gram Panchayat Development Plan (GPDP)** and leveraging funds from NREGA, TSP, and Forest Department schemes, the plantation drive will continue to expand. This ongoing effort will contribute to **restoring lost biodiversity**, enhancing **ecological resilience**, and **revitalising common and forest lands** with lakhs of native trees.

#### Investment Breakdown per GP

Item	Unit Cost	Quantity	Total	Source
Pit Digging (1X1X1 m)	₹150 per pit	12,000	₹18,00,000	In the first two GPs, through project investment, in the remaining GPs, through collaboration between NREGA, TSP and Forest Department
Saplings (Average cost)	₹25 per sapling	12,000	₹3,00,000	Same as above
Manure and compost per pit	25 per pit	12,000	₹3,00,000	Same as above
Fencing				Community Contribution
<b>Total</b>			<b>₹24,00,000</b>	

**Table 5.3 – Investment breakdown per GP**

#### Feasibility Technical Feasibility and Financial Viability Issues

##### Technical Challenges:

- Limited availability of diverse native species in government nurseries, particularly for species like Mahua, Timru, Harad, and Bamboo.
- Potentially low survival rates due to poor plantation techniques and inadequate post-plantation care.
- Risks of disputes over land ownership or usage rights, especially for common and forest fringe lands identified for plantation.
- Water availability during summer is necessary to keep the saplings and plants alive.

##### Financial Challenges include:

- High upfront costs (₹24,00,000 per GP) for executing plantation in the first two Gram Panchayats.
- Dependence on convergence with MGNREGA, TSP, and Forest Department, which could lead to delays or uncertainty in fund release for the remaining 18 GPs.

- Lack of budget allocation for essential fencing, which is critical to protecting saplings from grazing and human interference.
- Sustainability concerns persist for SHG-run nurseries beyond the project period, particularly in the absence of guaranteed market or institutional linkages.

**Mitigation Strategies to address these challenges include:**

- Establishing decentralised GP-based nurseries for demonstrations managed by trained SHGs, supported through project funds and technical guidance from forest officials.
- Organising capacity-building programs with practical modules on seed collection, nursery management, organic pest control, and planting techniques.
- Embedding maintenance activities such as watering and mulching into the MGNREGA job schedule to ensure community participation and plant survival.
- Conducting pre-plantation Gram Sabha consultations to secure consent and resolve land-related issues, while involving Forest Rights Committees as needed.
- Mobilising community contributions for low-cost fencing (e.g., live hedges or bamboo) and exploring Forest Department or TSP resources for additional protection.
- Integrating plantation plans into GPDPs and preparing the MGNREGA work list in advance to facilitate timely fund release.
- Encouraging SHGs to diversify nursery operations into fodder, fruit, or medicinal plants to sustain income, and linking them with ongoing forestry and restoration programs.

**Implementation Design and HR**

**Milestones of the Initiative**

**Year 1 – Demonstration Phase Begins**

- Establishment of Two Model Nurseries: Two Gram Panchayats (GPs) selected for piloting community-led nurseries. SHG members identified and trained in seed collection, nursery techniques, and indigenous species propagation (e.g., Mahua, Amla, Harad).
- Seed Collection and Nursery Operations Initiated: Seeds of native forest species were collected in collaboration with officials from the Forest Department. Nursery inputs were procured, and sapling raising commenced.
- Capacity Building: Forest Species Nursery Management Training was conducted for SHG women. Modules include site preparation, composting, sapling care, pest management, and record-keeping.
- GPDP Integration: Plantation activities integrated into the Gram Panchayat Development Plan (GPDP) and shelf of works developed under MGNREGA.

**Year 2 – Demonstration Plantation Implemented**

- Community Plantation Drive in 2 GPs: Around 12,000 saplings planted in each of the two demonstration GPs on identified forest and common lands, with full community participation under MGNREGA.
- Fencing and Maintenance Setup: Low-cost fencing strategies deployed (community contribution, bamboo hedges, etc.), and maintenance responsibilities assigned to wage labourers under NREGA.
- Monitoring and Learning: Survival rate and community feedback were documented to refine techniques. Demonstration sites are used for learning visits by other GPs and stakeholders.
- Mobilisation for Scaling: Selection of 6 new GPs for scaling in Year 3; SHG identification and orientation initiated.

**Year 3 – Scaling Phase I + Plantation Expansion**

- Establishment of 6 New SHG-Run Nurseries: Six additional nurseries were established in six new GPs with trained SHG members and initial convergence support from TSP, Forest Department, and MGNREGA.
- Training and Technical Support: SHGs receive on-site training and exposure visits to demonstration sites of GPs.
- Community-Led Plantation in 6 GPs: Saplings raised in the previous year were planted through NREGA-supported plantation drives in those GPs.
- Strengthening Convergence Mechanisms: Joint meetings with district-level departments (MGNREGA, Forest, TSP) were held to align resource flows and timelines.

#### **Year 4 – Scaling Phase II + Continued Plantation**

- Establishment of 6 More Nurseries: Another batch of six GPs initiates SHG-managed nurseries. Lessons learned from previous batches are applied to improve nursery operations and sapling survival.
- Plantation in GPs with Mature Saplings: Saplings from Year 3 nurseries planted across respective GPs using NREGA and community labour.
- Community Campaigns on Biodiversity: Awareness Drives on Native Species, Biodiversity Benefits, and Sustainable Harvesting of NTFPs.
- Tracking & Evaluation: Midline review to assess nursery performance, survival rate of plantations, and SHG leadership engagement.

#### **Year 5 – Scaling Phase III + Final Batch Plantation**

- Final Set of 6 Nurseries Established: SHGs in the last six GPs supported to establish nurseries using community-collected seeds and local inputs.
- Large-Scale Plantation in the Earlier 6 GPs: Saplings from Year 4 nurseries are now planted in their respective GPs.
- Knowledge Sharing & Cross-GP Learning: Best practices documented and disseminated through farmer-field schools, SHG exchange visits, and Panchayat-level meetings.

#### **Year 6 – Completion of Community Plantation Drive**

- Final Plantation Cycle Across Remaining GPs: Saplings from Year 5 nurseries planted, completing the community plantation drive across all 20 GPs.
- Post-Plantation Care Institutionalised: NREGA and GPDP provisions used to ensure watering, protection, and mulching of plantations.
- Sustainability Planning: Nurseries integrated into long-term forest restoration strategies. SHGs are linked to state forest schemes, tribal plans, and eco-restoration missions.

**Additional human resources required:** The two horticulture experts mentioned for the fruit tree plantation will also drive this initiative

**Institutions required, if any:** SHG, VO, Gram Sabha, Gram Panchayats and Forest Protection Committees

#### **Ecological Outcomes**

- Restoration of Biodiversity on Forest and Common Lands: Plantation of 240,000 native saplings (including Mahua, Timru, Harad, Amla, etc.) enhances the diversity of forest species and ecological balance.
- Climate Change Mitigation: Increased green cover contributes to carbon sequestration and stabilisation of microclimates.
- Improved Ecological Resilience: Dense native canopy improves soil moisture retention, reduces erosion, and enhances local ecosystems' ability to cope with climate variability.

- Conservation of Indigenous Tree Species: Seed collection and propagation safeguard genetic diversity and traditional forest ecosystems.
- Soil and Water Conservation: Native trees with deep roots help prevent soil erosion, improve groundwater recharge, and protect watershed integrity.

### **Economic Outcomes**

- Sustained Access to NTFPs for Traditional and Economic Use: Communities benefit economically from harvestable forest products, such as mahua flowers, Amla fruits, bamboo, harad, and Baheda.
- Women-Led Local Enterprises through SHG-Run Nurseries: SHGs generate income by managing nurseries, supplying saplings, and exploring allied avenues, such as medicinal and fodder plants.
- Job Creation through MGNREGA: Plantation and maintenance activities provide employment opportunities, especially for rural youth and women.
- Livelihood Diversification: Indigenous plantations support mixed-use landscapes that offer multiple economic benefits over time (NTFPs, eco-tourism potential, etc.).
- Cost-Effective Eco-Restoration Assets: Long-term investment in forest cover enhances land productivity and resilience at relatively low costs, leveraging convergence funding.

### **Socio-Institutional Outcomes**

- Strengthened Community Ownership and Participation: Gram Sabha consultations, community plantation drives, and local stewardship enhance collective accountability and cohesion.
- Empowerment of Women and SHGs: Women-led SHGs take on leadership roles in nursery management, training, and ecological restoration, thereby increasing their influence and visibility in village governance.
- Integration with Local Governance Mechanisms: Inclusion of plantation activities in Gram Panchayat Development Plans (GPDs) ensures local planning, budget allocation, and continuity.
- Improved Institutional Coordination: Joint planning and convergence among Gram Panchayats, the Forest Department, MGNREGA, and the Tribal Sub-Plan streamlines implementation and reduces fragmentation.
- Capacity Building and Knowledge Transfer: Training modules on nursery techniques, biodiversity, and restoration empower local actors, creating a skilled ecological workforce.
- Creation and Strengthening of Local Institutions: HGs, Forest Protection Committees, and Gram Sabhas play a crucial role in forest governance and sustainable resource use.
- Sustainability of Community Nurseries: series become permanent village assets, supported through ongoing schemes and local institutions that extend beyond the project period.

### **Results of the intervention**

- Two hundred forty thousand native forest species saplings were planted across 20 Gram Panchayats over a six-year period.
- Biodiversity in forests and common lands has been significantly restored through community-led efforts.
- Improved ecological resilience with increased canopy cover, soil conservation, and microclimate stabilisation.
- SHG-run nurseries established in villages, fostering women's leadership and local entrepreneurship.
- Sustained access to NTFPs, such as mahua, Bamboo, Amla, harad, and Timru, enhances traditional livelihoods.

- Climate change mitigation is achieved through increased green cover and carbon sequestration.
- Village-based seed collection and nursery practices help preserve indigenous species.
- Plantation institutionalised through GPDPs with long-term convergence from MGNREGA, TSP, and the Forest Department.
- Community mobilised to plant approximately 12,000 saplings per GP, strengthening local ownership.
- Nurseries continue beyond the project, supporting future eco-restoration initiatives.

## 5.3. Animal Husbandry

In the Ahwa block of Dang district, Gujarat, livestock rearing is a vital livelihood strategy for tribal communities, encompassing dairy farming, poultry farming, and goat rearing. Traditional practices such as raising Dangi cattle and indigenous goat and poultry breeds are integral to their culture and sustenance. However, challenges such as limited access to quality feed, animal health services, and proper market linkages hinder the full potential of these practices. Addressing these bottlenecks through targeted interventions can significantly enhance household income, nutrition, and soil health, thereby supporting sustainable agroecological practices in the region.

### 5.3.1. Improving livestock extension services through Capacity Building, Knowledge Exchange and Learning Platform for Pashu Sakhis

The details are already covered under A1, including CRP/PKS and PS. The following is a description of the implementation design.

#### Implementation Components & Approach

##### Training of 100 Pashu Sakhis on Agroecological Poultry, Dairy and Goat Rearing Practices

- **Scale & Phasing:**
  - **Year 1:** 2 training batches (40 Pashu Sakhis)
  - **Year 2:** 3 training batches (60 Pashu Sakhis)
  - **Batch size:** 20 Pashu Sakhis per training
- **Content focus:**
  - Agroecological feed & fodder management
  - Disease prevention, vaccination protocols, and basic veterinary first aid
  - Low-cost housing and sanitation for livestock
  - Value addition & market linkages for milk, eggs, and meat
- **Methodology:** Practical, demonstration-led approach with follow-up mentoring.
- **Budget:** ₹1,00,000 per training; **Total:** ₹5,00,000 (2 in Year 1, 3 in Year 2).

##### Cluster-Level Monthly Sharing and Knowledge Exchange Meetings

- **Objective:** Facilitate peer-to-peer learning, troubleshoot livestock health and management issues, and track adoption of best practices.
- **Frequency & Duration:** 1 meeting per cluster every month for the **first 3 years**.
- **Transition Plan:** After Year 3, the meetings will be continued by government livestock departments and line agencies.
- **Budget:** ₹10,000 per meeting.

### Annual Exposure Visits

- **Scale & Phasing:**
  - 5 exposure visits per year for the **first 3 years**
  - Each exposure visit includes 20 participants (Pashu Sakhis)
- **Destinations:** Successful dairy cooperatives, goat producers, and model poultry farms practising agroecology.
- **Purpose:** Enhance technical knowledge, expand networks, and motivate adoption of innovative practices.
- **Budget:** ₹1,50,000 per exposure visit; **Total:** 15 visits × ₹1,50,000

### Medicine and Vaccine Kits

- **Provision:** Each of the 100 Pashu Sakhis will receive a complete kit containing:
  - Veterinary medicines
  - Vaccines
  - First-aid materials
  - Ice box for cold chain management
- **Purpose:** Enable immediate community-level livestock healthcare.
- **Budget:** ₹5,000 per kit × 100 kits.

### Demonstration Farms

- **Set up:** 30 demonstration farms (15 in Year 1 and 15 in Year 2) showcasing best practices in dairy, goat farming, and poultry farming.
- **Function:** Serve as live training sites for farmers, enabling season-long demonstrations and farmer-to-farmer extension.
- **Budget:** ₹1,00,000 per demonstration unit.

### Incentive Payment to Pashu Sakhis

- **Amount:** ₹5,000 per month (₹60,000 per year)
- **Phasing:**
  - **Year 1:** 30 Pashu Sakhis
  - **Year 2:** 60 Pashu Sakhis
  - **Year 3–5:** 100 Pashu Sakhis
  - In **Years 4–5**, 50% of the incentive will be covered through payments for services by the community.
  - From **Year 6 onwards**, Pashu Sakhis become self-sustaining through service fees and livestock-based enterprises.

### 5.3.2. Promotion of Dairy-Based Enterprises

Cows play a pivotal role in agroecology, primarily through the production of cow dung, which serves as a vital organic manure for enhancing soil quality. In the Ahwa block, the indigenous Dangri breed and buffaloes are traditionally reared by tribal communities. However, these local breeds are not highly productive in terms of milk yield, typically providing only litres of milk per day when adequately fed, which is primarily used for household consumption.

The intervention of Vasudhara Dairy has had a significant impact on the dairy landscape in Ahwa block. With the establishment of around 254 cooperatives, 184 of which are currently functioning effectively, Vasudhara Dairy procures approximately 55,000 litres of milk daily. This success is attributed to the comprehensive support provided by Vasudhara Dairy, including financing, quality feed, animal health services, and the establishment of milk collection routes that penetrate deep into the block.

The ease of doing dairy has motivated many farmers to adopt more productive breeds, such as HF, Jersey, Sahiwal, and Gir cows, for setting up small dairy units with 2-3 cows each. While these breeds are not indigenous, they have undergone a process of naturalisation and are well-adapted to local conditions. The cow dung produced is stored in pits to create high-quality manure, which is applied to the fields during farming seasons, thereby improving soil fertility.

Vasudhara Dairy aims to scale up milk production to 100,000 litres per day. However, achieving this target requires access to the Tapi River water project, which is scheduled to be commissioned in 2027. As the current availability of drinking water for cattle remains a significant constraint, the dairy expansion has been planned for the third year of the project. Expansion of dairy activities will reduce the pressure on land for income generation, enhancing the sustainability of agroecological farming and increasing the availability of organic manure for soil enrichment.

Moreover, successful models like the NDDDB-supported Zakariyapura Bio Gas Unit demonstrate the potential of dairy-based biogas units. A small biogas unit powered by 2-3 cows can generate sufficient biogas to run a household kitchen, while the slurry produced serves as an excellent byproduct for agroecological farming. This integrated approach not only enhances dairy productivity but also promotes sustainable farming practices and improves health in the Ahwa block.

### How does the intervention contribute towards the different elements of the Agroecological Value Chain?

Value Chain Element	Improvements
1. Seed equivalent	The seed equivalent of dairy includes the provision of high-yielding milch animals, access to quality breeding services, and essential equipment—serving as the foundational inputs for initiating or strengthening dairy-based livelihoods. To support this, AKRSP, in partnership with BAIF, will organise annual Livestock Melas, enabling farmers to engage directly with verified livestock vendors and make informed purchases. Farmers will also have the option to procure milch animals along with heifer calves, which can be raised as future dairy stock. Priority will be given to promoting high-yielding indigenous breeds such as Gir, Sahiwal, and indigenous buffaloes, alongside HF and Jersey crosses. Pashu Sakhis will play a crucial role in delivering timely and supportive artificial insemination (AI) services in collaboration with the Veterinary Department, thereby strengthening local dairy ecosystems.
2. Inputs	The Prakrutik Krishi Sakhis (PKSs) and Pashu Sakhis (PSs) will play a key role in training dairy farmers on green fodder development, including the cultivation of nutrient-rich multi-species fodder crops like maize, hybrid napier, and leguminous varieties, as well as Azolla farming, which provides a sustainable and cost-effective protein supplement for livestock. Farmers will also be linked to Vasudhara Dairy for access to essential dairy inputs, including balanced feed concentrate, mineral mixtures, and veterinary supplies. Trained Pashu Sakhis, under the guidance of veterinary doctors from the Animal Husbandry Department and AKRSP, will provide basic first aid, deworming, and vaccination services at the village level. Additionally, Bio Resource Centres (BRCs) will support the supply of herbal and agroecological inputs—such as neem-based dewormers and ethno-

	veterinary remedies—to promote holistic and sustainable livestock health management.
<b>3. Agri+Dairy-advisory training and extension</b>	Advisory and extension services for dairy farmers will be delivered through a well-coordinated network of Pashu Sakhis (PSs) and Prakrutik Krishi Sakhis (PKSs), who are trained community resource persons. Pashu Sakhis will offer doorstep guidance on animal health, breed improvement, feeding practices, and disease prevention, in collaboration with veterinary staff. PKSs will complement this by advising farmers on fodder crop planning, organic feed alternatives, and integration of dairy with agroecological practices. Identified Pashu Sakhis will establish model dairy farms as Farmer Field Schools, where they will conduct regular training sessions on improved dairy management practices. PKSs will organise demonstrations on fodder crop cultivation, Azolla farming, and other low-cost green fodder solutions, helping dairy farmers enhance their access to nutritious feed. PKSs will also support the integration of dairy within the broader Integrated Farming System (IFS) approach, ensuring resource efficiency and sustainability. Through regular awareness camps, demonstration events, and field visits, these grassroots extension workers will provide timely, localised, and practical support to enhance productivity and sustainability in dairy farming.
<b>4. Method of growing</b>	Already covered above under advisory services to be provided through the Pashu Sakhis and Prakrutik Krishi Sakhis
<b>5. Pest and Disease Management</b>	Pashu Sakhis will play a key role in dairy pest and disease management by providing preventive care, early diagnosis, and basic treatment using a combination of traditional herbal remedies and scientific veterinary practices. They will be trained to identify common symptoms, administer first aid, and coordinate with veterinary doctors for vaccinations and advanced care. Additionally, Pashu Sakhis will serve as vital links between dairy producers, veterinary clinics, and institutional animal ambulance services, ensuring timely emergency care and support for more critical health issues.
<b>6. On-farm mechanisation</b>	BRCs and FPOs will provide access to essential mechanised tools and equipment such as chaff cutters, fodder harvesters, and milk chilling facilities to reduce drudgery and improve efficiency in dairy operations. In collaboration with Vasudhara Dairy, the BRCs will also facilitate access to feed mixing units and fodder processing equipment, enabling better feed management.
<b>7. Harvesting and post-harvesting processing</b>	While most of the milk produced will be collected directly at the village level through the dairy cooperative and transported by Vasudhara Dairy, there is potential for future value addition. Going forward, FPOs will support dairy farmers in converting a portion of their milk into high-value products, such as ghee and paneer, which have strong demand both locally and in distant markets. With proper branding and packaging through the FPOs, these products can be effectively marketed to tourists in the Saputara hill region, local consumers, and extended to urban markets such as Surat,

	Nashik, and Pune, creating additional income opportunities for dairy producers.
<b>8. Storage and logistics</b>	No storage is involved, as most of the milk is transported through Vasudhara Dairy. The logistics are also handled directly by the Vasudhara Dairy.
<b>9. Market Linkages - Local</b>	Milk marketing is primarily managed through Vasudhara Dairy, but initiatives will be implemented to convert a portion of the milk into high-value products, such as ghee and paneer. These products will be promoted and sold locally with support from the FPOs, leveraging FPO outlets in Saputara, weekly markets, and larger local market hubs. This approach will enhance the value proposition for dairy farmers while meeting local demand for high-quality dairy products.
<b>10. Market Linkages - Distant</b>	For high-value products like ghee and paneer, the block-level FPO will coordinate with markets in Surat, Pune, and Mumbai to facilitate their sale, ensuring wider market access and enhancing income opportunities for dairy farmers.

### Technical Feasibility Challenges

- **Water Scarcity Until Tapi Project Completion (2027):** Limited access to water in the majority of villages restricts fodder cultivation and expansion of livestock units, especially in the summer months.
- **Limited Veterinary Coverage and Extension Services:** The scarcity of veterinary professionals and the limited reach of government-run clinics result in delayed diagnoses, poor disease management, and reduced animal productivity.
- **Difficulty in Procuring Quality Milch Animals:** Smallholders face challenges in sourcing high-yielding, locally suitable breeds due to a lack of reliable suppliers and market information.
- **Low Institutional Convergence and Coordination:** Gaps in coordination among key stakeholders—such as AKRSP, FPOs, Vasudhara Dairy, the Veterinary Department, and Gram Panchayats—can hinder seamless execution and coverage.

### Financial Feasibility Challenges

- **High Upfront Investment Requirements:** Even with a 50% government subsidy (up to ₹47,500), the reimbursement-based system requires farmers to first invest ₹95,000—often unfeasible for the poorest households.
- **Low Access to Credit and Financial Services:** Tribal and remote communities face challenges in accessing formal credit for livestock purchase, feed, and infrastructure.
- **Overreliance on a Single Buyer (Vasudhara Dairy):** A lack of market diversification exposes producers to pricing fluctuations and dependency on a single procurement channel.

### Mitigation Strategies

- **Water Management and Phasing:** Dairy expansion will be aligned with the timeline of the Tapi Water Project. In the meantime, plantation and fodder activities will be prioritised in villages with relatively better access to water. Efficient water-use practices such as pitcher irrigation, azolla ponds, and green fodder demos will be promoted.

- **Strengthening Last-Mile Veterinary Services:** Over the first two years, Pashu Sakhis will be intensively trained in disease identification, AI, vaccinations, and basic treatments. AKRSP will designate two veterinary experts (one in-house and one at the FPO level) to provide technical support and quality control.
- **Ensuring Access to Quality Breeds:** Annual Livestock Melas will be organised in partnership with BAIF, enabling farmers to make informed purchases from verified breeders, focusing on high-yielding indigenous breeds such as Gir, Sahiwal, and buffaloes, alongside Jersey and HF, where appropriate.
- **FPO-Led Infrastructure Development:** Infrastructure support—such as milk chillers, weighing equipment, and logistics—will be strengthened through convergence with dairy cooperatives and government schemes, particularly to process some part of the milk to high-value products like Ghee and Paneer.
- **Financial Inclusion via Revolving Fund Mechanism:** From Year 3, a Revolving Fund will be set up at the FPO level, supporting 50 dairy units at any point with an advance of ₹47,500 per household. Repayments will be timed with the disbursement of subsidies to reduce household burden and maintain fund circulation.
- **Capacity Building for Financial Access:** Pashu Sakhis will assist households in completing documentation for loans and subsidies under TSP, DIC, and Veterinary Department schemes, thereby improving financial access and reducing upfront investment hurdles.
- **Market Diversification and Value Addition:** While Vasudhara Dairy will remain the primary procurement partner, the FPO will support the local processing of milk into high-value products, such as ghee and paneer. These will be marketed through FPO outlets, Saputara hill tourist markets, and urban centres like Surat, Pune, and Mumbai, reducing over-dependence on a single buyer.

## Implementation Design and HR

### Milestones of the Initiative

#### Year 1: Foundation and Capacity Building

- Recruit and train the first cohort of Pashu Sakhis on:
  - Basic veterinary care (diagnosis, treatment, vaccination)
  - Artificial insemination (AI) and reproductive health
  - Fodder cultivation techniques (e.g., azolla, CO4, napier)
- Train Krishi Sakhis to support green fodder and azolla demos.
- Begin community-level demonstrations on fodder cultivation. Conduct orientation sessions for communities on:
  - Dairy entrepreneurship
  - Available government subsidy schemes and eligibility
- Identify and prepare a database of aspiring dairy entrepreneurs.
- AKRSP to appoint two veterinary experts (1 within AKRSP, one at the FPO) for technical backstopping and mentoring of Pashu Sakhis.
- Establish dairy demonstration farms for training purposes.

#### Year 2: Institutional Setup and Demonstration

- Continue mentoring and field handholding of Pashu Sakhis.
- Initiate model dairy farms as Farmer Field Schools, led by trained Pashu Sakhis.
- Conduct community training sessions on:
  - Animal health
  - Green fodder and water-efficient cultivation

- High-yielding indigenous and cross-breeds
- Launch the Revolving Fund at the Block-level FPO to support 50 dairy units at a time with upfront capital of ₹47,500 per unit.
- Conduct training and exposure of aspiring dairy farmers in the demonstration farm.
- Facilitate the addition of 150 dairy units using revolving funds, including the expansion of existing dairy units.
- Organise the first Livestock Mela in collaboration with BAIF to facilitate informed animal procurement.
- Strengthen linkages with:
  - Vasudhara Dairy for milk procurement and pricing
  - Veterinary Department, TSP, and DIC for scheme access
- Support Pashu Sakhis in building the capacity of households to document subsidy and loan applications.
- Coordinate with FPOs and banks to begin groundwork for the revolving capital fund mechanism.

### **Year 3: Scaling of Dairy Units and Financial Mechanisms**

- Facilitate the establishment of 150 additional dairy units using revolving funds, prioritising vulnerable and landless households.
- Deepen training of Pashu Sakhis in financial literacy and repayment tracking.
- Roll out high-yield indigenous breeds and exotic breeds through demonstration farms.
- Organise the second Livestock Mela to ensure access to quality animals.
- Expand fodder demonstrations, integrating them with NRM and water resource sites.
- Begin exploring market opportunities for high-value dairy products (ghee, paneer) through FPO support.

### **Year 4–10: Expansion, Value Addition & Institutional Strengthening**

- Target annual addition of 150 new dairy units using revolving fund and government convergences, reaching 1350 + households by the end of Year 10.
- Strengthen milk collection systems, improve logistics in interior villages.
- Launch value addition and branding through FPOs:
  - Begin small-scale processing of milk to ghee/paneer
  - Sell through FPO outlets in Saputara, local haats, and urban markets (Surat, Pune, Mumbai)
- Integrate dairy planning into GPDPs and ensure convergence with MGNREGA, Veterinary Department, and Horticulture Schemes.
- Institutionalise Pashu Sakhis and Krishi Sakhis as community-based service providers.
- Monitor repayments and recycling of the revolving fund to maintain liquidity.

**Additional human resources required:** Two Veterinary Experts at the AKRSP level will be engaged for five years, along with three Livestock Master Trainers who will coordinate the entire livestock programme, including dairy, goat rearing and poultry and provide continuous technical support and mentoring to the Pashu Sakhis.

**Institutions required, if any:** Dairy Cooperative, Vasudhara Dairy, FPO, SHGs, VOs, CLF

### **Ecological, Economic, Social & Institutional Outcomes**

### **Ecological Outcomes**

- The adoption of integrated farming systems, which combine dairy farming with natural farming practices, will enhance nutrient cycling, reduce external inputs, and promote sustainable land use.
- Promoting the cultivation of green fodder (e.g., maize, azolla, hybrid napier) will contribute to improved soil health and reduced dependence on forest grazing, thereby helping to preserve local biodiversity.
- Improved cattle management practices and the use of bio-based veterinary care (herbal dewormers, traditional remedies) will minimise chemical runoff and environmental contamination.

### **Economic Outcomes**

- Establishing 150 dairy units annually will diversify household income sources and create stable livelihood opportunities for smallholder farmers.
- Linkages with Vasudhara Dairy and the development of local value chains (e.g., paneer, ghee) through FPOs will enhance market access and facilitate value addition, thereby increasing farm-level profitability.
- Access to revolving funds and government subsidies will reduce the barrier of upfront investment, allowing economically vulnerable households to initiate dairy enterprises.

### **Social and Institutional Outcomes**

- Women will be empowered as Pashu Sakhis and Prakritik Krishi Sakhis, becoming frontline extension agents and entrepreneurs, which will lead to greater gender inclusion and leadership in the livestock sector.
- Community knowledge and service delivery will be strengthened through the Pashu Sakhis and training of Livestock Master Trainers and Veterinary Experts at block and AKRSP levels.
- Village institutions, such as SHGs and FPOs, will be strengthened through their roles in financing, extension, and marketing. The integration of dairy into the GPDP will promote local ownership and convergence with schemes such as MGNREGA, NRLM, and TSP.
- Enhanced coordination among AKRSP, Vasudhara Dairy, BAIF, and government departments will build a robust institutional ecosystem to support sustainable dairy development.

### **Results of the intervention**

- 150 new small dairy units every year through convergence, contributing to the goal of 100,000 litres/day milk collection
- Increased income for small farmers through the sale of milk, supported by reliable procurement and fair pricing.
- Enhanced soil fertility through systematic use of cow dung and slurry as high-quality organic manure.
- Trained Pashu Sakhis and Krishi Sakhis lead extension on AI, health, and fodder, strengthening grassroots support.
- The FPO-based revolving fund supports low-income families in accessing subsidies, thereby improving equity in dairy promotion.
- Local breed promotion (Gir, Sahiwal, buffaloes) increases milk yield while maintaining adaptability.
- Annual livestock auctions offer access to high-quality animals and informed purchasing decisions.
- Improved water access from the Tapi project sustains dairy expansion and cattle welfare.
- Dairy growth complements agroecology, reducing land pressure and increasing manure availability.

### 5.3.3. Scaling Backyard Poultry in Ahwa Block: A Sustainable Livelihood and Nutrition Model

Implementing a **small-scale backyard poultry model** in Ahwa holds substantial potential for enhancing household incomes, improving nutrition, and promoting agroecological sustainability. **Indigenous poultry breeds** are ideal due to their adaptability to local climatic conditions, disease resistance, and dual utility for both eggs and meat. These birds can thrive on a **low-cost scavenging diet** supplemented with kitchen and farm waste, making them highly suitable for rural households.

#### Current Situation and Scaling Potential

- **Existing flock sizes** in villages range from:
  - **2–10 birds** (low level)
  - **10–20 birds** (middle level)
  - **20+ birds** (high level)

With appropriate technical support and improved management practices, participating households will be able to scale their poultry flock to **50–100 birds** over time. This will be achieved by promoting **backyard poultry (BYP)** among 10,000 households through the following model mix:

- **BYP unit with 20 birds** – 5,000 growers
- **BYP unit with 50 birds** – 3,000 growers
- **BYP unit with 100 birds** – 2,000 growers

These initial units will serve as an entry point, enabling rearers to gradually expand flock size, adopt better husbandry practices, and secure a steady, year-round income.

A total of **200 Breeding-cum-Mother Units**, each with a capacity of 500 birds, will be established to supply **vaccinated chicks aged 14–21 days** to backyard poultry (BYP) growers for rearing.

#### How does the intervention contribute towards the different elements of the Agroecological Value Chain?

Value Chain Element	Improvements
<b>1. Seed equivalent</b>	<p>In the poultry intervention model, multiple integrated components work together to ensure a reliable and sustainable supply of high-quality chicks along with early-stage support for poultry rearers. The process begins with the establishment of <b>Breeding-cum-Mother Units</b> managed by trained Pashu Sakhis. These units provide a consistent, locally managed source of quality chicks, addressing the common challenge of limited access to improved breeds.</p> <p>The Breeding-cum-Mother Units also offer <b>controlled brooding for the first 14–21 days</b>, partial vaccination, and essential early-stage care. This significantly reduces chick mortality, improves health, and enhances the growth potential of chicks.</p> <p>After the brooding period, <b>healthy, partially vaccinated chicks aged 14–21 days</b> are distributed to poultry growers for rearing. This approach ensures that growers receive robust, well-started chicks, minimising early-stage risks, enhancing survival rates, and improving overall productivity.</p>
<b>2. Inputs</b>	<p>The poultry intervention ensures access to quality inputs—such as chicks and feed—through a decentralised, community-managed system. High-</p>

	<p>quality day-old Desi chicks are produced in decentralised Breeding cum Mother units, ensuring a consistent, timely, and locally available supply. To ensure proper nutrition, farmers are trained to prepare low-cost, locally available feed using resources like Azolla, broken grains, and kitchen waste. Additionally, the intervention promotes <b>safe scavenging feeding</b> through community-managed rearing systems that allow birds to forage naturally while minimising exposure to disease and predators. Pashu Sakhis provide continuous support on feeding practices, health monitoring, and vaccination, ensuring the long-term productivity and well-being of poultry birds.</p>
<p><b>3. Poultry-advisory training and extension</b></p>	<p>A cadre of trained Pashu Sakhis plays a pivotal role in building the knowledge and capacities of backyard poultry rearers. Selected Pashu Sakhis establish and manage <b>breeding cum mother units</b> and <b>model backyard poultry farms</b> that serve as practical demonstration sites for training other farmers in improved poultry rearing practices, including housing, feeding, health management, and biosecurity. These model farms act as local learning hubs where hands-on sessions are conducted regularly.</p>
<p><b>4. Method of growing</b></p>	<p>The backyard poultry model will be implemented using low-cost, locally adapted methods to support small and marginal households. Chicks will be supplied through established Mother Units managed by trained Pashu Sakhis/entrepreneurs, ensuring quality and timely availability. Pashu Sakhis, along with Mother Unit entrepreneurs, will provide continuous support on disease prevention, vaccination, and basic veterinary care. Households will be trained to build simple poultry sheds using local materials for protection and hygiene. Feed mixes will be developed using locally grown resources and supplied through the FPOs to ensure nutritional adequacy at affordable costs. Demonstration units will serve as practical learning centres to promote widespread adoption of the model.</p>
<p><b>5. Pest and Disease Management</b></p>	<p>Effective pest and disease management is critical to ensuring the sustainability and productivity of the backyard poultry model. Under this initiative, a combination of traditional knowledge and modern veterinary practices will be used to safeguard poultry health. Trained Pashu Sakhis and Mother Unit Entrepreneurs will play a central role in early identification, diagnosis, and management of common poultry diseases such as Newcastle disease, Fowl Pox, and Coccidiosis. Regular vaccination and deworming schedules will be implemented at the Mother Unit as well as through door-to-door outreach and village-level poultry health camps. Basic first-aid kits and preventive medicines will be made available with Pashu Sakhis and at the Mother Units. Hygiene and sanitation measures, such as proper waste disposal, disinfection of poultry sheds, and safe feed storage, will be promoted through farmer training sessions. Awareness campaigns will also focus on biosecurity measures to prevent disease outbreaks. Additionally, locally available herbal remedies will be integrated where feasible, reducing reliance on costly chemical treatments.</p>

<b>6. On-farm mechanisation</b>	The breeding cum mother unit will play a central role in addressing equipment needs for brooding and ensuring the supply of high-quality chicks. The FPOs will be equipped with refrigeration units to store vaccines and medicines, and the Pashu Sakhis will have ice boxes to carry vaccines for door-to-door vaccination.
<b>7. Harvesting and post-harvesting processing</b>	The desi birds raised by the backyard farmers will be sold partly directly by the local farmers and predominantly through the FPO-led marketing network
<b>8. Storage and logistics</b>	Not relevant
<b>9. Market Linkages - Local</b>	The block-level and cluster-level Farmer-Producer Organisations (FPOs) will facilitate local poultry marketing by establishing a network of retailers and wholesalers operating within their respective areas. Additionally, poultry growers will have the opportunity to sell their products directly in local weekly markets, as well as within their villages and communities during festivals.
<b>10. Market Linkages - Distant</b>	Market Linkages (Distant): The block-level FPO, in coordination with the cluster-level FPOs, will facilitate the marketing of surplus production to Pune and Mumbai, which are predominantly non-vegetarian markets, thereby expanding the reach of the poultry products.

### Investment requirements

To strengthen backyard poultry (BYP) production and ensure a sustainable supply of quality chicks, the intervention will establish both breeder-level infrastructure and grower-level units. The costing and phasing are as follows:

- Breeding-cum-Mother Units: 200 units of 500-bird capacity will be set up, each costing ₹2,00,000 for the shed and equipment, amounting to ₹4,00,00,000. In addition, working capital support of ₹50,000 per unit will be provided, totalling ₹1,00,00,000. These units, managed by Pashu Sakhis, will rear chicks for the first 14–21 days, giving vaccination and basic care, before distributing them to growers.
- BYP Grower Units:
  - 20-bird model: 5,000 growers will be supported with a unit cost of ₹7,000, totalling ₹3,50,00,000.
  - 50-bird model: 3,000 growers will receive units costing ₹15,000 each, totalling ₹4,50,00,000.
  - 100-bird model: 2,000 growers will receive units costing ₹30,000 each, totalling ₹6,00,00,000.

### Feasibility (Technical Feasibility and Financial Viability Issues)

## Technical Challenges

One of the primary technical challenges in the poultry intervention model is the limited access to traditional, hardy poultry breeds, which can affect the consistency of chick quality and availability. Additionally, setting up effective Mother Units with the required infrastructure and trained entrepreneurs may pose operational difficulties, especially in rural settings with limited access to specialised facilities. Disease management also presents a challenge, as early-stage mortality can be significant without effective vaccination and biosecurity measures in place. Ensuring balanced nutrition for poultry in the absence of commercial feed requires proper training and support to help farmers utilise locally available, cost-effective feed resources. Lastly, scaling the model to engage a large number of poultry rearers while maintaining quality control and health management requires robust coordination and infrastructure across the clusters.

## Financial Challenges

The financial challenges of the model are substantial, with high initial capital expenditure (CAPEX) for infrastructure, including the construction of poultry sheds, breeding cum mother units, and the purchase of equipment. The operational expenses (OPEX) for running the Mother Units over 21 days could also place a significant financial burden on the implementing entities. Additionally, the project's economic sustainability relies heavily on the income generated from selling chicks, feed, and mature poultry, which could be affected by market fluctuations or low demand in the early stages of development. Ensuring financial viability, particularly for small-scale poultry growers, requires meticulous financial planning, ongoing investment in infrastructure and operational support.

## Mitigation Strategies

To address these challenges, several mitigation strategies are proposed. Decentralised Breeding-cum-Mother Units will be established under the guidance of trained Pashu Sakhis/Entrepreneurs to ensure a consistent and timely supply of hardy indigenous chicks, thereby reducing dependency on external suppliers. These units will streamline brooding processes and reduce early-stage mortality by providing controlled conditions for chick rearing, while also creating a local, trained workforce to manage the operations. Regular vaccination and health support, facilitated by trained Pashu Sakhis, will mitigate disease risks, ensuring healthier poultry.

To overcome the financial challenges, the model will focus on economies of scale by engaging 50 poultry growers per Breeding-cum-Mother Unit, sharing costs and generating income through the sale of mature birds. Training farmers in cost-effective feeding practices and providing continuous advisory services will help reduce operational costs. Furthermore, the model's focus on decentralisation and local ownership, particularly through women entrepreneurs, ensures that the intervention is adaptable, sustainable, and responsive to local needs.

## Implementation Design and HR

### Milestones of the Initiative

#### Year 1: Laying the Foundation

- Planning and Community Mobilisation
  - Mapping of interested poultry growers and potential Pashu Sakhis.
  - Setting up of BYP Demonstration Units by Pashu Sakhis for training
  - Orientation sessions for FPOs and SHGs on the poultry model.
  - Training of BYP Growers
- Infrastructure Development
  - Construction and setup of 100 Breeding cum Mother Units of 500 chick capacity in one cycle.

- Procurement and installation of breeding and brooding infrastructure.
- Capacity Building
  - Selection and training of 100 Pashu Sakhis and potential Mother Unit Entrepreneurs.
  - Training on chick brooding, vaccination, disease control, feed preparation, and recordkeeping.
- BYP Initiation
  - Initiation of 1500 units 20 birds size, 1500 units 50 birds size and 1000 units of 100 birds size

### **Year 2: Scaling and Stabilisation**

- Operational Expansion
  - Setting up of an additional 100 Breeding cum Mother Units
  - Scale-up to an additional 1500 units, 20 Birds size, 1500 units 50 birds size and 1000 units 100 birds size
- Health & Extension Support
  - Systematic follow-up vaccination and health monitoring by Mother Unit Entrepreneurs and Pashu Sakhis.
  - Development of poultry health calendars for each grower.
- Feed & Nutrition
  - Training for growers on the use of Azolla, kitchen waste, and broken grains for supplementary feeding.
  - Initiation of local Azolla beds and feed resource demonstrations by CRPs and Prakrutik Krishi Sakhis.
- Waste Management and Agroecology
  - Promotion of poultry litter composting and its use in backyard farms.

### **Year 3: Consolidation and Livelihood Integration**

- Outreach expansion
  - Setting up 2000 additional 20-bird units
- Entrepreneurship Development
  - Mother Unit Entrepreneurs and Pashu Sakhis were supported to register as rural micro-enterprises.
  - Business planning and soft loan linkage (where feasible).
- Marketing Initiatives
  - Linkages with local and regional markets (e.g., Saputara, Surat).
  - Branding of Desi poultry under FPO-led channels.
- Community Engagement
  - Farmer field days and poultry melas to promote the model.
  - Documentation of best practices for replication.

**Additional human resources required:** The veterinarians have already been assigned under the dairy initiative to provide ongoing support and guidance for this initiative, ensuring technical assistance and advice for managing animal health, vaccinations, disease control, and overall veterinary care throughout the poultry farming process.

**Institutions required, if any:** Successful implementation of the poultry initiative relies on strong community-based institutions. Cluster-level FPOs will manage medicines, input supply, and marketing. SHGs and women's federations will mobilise poultry rearers and promote women entrepreneurs. Trained Pashu Sakhis and Mother Unit Entrepreneurs will provide extension, health, and brooding support. Panchayats will ensure convergence with schemes and local facilitation.

## Ecological, Economic, Social & Institutional Outcomes

**Ecological Outcomes:** The poultry initiative promotes sustainable practices by encouraging the use of backyard models that integrate well with local ecosystems. Poultry litter will be composted and utilised as organic manure, enhancing soil health and promoting agroecological farming practices. Reduced reliance on commercial feed through the use of locally available inputs (e.g., Azolla, kitchen waste) minimises environmental impact.

**Economic Outcomes:** The model enables income generation for over 10,000 women poultry growers by reducing early mortality through brooding support and ensuring a steady supply of high-quality chicks. Supplementary nutrition, vaccination, and disease control improve bird survival and productivity. FPO-led marketing enhances market access, including linkages with urban centres like Pune and Mumbai, boosting profitability for smallholders.

**Social & Institutional Outcomes:** The initiative empowers women through roles as Pashu Sakhis and Mother Unit Entrepreneurs, fostering rural entrepreneurship. SHGs and federations play crucial roles in mobilising producers and ensuring effective outreach. FPOs act as anchors for supply, capacity building, and marketing. These structures enhance local ownership, improve institutional coordination, and build a scalable and inclusive poultry value chain in tribal areas.

### Results of the Poultry Intervention

- **Improved Household Incomes:** Scaling up poultry units to 50-100 birds generates ₹15,000 in additional income every six months.
- **Increased Poultry Flocks:** Households can scale from 2-10 birds to 50-100 birds, promoting livelihood diversification.
- **High-Quality Chick Supply:** Establishment of local breeding cum mother units ensures a consistent, timely supply of hardy indigenous chicks.
- **Enhanced Health and Productivity:** Vaccination and disease management by trained Pashu Sakhis minimises losses, promoting healthier flocks.
- **Sustainable Feeding:** Utilising locally available feed and waste reduces costs while maintaining a nutritional balance.
- **Agroecology Promotion:** Composting poultry litter as organic manure enhances soil health, supporting agroecological farming practices.
- **Women's Empowerment:** Trained Pashu Sakhis manage the Breeding-cum-Mother Units, fostering women's entrepreneurship and strengthening local ownership. All BYP growers are also women, ensuring that the intervention directly benefits and empowers them economically and socially.
- **Scalable Model:** 10,000 poultry growers across 3 clusters, ensuring long-term poultry ecosystem growth.

### 5.3.4. Goat Rearing Model for Livelihood Enhancement

Goat rearing is a widely practised and popular livelihood option in the region. The Veterinary Department, in collaboration with the Tribal Sub-Plan (TSP), is currently promoting **10 female + 1 male goat units**. Under this scheme, a **subsidy of up to ₹45,000** is provided per unit for a total investment of ₹90,000, covering the cost of goats, shed construction, and basic equipment. The Department of Veterinary Services administers the subsidy.

However, despite high interest among farmers, especially from poorer households, the uptake has been limited due to several bottlenecks:

- **A cumbersome application process** requiring upfront investment from the farmer
- **Subsidy is reimbursed only after the purchase**, making it inaccessible to the poorest
- **Lack of standardisation** in goat farming practices due to the limited technical support agencies in the area

To address these challenges, **identified Pashu Sakhis** will establish **Model Goat Rearing Units**, which will serve as demonstration and training sites for other interested farmers. These Pashu Sakhis will also offer doorstep vaccination, health check-ups, and advisory services, including assistance with filling out the online application portal for subsidies.

Additionally, a **Revolving Fund will be set up at the FPO level**, which will:

- Provide **initial financial support** to selected goat rearers to set up their units
- Enable farmers to **claim the government subsidy** after setup
- Ensure the **return of funds to the FPO** upon receipt of the subsidy, allowing reuse of the funds for other beneficiaries

A total of **500 Goat Units of 5+1 (5 females and one male)** will be established, with **150 units in Year 1, 150 units in Year 2, and 200 units in Year 3**. Each unit will cost **₹45,000**, of which **50% will be mobilised through government support under the Tribal Sub-Plan (TSP)**, and the remaining **50% will cover shed and equipment costs**, funded by the project. Similarly, **500 Goat Units of 10+1** will be promoted, with the same phasing—**150 units in Year 1, 150 units in Year 2, and 200 units in Year 3**. Each of these units will cost **₹90,000**, with **50% financed through convergence with TSP** and the remaining **50% to be invested by the project** towards the shed and equipment. This blended financing approach ensures affordability, resource optimisation, and broader adoption of improved goat-rearing practices.

#### **How does the intervention contribute towards the different elements of the Agroecological Value Chain?**

<b>Value Chain Element</b>	<b>Improvements</b>
<b>1. Seed equivalent</b>	In goat rearing, the <b>“seed equivalent”</b> lies in the use of high-quality breeding stock—particularly the provision of <b>1 high-quality male (buck)</b> with every <b>10 female goats for 10+1 unit and one high-quality male (buck)</b> with every <b>five female goats for 5+1 unit</b> models. These well-bred males serve as the genetic foundation, enabling natural herd multiplication. <b>Pashu Sakhis will play a crucial role in identifying healthy, high-performing male bucks and facilitating their procurement and transfer</b> to the respective goat units, thereby ensuring breed quality and compatibility. Not only will the <b>Model Goat Rearing Units</b> established by trained Pashu Sakhis serve as centres for proper breeding, herd health, and selection of strong progeny, but <b>mature bucks from the initial goat units</b> will also be rotated to newer units through a <b>“Passing the Buck” system</b> —a proven model championed by Heifer International.
<b>2. Inputs</b>	In the community-managed grazing model, village communities will take collective responsibility for goat grazing through a rotational supervision system. Each household will nominate a member to manage the collective goat grazing for a day, rotating responsibility among all participating families. This shared approach reduces individual burden and ensures proper care and oversight. To support this model, common grazing lands

	will be rejuvenated and developed under the Gram Panchayat Development Plan (GPDP), ensuring sustained fodder availability.
<b>3. Goat rearing-advisory training and extension</b>	A few selected Pashu Sakhis will establish model goat farms in each cluster, which will function as Farmer Field Schools (FFS) to demonstrate best practices in goat rearing. These model farms will serve as hands-on training and learning sites for other goat rearers in the region. In addition, all trained Pashu Sakhis will regularly monitor goat health, diagnose early signs of disease, administer vaccinations, and provide advisory and extension support to maintain a healthy and productive goat stock across the community.
<b>4. Method of growing</b>	The Pashu Sakhis will support methods of Growing
<b>5. Pest and Disease Management</b>	Pest and disease management in goat rearing will be primarily facilitated by trained Pashu Sakhis, who will conduct regular health check-ups, ensure timely vaccinations, and monitor for early signs of diseases such as PPR, FMD, and parasitic infections. They will provide doorstep advisory services, basic treatment, and referrals to veterinary experts when needed. Through routine deworming, hygiene promotion, and community awareness, Pashu Sakhis will play a key role in minimising morbidity and maintaining herd health.
<b>6. On-farm mechanisation</b>	On-farm mechanisation requirements for goat rearing are minimal, as the practice primarily relies on manual management and traditional techniques. However, to improve efficiency, equipment like <b>chaff cutters</b> for efficient fodder preparation from crop residues and green fodder can be accessed through the <b>Bio-Resource Centre (BRC)/FPOs</b> , which will offer a <b>rental model</b> for the equipment, making it affordable for goat rearers.
<b>7. Harvesting and post-harvesting processing</b>	Not relevant, as Goats are marketed directly without processing
<b>8. Storage and logistics</b>	Not relevant
<b>9. Market Linkages - Local</b>	The cluster and block-level FPOs will establish a network of local buyers to facilitate the bulk purchase of goats within the community. Additionally, growers will have the opportunity to sell directly in weekly markets or to wholesalers, ensuring broader market access and enhancing the sales potential of their livestock.
<b>10. Market Linkages - Distant</b>	The block-level FPO will facilitate the sale of goats to distant potential markets, such as Pune and Mumbai.

#### Feasibility (Technical Feasibility and Financial Viability Issues)

### **Technical Feasibility Challenges:**

- **Lack of Standardised Practices and Technical Support:** One of the key challenges in implementing the goat rearing model is the lack of standardised goat farming practices across different regions. Many farmers, especially those in rural areas, may lack access to proper technical training or support, resulting in inconsistencies in herd health, productivity, and overall farm management.
- **Disease and Pest Management Risks:** Goat rearing is susceptible to various diseases, including PPR (Peste des Petits Ruminants) and FMD (Foot-and-Mouth Disease), as well as parasitic infections. Without proper disease management practices, these can cause substantial losses to farmers, especially if early detection and intervention are not available.
- **Sustainability of Grazing Resources:** The community-managed grazing model requires well-maintained and sustainable grazing lands. Overgrazing or poor management of these resources can lead to land degradation and a reduced ability to support healthy livestock. This poses a threat to the long-term sustainability of the model.

### **Financial Feasibility Challenges:**

- **High Upfront Investment and Subsidy Accessibility:** Goat rearing units require a significant initial investment, which can be a barrier for the poorest farmers. Additionally, the government subsidy that covers part of the investment is reimbursed only after the setup, which means farmers must make upfront payments, making the process less accessible for low-income households.
- **Operational Costs:** Although the Revolving Fund can assist with initial setup costs, ongoing operational expenses, including feed, veterinary services, and healthcare, can be a significant financial burden. Farmers must have a consistent income to maintain these costs, and a lack of access to working capital can lead to difficulties in sustaining their operations.
- **Market Linkages and Price Volatility:** Access to stable markets for selling goats is crucial for the financial success of the model.

### **Mitigation Strategies:**

- **Standardised Training and Support:** To overcome the lack of technical knowledge, Pashu Sakhis will be trained to establish Model Goat Rearing Units that will function as demonstration and training centres. These centres will provide hands-on training to farmers on best practices in goat rearing, disease management, breeding, and general farm management. Regular monitoring and advisory services will ensure that farmers adopt standardised practices, thereby improving the overall productivity and health of their goats.
- **Disease Management and Health Monitoring:** Pashu Sakhis will play a crucial role in managing goat health. They will conduct regular health check-ups, administer vaccinations, and ensure early detection of diseases. This system of regular monitoring and doorstep services will help reduce disease-related losses and improve overall herd health. Additionally, community awareness campaigns on hygiene and preventive care will be conducted to minimise risks.
- **Grazing Land Management and Resource Sustainability:** To address the issue of grazing land sustainability, the Gram Panchayat Development Plan (GPDP) will support the rejuvenation of common grazing areas. Additionally, a rotational grazing system will be implemented, where each household takes turns overseeing grazing, ensuring that the land is not overexploited. This will maintain the balance between livestock grazing needs and land health.
- **Financial Support through a Revolving Fund:** To ease the financial burden on farmers, a Revolving Fund will be established at the FPO level. This fund will provide initial financial assistance to goat rearers for the setup of their units, enabling them to claim the government

subsidy once they have established their units. The Revolving Fund will be replenished once the subsidy is received, allowing other farmers to benefit from it.

- **Market Linkages and Price Stabilisation:** To ensure stable market access, FPOs will facilitate local and distant market linkages. A network of local buyers will be established to encourage bulk purchases, and the FPO will also assist in connecting farmers with distant markets, such as Pune and Mumbai. This will help mitigate price volatility by creating multiple channels for selling the goats and ensuring a more consistent market demand.

## Implementation Design and HR

### Milestones of the Initiative

#### Year 1: Foundation, Capacity Building, and Initial Setup

- **Selection and Training:** Identify and train 5–10 Pashu Sakhis per cluster, equipping them with skills in goat management, health care, and subsidy facilitation.
- **Model Goat Rearing Units:** Establish model 5+1 and 10+1 goat units with trained Pashu Sakhis, functioning as Farmer Field Schools (FFS) for hands-on learning.
- **Initial Unit Setup:** Promote 150 units of 5+1 (₹45,000 each) and 150 units of 10+1 (₹90,000 each), with 50% of the cost covered through TSP convergence and 50% project-funded for shed and equipment investment.
- **Revolving Fund:** Provide a revolving fund to the FPO for 50 goat units in Year 1 to offer advance capital support, ensuring timely setup and access to subsidies for early adopters.
- **Health & Extension Services:** Pashu Sakhis begin regular health monitoring, vaccination drives, and advisory services for goat rearers.
- **Subsidy Facilitation:** Map eligible farmers, prepare necessary documents, and initiate groundwork for online subsidy applications.

#### Year 2: Revolving Fund Utilisation and Expanded Coverage

- **Fund Recycling:** Revolving fund capital returns from Year 1 beneficiaries are reinvested for additional goat unit setup.
- **Unit Expansion:** Establish 150 units of 5+1 and 150 units of 10+1 following the same 50–50 funding structure.
- **Application Support:** Pashu Sakhis provides one-on-one assistance with subsidy applications, including form completion, document scanning, and uploading to portals.
- **Peer Learning:** Model units function as demonstration and application support centres, mobilising farmers in clusters.
- **Grazing Management:** Launch community-managed grazing systems with rotational responsibilities and initiate common land development under GPDP.

#### Year 3: Intensification and Institutionalisation

- **Scale-Up:** Establish 200 units of 5+1 and 200 units of 10+1 through combined TSP and project investment.
- **Institutional Capacity:** Pashu Sakhis lead cluster-wide rollout of standardised goat management practices, pest and disease control measures, and improved breeding services.
- **Digital Enablement:** Enhance subsidy application success rates and reduce delays through structured, technology-driven application tracking and management.

**Additional human resources required:** already provisioned under dairy

**Institutions needed, if any:** SHGs, VOs, CLF, FPO, Gram Sabha

## Ecological, Economic, Social & Institutional Outcomes

### Ecological Outcomes:

- Improved Grazing Management: The adoption of a community-managed rotational grazing model reduces overgrazing and facilitates the sustainable use of common lands.
- Soil and Fodder Regeneration: Rejuvenation of grazing lands through the Gram Panchayat Development Plan (GPDP) enhances soil fertility, promotes native fodder species, and improves local biodiversity.
- Reduced Carbon Footprint: Localised, small-scale goat rearing, as opposed to industrial livestock systems, has a lower ecological footprint, mainly when supported by traditional and organic health practices.

### Economic Outcomes:

- Increased Household Income: With proper healthcare, training, and market access, each goat unit can provide a sustained supplementary income, particularly benefiting poor and landless households.
- Access to Subsidies and Revolving Funds: The intervention enables even the poorest families to access government subsidies through upfront support from the FPO-managed revolving fund.
- Market Integration: Enhanced local and distant market linkages increase farmers' bargaining power and income through better prices and bulk selling opportunities.

### Social & Institutional Outcomes

- Promotes inclusion by prioritising support to the poorest and most vulnerable households.
- Strengthens community cohesion through shared grazing management and peer learning from Model Goat Units.
- Builds institutional capacity of FPOs, SHGs, and local livestock rearers' collectives in service delivery, finance, and market facilitation.
- Improves convergence with government departments (Veterinary, TSP, Panchayati Raj), increasing scalability and resource leverage.
- Ensures last-mile extension and veterinary services through a decentralised, community-based model led by trained Pashu Sakhis.

### Results of the Goat Rearing Intervention

- 1,000 Goat Rearing Units Established through a revolving fund mechanism, enabling scale and sustainability.
- 50+ Pashu Sakhis Trained and Operational- Across the clusters, Pashu Sakhis will lead goat health monitoring, extension services, and digital support for subsidy applications.
- Subsidy Access Rate Achieved- With direct online application support from Pashu Sakhis, 100 goat rearers are expected to claim the ₹45,000 subsidy successfully.
- 1000 Households Benefit with an annual income increase of approximately INR 25,000 for 500 households and an increase of approximately INR 50,000 for 500 families, with 70% women's participation. Targeting vulnerable and low-income families, especially women, the intervention ensures inclusive livelihood enhancement.

## 5.4. Natural Resource Management

### 5.4.1. Facilitating GPDP Planning and Implementation with Ridge-to-Valley Approach across 122 Villages

As identified in Chapter 3, despite the presence of various government programs such as MGNREGA, the 15th Finance Commission, the Tribal Sub-Plan (TSP), and Irrigation Department projects, the approach to watershed and natural resource management remains fragmented and scheme-specific. This limits the adoption of a holistic, landscape-based Ridge-to-Valley Integrated Natural Resource Management (INRM) approach. Consequently, the undulating terrain experiences high surface runoff, severe soil erosion, and heavy siltation of check dams—reducing irrigation efficiency and water storage potential.

A key limitation lies in the capacity of frontline facilitators—such as NREGA Mates—who are tasked with planning natural resources under the Gram Panchayat Development Plan (GPDP). Many lack the technical knowledge, facilitation skills, and tools required for effective ridge-to-valley planning. Existing planning processes are often top-down and fail to incorporate local knowledge, particularly from women, smallholders, and marginalised communities. Advanced tools such as GIS mapping and satellite imagery are underutilised, leading to generic and less effective plans.

Access to irrigation and improved soil moisture retention is central to enabling agroecological transitions. Even limited irrigation allows farmers to diversify cropping systems, integrate livestock, and cultivate fruit and forest species—boosting biodiversity, securing non-timber forest products (NTFPs), and strengthening climate resilience.

#### Implementation Design and Investment Plan

##### Year 1 – Foundation and Capacity Building

- Acquisition of a **tailored GIS-based INRM planning application** (INR 10 lakhs), adapted from existing platforms and customised for agroecology-based, convergence-oriented planning at the landscape level.
- **Training of 122 NREGA Mates** through **3 training batches** (35–45 participants each) for **INR 60,000 per batch**.
- **Training of Gram Panchayat members** through **3 cluster-level workshops** (one per cluster) for **INR 30,000 each** to strengthen participatory GPDP preparation.
- **Provision of PRA Toolkits** worth INR 1,000 each, including a village profile, revenue map, satellite map, toposheet, and PRA stationery. **Fifty toolkits** will be distributed in Year 1, covering the first batch of villages.
- **Village-level INRM Planning Processes:** 3-day participatory planning in **50 villages** led by NREGA Mates and AKRSP experts.
- **Incentives for NREGA Mates:** INR 5,000 per completed village plan (50 villages).

##### Year 2 – Completing Planning Coverage

- Distribution of the **remaining 72 PRA toolkits** and facilitation of **3-day INRM planning processes** in the remaining 72 villages.
- **Incentives for NREGA Mates:** INR 5,000 per completed plan (72 villages).
- Digitisation of all INRM plans, including integration of activity costing and scheme convergence details.

##### Year 3 to Year 10 – Implementation

- Implementation of GPDP-aligned INRM plans in collaboration with MGNREGA, TSP, and the 15th Finance Commission.
- **Coverage of 5,000 hectares per year** from Year 3 onwards, achieving **40,000 hectares** of restored, managed, and productive land by Year 10.
- Ridge-to-valley works to include water harvesting, soil conservation, irrigation infrastructure, and agroecological land-use optimisation.

## Feasibility (Technical Feasibility and Financial Viability Issues)

### Technical Challenges

- Limited capacity of NREGA Mates and Panchayat teams in PRA and ridge-to-valley planning.
- Underutilization of GIS and remote sensing tools.
- Top-down planning culture and fragmented scheme implementation.
- Lack of dedicated technical handholding.

### Financial Challenges

- Delays in fund flow from government schemes.
- Limited budgets for high-quality participatory planning.
- Dependency on convergence with external schemes.

### Mitigation Strategies

- **Comprehensive Capacity Building** of all NREGA Mates and Panchayat members through structured training.
- **Dedicated Technical Support** from 3 Cluster-Level INRM Experts and AKRSP Master Trainers.
- **Customised GIS Application** for agroecology-based convergence planning.
- **Performance-linked Incentives** for frontline workers to ensure quality output.
- **The Convergence-Driven Financing Model** mobilises and aligns resources from multiple schemes.
- Regular District and block-level coordination meetings between AKRSP and all stakeholders to ensure timely convergence and fund flow.

## Ecological, Economic and Social Benefits

### Ecological

- Enhanced soil and water conservation, groundwater recharge, and biodiversity restoration.
- Reduced siltation in water bodies and improved climate resilience.

### Economic

- Increased agricultural productivity and diversified income streams through agroforestry, livestock integration, and NTFPs.
- Large-scale wage employment via MGNREGA works.
- Enhanced asset creation and secure fund convergence.

### Social & Institutional

- Empowered Gram Panchayats with participatory decision-making processes.
- Strengthened the capacities of over 122 NREGA mates and Gram Panchayat and Gram Sabhas of all villages.
- Gender-equitable and inclusive planning processes.
- Institutionalised, digitised INRM planning with transparent, multi-year execution.

## Results of the INRM-Based Interventions

- 122 Villages Covered – Participatory ridge-to-valley INRM planning completed in all 122 villages, ensuring holistic watershed management.
- 122 NREGA Mates & Rojgar Sewaks Trained – Equipped with skills in GIS-based INRM planning, Participatory Rural Appraisal (PRA), climate-resilient land use, and gender integration.
- 50%+ Women’s Participation Achieved – Guaranteed gender-responsive planning and equitable decision-making.
- INRM Plans Fully Digitised – Detailed Project Reports (DPRs) Developed with Activity-Wise Costing, GIS Maps, and Convergence Frameworks.
- Government Convergence Achieved – 100% integration of proposed activities with public financing sources such as MGNREGA, Tribal Sub-Plan (TSP), and the 15th Finance Commission.
- 40,000 Hectares of Land Treated – Through ridge-to-valley soil and water conservation, irrigation infrastructure, agroforestry, and pasture development over Years 3–10.
- Enhanced Climate Resilience – Reduced runoff and erosion, improved soil moisture retention, increased groundwater recharge, and diversified climate-resilient livelihoods.

**Additional HR:** Three INRM experts will be engaged at the AKRSP level to provide specialised training to NREGA Mates, Gram Panchayats, and Gram Sabhas across three clusters covering 122 villages. These experts will also facilitate planning and implementation in close collaboration with relevant government departments.

### 5.4.2. Implementation of Irrigation Systems

The Ahwa landscape in Dang district is characterised by hilly and forested terrain, high monsoon rainfall, and a dense network of perennial and seasonal rivers and streams. Key rivers flowing through the area include the **Purna, Girna, Ambika, and Khapri**, along with numerous smaller tributaries and nalas. Many of these rivers retain **sufficient water until early summer**, while in specific locations—particularly in perennial stretches and downstream of storage structures—they can **provide year-round irrigation**.

In addition to these natural water sources, the landscape contains **multiple existing check dams**. Under the Gram Panchayat Development Plan (GPDP), many of these areas will be **desilted and rehabilitated through the MGNREGA, with support mobilised through the irrigation department**. This will significantly increase water storage capacity, improve groundwater recharge, and establish reliable irrigation supply points.

This hydrological setting creates an opportunity for **integrated and decentralised irrigation solutions**:

- **Solar-Based Lift Irrigation:** Ideal for off-grid or unreliable power areas, using perennial river pools or post-monsoon flows to lift water to higher-elevation fields.
- **Diversion-Based Irrigation:** Captures stream and river flows through small weirs or intakes, channelling water to nearby farmland with minimal infrastructure.
- **River-Based Electrically Powered Lift Systems:** Uses electricity (grid) to pump river water to irrigate farm land areas, particularly where rivers hold year-round water.

By leveraging perennial water availability, rehabilitated check dams, and clean energy solutions, these systems can **extend irrigation well beyond the monsoon**, increase cropping intensity, improve water-use efficiency, and enhance climate resilience for tribal farming communities in Ahwa block. The

following are the various irrigation systems and their descriptions, which are necessary to support farming activities in the Ahwa block.

### Solar-Based Lift Irrigation Systems

**Model:** Community-managed solar-powered pumping systems designed to lift water from perennial rivers, streams, or check dams to command areas situated at higher elevations.

**Capacity:** Each system is designed to irrigate **20–25 acres**, with actual coverage depending on water source availability, elevation head, and system efficiency.

**Components:** High-efficiency solar photovoltaic panels, submersible or centrifugal pumps, delivery pipelines, storage tanks, mounting structures, and necessary civil works.

**Costing:** Estimated at **₹5.5 lakhs per unit**, inclusive of pump sets, solar modules, mounting structures, delivery system, storage, and civil works.

### Implementation Design

A total of **90 units** will be established over three years, with **30 units added each year**.

- **Year 2:** 100% of the units will be funded and implemented through project investment.
- **Years 3 & 4:** 50% of the units each year will be co-financed through convergence with Irrigation Department schemes, reducing direct project expenditure while expanding outreach.

This phased approach will ensure both rapid early deployment and sustained scale-up through institutional convergence.

### River-Based Electrically Powered Lift Irrigation Systems

**Model:** Electrically operated pump sets designed to lift water directly from rivers or check dams and convey it to agricultural fields through a network of delivery pipelines. Suitable for perennial stretches or storage structures that maintain sufficient discharge year-round.

**Capacity:** Each unit is designed to irrigate **10–15 acres**, depending on water availability, elevation head, and efficiency of the delivery system.

**Components:** Electric pump set (submersible or centrifugal), control panel, delivery pipelines, valves, and fittings. Civil works and electrical connections will be mobilised separately through convergence with government irrigation programs.

**Costing:** Estimated at **₹50,000 per unit**, covering pump sets, control panels, and delivery pipelines only.

**Implementation Design:** A total of **120 units** will be deployed over four years, with 30 units deployed each year, from Year 1 to Year 4.

### Diversion-Based Irrigation (DBI) Systems

**Model:** Gravity-fed diversion structures constructed across rivers or perennial streams to channel water through open channels or pipelines to agricultural fields. Designed for minimal energy use, utilising natural slope wherever possible.

**Capacity:** Each DBI unit is expected to irrigate **50–60 acres**, depending on stream flow, command area layout, and conveyance efficiency.

**Components:** Diversion weir or intake structure, sedimentation tank (where required), conveyance channels or pipelines, gates, and control structures.

**Costing:** Estimated at ₹3,00,000 per unit, with ₹1,50,000 provided by the project and ₹1,50,000 contributed by the community in cash, kind, or labour.

**Implementation Design:** A total of 10 DBI systems will be implemented over two years:

- **Year 1:** 5 units
- **Year 2:** 5 units

## Feasibility Challenges and Mitigation Strategies

### Technical Challenges

- **Topographical Constraints:** The hilly terrain of Ahwa may necessitate higher pumping heads, thereby increasing energy demand and impacting efficiency.
- **Seasonal Water Variability:** Certain river stretches may experience reduced flows in late summer.
- **Operation & Maintenance (O&M) Capacity:** Limited local technical skills may lead to breakdowns or improper system use.
- **Electricity Reliability for Grid-based Systems:** Frequent outages in rural areas may disrupt irrigation schedules.

### Financial Challenges

- **High Capital Cost for Solar Systems:** At ₹5.5 lakhs per unit, the investment is substantial.
- **Community Contribution for DBI Systems:** ₹1.5 lakhs per unit could be difficult for low-income households to mobilise.
- **Sustainability of O&M Fund:** Long-term system functioning depends on the timely collection of water charges.

## Mitigation Strategies

To address the above challenges, the intervention will apply a combination of technical, financial, and institutional measures. Detailed hydrological and topographical surveys will guide site selection to ensure optimal elevation, flow, and efficiency. Energy-efficient pumps and hybrid solutions will be used where the electricity supply is inconsistent, while DBI systems will be prioritised in locations with natural slopes. Seasonal water shortages will be mitigated through the integration of rehabilitated check dams and storage tanks into the design. Financially, a phased implementation will enable the blending of project funds with government schemes (Irrigation Department, MNRE solar subsidies) and farmer contributions in cash, in kind, or in labour. O&M sustainability will be ensured through the formation and capacity building of Water User Committees, the establishment of transparent tariff systems, and the training of local technicians for timely maintenance and repairs.

## Ecological, Economic, and Social Benefits

### Ecological

- Reduced dependence on groundwater, promoting aquifer recharge through surface water utilisation.
- Adoption of solar-powered pumps reduces carbon emissions compared to diesel-based systems.
- Rehabilitation of check dams enhances biodiversity in aquatic and riparian zones.

## Economic

- Increased cropping intensity.
- Higher yields and incomes due to assured irrigation for high-value crops (vegetables, pulses).
- Reduction in diesel/electricity costs for irrigation, improving net farm profitability.
- Creation of local service and maintenance enterprises.

## Social

- Strengthened community institutions through WUCs and collective O&M.
- Reduced drudgery for women in fetching water for household/kitchen gardens.
- Enhanced food security and dietary diversity through multi-season cropping.
- Greater resilience to climate shocks reduces migration during lean seasons.

## Additional Human Resources Required by AKRSP

- **Irrigation Engineer / Technical Coordinator (1 full-time):** Design, supervise, and quality-check installations; train community technicians.
- **Field Supervisors (2–3):** Oversee site selection, mobilise communities, and coordinate with government departments for convergence.
- **Community Resource persons (4–5, part-time or full-time):** Facilitate formation and strengthening of WUCs, manage cost-sharing processes, and monitor O&M.
- **Monitoring & Evaluation Officer (shared resource):** Track performance indicators, document learnings, and support adaptive management.

## Institutions Required

- Water User Committees (WUCs): Grassroots bodies responsible for system management, tariff collection, O&M oversight, and equitable water distribution.
- Gram Panchayats: Facilitate MGNREGA convergence for civil works and check dam rehabilitation; provide governance support for WUCs.
- Irrigation Department: Provide technical approvals, co-financing, and infrastructure support under state schemes.
- MNRE/Renewable Energy Agencies: Facilitate access to subsidies and technical specifications for solar lift systems.
- MGNREGA Implementing Agencies: Fund labour-intensive works like excavation, channel construction, and desilting.
- Local Technical Service Providers: Offer repair, spare parts supply, and on-site troubleshooting services.
- Financial Institutions / SHGs / FPOs: Provide credit or microfinance support to the community.

## Results of the Intervention

- **Physical Outputs:**
  - 90 solar lift systems installed over 3 years, each irrigating 20–25 acres.
  - 120 electric lift systems installed over 4 years, each irrigating 10–15 acres.
  - 10 DBI systems implemented over 2 years, each irrigating 50–60 acres.
  - Rehabilitation and use of multiple check dams as irrigation storage points.
- **Outcomes:**
  - Total additional irrigated area: **~3,800–4,200 acres** across the block.
  - Cropping intensity increased by up to 80%.
  - Over 2,500 tribal farming households with improved access to irrigation
  - Reduction in irrigation-related GHG emissions by replacing diesel pumps.
  - Improved household food security and incomes by 30–50% over baseline.

- Functioning WUCs in each intervention site, ensuring long-term system sustainability.

### 5.4.3. Special Initiatives on Land levelling

#### Context

The Ahwa block in Dang district is predominantly inhabited by tribal farming communities, with agriculture carried out on undulating, sloping, and fragmented plots. These uneven fields result in inefficient water distribution, high runoff during monsoons, and soil erosion, ultimately reducing the effective cultivable area. As a result, productivity remains low, and water-use efficiency is poor, especially in rainfed and partially irrigated areas.

Land levelling—by converting sloping and irregular plots into level fields—can significantly enhance moisture retention, facilitate uniform crop growth, reduce soil erosion, and enable better irrigation coverage. Given Ahwa’s high monsoon rainfall and access to perennial rivers and check dams, improving the base condition of farmlands through levelling will amplify the benefits of irrigation and other soil conservation measures.

#### Implementation Design

The intervention will follow a two-phase approach—a demonstration phase and a scale-up phase—with an emphasis on manual labour to maximise local employment and community participation.

##### Phase 1 – Demonstration (Years 2 & 3)

- Coverage: 1,000 hectares total over two years, with 500 hectares implemented each year.
- Method: Land levelling will be carried out primarily through manual labour, employing local community members under project support to ensure wage employment.
  - Activities will include earth cutting, filling, bund shaping, and surface smoothing.
  - Machinery (e.g., tractor-mounted levellers or excavators) will be used only under challenging terrains—such as steep slopes, rocky patches, or inaccessible areas—where human-based work is impractical.
- Farmer Selection: Priority to small and marginal farmers, fragmented landholders who adopt other water conservation measures.
- Support Structure: AKRSP will provide technical layout design, supervision, and facilitation of convergence with Gram Panchayats.

##### Phase 2 – Scale-Up (Years 4 to 9)

- Coverage: Expanded through MGNREGA to cover 7,000 hectares over six years.
- Institutional Convergence:
  - Land levelling will be included in Gram Panchayat Development Plans (GPDPs).
  - Funding and labour mobilisation will be primarily through MGNREGA, ensuring community wage benefits.
- Capacity Building: Training of local groups in measuring, marking, and executing levelling works to maintain quality.
- Community Engagement: Involvement of FPOs, SHGs, and WUCs to ensure equitable coverage and transparent beneficiary selection.

#### Feasibility Challenges and Mitigation Strategies

## Technical Challenges

- Labour Availability: Large-scale manual works require consistent labour mobilisation, which may be difficult during peak agricultural seasons.
- Terrain Variability: Rocky, steep, or inaccessible areas can slow progress and require specialised machinery.
- Measurement and Quality Control: Inaccurate levelling can lead to uneven water distribution and sub-optimal results.
- Weather Dependency: Heavy rains during the monsoon can disrupt work schedules and damage partially levelled plots.

## Financial Challenges

- Upfront Costs for Demonstration Phase: Although MGNREGA will be leveraged later, initial demonstration works require project funding.
- Equipment Access for Difficult Terrains: Hiring machinery in remote areas may incur higher costs.
- Sustained Funding for Scale-Up: MGNREGA convergence depends on timely approvals in GPDPs.

## Mitigation Strategies

- Labour Mobilisation: Align work with the agricultural calendar, prioritising off-peak seasons, and mobilise SHGs and youth groups for participation.
- Technical Supervision: Train CRPs in measurement and levelling techniques; use laser levels for demonstration plots to set benchmarks.
- Machine Use in Select Areas: Reserve machinery for steep, rocky, or otherwise impractical sites, thereby reducing the cost burden.
- Institutional Convergence: Early integration into GPDPs and active liaison with MGNREGA officials to ensure timely inclusion and fund release.
- Weather Preparedness: Schedule levelling in pre-monsoon and winter months to avoid work disruption.

## Ecological, Economic, and Social Benefits

### Ecological

- Reduced soil erosion and nutrient loss during monsoon rains.
- Improved rainwater infiltration and reduced surface runoff.
- Enhanced soil moisture retention, supporting dry-season cropping.

### Economic

- Increased crop yields (estimated 10–20% improvement) due to uniform water and nutrient distribution.
- Lower irrigation costs due to efficient water application.
- Generation of local wage employment through manual work under MGNREGA.
- Potential for mechanisation in levelled fields, reducing future land preparation costs.

### Social

- Equitable access to productivity-enhancing interventions, especially for small and marginal farmers.
- Strengthened community institutions through collective planning and implementation.

- Empowerment of women and vulnerable groups through MGNREGA-based employment opportunities.
- Reduced migration by creating local wage and farming opportunities.

#### **Additional Human Resources Required by AKRSPI**

- Land Development Technical Coordinator (1): Oversee technical design, measurement standards, and quality control.
- Field Supervisors (2–3): Mobilise communities, ensure quality of manual works, and liaise with MGNREGA officials.
- Community Resource persons (4–6): Facilitate farmer selection, coordinate labour groups, and monitor work progress.
- Monitoring & Documentation Officer (shared resource): Track coverage, document pre- and post-productivity changes, and compile learning for scale-up.

#### **Results of the Intervention**

##### Physical Outputs

- Demonstration Phase: 1,000 ha levelled in Years 2 & 3.
- Scale-Up Phase: 7,000 ha levelled in Years 4–9 through MGNREGA convergence.
- Total Coverage: 8,000 ha over the project period.

##### Outcomes

- Farmers Benefited: ~14,000 farmers (0.5 ha per farmer on average).
- Agricultural Impact:
  - Cropping intensity increases by 15–25%.
  - Reduction in irrigation water use by 10–15%.
  - Yield gains of 10–20% across major crops.
- Socio-Economic Impact:
  - Significant local wage generation through manual work.
  - Reduced outmigration during lean periods.
- Institutional Strengthening:
  - Active role of Gram Panchayats and WUCs in planning and monitoring.
  - Sustainable inclusion of land levelling in GPDPs for ongoing work beyond project tenure.

#### **5.4.4. Multistakeholder platform at the district level**

##### Context

AKRSP's longstanding presence and trust in Ahwa block positions it uniquely to strengthen and institutionalise a multi-stakeholder platform (MSP) that supports agroecological transformation and climate resilience in The Dangs. This will be anchored in the existing District Level Coordination Committee (DLCC), through which AKRSP can convene regular meetings, foster convergence across departments, align extension services with local needs, and mobilise community participation.

##### Coordination of DLCC Meetings

- The District Collector chairs the DLCC, with the District Development Officer (DDO) or District Rural Development Agency (DRDA) Director typically serving as key members or secretaries. These officials convene meetings, set agendas, and ensure follow-up on action points.
- Meetings are organized regularly—ideally monthly or quarterly—and include representatives from all relevant departments. The chairing and secretarial responsibilities ensure administrative follow-through and accountability.
- The DLCC serves as a platform to review progress, share feedback, resolve bottlenecks, and coordinate across departments such as Agriculture, Horticulture, Forest, Animal Husbandry, Irrigation, Renewable Energy, and Cooperation.

### Key Departments and Their Roles

Within this DLCC-guided MSP, the following departments will play crucial roles:

- Agriculture Department – Delivery of agroecological cropping practices training, input subsidies, and technical support.
- Horticulture Department – Promotion of kitchen gardens, orchards, and nutrient-rich horticultural produce.
- Forest Department – Community-led tree plantations, management of NTFPs (uncultivated forest foods), and sustainable agroforestry linkages.
- Livestock and Animal Husbandry Department – Support for improved breeds, backyard poultry, veterinary services, and fodder management.
- Irrigation Department – Strengthening water-harvesting infrastructure, check-dams, and micro-irrigation to enhance resilience.
- Integrated Natural Resource Management (INRM) – Soil and watershed management for sustainable land use.
- Renewable Energy Department – Expansion of solar irrigation pumps, biogas units, and decentralized energy systems for farming.
- Cooperation Department / District Industries Centre (DIC) – Formation and capacity building of FPOs, value-chain development, and market linkages.
- Women & Child Development / Education Departments – Synergizing nutrition-sensitive agriculture with school and anganwadi programs for dietary security.

### AKRSP's Role & Resource Leveraging

AKRSP will coordinate this MSP by:

- Liaising with the District Collector's office to include agroecological transformation on the DLCC agenda.
- Ensuring representation of farmer groups, women's SHGs, technical experts, FPOs, and NGOs in DLCC meetings.
- Facilitating preparatory consultations in villages to surface local needs and co-design agenda items.
- Documenting meeting minutes, tracking action points, and mobilizing follow-up through AKRSP's field staff.
- Leveraging its intra-landscape resources, both financial (for facilitation, travel, and documentation) and human (seasonal facilitators and thematic experts), to ensure coordination and continuity.

### Expected Outcomes

- At least 4–6 DLCC meetings per year, with youth, farmer, FPO, and technical representation.

- Convergence initiatives planned under the investment proposal are successfully financed.

#### 5.4.5. Use of Technology for Landscape Monitoring by AKRSP

AKRSP will leverage the AKDN Nature-based Solutions (NbS) platform, developed with the Aga Khan Foundation, to systematically register, monitor, and evaluate all landscape-level interventions in Ahwa block. In line with the IUCN–UNEP definition of NbS (2022), this platform ensures that interventions not only conserve and restore ecosystems but also enhance resilience, livelihoods, and human well-being. The platform’s Planting Register enables geo-referenced tracking of activities such as block plantations, assisted natural regeneration, agroforestry, horticulture, regenerative agriculture, and tree-based livelihoods. Using the ArcGIS Survey123 mobile application, field teams collect standardized data on plantation sites, including geo-coordinates, species composition, planting density, photos, and survival rates. This data synchronizes in real time to ArcGIS Online dashboards, where GIS analysts validate, clean, and integrate information into dynamic map layers. These dashboards then provide live status updates on survival percentages, canopy growth, biomass accumulation, and estimated carbon sequestration, thus enabling adaptive management.

To complement field data, AKRSP will also integrate remote sensing and satellite-based monitoring (using Landsat, Sentinel, and MODIS imagery) to track long-term ecological changes. Vegetation indices (NDVI and others) will be used to detect canopy expansion or dieback, model biomass growth, and assess land-cover change. Suitability mapping tools in ArcGIS further allow analysts to overlay slope, soil, and watershed data to identify priority zones for interventions. Together, this mixed-method monitoring system ensures a robust, scientific, and data-driven approach to landscape governance, while also providing restricted community access so that farmer groups, SHGs, and FPOs can securely view their zones and build ownership of ongoing NbS activities. Through this system, AKRSP will not only track plantation survival but also evaluate long-term transformations in resilience, biodiversity, and agroecological sustainability across Ahwa.

#### Step-wise Monitoring Process

- Field data collection – Enumerators use ArcGIS Survey123 to capture geo-coordinates, species data, survival rates, and photos.
- Real-time synchronization – Data automatically uploads to the AKDN ArcGIS Online server and appears as live map layers.
- Validation and cleaning – GIS analysts check GPS accuracy, ensure points fall within polygons, and correct errors.
- Dashboard integration – Data feeds into visual dashboards showing plantation coverage, growth status, survival %, and carbon estimates.
- Satellite analysis – Remote sensing imagery (Landsat, Sentinel, MODIS) is analyzed for NDVI trends, biomass growth, and canopy changes.
- Suitability mapping – Overlay slope, soil, and watershed datasets to identify priority areas for future NbS activities.
- Periodic refresh – Repeat surveys at intervals (6 months, 1 year, 5 years) track survival and adaptive management outcomes.
- Community and institutional access – Role-based dashboards give communities, FPOs, and NGOs visibility into their zones, fostering transparency and ownership.
- Decision-making and convergence – Insights are shared with DLCC and relevant departments to align agroecological interventions with government schemes.

The cost for the same will be covered under ‘anchor organisation costs’.

## 5.5. Biodiversity

### 5.5.1 Biodiversity Register and Volunteering Programme

The landscape project places a deliberate and practical focus on biodiversity relevant to agriculture, emphasising species and ecological functions that directly support farming systems. At the beginning of the project, a team of agrobiodiversity experts will visit the landscape and map the beneficial agrobiodiversity in terms of crops, trees, pollinators (e.g. bees, butterflies), pest predators (e.g. birds, insects), soil organisms (e.g. earthworms, microbes), amphibians (e.g. frogs), and livestock breeds. This team will enhance the biodiversity register and other documentation using participatory methods and traditional knowledge to update the People's Biodiversity Register (PBR), documenting habitats, landraces, and community practices. The team will help identify key ecosystem services supported by local biodiversity, such as pollination, pest regulation, soil health, and water management, and suggest ways to enhance agriculture-relevant biodiversity in the landscape. They will also support the identification and management of non-beneficial organisms, including invasive species and pest hosts. Additionally, the team will work to build the capacity of local students and youth to monitor and document biodiversity using participatory tools, including registers, species surveys, and digital platforms.

As part of this, a *Biodiversity Volunteering and Management Programme* will be introduced, engaging trained community representatives who will function as a local cadre to regularly monitor, record, and support the management of biodiversity in their areas, ensuring continued community participation and long-term stewardship of local ecosystems.

## 5.6. Market Development

### 5.6.1. Promoting Farmer-Producer Organisations for improved marketing of agricultural, livestock and NTFP goods

Despite the region's substantial potential for producing high-value agricultural commodities, livestock products, and Non-Timber Forest Products (NTFPs), there is a severe lack of organised marketing systems to support these sectors. While milk collection and sale are well-supported through Vasudhara Dairy, other produce, such as millets, pulses, goat meat, desi poultry, and naturally harvested NTFPs, remain underserved and unorganised.

Currently, there is no structured mechanism to distinguish or promote naturally or organically grown products from chemically grown alternatives in the market. As a result, farmers receive little to no premium for sustainable and traditional practices, which discourages the cultivation of these crops and the rearing of indigenous livestock breeds, despite their strong market potential.

This lack of organised value chains has led to stagnation in production and disincentivised agroecological practices. Farmers often resort to distress sales or are forced to accept low prices from intermediaries. Moreover, due to the absence of proper infrastructure for aggregation, sorting, processing, and packaging, produce loses its value before it reaches the market.

However, with enhanced access to irrigation, better extension support, and timely availability of high-quality bio-inputs, there is a strong likelihood of increased production in the coming years. To ensure that this increased production translates into improved income and livelihood outcomes for farmers, there is an urgent need to establish a decentralised yet connected marketing infrastructure.

The proposed Farmer-Producer Organisations (FPOs)—including one block-level FPO and three strategically located cluster-level FPOs—will serve as the institutional mechanism to aggregate, process, and market these products. These FPOs will:

- Enable primary processing and value addition at the cluster level (cleaning, drying, sorting, basic storage).
- Handle advanced processing, packaging, and branding at the block level.
- Build direct linkages with premium markets for naturally grown and traditional products.
- Support the adoption of agroecological practices by offering better returns for sustainably produced goods.

This integrated value chain approach will help tribal farmers secure better prices, reduce dependency on intermediaries, and promote long-term ecological sustainability and economic resilience.

#### **Intervention Model for Cluster and Block-Level FPOs in Ahwa Block, Dang District:**

To address the challenges of unorganised marketing, low value realisation, and lack of infrastructure for agricultural, livestock, and NTFP-based products, a federated FPO model will be established in Ahwa block, led by tribal women farmers. This includes **three Cluster-Level FPOs** and **one Block-Level Apex FPO**, designed to function in synergy for the aggregation, processing, packaging, and marketing of products.

#### **Institutional Structure**

- **Three Cluster-Level FPOs**, each covering ~9 Gram Panchayats (40–42 villages), will be established, each enrolling a minimum of **2,000 farmer members** (~50% of the catchment population). At least **50% of the board members will be women** to ensure gender-inclusive governance.
- Each farmer member will subscribe to **one equity share of ₹1,000**, generating an initial equity base of **₹20 lakh per cluster-level FPO**.
- The **Block-Level FPO** will serve as an apex marketing and processing entity, formed as a federation of the three Cluster FPOs. The board of this apex FPO will comprise elected representatives from the member FPOs, ensuring democratic ownership and decision-making.

#### **Infrastructure and Facilities**

- **Cluster-level FPOs** will establish **basic infrastructure for aggregation**, including collection centres, cleaning, sorting, grading, drying platforms, and small storage units. These facilities will be aligned with the requirements of local crops (e.g., millets, pulses), NTFPs (e.g., honey, medicinal plants), and livestock products (e.g., goat meat, desi poultry).
- The **Block-Level FPO** will handle **advanced value addition**, including branding, packaging, labelling, and high-end processing (e.g., millet-based food products such as biscuits, ready-to-cook mixes, etc.). It will also house marketing and dispatch operations.

#### **Technical and Advisory Services**

- A cadre of **Agroecology Experts, Veterinary Experts, Bio-Resources Experts, and Marketing Experts** will be engaged to anchor the thematic verticals across FPOs.
- These experts will collaborate with **Krishi Sakhis** and **Pashu Sakhis** (community-based agri-livestock resource persons) to:
  - Facilitate timely and bulk procurement of high-quality bio-inputs, fodder, and seeds.
  - Provide customised training, input planning, and advisory support to members.

- Align production cycles with demand-driven marketing strategies through seasonal business planning to optimise operations.

### Market Linkages and Financial Model

- The Block-Level FPO will establish robust **market linkages with urban and regional markets**, including Surat, Nashik, and Mumbai. MoUs will be sought with traders, retailers, and online platforms for direct-to-market sales.
- A **transparent and inclusive pricing mechanism** will be implemented. Farmers will be paid **upfront at the time of product aggregation**, ensuring stable cash flow and reducing the need for distress selling.
- The FPO will retain a **pre-agreed service margin**, approved by the General Body, to sustain operations and reinvest in infrastructure and services.
- Revenue will be enhanced through:
  - Processing margins.
  - Aggregated input sales.
  - Premiums on naturally grown products and fair-trade certifications.

### Capacity Building and Compliance

- All FPO personnel—including the **Board of Directors, CEO, and operations staff**—will undergo structured capacity building on:
  - FPO governance and statutory compliance (ROC, income tax, GST, etc.).
  - Financial management, bookkeeping (Tally, MIS), and internal audits.
  - Business planning, customer relationship management (CRM), and inventory management.
  - Digital literacy for operations and e-marketing.
- Regular exposure visits to successful tribal FPOs (e.g., in Odisha, Jharkhand, and Madhya Pradesh) and partnerships with established incubators, such as **SFAC, NABARD, NRLM, and FPC Producer Companies**, will be explored for mentorship and growth.

### Upgradations and Innovation Opportunities

- Digital procurement and sales tracking tools (e.g., mobile-based procurement apps such as **REMS by Digital Green** or **FPO One** by Samunnati) will be introduced.
- Organic/natural certification clusters can be piloted in select villages to access premium markets.
- Cold storage or solar-powered dryers will be installed for perishables (e.g., fruits, milk, vegetables, etc).
- Skill-building and training for **women in leadership roles** will be prioritised to promote gender justice and inclusive entrepreneurship.

### Cost Estimate for Setting Up a Block-Level FPO in Ahwa Block, Dang District, Gujarat

The following is the cost estimate for establishing a block-level Farmer-Producer Organisation (FPO) in Ahwa block. This FPO will focus on processing, packaging, and marketing agricultural produce, non-timber forest products (NTFPs), goat, dairy, and poultry products, while also integrating millet value chains and establishing soil/water testing facilities.

#### Capital Expenditure (CAPEX)

Item	Estimated Cost (INR)
Land and Building	20,00,000
Processing Equipment	15,00,000
Livestock Infrastructure	5,00,000
Cold Storage	10,00,000
Packaging Unit	8,00,000
Transportation Vehicle	15,00,000
IT Infrastructure	3,00,000
Furniture and Fixture	2,00,000
Total CAPEX	78,00,000

**Table 5.4 – Item-wise CAPEX (Block-Level FPO)**

#### Additional Investments

Item	Cost (INR)
Working Capital Requirement	1,25,00,000
Revolving Grant – Dairy Units	50 Dairy Units @ 47,500 per Unit = 23,75,000
Revolving Grant – Goat Units	50 Goat Units @ 90,000 per Unit = 45,00,000
Millet Seed System	62,50,000
Packaging, Branding & Marketing for Millet Products	25,00,000
Block Level Soil Testing Lab	80,00,000
Block Level Water Testing Lab	70,00,000

**Table 5.5 – Item-wise additional investments (Block-Level FPO)**

#### Operational Expenditure (OPEX – Annual)

Total Annual OPEX: INR 60,00,000

#### Cost Estimate for One Cluster-Level FPO in Ahwa Block, Dang District

##### Capital Expenditure (CAPEX)

Item	Estimated Cost (INR)
Collection Shed and Storage Unit	7,00,000
Sorting and Grading Equipment	5,00,000
Digital Weighing Machine	50,000
Grain/Fruit Drying Platform	1,00,000
Furniture, Fixtures, Computers and Printers	1,00,000
Solar Power Backup	1,50,000
Moisture Meter	10,000
Solar Dryer	50,000

**Table 5.6 – Item-wise CAPEX (One Cluster-Level FPO)**

Milk Chilling Plant	8,00,000
Signage and Branding	20,000
Vegetable Cold Storage Unit	3,50,000
Miscellaneous	20,000
Compact Millet Mixer Grinder (3 per cluster)	4,00,000
<b>Total CAPEX</b>	<b>32,50,000</b>

### Operational Expenditure (OPEX – Annual)

- Total Annual OPEX: INR 11,00,000

### Working Capital

- Working Capital Requirement: INR 50,00,000 per Cluster-Level FPO
- Total for 3 Cluster-Level FPOs: INR 15,00,000

### Feasibility (Technical Feasibility and Financial Viability Issues)

#### Technical Feasibility Challenges

- Quality Standards in Processing & Packaging:
  - FPOs must develop the capacity to process agricultural produce to high-quality standards, thereby fetching premium prices in competitive markets.
- Infrastructure Constraints:
  - Adequate infrastructure for aggregation, sorting, cleaning, and storage at the cluster level, as well as advanced processing, branding, and packaging at the block level, needs to be developed from scratch. Organisational Governance, Systems and processes:
    - The FPOs need to have a strong organisational governance structure, which is people-led, supported by appropriate structures and processes, and such experiences are not currently available within the local community
- Logistical Coordination Across Geographies:
  - Coordinating activities across 27 Gram Panchayats through multiple FPOs could be technically complex.

#### Financial Feasibility Challenges

- Initial Capital Requirement:
  - A substantial upfront investment is needed for infrastructure development, the recruitment of experts, and the setup of organisational systems.
- Ensuring FPO Sustainability:
  - The long-term financial sustainability of FPOs depends on achieving scale, ensuring service margins, and maintaining member participation.
- Farmer Contribution and Ownership. Mobilising equity contributions from small and marginal tribal farmers could be challenging due to their limited disposable income.
- Cash Flow and Payment Mechanisms:
  - Ensuring upfront payments to farmers while awaiting delayed mark realisations may create liquidity issues.

#### Mitigation Strategies

- Phased Implementation Plan:

- Gradual rollout from 3 Cluster-Level FPOs to 1 Block-Level Apex FPO, covering 27 Gram Panchayats, ensures manageable scaling and learning-by-doing.
- Technical Expert Deployment:
  - Onboarding of experts in agroecology, veterinary science, marketing, and bio-resources to support continuous learning and field-level innovation.
- Skilling and Capacity Building:
  - Regular training of FPO boards, CEOs, Krishi and Pashu Sakhis, and farmers on governance, agroecology, financial management, and digital tools.
- Infrastructure Investment:
  - Cluster-level infrastructure for aggregation and drying; block-level setup for advanced processing and packaging, supported by solar-powered dryers and cold storage in later stages.
- Market and Pricing Strategy:
  - Transparent pricing mechanisms, MoUs with urban/regional market players, and value addition through PGS certification and branding.
- Promoting Ownership and Inclusivity:
  - Mobilising equity contributions to enhance farmer ownership; mandating 50% women representation in governance to foster inclusion and accountability.
- Digital Integration for Efficiency:
  - Use of digital procurement apps and digital marketing strategies to increase market reach and streamline operations.
- Membership Growth Strategy:
  - Scale up from 6,000 members by Year 5 to 90% saturation of farmers in Ahwa block by Year 10, enabling economies of scale.
- Revenue Model for Sustainability:
  - FPOs will generate revenue through service margins, processing, and access to premium pricing in organic/niche markets.

## Implementation Design and HR

### Milestones of the Initiative

#### Year 1 – Foundation, Institutional Setup & Early Initiatives

- Legal registration and operationalisation of 3 Cluster-Level FPOs and 1 Block-Level Apex FPO.
- Recruitment and intensive training of FPO Board Members, CEOs, and operational staff.
- Onboarding of sectoral technical experts (agroecology, veterinary care, marketing, bio-resources).
- Establishment of governance norms, internal policies, and the member equity contribution system.
- Initiation of revolving grant for Goat Units (50 units @ ₹90,000 per unit) and rollout of goat-based enterprise activities.

- Initiation of Block-Level Soil Testing Laboratory setup to support improved crop and soil health management.
- Initial awareness drives and mobilisation to prepare farmers for joining FPO membership in Year 2.

### **Year 2–3 – Infrastructure Rollout, Membership Growth & Market Entry**

- Receipt and installation of significant CAPEX investments for Block and Cluster Level FPOs:
  - Block Level FPO infrastructure: land and building, processing equipment, livestock infrastructure, cold storage, packaging unit, vehicles, IT and furniture.
  - Cluster Level FPO infrastructure: collection sheds, storage units, sorting and grading equipment, vegetable cold storage units, solar power backup, drying platforms, milk chilling plants, millet processing equipment, branding materials, etc.
- Membership expansion to at least 6,000 farmers with 50% women participation.
- Establishment of aggregation infrastructure at the cluster level: collection centres, drying and sorting units.
- Initiation of primary processing activities (cleaning, grading, drying) at Cluster FPOs.
- First-level product aggregation and trial sales in local and regional markets.
- Introduction of millet seed system development and investments in packaging, branding, and marketing of millet-based products.
- Initial market linkages were established through MoUs with traders, processors, and retail buyers.
- Capacity building for members in group governance, digital literacy, and sustainable agroecological practices.

### **Year 4–5 – Value Chain Development & Business Systems Consolidation**

- Launch of advanced processing and packaging facilities under the Block-Level Apex FPO.
- Operationalisation of the water testing laboratory for improving water quality in production and processing activities.
- Development and implementation of a transparent pricing mechanism ensuring timely and fair payments to farmers.
- Introduction of business planning practices, costing systems, and profit-tracking models for all FPOs.
- Rollout of marketing tools, branding strategies, and promotional campaigns for FPO products.
- Strengthening of MIS systems, internal audit mechanisms, and financial oversight frameworks.
- Enhanced aggregation and logistics efficiency to serve broader regional markets.

### **Year 6–10 – Expansion, Certification, Infrastructure Scaling & Sustainability**

- Membership expansion to cover 90% of total farmers in Ahwa block (~10,000+), achieving gender and social inclusion targets.
- Completion of the Participatory Guarantee System (PGS) organic certification for a large portion of members.

- Commissioning of additional cold storage units, solar-powered dryers, and advanced processing capacity to preserve quality and increase value.
- Entry into premium markets through certified organic branding and niche marketing channels targeting urban health-conscious consumers and institutional buyers.
- Strengthening convergence linkages with government schemes (NRLM, MGNREGS, NABARD, etc.) for ongoing support and expansion.
- Achievement of financial self-sustainability for all FPOs through service margins, processing fees, and value-added sales.
- Preparation of an exit and sustainability roadmap for AKRSP, with transition to community-led management structures.

### **Promotion of Millets, Vegetables, and Other Value Chains through Cluster and Block-Level FPOs in Ahwa**

The federated FPO model proposed for Ahwa block—comprising three Cluster-Level FPOs and one Block-Level Apex FPO—is designed to systematically strengthen value chains for millets, vegetables, pulses, livestock products, and NTFPs. Each cluster FPO will aggregate produce from ~9 Gram Panchayats (40–42 villages), covering nearly 2,000 farmer members per cluster, while the apex FPO will lead advanced processing, branding, and marketing across the block.

For millets, cluster-level FPOs will establish community collection and processing units with cleaning, de-hulling, drying, and storage facilities. This will allow farmers to process finger millet, little millet, and other varieties both for household consumption and for local markets. The block-level apex FPO will invest in advanced processing infrastructure for millet flour, ready-to-cook mixes, and other value-added millet products. Packaging, branding, and certification through Participatory Guarantee Systems (PGS) will help position “Ahwa Millets” as a signature product line in health-conscious urban markets such as Surat, Nashik, Mumbai, and Pune. At the same time, small-scale services at cluster FPOs will encourage farmers to process millet for home use at low cost, reinforcing local consumption and nutrition security.

For vegetables—such as brinjal, okra, bitter gourd, and cluster bean—the cluster-level FPOs will provide aggregation, sorting, grading, and short-term storage facilities to preserve freshness and quality. A major value addition will be made possible through the cold storage infrastructure proposed at the Block-Level FPO, which will extend the shelf life of perishable vegetables, pulses, and even dairy or livestock-based products. By reducing post-harvest losses and stabilizing supply over time, this infrastructure will enable farmers to sell produce in higher-value regional markets (Surat, Nashik, Pune) and avoid distress sales during seasonal gluts. The cold storage will also help maintain the quality of processed millet products and PGS-certified goods until bulk consignments are marketed.

In addition to these, the FPOs will integrate pulses, livestock (goat, poultry, dairy), and NTFPs (like honey, medicinal plants) into their value chain operations. Cluster FPOs will aggregate these products and provide basic processing and storage, while the block-level FPO will handle cold storage, packaging, branding, certification, and establish linkages with institutional buyers and premium markets. A transparent pricing and upfront payment mechanism will reduce distress sales, while capacity building of farmers, especially tribal women leaders, will strengthen ownership and governance of the institutions.

By providing decentralized aggregation at cluster level and centralized advanced processing, cold storage, and marketing at block level, this model addresses the critical barriers in Dang’s agricultural

economy—low price realization, weak market access, and absence of infrastructure—while simultaneously promoting agroecological and organic practices through better input services, bio-resource support, and assured market premiums. The result will be stronger, more sustainable value chains for millets, vegetables, and allied products, leading to higher incomes, improved food security, and long-term ecological resilience in Ahwa block.

**Additional human resources required:** AKRSP will need one Institutional Capacity Development Expert to support FPO formation and organisational development, and one marketing Expert to lead and support marketing initiatives for five years.

## Ecological, Economic, Social and Institutional Outcomes

### Ecological Contributions

- Promotion of agroecological farming through training and input services, leading to reduced use of chemical fertilisers and pesticides.
- Support for the adoption of bio-inputs, such as compost, bio-pesticides, and indigenous seed varieties, through collective procurement.
- Facilitation of sustainable livestock care through CRPs, Krishi and Pashu Sakhis, promoting better animal health and fodder practices.
- Dissemination of climate-resilient practices tailored to local ecological conditions through expert guidance.

### Economic Contributions

- Aggregation and collective marketing of agricultural and livestock produce for better price realisation.
- Establishment of processing units (drying, grading, packaging) that add value and increase farmer margins.
- Direct linkages with urban and regional markets that bypass intermediaries and ensure transparent pricing.
- Introduction of fair pricing and upfront payment mechanisms to reduce farmer dependence on informal credit.
- Provision of affordable input and service delivery (seeds, bio-inputs, veterinary care) at scale to reduce costs and improve productivity.
- Support for digital marketing and brand building, increasing the market reach and price competitiveness of local produce.

### Social-Institutional Contributions

- Formation and strengthening of Cluster-Level and Block-Level FPOs as farmer-owned, democratically governed institutions.
- Inclusion of women in governance structures, with at least 50% representation in FPO boards.
- Capacity building of members and leaders in governance, financial literacy, and enterprise development.
- Facilitation of linkages with government schemes, financial institutions, and private players, improving access to services and entitlements.

- Development of leadership and negotiation skills within the farming community, especially among tribal women.

### Results of the FPO Intervention

- **3 Cluster-Level FPOs:** Established, covering 9 Gram Panchayats each, with 2,000 farmer members per FPO.
- **6,000 Farmer Members:** Expected by Year 5, with 50% of the members being women farmers.
- **1 Block-Level Apex FPO:** Formed as a federation of 3 cluster-level FPOs for marketing and processing.
- **INR 20 Lakh Equity:** Generated through member subscription of ₹1,000 per member per cluster-level FPO.
- **Infrastructure Set-Up:** Aggregation, cleaning, sorting, and storage units established at the cluster level.
- **Market Linkages:** Direct connections with urban markets like Surat, Nashik, and Mumbai for premium prices.
- **30% Premium on Naturally Grown Products:** Achieved through value-added processing and branding.
- **Capacity Building:** FPO staff and board members trained in governance, financial management, and digital literacy.
- **100% Women's Participation:** At least 50% of board members in each FPO are women.
- **Services Offered:** Aggregation, processing, packaging, market linkages, agroecological support, and financial transparency.
- **Benefits to Members:** Higher income, better pricing, reduced dependency on intermediaries, empowerment, and sustainable business practices.

## 5.7. Energy

### 5.7.1. Setting Up Dairy-Linked Biogas Units

The Dairy-Linked Biogas Unit Intervention Model in Ahwa block is designed to offer an integrated solution for clean energy access and agroecological farming among rural households. Building on successful models such as the Zakariyapura unit supported by the National Dairy Development Board (NDDDB), the intervention taps into the untapped potential of livestock—particularly dairy cattle—as a renewable source of both cooking energy and organic fertiliser. Biogas units convert cattle dung from just 2–3 cows into sufficient energy to power household kitchens. At the same time, the slurry byproduct serves as a nutrient-rich organic input that enhances soil health and reduces dependency on chemical fertilisers. The initiative begins with the establishment of three demonstration units—one in each cluster—to serve as live learning sites. With a cost-effective structure (₹37,000 per unit, of which ₹22,000 can be subsidised through carbon financing), the model is poised for rapid scale-up through convergence with government schemes, such as the Gobar-Dhan Yojana, the Gujarat Energy Development Agency (GEDA), and support from local dairy institutions, including Vasudhara Dairy. By empowering Krishi and Pashu Sakhis to support mobilisation and access to subsidies, the intervention

aims to install 1,000 units over five years, providing sustainable energy solutions while promoting circular, agroecological farming practices in tribal communities.

### Feasibility (Technical Feasibility and Financial Viability Issues)

#### Technical Feasibility Challenges

- **Low Livestock Ownership and Productivity:** Many tribal households in Ahwa may own fewer than 2–3 milch animals, which is the minimum requirement for viable biogas production. Inconsistent dung availability due to poor livestock feeding practices or seasonal migration can also affect gas generation.
- **Limited Technical Know-how:** Building and maintaining biogas units requires specialised technical knowledge, particularly in construction quality, dome design, gas flow, and slurry outlet mechanisms. Local masons and farmers may lack prior experience with such systems.
- **Lack of Water Availability:** Water is needed to mix dung for fermentation. Seasonal water scarcity in Dang, particularly during the summer months, could disrupt continuous gas production.

#### Financial Feasibility Challenges

**High Upfront Investment Costs:** The total cost of ₹37,000 per unit may be unaffordable for marginal tribal farmers, even after availing the ₹22,000 carbon financing subsidy. Mobilising the remaining ₹15,000 as gap funding remains a critical challenge.

- **Delayed or Complex Subsidy Disbursement:** Navigating government schemes like GEDA or Gobar-Dhan Yojana often involves delays or bureaucratic hurdles, especially for illiterate or digitally excluded tribal households.
- **Limited Access to Affordable Credit:** Formal financial institutions may be reluctant to lend for biogas units due to perceived risks, lack of credit history, or inability to mortgage assets.
- **Unclear Monetisation of Co-benefits:** While slurry improves soil fertility, it doesn't generate direct cash income. Thus, the financial benefits of the system may not be immediately visible to poor households.

#### Mitigation Strategies

- **Demonstration Units and Local Capacity Building:** Establishing three fully funded cluster-level demonstration units will address technical gaps through hands-on training for farmers, local masons, and Krishi/Pashu Sakhis. These will also create community confidence in the model.
- **Customised Targeting and Technical Design:** Prioritise households with adequate cattle ( $\geq 2$  cows) and access to water. Tailor unit sizes or consider linking poultry waste in cases with mixed farming systems. The promotion of dairy through the intervention will further strengthen the prospect of the Bio Gas Unit.
- **Strengthen Institutional Convergence and Facilitation:** AKRSP will facilitate access to schemes such as GEDA, Gobar-Dhan Yojana, and Carbon Financing, easing the burden of paperwork and compliance through Pashu Sakhis and community volunteers.
- **Innovative Financing Mechanisms:** Explore revolving fund models, group loans through SHGs, or community-led financing pools to bridge the ₹15,000 gap. Partnerships with Vasudhara Dairy or CSR programs can help co-finance units.
- **Promote Slurry as a Value Proposition:** Educate farmers about the agronomic benefits of slurry through field demonstrations and crop trials. Promote its role in improving yields, reducing fertiliser costs, and contributing to organic certification goals.

- Ongoing Monitoring and Maintenance Support: Provide post-installation technical support for maintenance and troubleshooting through trained local service providers or panchayat-level energy coordinators.

## Implementation Design and HR

### Milestones of the Initiative

#### Year 1: Preparation and Demonstration

- Set up three demonstration biogas units (1 per cluster)
- Train Krishi and Pashu Sakhis on biogas and slurry use
- Create awareness in villages using demo units
- Prepare a list of interested farmers with 2–3 cows
- Start partnerships with GEDA, Gobar-Dhan Yojana, Carbon Finance, Systema, and Vasudhara Dairy

#### Year 2: Start of Scale-Up

- Install 200 biogas units for selected dairy farmers
- Train farmers to use slurry in their fields
- Set up a basic system to track unit performance
- Help farmers get subsidies with AKRSP support
- Train local masons and technicians for future work

#### Year 3: Expansion Continues

- Install another 200 units (total 400 units so far)
- Increase the use of farming for better soil
- Reduce the use of firewood and cooking gas
- Organise farmer visits to demo households
- Explore ways to share or sell extra slurry

#### Year 4: Deeper Integration

- Install 200 more units (total 600 units)
- Use slurry more widely in cluster-level farming
- Start collecting data on energy, health, and farming benefits
- Support farmers to co-invest or take small loans for units

#### Year 5: Strengthen and Diversify

- Install 200 units (total 800 units)
- Share your learning and experiences from the energy forums with the government and the private sector.

#### Year 6: Completion of Phase 1

- Install final 200 units (total 1,000 units)

- Conduct a block-level review of results and impact
- Involve SHGs and Panchayats in future promotion
- Plan for expansion to nearby areas or a new phase

**Additional human resources required:** Two Bio Gas Technicians will be required for technical support, maintenance and troubleshooting at AKRSP (I)

**Institutions required, if any:** FPO, Gram Sabha and Gram Panchayats will play an active role in planning and implementation.

### Ecological, Economic, Social and Institutional Outcomes

**Ecological Benefits:** Biogas units reduce dependence on firewood and fossil fuels, lowering deforestation and carbon emissions. The slurry byproduct enriches soil health and replaces chemical fertilisers, enhancing sustainable agriculture and soil biodiversity.

**Economic Benefits:** Households save on fuel expenses and earn additional income through improved crop yields resulting from the use of organic slurry. Upfront cost support and subsidies reduce financial burdens, making it accessible to marginal farmers.

**Social Benefits:** Promotes clean cooking, reducing indoor air pollution and improving health, especially for women. Empowers communities through training and supports local employment and sustainable rural development.

### Results of the Intervention

- Demonstrated successful models show that biogas from 2–3 cows can power household kitchens
- Biogas slurry improves soil health and supports agroecological farming
- Three cluster-level demo units will raise community awareness and build capacity
- 1,000 biogas units to be installed over five years, promoting clean energy
- Convergence with GEDA, Gobar-Dhan Yojana, and Carbon Financing ensures long-term sustainability

## 5.8. Nutrition

### 5.8.1. Community-Based Nutrition Education

A preliminary assessment of diet diversity and quality in the three landscapes reveals that, while dietary diversity is relatively high, indicating access to a variety of food groups, there is also an unexpectedly high consumption of snacks, processed foods, and sugar-sweetened beverages. This trend is shocking, given that these areas are remote, which have historically been less exposed to the commercial food industry.

These findings highlight the need to address the double burden of nutrition, promoting healthy, diverse diets while also reducing the consumption of ultra-processed and unhealthy foods. Interventions promoting healthy diets are critical as these communities are likely in the midst of a nutrition transition. Consequently, interventions in these regions must be designed to address both dimensions.

**Education-based interventions** have been planned for the landscape, aiming to build awareness and shift everyday food choices. Targeted programs within communities include school programs, community-based awareness campaigns, and training of government frontline workers.

## Feasibility

### Technical Feasibility and Financial Viability Considerations

- In the context of agroecological landscapes in India, education-based strategies must be locally relevant and community-driven.
- Success depends on the quality, accessibility, and cultural relevance of behaviour change materials, as well as the capacity of local actors to deliver consistent messaging.
- Cost-efficiency can be improved by integrating nutrition training with ongoing capacity-building efforts for government functionaries and women leaders in the landscape.

### Potential Risks and Unknowns:

- Resistance to behaviour change may occur due to ingrained food habits or social norms. Community-led action to reinforce healthy diets and curb the rise of non-communicable diseases is critical to the success of these strategies.
- Effective monitoring and periodic reinforcement are needed to ensure sustainability and scale.

## Ecological, Economic, and Social Benefits

### Social Benefits:

- Improved public health and nutrition outcomes through reduced consumption of ultra-processed foods and better-informed dietary choices.
- Empowerment of women leaders and frontline workers through skill-building and increased visibility in the community.
- Enhanced intergenerational impact through school-based education, potentially shifting dietary behaviours from a young age.

### Economic Benefits:

- Improved dietary practices with long-term adherence can contribute to reduced health expenditures at the household level over time.

## Implementation Design and HR

Implementation is planned over 5 years, with phased roll-out starting with content development and initial training in Year 1, followed by implementation and periodic reinforcement. Beyond the five years, nutrition-related interventions and community engagement can be implemented by local stakeholders and the community based on their specific needs.

### How Will It Be Implemented?

A multi-level behaviour change strategy will be used, focusing on education and community-led action:

- **School Programs**
  - Children will learn to identify healthy foods and understand the harms of processed and sugary foods.

- **Community-based Awareness Campaigns**
  - Led by trained women leaders inspired by successful models like *Health Karyakarta* (Deccan Development Society) and *Poshan Vanitha* (WASSAN).
- **Training Frontline Government Workers**
  - ASHAs, Anganwadi workers, and schoolteachers will be trained as key influencers of nutrition.
- **Supportive Materials**

To implement this strategy effectively, financial support is required for the development and testing of resource material, training programs, and behaviour change campaigns within the community. These interventions should be supported by a suite of accessible, high-quality resources, including:

- Nutrition-focused school curriculum materials,
- Practical guides and flipbooks for frontline workers, and
- Audio-visual content (radio, short videos) is periodically developed and disseminated in local languages, ready for circulation via WhatsApp or community screenings.

#### **Key Stakeholders in Implementation**

- Anchor Organisations in each landscape will lead coordination and oversight.
- Trained women leaders leading community-based awareness efforts
- Frontline government workers (ASHA, Anganwadi workers, schoolteachers), and local schools will implement ground-level activities.
- Nutrition experts will be engaged for content development.
- District Administration will support the integration with existing schemes, providing policy and budget support.
- The Gram Panchayat will support ground-level implementation, mobilise other stakeholders, and facilitate community engagement.

#### **Additional Human Resources Required**

- Nutrition communication specialist (content development and training)
- Audio-visual content creator (local language expertise)
- Community facilitators (to coordinate school and village-level efforts)

#### **Institutions Required, If Any**

No new institutions are proposed; the intervention will leverage existing public health and education systems.

### **5.8.2. Agroecology in Schools: Integrated Food and Farming System Curriculum**

The children today are growing far away from the idea of how their food is grown and where it is coming from. There is a need for generating an environmental literature in today's school curriculum

enabling the students to learn about their food, how it is grown, what sources are being used, and various other environmental issues.

### **The Solution: Learning Rooted in Life**

This intervention takes from a solution designed by the Centre for Sustainable Agriculture (CSA), Hyderabad, in collaboration with Help Us Help Them (HUHT), Kolkata, launched a pioneering initiative at Adhigam Bhoomi, a residential school for 1000 underprivileged girls in West Bengal. The goal: to integrate food and farming systems into the formal school curriculum, turning the act of growing food into a core learning experience.

The solution positions farming not as a peripheral vocational option, but as a core knowledge system with cross-disciplinary value. By aligning classroom education with hands-on agricultural practice, the curriculum promotes:

- Environmental literacy
- Understanding of food systems
- Healthier food habits
- Life skills and teamwork
- Emotional and psychological development

### **Primary Objectives**

- To design and implement an age-appropriate food and farming curriculum for children aged 6–16 years (Grades 1–10)
- To promote food literacy, healthy food habits, and nutrition security
- To connect academic subjects with practical farming experiences
- To build environmental consciousness and local market awareness
- To develop leadership, responsibility, and teamwork among students
- To create a learning ecosystem that supports holistic child development

### **Strategy and Implementation Plan**

#### **1. Curriculum Development**

- CSA has developed a full curriculum framework and prepared teacher and student manuals for Grades 1 to 10, reaching to 1000 girls, from the backward classes in the Sundarbans district of West Bengal.
- Curriculum is divided into three categories with different themes:
  1. Understanding Food for children aged 6 to 8 years
  2. Natural resources, health & nutrition, biodiversity, ecosystems, for children aged 9 to 12 years and
  3. Understanding local agriculture and hands-on experience in farming for children aged 13 to 15 years.

#### **2. Teacher Training and Support**

- Teachers from HUHT's residential school were trained by CSA.

#### **3. Field-Based Learning**

- Students engage in hands-on activities such as soil preparation, sowing, weeding, harvesting, and basic cooking.

- The curriculum integrates with the NIOS academic framework, ensuring learning continuity while innovating pedagogy.

#### 4. Linking Home and School

- Students return to their villages for two months annually and apply their learning at the household or community level, reinforcing practical knowledge.

The project envisions a future where every child learns not just how to read and write, but also how to grow food, eat well, and care for the planet. By integrating food and farming into mainstream education, we nurture children who are healthier, wiser, and more connected to their environment.

This Integrated Learning is not just a curriculum—it is a philosophy of education that roots learning in the soil, shapes it through experience, and harvests it in the form of healthier, more resilient future generations.

## 5.9. Enterprise Development

### 5.9.1. Promotion of Enterprise Models

To foster enterprise, drive economic development, and inspire youth, we suggest a dedicated investment of ₹1 crore. This investment could be channelled to a specialised agency (which could also be an anchor organisation) tasked with implementation. It is proposed that the funding be phased over three years, with approximately ₹33 lakhs released annually, contingent on achieving key project milestones. These funds would be intended to cover the agency's operational costs and provide technical expertise for enterprise development.

This would support the creation of a strong local team, including a manager, coordinators, and field staff, who would provide hands-on support to new businesses. The aim is to establish 8-10 diverse, economically viable, and environmentally friendly enterprises. A portion of the funds would also be allocated for crucial activities such as training, branding, and integrating clean energy solutions like solar power to enhance profitability and sustainability. The ultimate goal of this proposed investment is to build resilient local economies and empower rural communities, with a particular focus on women and young people.

Examples of the types of enterprises that could be supported include:

- Primary Processing Units: Small-scale, community-run units for milling rice, pulses, and oilseeds, often powered by renewable energy.
- Millet and Ready-to-Eat (RTE) Enterprises: businesses that process local millets into flour, snacks, and other value-added food products for local and urban markets.
- Renewable Energy-Powered Enterprises: Using solar or other clean energy to power irrigation, processing units, and other agricultural equipment to reduce fuel costs and improve productivity.

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## PART 2 – INVESTMENT PLANNING FOR INTERVENTIONS

The linked plan provides a detailed and consolidated overview of investments and their breakdowns for Ahwa's agroecological transformation plan over the total implementation period. The

implementation cost for each intervention in each domain, as well as a breakdown of the expenses from primary sources, including community contributions, government scheme convergences, grants, debt, and guarantees, has been calculated and presented categorically.

## **INVESTMENT PLAN FOR AGROECOLOGICAL TRANSFORMATION IN AHWA**



# Landscape Investment Plan for Ahwa

## 6.1 Introduction to the Investment Framework

The landscape investment plan for Ahwa block in Dang district, Gujarat, represents a comprehensive strategy for agroecological transformation across 122 villages spanning approximately 560 square kilometres. This investment framework addresses the unique challenges of a predominantly tribal landscape characterised by hilly terrain, high monsoon rainfall, and traditional farming systems, while capitalising on its rich biodiversity, strong community institutions, and the region's designation as Gujarat's first 100% organic farming district.

The investment plan is structured around eight thematic areas as detailed in the previous sections. The total investment requirement stands at ₹146.70 crores (net investment after government funds and community contributions), with implementation phased over three stages to ensure sustainable adoption and institutional capacity building.

## 6.2 Investment Architecture and Financing Strategy

### 6.2.1 Overall Investment Structure

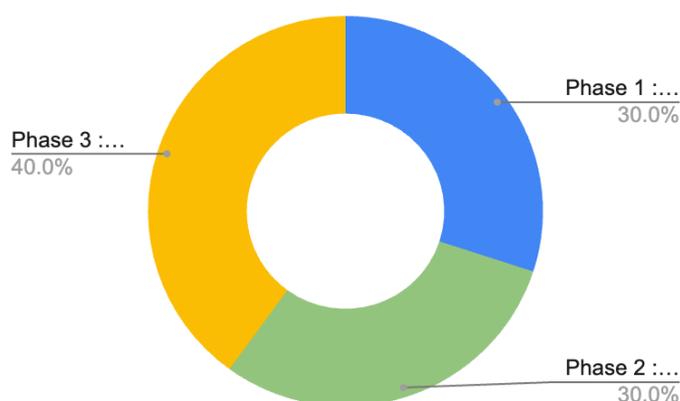


Fig. 6.1 – Overall Investment Structure

The total cost of the agroecological transformation program is estimated at ₹378.45 crores, with ₹191.88 crores available through existing government schemes and ₹39.87 crores as community contribution, leaving a net investment requirement of ₹146.70 crores. **The investment requirement of ₹146.70 crores leverages ₹231.75 crores in combined government and community resources, achieving a 1:1.58 ratio that amplifies impact while ensuring local ownership and sustainability.** The full details can be found in the sheet [here](#).

This investment is distributed across three implementation phases:

- **Phase 1 (Years 1-3):** ₹44.01 crores, focusing on establishing foundational infrastructure, capacity building, and piloting key interventions
- **Phase 2 (Years 4-6):** ₹44.01 crores for scaling successful models and strengthening institutional frameworks
- **Phase 3 (Years 7-10):** ₹58.68 crores for full-scale implementation and sustainability mechanisms

The financing mix employs multiple instruments tailored to intervention types, farmer capabilities, and institutional maturity. Grants comprise the largest share for capacity building and non-revenue generating activities, while returnable grants, results-based financing, and debt instruments support productive investments. Guarantee mechanisms and interest subventions are strategically deployed to de-risk private investments and reduce the cost of capital for smallholder farmers and community institutions.

## 6.2.2 Financing Instruments and Allocation

The investment plan utilises six primary financing instruments, each serving specific purposes within the agroecological transformation:

### Grants (Technical Assistance/Pilots)

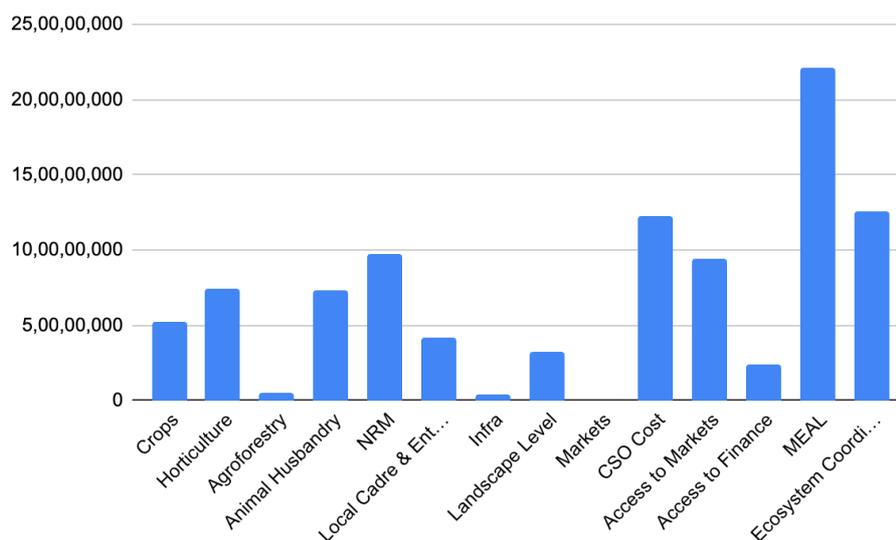


Fig. 6.2 – Grants

Grants constitute ₹97.08 crores (25.6% of total investment) and provide 100% of funding for ecosystem coordination, social capital development, and substantial portions of agroforestry and NRM

interventions. These non-returnable funds support critical activities, including capacity building for 100 Community Resource Persons and 100 Pashu Sakhis, creation of community-level soil conservation and water harvesting structures (₹7.32 crores), establishment of Bio-Resource Centres and seed systems (₹5.26 crores), nutrition education interventions, and payments for agroforestry on private farm bunds (₹7.43 crores). Grants are particularly important in Phase 1 to establish foundational institutional capacity and test innovative agroecological approaches. Total grant allocation across all three phases amounts to ₹97.08 crores, with ₹36 crores in Phase 1 investments to anchor landscape transformation, ensuring knowledge systems and community institutions receive sustained support for long-term sustainability.

### Returnable Grants

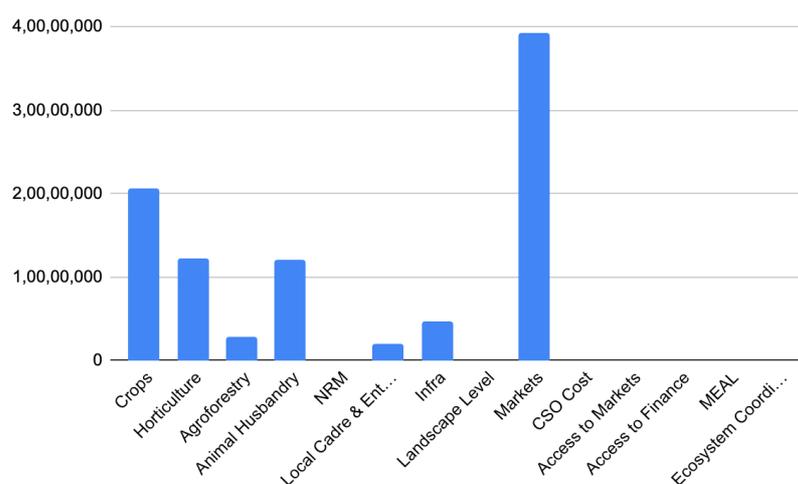


Fig. 6.3 – Returnable Grants

Returnable Grants provide approximately 6.4% of the net investment required in the Ahwa block, amounting to 9.38 crore rupees out of the total 146.70 crore net investment. They are largely allocated for revenue-generating physical infrastructure such as processing units for millets, pulses and oilseeds, community and SHG-managed nurseries for fruit and forest species, collection and aggregation centres at cluster-level FPOs, pack houses and grading facilities, and Bio-Resource Centres for bio-input production. Since FPOs in Ahwa block are still nascent, working capital has been substantially addressed through revolving fund mechanisms totalling approximately 1.18 crore rupees across dairy and goat units, with additional working capital support of 2.75 crore distributed across cluster and block-level FPOs. Other interventions, like the creation of physical capital, such as the three cluster-level Bio-Resource Centres with a combined investment of 54 lakh, are initially met with a mix between grants and returnable grants, eventually transitioning to debt as these enterprises mature and demonstrate revenue-generation capacity. This instrument bridges the gap between full grants and commercial loans, recognising the medium-term revenue potential of agroecological enterprises while ensuring affordability and accessibility for tribal farming communities in the early stages of development.

### Results-Based Financing

Results-Based Financing accounts for ₹6.53 crores (4.5% of total net investment), strategically deployed where performance can be directly measured. The largest allocation goes to agroforestry (₹3.94 crores), linking payments to actual tree survival and growth rather than just planting activities.

Animal husbandry (₹87.72 lakhs) ties funding to livestock health and productivity improvements, while natural resource management (₹37.33 lakhs) rewards verified soil and water conservation outcomes. Ecosystem coordination through CSO costs (₹1.17 crores) links payments to institutional development milestones and successful convergence with government schemes. This payment-for-results framework builds accountability while providing flexibility for communities to innovate in achieving agreed-upon outcomes, ensuring that investments translate into tangible ecological and livelihood improvements for tribal farming households in Ahwa block.

### Debt Financing

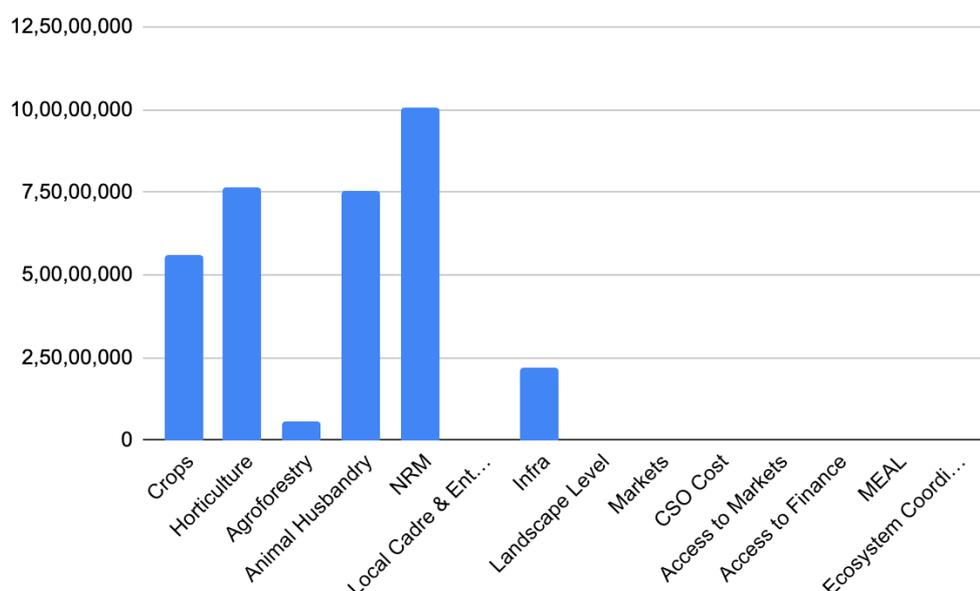


Fig. 6.4 – Debt Financing

Debt Financing totals ₹33.73 crores (23% of total net investment), concentrated in sectors with shorter payback periods and proven revenue generation. Natural resource management leads with ₹10.08 crores in debt for irrigation systems, land levelling, and watershed development, supported by ₹1.61 crores in guarantees and ₹1.61 crores in interest subvention. Animal husbandry receives ₹7.56 crores in debt for integrated farming systems, dairy units, goat rearing, and poultry infrastructure, with ₹87.72 lakhs in guarantees and interest subvention. Crops receive ₹5.63 crores in debt with ₹63.77 lakhs in guarantees and interest subvention for input supply, cultivation expenses, and bio-resource centres. Horticulture (₹7.67 crores debt) employs debt financing for modified wadi plantations and nursery infrastructure, while local cadre and entrepreneurs (₹1.01 crores debt) use borrowing for enterprise development and working capital. The debt architecture, de-risked through ₹3.91 crores in guarantees and ₹3.91 crores in interest subvention, builds financial inclusion while establishing creditworthiness for future commercial financing among tribal farming communities.

Guarantee Mechanisms totalling ₹3.91 crores (11.6% of debt financing) support borrowing by covering default risks, particularly important for first-time borrowers from tribal communities and nascent Farmer Producer Organisations. Natural resource management carries the highest guarantee coverage at ₹1.61 crores, followed by animal husbandry (₹87.72 lakhs), horticulture (₹88.97 lakhs), crops (₹63.77

lakhs), and local cadre and entrepreneurs (₹11.69 crores). This instrument is critical for unlocking commercial finance in Ahwa block with its limited credit history and predominantly tribal population.

Interest Subvention totalling ₹3.91 crores reduces the effective interest rate on loans, making debt more affordable for smallholders and community institutions. Natural resource management receives the largest subsidy at ₹1.61 crores, reflecting the significant capital costs for irrigation infrastructure and watershed development with gradual returns. Animal husbandry (₹87.72 lakhs), horticulture (₹88.97 lakhs), crops (₹63.77 lakhs), and local cadre and entrepreneurs (₹11.69 lakhs) also benefit from interest rate reductions, enabling communities to access formal credit while managing repayment burdens during the gestation period of investments.

## 6.3 Sectoral Investment Priorities

### 6.3.1 Sustainable Production Systems (Crops)

**Crop Production Investments:** The agricultural inputs investment totalling ₹12.99 crores aims to transition Ahwa's predominantly tribal landscape from low-input subsistence farming to productive agroecological agriculture. Currently, approximately 87-88% of households in the Ahwa block depend on agriculture, with most farming conducted on small, rainfed holdings in hilly terrain. The supply of seeds and bio-inputs for consumption crops, including paddy, millets (nagli, varai, kodo), pulses (black gram, green gram, pigeon pea), and vegetables requires a net investment of ₹9.47 crores with government funds of ₹1.50 crores (14%) covering a portion of the ₹10.97 crore total cost. The remaining ₹9.47 crores will be sourced through grants (₹5.58 crores), returnable grants (₹76.33 lakhs), and debt (₹4.82 crores). For cash crops, the net investment needed is ₹62.50 lakhs annually, requiring funding through a mix of grants (₹23.44 lakhs), returnable grants (₹14.06 lakhs), and debt (₹34.38 lakhs). Critical infrastructure investments include ₹55.50 lakhs for three cluster-level Bio-Resource Centres (with ₹12 lakhs community contribution) to produce diverse bio-inputs like Jeevamrut, Beejamrut, bio-pesticides, and bio-fertilisers, addressing the current constraint of limited access to quality organic inputs. Seed banks and community seed exchange networks require ₹46.35 lakhs (with ₹6.25 lakhs community contribution) to conserve and multiply traditional varieties that are well-adapted to local conditions. Fixed capital for warehousing, processing and transportation requires ₹1.76 crores net investment, enabling FPOs to add value through cleaning, grading, and packaging of millets, pulses, and other crops. The Participatory Guarantee System (PGS) for organic certification requires ₹13.13 lakhs net investment from a total cost of ₹26.25 lakhs (with ₹13.13 lakhs community contribution), providing market recognition for Ahwa's naturally grown products and enabling premium pricing in urban markets.

**Agroforestry and Afforestation** Agroforestry and Afforestation represent a critical sectoral investment with a net requirement of ₹1.59 crores (total cost of ₹14.74 crores), addressing the need to diversify income sources and restore degraded lands in this forested landscape where over 85-90% of the area is under forest cover. The supply of quality planting materials (₹5.40 crores total cost, with ₹54 lakhs net investment after ₹4.86 crores in government funds) supports the Modified Wadi model, establishing 6,000 units (each 0.2 ha) over six years through a phased approach 1,000 demonstration units in the first three years funded by the project, followed by scaling through convergence with NABARD Wadi Programme, MGNREGA, and Tribal Sub-Plan. Priority fruit species identified through village consultations include mango, custard apple, cashew, moringa (drumstick), amla, and ber, planted along farm bunds to provide supplementary income without displacing food crops.

The creation of on-field infrastructure like irrigation, bunding, and fencing for agroforestry systems (₹9.34 crores total cost, with ₹1.05 crores net investment after ₹5.29 crores government funds and ₹3

crores community contribution) ensures sapling survival and protection from grazing. This investment is funded through grants (₹24.30 lakhs), results-based financing (₹20.25 lakhs) linked to tree survival and growth, and debt (₹9.45 lakhs) in Phase 1. Twenty SHG-managed nurseries will be established across 20 Gram Panchayats to supply locally produced saplings, creating women-led enterprises while reducing dependence on distant government nurseries. By integrating fruit-bearing trees with traditional cropping systems, these investments create diversified revenue streams, improve household nutrition, enhance soil conservation and microclimate stability, and restore biodiversity in this ecologically sensitive Western Ghats landscape.

**Horticulture Development** (₹60.48 crores total cost, with ₹42.50 crores government funds and ₹1.65 crores community contribution, leaving ₹16.33 crores net investment) focuses on the supply of bio-inputs for intensive organic vegetable production, capitalising on Ahwa's favourable agro-climatic conditions with an annual average rainfall of 2,396 mm. Currently, net irrigated area constitutes only ~15% of cultivable land, limiting Rabi and summer cropping. The horticultural strategy emphasises agroecological practices delivered through 120+ Farmer Field Schools and 30 demonstration farms managed by trained Prakruti Krishi Sakhis, reaching 90% of farming households. The net investment of ₹16.33 crores is funded through grants (₹7.79 crores), returnable grants (₹1.59 crores), and debt (₹7.67 crores) with ₹88.97 lakhs in guarantees and interest subvention, recognising the revenue-generation potential from vegetable sales. This infrastructure enables tribal farmers to transition from subsistence to market-oriented vegetable cultivation while maintaining organic integrity, with block and cluster-level FPOs providing aggregation, grading, packaging, and direct market linkages to ensure fair price realisation and reduced dependence on local intermediaries.

### 6.3.2 Livelihood and Economic Empowerment

**Animal Husbandry Investments** Animal Husbandry Investments totalling ₹16.10 crores net (₹30.15 crores total) recognise livestock as a critical livelihood component for Ahwa's tribal population, where traditional practices include rearing indigenous Dangi cattle, goats, and desi poultry. The supply of chicks and ducks for backyard rearing (₹12.60 crores net from ₹19 crores total, with ₹6.40 crores community contribution) will establish 10,000 backyard poultry units across three scales: 5,000 units with 20 birds, 3,000 units with 50 birds, and 2,000 units with 100 birds, supported by 200 breeding cum mother units (500 bird capacity each) managed by trained Pashu Sakhis. This addresses the current challenge of high mortality rates due to disease outbreaks and limited access to quality day-old chicks, while building on indigenous breeds like Kadaknath alongside improved varieties like Rhode Island Red.

A revolving fund mechanism at the FPO level will provide initial capital support, enabling farmers to claim subsidies post setup and replenish the fund for other beneficiaries. The dairy promotion component supports 150 new units annually through convergence with Vasudhara Dairy, which currently operates 254 milk collection cooperatives procuring 55,000 litres daily, targeting 100,000 litres per day by leveraging the upcoming Tapi River water project (2027) to address current water scarcity constraints. These investments employ innovative financing across phases with grants (₹1.84 crores), returnable grants (₹33.48 lakhs), and debt (₹1.40 crores), with ₹19.05 lakhs in guarantees and interest subvention, directly benefiting farming households while strengthening women's leadership through Pashu Sakhis providing doorstep veterinary services, vaccination, and breed improvement support.

**Market Development Infrastructure** totalling ₹3.92 crores net investment bridges the production market gap through working capital and operational support for Community-Based Organisations. Working capital for CBOs, including FPOs and Women Federations (₹2.74 crores net from ₹3.44 crores total, with ₹25 lakhs government funds and ₹45 lakhs community contribution) will establish revolving funds enabling three cluster-level FPOs and one block-level apex FPO to aggregate, process, and

market agricultural produce, livestock products, and NTFPs. This patient capital is essential in Ahwa, where commercial banking infrastructure remains limited and current marketing relies heavily on local weekly haats (Ahwa on Monday, Galkund on Tuesday, Samgahan on Sunday) and intermediaries who dominate trade with low farmgate prices. The investment is structured through returnable grants (₹1.64 crores) and seed equivalent financing (₹1.10 crores) across phases, recognising the revenue generation potential as FPOs mature. CBO expenses, including salaries, business development, and non-operational costs (₹1.18 crores net from ₹1.18 crores total), will support capacity building in governance, financial management, quality control, and digital marketing, with at least 50% women representation in board positions, ensuring gender inclusive decision making. This funding structure enables the block level FPO to handle advanced processing (milling, packaging, branding) while cluster level FPOs manage primary aggregation (cleaning, sorting, grading), particularly for millets, pulses, vegetables, dairy products, goat meat, and desi poultry, creating "Ahwa" or "Dang Naturals" branded products positioned for urban markets in Surat, Nashik, and Mumbai, as well as tourist demand in nearby Saputara hill region.

### 6.3.3 Natural Resource Management

Natural Resource Management investments address the fundamental water scarcity challenge in Ahwa's rain-dependent landscape, where agriculture is predominantly confined to the Kharif season. The Ahwa block experiences an annual average rainfall of 2,396 mm, making it one of the wettest regions in Gujarat. However, the hilly terrain causes rapid surface runoff during monsoons, resulting in limited groundwater recharge and acute summer water scarcity. Currently, the net irrigated area in Dang district stands at only 1,441 hectares, representing a mere 3% of the net sown area, with several villages visited during TAPE assessments having no irrigation whatsoever and relying entirely on monsoon rainfall.

These investments totalling ₹172.77 crores will expand significantly beyond the current infrastructure, with ₹124.30 crores mobilised through government convergence, ₹27.03 crores from community contribution, and ₹21.45 crores in net investment required. The program will create a comprehensive ridge-to-valley watershed management covering 40,000 hectares over eight years through soil and water harvesting structures, afforestation, rewilding, and grassland development at the community level. This includes establishing 90 solar-based lift irrigation systems over three years (each irrigating 20 to 25 acres), 120 river-based electrically powered lift systems over four years (each covering 10 to 15 acres), and 10 diversion-based irrigation systems over two years (each irrigating 50 to 60 acres). The program will also undertake desilting and rehabilitation of approximately 300 existing check dams, of which only 125 have been repaired despite the irrigation department's identified need.

The integration of traditional practices, including terracing and bunding already used by tribal farmers, with modern techniques like micro irrigation and GIS-based planning ensures culturally appropriate and technically sound solutions. Community ownership through Water User Committees will be strengthened to ensure equitable water distribution and sustainable resource management, enabling farmers to extend cropping beyond Kharif into Rabi and summer seasons for vegetables, pulses, and fodder crops.

### 6.3.4 Governance and Ecosystem Coordination

Governance and Ecosystem Coordination represents a comprehensive investment in institutional strengthening and program management totalling ₹72.22 crores. Social Capital Development (₹6.49 crores net investment) forms the backbone of the agroecological transformation, recognising that technical interventions alone cannot succeed without strong community institutions and enhanced capacities. Capacity building programs for farmers including Farmer Field Schools (₹26.64 lakhs net

investment with ₹3 lakhs government funds and ₹19.52 lakhs community contribution), community cadre expenses for honorarium, incentives, capacity building and exposure visits (₹3.44 crores net investment with ₹82.80 lakhs community contribution), entrepreneurship development (₹1 crore net investment), and nutrition and agroecology education interventions (₹1.51 crores net investment) reflect their foundational importance across all three phases.

The investment in nutrition education directly addresses critical malnutrition indicators documented in NFHS-5 data, showing 82% anaemia among children aged 6 to 59 months, 77.6% anaemia among non-pregnant women, 33.7% underweight women, 37.6% child stunting, and 41% wasting among children under five years. By promoting production and consumption of nutritious traditional foods like finger millet, little millet, pulses, and indigenous vegetables through village-level interventions, these programs link agricultural transformation with health outcomes. Strengthening of government institutions, including Gram Panchayats and KVKs (₹27.37 lakhs net investment) recognises the critical role of local governance in landscape transformation, particularly important given the need to integrate MGNREGA planning with ridge-to-valley natural resource management approaches.

Ecosystem Coordination (₹64.67 crores net investment) funds the operational machinery necessary for landscape-level implementation across 560 square kilometres covering 122 villages under 27 Gram Panchayats. The anchor organisation costs (₹15.77 crores) support field teams, monitoring systems, and coordination mechanisms essential for the challenging terrain. Specialised support includes finance mechanisms (₹3.15 crores), market development (₹9.46 crores), policy and communications (₹6.31 crores), research and MEL (₹15.77 crores), and CAT ecosystem coordination (₹12.61 crores). Development of digital infrastructure and services (₹10 lakhs) and setting up testing labs, including soil and water testing facilities (₹1.5 crores) provides an essential technical backbone.

This coordination layer ensures coherent implementation while coordinating multiple departments, including Agriculture, Forest, Animal Husbandry, Watershed Development, Irrigation, and ATMA, alongside community institutions such as SHGs, FPOs, Water User Committees, and Forest Protection Committees. The MEL component ensures rigorous documentation of this pioneering tribal agroecology transformation for replication elsewhere in Gujarat's tribal regions.

## 6.4 Implementation Phasing and Risk Mitigation

The implementation strategy balances the urgency of addressing poverty and malnutrition in this predominantly tribal landscape with the reality of institutional capacity constraints and the need for learning and adaptation. The total investment of ₹378.45 crores comprises ₹191.88 crores in government funds available (50.7%), ₹39.87 crores in community contribution (10.5%), and ₹146.70 crores in net investment required (38.8%). The net investment employs a diverse financing mix: ₹97.08 crores in grants (66.2%), ₹9.38 crores in returnable grants (6.4%), ₹6.53 crores in results-based financing (4.4%), ₹33.73 crores in debt (23.0%), with ₹3.91 crores each in guarantees and interest subvention to de-risk lending and borrowing.

The financing architecture reflects the nature of investments across sectors, phased over three periods with ₹44.01 crores net investment in each of Phase 1 and Phase 2, and ₹58.68 crores in Phase 3. Social interventions including landscape level programs (₹3.16 crores net investment with ₹5.50 crores government funds), local cadre and entrepreneurs (₹4.44 crores net investment with ₹82.80 lakhs community contribution), and ecosystem coordination including CSO costs (₹15.77 crores), access to markets (₹9.46 crores), access to finance (₹3.15 crores), MEAL (₹22.08 crores), and CAT coordination (₹12.61 crores) totaling ₹58.93 crores entirely in net investment, are predominantly grant funded, recognizing their foundational and public good nature.

Productive sector investments employ blended finance to build bankability. Crops (₹12.99 crores net investment with ₹1.50 crores government funds and ₹31.38 lakhs community contribution) use ₹5.26 crores grants, ₹2.07 crores returnable grants, ₹3.94 lakhs RBF, and ₹5.63 crores debt with ₹63.78 lakhs each in guarantees and interest subvention. Animal husbandry (₹16.09 crores net investment with ₹7.65 crores government funds and ₹6.40 crores community contribution) employs ₹7.32 crores grants, ₹1.21 crores returnable grants, and ₹7.56 crores debt with ₹87.72 lakhs each in guarantees and interest subvention, demonstrating high debt proportions reflecting shorter payback periods and proven market demand.

Agroforestry (₹16.33 crores net investment with ₹42.50 crores government funds and ₹1.65 crores community contribution) uses ₹7.43 crores grants, ₹1.22 crores returnable grants, and ₹7.67 crores debt with ₹88.97 lakhs each in guarantees and interest subvention, given the longer gestation period for tree crops. Horticulture (₹13 crores net investment with ₹1.50 crores government funds and ₹31.38 lakhs community contribution) balances ₹5.25 crores grants with ₹2.07 crores returnable grants and ₹5.63 crores debt. Natural resource management (₹21.45 crores net investment with ₹124.30 crores government funds and ₹27.03 crores community contribution) combines ₹9.76 crores grants, ₹1.61 crores RBF, and ₹10.08 crores debt, while infrastructure development (₹3.91 crores net investment with ₹25 lakhs government funds and ₹45 lakhs community contribution) uses ₹3.92 crores returnable grants establishing revolving funds.

Risk mitigation is embedded through multiple mechanisms: diversified financing sources reducing dependence on any single channel; guarantee mechanisms and interest subventions totalling ₹7.82 crores reducing lender and borrower risk in a landscape with limited credit history; strong emphasis on community institutions including SHGs, FPOs, and Water User Committees ensuring local ownership beyond project life; and strategic convergence with ongoing government schemes including MGNREGA for watershed work and plantation, National Mission on Natural Farming, National Livestock Mission, Gobar-Dhan Yojana, GEDA solar programs, and tribal development schemes providing ongoing support through the ₹191.88 crores government convergence.

The investment plan positions Ahwa for transformation from an isolated, predominantly subsistence-based tribal landscape to a model of agroecological development in Gujarat's tribal regions, achieving food security, livelihood diversification, and ecological restoration through carefully structured, community-owned investments that respect cultural heritage while building economic resilience.



# Potential Impact of Interventions

It is possible to draw connections between the outcomes of interventions and their resulting impacts on key focus areas relevant to agroecology, using multiple frameworks. At this stage, there is insufficient data to quantify the extent of the effects of these interventions using different frameworks. In the following sections, efforts have been made to connect the potential impact of interventions, either in qualitative terms or in terms of rough estimates, which are more directional than specific.

## 7.1. Interventions and Agroecological Principles

**Table 7.1** presents the assessment of how each of the thirteen agroecological principles is currently reflected in the landscape, using a scoring scale of 0 to 4. These scores draw on discussions held through the TAPE tool in selected villages and are refined through the judgment of the anchor organisation based on its field experience. The accompanying rationale explains the basis for each current score.

For each principle, the table also identifies the interventions proposed in the landscape that are expected to strengthen its expression in practice. These interventions indicate pathways for strengthening the integration of each principle into farm systems and the broader food system.

## 7.2. Response to the Climate Crisis

The response to the climate crisis can be seen as measures taken towards mitigation, adaptation and building resilience. **Table 7.2** outlines the potential impacts of the intervention outcomes. For example, Carbon sequestration and reduced emissions achieved through some interventions lead to climate change mitigation. An effort has been made to connect various interventions and their outputs to these desirable outcomes. At this stage, quantifying the extent of the intervention's effects is outside the current scope due to a lack of relevant data.

This framework is an adapted version of the approach and principles outlined in the FAO's 2020 report, 'The potential of agroecology to build climate-resilient livelihoods and food systems' (FAO, 2020). It draws on the core elements of agroecology, as well as the pathways and indicators for resilience identified in the FAO study. It contextualises them for block-level agroecological planning and intervention assessment.

Scoring Criteria - Scores to given according to the following scale of integration: 0 (Non-existent) - 1 (Very Low) - 2 (Low) - 3 (High) - 4 (Very High)

S. No.	Agroecological Principles (Revised)	Current Assessment of the Landscape (Score based on TAPE Assessment)	Rationale for the current score	Interventions that potentially improve the integration of the agroecology principle
1	<p><b>Recycling -</b> Preferentially use local renewable resources and close as far as possible resource cycles of nutrients and biomass.</p>	1	<p>Currently, recycling practices in the landscape are minimal and mostly limited to the use of farmyard manure and occasional composting. Farmers largely rely on external inputs for soil fertility, and crop residues are often left unutilized or burned, leading to loss of valuable organic matter. There is no structured system for nutrient recycling or institutional mechanism to promote these practices, resulting in low integration of circular nutrient flows.</p>	<p>This criterion addresses the efficient reuse and recycling of resources within the agroecosystem—such as crop residues, water, seeds, animal waste, and energy—while minimising external inputs and waste.</p> <p>Through the active engagement of Prakritik Krishi Sakhis (PKSs) and Pashu Sakhis (PSs), farmers are trained and supported to adopt on-farm recycling practices. These include composting of crop residues, preparation of bio-fertilisers and botanical pesticides, and the use of animal dung and urine for nutrient enrichment—resulting in minimal waste discharge or burning of agricultural by-products.</p> <p>The Gram Panchayat Development Planning (GPDP) process integrates water conservation strategies, ensuring that water harvesting structures and micro-irrigation systems are prioritised and implemented at the community level.</p> <p>Seed self-reliance is strengthened through the support of Bio-Resource Centres (BRCs), PKSs, and Lead Farmers, who promote on-farm seed saving and community seed exchange systems. As a result, at least 50% of the seeds used are self-produced or locally exchanged, reducing dependence on commercial hybrid varieties.</p> <p>In livestock, Pashu Sakhis ensure sustainable breeding practices by promoting buck and ram exchange within and between neighbouring farms, thereby conserving local breeds and reducing costs. In dairy units, the adoption of bio-digestor technology enables the conversion of cow dung into biogas, providing a renewable source of clean energy for household cooking.</p> <p>Collectively, these integrated practices across crop, livestock, and energy systems demonstrate a high degree of resource recycling and circularity.</p> <p>To promote recycling of organic materials, the Ahwa interventions include the establishment of Bio-Resource Centres (BRCs) that will facilitate the production of compost, Jeevamrit, and Beejamrit using locally available biomass and cow dung. Additionally, dairy-linked biogas units are proposed to convert animal waste into energy and</p>

				organic slurry, closing nutrient loops within farm systems. Training farmers in composting techniques, crop residue management, and integration of livestock waste into soil enrichment practices will ensure effective recycling and reduce external dependencies.
<b>2</b>	<b>Input reduction</b> - Reduce or eliminate dependency on purchased inputs and increase self-sufficiency.	1	The existing agricultural system is characterized by high dependence on chemical fertilizers and pesticides, which has become a norm for ensuring productivity. While a few farmers have experimented with natural farming inputs like Jeevamrit or organic compost, these practices are not widespread, and the availability of bio-inputs is limited. This results in a production system that is resource-intensive and vulnerable to rising costs and external supply shocks.	The planned interventions aim to reduce dependency on external chemical inputs through localized production and promotion of bio-fertilizers and bio-pesticides at the BRCs. Farmers will be trained in natural farming methods, including the use of traditional inputs like Jeevamrit, Neemastra, and plant-based pest repellents. The easy availability of these inputs and increased awareness of their efficacy will enable a gradual shift away from synthetic chemicals, thereby lowering cultivation costs and environmental risks.
<b>3</b>	<b>Soil health</b> - Secure and enhance soil health and functioning for improved plant growth, particularly by managing organic matter and enhancing soil biological activity.	2	Soil health in the current landscape is moderately maintained, with some farmers using organic matter and practicing basic soil conservation techniques. However, there is low adoption of advanced measures such as mulching, cover cropping, and systematic addition of compost or bio-fertilizers. This leads to declining organic carbon levels and compromised soil fertility in the long term.	Ahwa's interventions to enhance soil health include promoting mulching, compost application, cover cropping, and soil-moisture conservation practices. INRM (Integrated Natural Resource Management) efforts, such as contour bunding, trenching, and vegetative barriers, will prevent erosion and improve groundwater recharge. The use of organic matter from livestock and crop residues, combined with technical training on sustainable soil practices, is expected to increase soil fertility, structure, and microbial activity over time.
<b>4</b>	<b>Animal health</b> - Ensure animal health and welfare.	1	Animal health services are underdeveloped, with limited access to veterinary care and preventive health programs. Farmers rely on irregular government health camps or local informal advice, which often results in untreated diseases and poor animal welfare. There are no community-level systems to ensure timely vaccinations, deworming, or nutrition support for livestock.	To address livestock well-being, the Ahwa plan includes the deployment of trained Pashu Sakhis who will deliver first-line ethno-veterinary care, routine vaccinations, and deworming support. Infrastructure for livestock housing and feeding will be improved, particularly under backyard poultry and goat-rearing initiatives. Animal health camps and regular supply of preventive kits will ensure disease control and improved productivity. These efforts will reduce animal stress and mortality while supporting diversified livelihoods.
<b>5</b>	<b>Biodiversity</b> - Maintain and enhance diversity of species, functional diversity and genetic resources and thereby maintain overall agroecosystem biodiversity in time and space at field, farm and landscape scales.	1	Biodiversity exists naturally in the form of mixed cropping and nearby forest patches, but there is no structured approach to maintaining or enhancing it. Farm systems are dominated by a few major crops, and tree cover is limited, which reduces ecological stability. The lack of planned agroforestry or crop diversification constrains the landscape's ecological resilience.	The landscape will demonstrate a high degree of biodiversity and integration of diverse productive systems as a result of targeted agroecological interventions. More than three major crops (millet, pulses, rice, maize, vegetables, etc) of indigenous varieties, each occupying a significant area, will be cultivated—these are carefully selected based on their adaptability to local agroclimatic conditions and resilience to climate variability. This diversification will be supported through enhanced agroecological extension services, increased availability and use of bio-inputs, and improved access to irrigation and soil and water conservation measures.  In addition to crop diversification, the landscape will support more than three animal species in significant numbers due to structured

			<p>interventions in poultry, dairy, and goat rearing. These livestock systems will be integrated into farming systems, enhancing nutrient cycling and livelihood resilience.</p> <p>Agroforestry and the promotion of multipurpose forest species will contribute to increased perennial plant diversity, resulting in a significant presence of trees and shrubs of different species across the landscape. This not only enhances ecological stability but also supports long-term productivity.</p> <p>Finally, the presence of multiple productive activities—including crop cultivation, livestock, agroforestry, and value chain linkages—will be enabled through strengthened Farmer Producer Organizations (FPOs), integrated extension services, and convergence with institutional platforms. These diversified and synergistic activities reinforce the multifunctionality and resilience of the agroecological landscape, justifying a high score of “3” under this criterion.</p>
6	<p><b>Synergy</b> - Enhance positive ecological interaction, synergy, integration and complementarity amongst the elements of agroecosystems (animals, crops, trees, soil and water).</p>	1	<p>There is some level of synergy between crops and livestock in the form of manure use, but this is neither optimised nor integrated into a holistic farming system. Livestock feeding relies heavily on external sources, and nutrient cycles between crops and animals are not fully developed. The absence of planned systems means that potential complementarities between components remain untapped.</p> <p>The programme will adopt an Integrated Farming Systems (IFS) approach, actively facilitated by Prakruti Krishi Sakhis (PKSs) and Pashu Sakhis (PSs) through structured farm planning and Farmer Field Schools (FFSs). This approach ensures strong crop-livestock integration, where livestock are primarily fed using on-farm resources such as crop residues, by-products, and managed grazing. In return, animal manure is recycled as a key source of organic fertilizer, and animals also contribute traction where needed, creating a closed-loop system that enhances resource efficiency. PKSs will demonstrate agroecological practices such as regular crop rotation, intercropping, rotational grazing, and the use of cover crops and residues for soil coverage—leading to improved soil health and minimized soil disturbance. In addition, the promotion of fruit trees along farm bunds and village-level plantation drives of multipurpose forest species will result in a high degree of integration of perennial systems, delivering multiple ecosystem services such as shade, fodder, soil stabilization, and biodiversity enhancement. These synergies between plants, animals, humans, and the environment, fostered through local demonstration and learning platforms, contribute to resilient and productive agroecological landscapes.</p>
7	<p><b>Economic diversification</b> - Diversify on-farm incomes by ensuring that small-scale farmers have greater financial independence and value addition</p>	1	<p>Current livelihoods in the landscape are highly dependent on crop farming, with limited alternative income sources. While some households engage in small-scale livestock rearing, these activities are not organised as enterprises. The lack of structured value chains and processing units restricts farmers' ability to diversify income streams.</p> <p>The Ahwa plan encourages livelihood diversification through the development of dairy, goat-rearing, and backyard poultry enterprises, particularly for women's SHGs. Additionally, processing and value addition for forest products and agroforestry produce—such as drying, grading, or packaging—will be supported through cluster-level facilities. Strengthening Farmer-Producer Organisations (FPOs) will further help aggregate and market a diverse range of products, reducing income risks from monocropping.</p>

	opportunities while enabling them to respond to demand from consumers.			
8	<b>Co-creation of knowledge</b> - Enhance co-creation and horizontal sharing of knowledge including local and scientific innovation, especially through farmer-to-farmer exchange.	1	Knowledge co-creation is minimal in the present context. Farmers mainly depend on government extension agents or informal knowledge exchange, which lacks regularity and technical depth. There is no institutionalized platform for peer-to-peer learning, exposure visits, or collaborative problem-solving on agroecological practices.	At least two dedicated platforms will be established to facilitate the transfer and co-creation of agroecological knowledge—one for Prakruti Krishi Sakhis (PKSs) and one for Pashu Sakhis (PSs). These platforms will enable continuous peer learning, experience sharing, and joint problem-solving. The PKSs and PSs will actively train and mentor farmers on agroecological principles and practices, contributing to their widespread adoption. Furthermore, integration with FPOs, SHGs, Gram Sabha-led GDP planning, and Farmer Field Schools will create a highly interconnected producer ecosystem. This network will foster strong community engagement, participatory decision-making, and the dynamic exchange of traditional and scientific knowledge, thereby strengthening the local agroecological transition.
9	<b>Social values and diets</b> - Build food systems based on the culture, identity, tradition, social and gender equity of local communities that provide healthy, diversified, seasonally and culturally appropriate diets	2	Food systems in the area still retain traditional elements, but dietary diversity is limited and nutrition security is a concern. Women have some role in household food planning, but their influence in agricultural decision-making is restricted. Cultural practices supporting local food consumption exist but lack strong institutional backing.	<p>The programme places strong emphasis on promoting local food systems and preserving cultural food traditions through the advisory roles of Prakruti Krishi Sakhis (PKSs) and Pashu Sakhis (PSs). By advocating for integrated farming systems, PKSs and PSs will encourage the production and consumption of a diverse range of locally available, nutrition-rich foods thereby ensuring food sufficiency and dietary diversity at the household level. In collaboration with Anganwadi Workers, PKSs and PSs will also receive training in nutrition education to enhance awareness of balanced diets and the importance of traditional food practices. Special focus will be placed on reviving and disseminating knowledge about nutrition-rich traditional recipes made from indigenous varieties and breeds, using time-tested methods of preparation. These efforts will not only strengthen community nutrition outcomes but also reinforce cultural identity and intergenerational transmission of culinary heritage—key pillars of agroecology.</p> <p>Food systems will be strengthened by promoting nutrition-sensitive farming and indigenous food species. Women-led SHGs will play a central role in improving household nutrition and cultural food practices.</p>
10	<b>Fairness</b> - Support dignified and robust livelihoods for all actors engaged in food systems, especially small-scale food producers, based on	2	Current fairness in the agricultural system is not strong due to dependence on middlemen for marketing and lack of bargaining power for farmers. Price realization for produce is poor, and smallholder farmers are particularly vulnerable to market volatility. There are no organized structures like Farmer Producer	<p>The intervention strongly promotes human dignity, social equity, and community well-being, with a particular focus on women's empowerment, youth engagement, and animal welfare.</p> <p>Women's leadership is being actively strengthened across multiple community institutions, including Self-Help Groups (SHGs), Village Organizations (VOs), Cluster-Level Federations (CLFs), Gram Sabhas,</p>

<p>fair trade, fair employment and fair treatment of intellectual property rights.</p>		<p>Organizations (FPOs) to aggregate produce and negotiate better prices.</p>	<p>Gram Panchayats, and Farmer Producer Organizations (FPOs). This ensures that women are meaningfully empowered in decision-making processes and have equitable access to productive resources, services, and entitlements. Women's collectives are not only functional but actively contribute to household welfare, community development, and local policy planning and implementation.</p> <p>The model emphasizes family farming systems where both men and women share responsibilities, access capital, and jointly make decisions. A dedicated cadre of trained Prakritik Krishi Sakhis (PKSs) and Pashu Sakhis (PSs)—predominantly women—will act as agents of change, fostering equity in extension services and leadership.</p> <p>Youth engagement is promoted through the creation of dignified, income-generating opportunities in farming, livestock, and entrepreneurship via FPOs and BRCs. This not only reduces distress migration but also attracts young people to remain and invest in their rural communities.</p> <p>In animal husbandry, the intervention promotes a humane approach centred on animal well-being. Training and extension services ensure that livestock are protected from hunger, thirst, and disease. While challenges around slaughter-related stress remain, the overall focus is on improving animal care, preventive health, and ethical treatment.</p> <p>Collectively, these efforts reflect a strong commitment to upholding human rights, gender equality, and social justice.</p>
<p><b>11</b> <b>Connectivity</b> - Ensure proximity and confidence between producers and consumers through promotion of fair and short distribution networks and by re-embedding food systems into local economies.</p>	<p>1</p>	<p>Connectivity between producers and consumers is negligible. Farmers mostly sell their produce at local markets through intermediaries, which reduces income and transparency. There are no mechanisms for direct marketing or traceability systems that can enhance trust and shorten value chains.</p>	<p>The intervention actively fosters a circular and solidarity-based local economy by strengthening localised production, distribution, and consumption systems.</p> <p>Cluster-based Farmer Producer Organisations (FPOs), supported by local outlets and established networks with input dealers and markets, will ensure that surplus agricultural produce—once processed—is marketed and sold within the local region, and only the excess goes outside the block. This minimises transportation costs, reduces food miles, and retains value within the community.</p> <p>Bio-Resource Centres (BRCs) play a crucial role in processing locally available raw materials such as cow dung, cow urine, and crop residues into value-added bio-inputs like compost, bio-fertilisers, and botanical pesticides. These inputs are then made available to nearby farmers, ensuring that a majority of agricultural inputs are both produced and consumed locally.</p>

			<p>The FPOs will also facilitate a solidarity-based exchange network by linking Prakritik Krishi Sakhis (PKSs), Pashu Sakhis (PSSs), and Self-Help Groups (SHGs) across villages in Ahwa block. This enables the surplus from one village to meet the input or food deficits of another, fostering intra-community resilience and economic interdependence.</p> <p>As a result, a significant proportion of food, bio-inputs, and other agri-resources will be locally produced, distributed, and consumed, supporting both circular resource flows and inclusive economic relationships.</p>
12	<p><b>Land and natural resource governance</b> - Strengthen institutional arrangements to improve, including the recognition and support of family farmers, smallholders and peasant food producers as sustainable managers of natural and genetic resources.</p>	1	<p>Land and natural resource governance mechanisms are weak. While common lands exist, their management is often informal and unregulated. Institutional frameworks for participatory planning and integrated resource management are largely absent.</p> <p>The initiative introduces a transformative approach to land and natural resource governance by shifting from a top-down, department-led, and scheme-driven model to a participatory, landscape-based planning approach. Adopting the ridge-to-valley model, the intervention emphasizes treating the entire watershed systematically, ensuring effective soil and water conservation, reduced siltation, and enhanced water availability for irrigation and ecosystem regeneration.</p> <p>Planning and implementation are led through Gram Sabhas and community-level institutions, with facilitation by trained MGNREGA mates, the majority of whom are women. This ensures that women are not only involved but also empowered to influence decisions on asset creation and resource use. Women's priorities—such as access to drinking water, kitchen gardens, fuelwood, and fodder—are intentionally integrated into planning, aligning natural resource management (NRM) with household-level needs.</p> <p>Furthermore, special efforts are made to include the poorest and most vulnerable households in planning processes. Their livelihood priorities are identified and addressed through inclusive resource governance and the creation of productive assets that directly benefit them.</p> <p>This participatory and equity-focused model ensures that access to and control over natural resources is shared, needs-responsive, and environmentally sustainable.</p> <p>Natural resource governance will be reinforced by preparing integrated plans under GPDP, ensuring convergence with schemes like MGNREGA. GIS-based planning tools will be used for participatory land and water management.</p>
13	<p><b>Participation</b> - Encourage social organisation and greater participation in decision-making by</p>	1	<p>Participation in decision-making and planning is limited to select individuals, and collective action remains weak. Farmers lack strong organizations to represent their interests, and women's</p> <p>The intervention represents a major shift from the current scenario of minimal or no farmer participation in agricultural and natural resource governance to an inclusive, multi-tiered participatory framework. It creates systematic avenues for farmers—especially women, smallholders, and marginalized groups—to actively participate in</p>

<p>food producers and consumers to support decentralised governance and local adaptive management of agricultural and food systems.</p>		<p>participation in governance and agricultural planning is minimal.</p>	<p>decision-making processes related to agriculture, land use, and natural resource management.</p> <p>Participation is institutionalized through joint village-level planning and implementation, anchored in Gram Sabha deliberations and Gram Panchayat-level planning mechanisms under the Panchayati Raj Institutions (PRIs). This grassroots planning approach ensures that farmers' voices are integrated into local development priorities and schemes.</p> <p>At the next level, Prakritik Krishi Sakhis (PKSs), Pashu Sakhis (PSs), and FPO board members serve as key farmer representatives, engaging in structured dialogues with local authorities, block-level officials, and district-level policymakers. Their involvement ensures that ground-level experiences and needs inform higher-level planning, influencing the design and implementation of agroecological and rural development policies.</p> <p>This multilevel participation—from village to district—builds farmers' confidence, increases transparency, and fosters bottom-up accountability.</p>
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**Table 7.1 – Integration of the 13 principles of agroecology**

Intervention	Output	Mitigation		Adaptation			Resilience					
		Carbon Sequestration	Reduced Emissions	Diversification	Soil and Water Conservation	Knowledge & Capacity	Social Resilience	Ecological Resilience	Economic Resilience	Health & Nutrition Resilience	Traditional Knowledge	Reflective Learning
Setting up a capacity building, knowledge exchange and learning platform for improved extension services on agroecological farming, including crops, horticulture and animal husbandry	Decentralised agroecology extension via 100 CRPs/PKSs & 100 PSs reaches 90% households, boosting adoption of climate-resilient practices. Cuts chemical use, restores soil health, conserves water, lowers emissions, diversifies income, empowers women leaders, and strengthens community adaptation & resilience.	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Farmer Field Schools and Demonstration Models for Agroecological Learning	122 Farmer Field Schools & 30 demo farms embed hands-on agroecology, reaching 20k+ households. Boosts the adoption of low-input, climate-resilient farming, reduces chemical use, restores soil health, conserves water, diversifies income, empowers women leaders, and strengthens adaptation & community resilience.	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Promotion of Intensive Vegetable Cultivation	Promoting Ellis-based vegetable farming with drip irrigation, combined with agroecological practices, boosts yields and reduces water losses. Enhances climate resilience through diversified crop production, improved soil health, and increased market access; lowers emissions through the use of natural inputs; and strengthens livelihoods and promotes women's leadership.	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Traditional seed conservation,	The intervention conserves indigenous seeds through community seed banks, reduces	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

propagation and diversity	the use of hybrid seeds, thereby lowering emissions, ensures access to climate-resilient varieties for variable weather conditions, and preserves crop diversity to withstand pests, drought, and rainfall shocks.											
Promoting Bio-Resource Centres	The intervention produces diverse local bio-inputs reducing chemical use and emissions, supports adaptation by managing pests and enhancing soil health, and builds resilience through improved biodiversity and productivity.	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Soil Health Rejuvenation	Restores soil carbon and fertility, reducing fertiliser emissions, adapting farms to climate stress, and building resilience through improved water retention, biodiversity, and sustained productivity.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
PGS certification	PGS reduces chemical input, lowering emissions, and adapts farms through organic practices, building resilience through peer networks, local markets, and biodiversity-friendly farming systems.	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Integrated Crop Development and Value Chain Support in Ahwa Landscape	Boosts mitigation by cutting chemical use, adaptation via crop diversity & water security, and resilience through FPO-led value chains, soil health, and climate-smart infrastructure.	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Modified Wadi Model with Plantation on Farm Bunds	Modified Wadi Model boosts mitigation via carbon sequestration, adaptation via diversified crops, and resilience through stable incomes, biodiversity, and soil restoration	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Community-Led Forest Species Plantation Drive facilitated through MGNREA Planning to Improve Biodiversity and promote NTFP	Community-led forest plantations cut emissions via carbon sequestration, adapt by restoring native species for climate-resilient ecosystems, and build resilience through NTFPs, soil health, and biodiversity.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Promotion of Dairy-Based Enterprises	Integrated crop, dairy, and value chain support mitigates emissions through agroecology ethnoveterinary practices, adapts to climate change through crop diversity, management and livestock management, and builds resilience via FPO markets and stable incomes.	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Scaling Backyard Poultry	Local hardy breeds, composting litter, and low-cost feed cut emissions (mitigation), ensure climate-adapted poultry (adaptation), and diversify livelihoods for shocks (resilience)	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Goat Rearing Model for Livelihood Enhancement	Rotational grazing & fodder regeneration sequester carbon (mitigation), resilient breeds & vet care adapt to climate stress, and community-led models boost livelihood resilience.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Facilitating GPDP Planning and Implementation with Ridge-to-Valley Approach	Soil & water conservation boosts soil health, biodiversity, and moisture, sequesters carbon, reduces erosion and crop loss, and improves yields, incomes, and long-term climate resilience.	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Implementation of Irrigation Systems	Extends irrigation beyond monsoon, boosts cropping intensity, reduces diesel use via solar pumps (mitigation), ensures year-round water (adaptation), and builds WUCs for long-term resilience.	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Special initiatives on Land levelling	Levels land to cut erosion, boost soil moisture, and improve water use—raising yields, incomes, and crop diversity (adaptation/resilience) while enhancing soil carbon storage (mitigation)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FPO Intervention	Strengthens farmer networks for market access, inputs, and training—boosting adaptive capacity, diversifying incomes, and enabling climate-smart practices that cut emissions and build resilience.	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Bio Gas Intervention	Replaces firewood and fossil fuels with biogas—cutting GHGs (mitigation), reducing deforestation, improving soil via slurry use (resilience), and ensuring clean, reliable energy (adaptation).	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y

**Table 7.2 – Potential Climate Outcomes of Interventions**

### 7.3. Increasing Incomes

Income estimates have many facets. For example, the production of commodities within the landscape, such as vegetables, will result in a reduction of imports from outside the landscape. On the other hand, the sale of commodities produced within the landscape and sold outside it will lead to increased income. Increased production and/or productivity does not necessarily lead to increased incomes. Some of the interventions in the landscape aim to fortify the self-reliance of the landscape by increasing local production and consumption of items that are currently imported.

The tables below indicate increased production, productivity, enhanced resource base, and higher cropping intensity, among other factors, leading to higher outputs and incomes, based on certain assumptions. These estimates have been made at the landscape level, rather than the household level.

**Table 7.3** provides a summary of the landscape-level income enhancement.

S. No	Intervention	Approximate additional total value creation in one year after reaching the full scale of the intervention (in crores)	Approximate additional total value creation in five years of the intervention (in crores)
1	Crops	22.62	113.09
2	Vegetable	25	122.91
3	Fruits	9.12	45.62
4	Milk	12.825	64.125
5	Poultry	36	180.00
6	Goat	3	15.00
7	Wage	12.1625	60.8125
	<b>Total</b>	<b>120.31</b>	<b>601.55</b>

Description: The following analysis presents the value of production resulting from agroecological interventions. It is not an analysis of the farmer's income.

**Table 7.3 – Summary of landscape-level income enhancement**

The following tables (tables 7.4-7.9) provide a comprehensive overview of estimated income through post-intervention projections for different commercial or marketable outputs. This estimation is based on assumptions.

Income from crops and vegetables															
Name of the crop	Dangs Data			Ahwa Data ( Current Situation)					Ahwa Data ( Post Intervention Situation)					Improvement in Income (in Lakhs) in one year	Improvement in income (in Lakhs) in five years
	Area under production (Ha)	Production (MT)	Yield (MT/Ha)	Area under production (Ha)	Production (MT)	Yield (MT/Ha)	Average Farm Gate price (per Kg)	Current Value (in Lakhs)	Area under production (Ha)	Yield (MT/Ha)	Production (MT)	Average Farm Gate price (per Kg)	Post Intervention Value (in Lakhs)		
Crops														<b>2262</b>	11308.59567
Unirrigated Rice	27678	60407	2.18	9226	20136	2.18	45	9061	9226	2.18	20136	50	10068	1007	5033.916667
Millet	8344	8682	1.04	2781	2894	1.04	23	666	3616	1.14	4138	30	1242	576	2879.53
Black Gram	9392	10691	1.14	3131	3564	1.14	40	1425	3444	1.25	4312	43	1854	429	2143.5455
Ground Nut	3765	4627	1.23	1255	1542	1.23	60	925	1381	1.35	1866	63	1176	250	1251.6035
											0		0	0	0
Vegetables											0		0	<b>2458</b>	12291.17527
Bringle	986	17147	17.39	329	5716	17.39	25	1429	394.4	17.39	6859	27.5	1886	457	2286.013667
Okra	2695	39670	14.72	898	13223	14.72	35	4628	1078	14.72	15868	38.5	6109	1481	7405.374667
Tomato	652	14292	21.92	217	4764	21.92	20	953	260.8	21.92	5717	22	1258	305	1524.4096
Cluster bean	521	8065	15.48	174	2688	15.48	25	672	208.4	15.48	3226	27.5	887	215	1075.377333

Table 7.4 – Overview of estimated income from crops and vegetables through post-intervention projections

Income from Fruits																			
Area covered under Fruit Tree Plantation (Ha)	No of Fruit Trees Planted per Ha	Total No of Planted Trees	Mango			Custard Apple			Amla			Cashew			Ber			Total value post intervention in one year (In lakhs)	Total Value post-intervention in five years
			No of Plants	Average Yield (kg/tree)	Average Price	No of plants	Average Yield (kg/tree)	Average price	No of Plants	Average Yield (kg/tree)	Average Price	No of Plants	Average Yield (kg/tree)	Average Price	No of Plants	Average Yield (kg/tree)	Average Price		
1200	80	57600	17280	80	50	11520	8	80	11520	20	30	11520	6	80	5760	20	20	912.38	4561.92

**Table 7.5 – Overview of estimated income from fruits through post-intervention projections**

Income from Dairy								
New Dairy Units Set Up	Additional Milch Animals	Average Milk Yield Per day ( litre)	Average Milking Period ( days)	Total Annual increase in Milk Production ( Litre)	Total Increase in Milk Production in Five Years of the Intervention (Litre)	Average rate of milk	Total Value Post Intervention in one year ( in Lakhs)	Total Value Post Intervention in five years ( in Lakhs)
1350	1350	10	250	3375000	16875000	38	<b>1282.5</b>	<b>6412.5</b>

**Table 7.6 – Overview of estimated income from dairy through post-intervention projections**

Income from Poultry							
Poultry Units Set Up	Additional Birds per shed per cycle	No of cycles in a year	No of cycles in 5 years	Total Birds Sold per Year	Average price per bird	Total Value Post Intervention in one year ( in Lakhs)	Total Value Post Intervention in five years ( in Lakhs)
5000	20	2	10	200000	400	800	4000
3000	50	2	10	300000	400	1200	6000
2000	100	2	10	400000	400	1600	8000
						<b>3600</b>	<b>18000</b>

**Table 7.7 – Overview of estimated income from poultry through post-intervention projections**

Income from Goat Rearing						
Goat Units Set Up	No of Goats sold Annually per Unit	No of goats sold in 5 years per unit	Total Goats Sold in 5 Years	Average value of goat in Rs	Total Value Post Intervention in one year (in Lakhs)	Total Value Post Intervention in 5 years (in lakh)
500	10	50	25000	4000	200	1000
500	5	25	12500	4000	100	500
Total					300	1500

**Table 7.8 – Overview of estimated income from goat rearing through post-intervention projections**

Income from wage					
Activity	Total land based area treated in Ha every year in the maturity stage	No of days of employment generated per ha	Minium Wage rate	Total Wage Income in one year (lakhs)	Total wage income in five years (in Lakhs)
Land levelling	1000	150	486.5	729.75	3648.75
INRM (Ridge to valley)	5000	20	486.5	486.5	2432.5
				<b>1216.25</b>	<b>6081.25</b>

**Table 7.9 – Overview of estimated income from wage through post-intervention projections**

## 7.4. Enhanced Biodiversity

As outlined in Chapter 5, Section 5.5, the agrobiodiversity plan will be developed by technical experts during the implementation phase.

The following are the different interventions and their impact on improving the biodiversity of Ahwa.

### **Traditional Seed Conservation**

*Impact:* Safeguards indigenous crop genetic diversity; reduces dependence on hybrid seeds; maintains traits suited to local pests, soils, and climate.

*Biodiversity Link:* Strengthens on-farm agrobiodiversity, fosters pollinator-friendly crops, and preserves rare varieties.

### **Bio-resource Centres**

*Impact:* Promotes compost, bio-pesticides, and bio-fertilisers; reduces synthetic chemical use.

*Biodiversity Link:* Restores soil microbial diversity, supports beneficial insects, and maintains ecological balance in farmlands.

### **Soil Health Rejuvenation**

*Impact:* Enhances soil organic carbon, nutrient cycling, and moisture retention.

*Biodiversity Link:* Boosts soil microorganisms, earthworms, and arthropod populations; improves habitat quality for below-ground biodiversity.

### **Ridge-to-Valley NRM**

*Impact:* Reduces erosion, restores degraded lands, and recharges groundwater.

*Biodiversity Link:* Facilitates natural regeneration of vegetation, supports habitat continuity for native fauna, and enables replanting with local species.

### **Irrigation & Land Levelling**

*Impact:* Enhances water distribution and soil moisture, facilitating diverse cropping and agroforestry practices.

*Biodiversity Link:* Encourages integration of multi-species farming systems and plantation of local tree species along bunds.

### **Modified Wadi Plantation**

*Impact:* Establishes multi-tier fruit, timber, and fodder tree systems on smallholder farms; improves soil and microclimate.

*Biodiversity Link:* Creates diverse agroforestry habitats, supports pollinators and birds, and reintroduces local perennial species.

### **Community-driven Native Forest Species Plantation**

*Impact:* Restores degraded forest areas with indigenous species; improves canopy cover and ecosystem services.

*Biodiversity Link:* Revives native flora, enhances habitat for wildlife, and strengthens ecological corridors.

### **Dairy, Poultry & Goat-based Enterprises**

*Impact:* Encourages fodder cultivation, reduces grazing pressure on common areas, and supports traditional ethnoveterinary practices.

*Biodiversity Link:* Revives grassland diversity, reduces overharvesting of wild plants, and maintains local livestock breeds.

### **Dairy-linked Biogas Units**

*Impact:* Reduces reliance on firewood, lowering deforestation; provides slurry to enrich soils.

*Biodiversity Link:* Protects forest biodiversity; increases soil microbial diversity and improves nutrient-rich habitats for invertebrates.

### **Integrated Crop Development & Value Chains**

*Impact:* Encourages agroecological practices, diversified cropping, and reduced chemical inputs.

*Biodiversity Link:* Increases field-level species diversity and supports pollinators and natural predators.

### **Community-based Nutrition Education**

*Impact:* Creates demand for diverse, local, and indigenous foods.

*Biodiversity Link:* Incentivises conservation of local crop and livestock varieties, and promotes sustainable harvest of wild foods and NTFPs.

## **7.5. Improving the Quality of Natural Resources**

The following interventions are designed to enhance, restore, and sustainably manage Ahwa's natural resources—land, water, forests, and commons—while actively improving biodiversity and ecological resilience.

### **Enhancing Natural Resources**

- **GPDP-Based INRM Planning Following Ridge-to-Valley Approach and Its Implementation** – Community-led integrated planning of soil and water conservation measures in alignment with Gram Panchayat Development Plans, ensuring scientific prioritisation from ridge to valley to reduce erosion, recharge groundwater, and promote vegetative regeneration.
- **Modified Wadi Plantation with Horticulture and Forestry Species** – Integrates horticulture crops with multi-purpose forestry species and soil-moisture conservation structures on farmer fields, creating productive agroforestry systems while restoring degraded soils.
- **Community-Driven Plantation of Locally Suitable Forest Species** – Plantation of indigenous forest species on degraded commons and forest fringes to restore habitat connectivity, increase canopy cover, and prevent further degradation.

### Rebuilding or Repairing Past Work

- **Land Levelling Support for Farmers** – Improves water distribution, conserves soil moisture, and enhances cultivable land availability on undulating plots, enabling diversified cropping and the integration of tree-based systems.
- **Repair and Renovation of Existing Water Harvesting Structures** – Restores check dams, farm ponds, and other water harvesting structures to their designed storage capacity, thereby improving water security and irrigation potential.
- **Desilting of check dams removes** accumulated silt to restore water storage capacity. Nutrient-rich silt is then reused on farmlands to improve soil fertility and structure.

### Demand-Side Management of Natural Resources

- **Water Budgeting and Participatory Water Governance** – Establishes village-level water budgeting committees to plan crop-water allocations, align water use with availability, and promote equitable distribution, drawing from WOTR's proven models.
- **Promotion of Micro-Irrigation Systems** – Facilitates the adoption of drip and sprinkler systems to maximise water-use efficiency, reduce evaporation losses, and enable more diverse cropping with reduced water demand.

### Other Linked Interventions Supporting Resource Quality

- **Soil Health Rejuvenation through Bio-Inputs (A6)** – Promotes composting, bio-fertilisers, and green manuring to restore soil organic carbon, improve nutrient cycling, and increase soil microbial diversity.
- **Dairy-Linked Biogas Units (F1)** – Converts cattle dung into clean energy, reducing dependence on firewood; slurry byproduct enhances soil fertility and boosts beneficial soil biota.
- **Traditional Seed Conservation (A4)** – Conserves indigenous crop genetic diversity suited to local soils and climate, supporting resilience against pests and diseases while maintaining agrobiodiversity.

## 7.6. Enhancing Food and Nutrition Security

The goal of this project is to ensure local availability of all food groups, preferably grown in the local area. Efforts will also be made to revive traditional cooking and consumption practices, which are expected to lead to enhanced bioavailability of nutrients in the food. This will be accomplished through the intervention of nutrition education.

**Food and nutrition security** in Ahwa will be strengthened through a combination of soil, water, and biodiversity restoration measures that increase farm productivity, crop diversity, and dietary quality. **Improved soil health** (via bio-inputs, silt application, and organic matter) will boost yields of nutrient-rich crops such as millets, pulses, and vegetables. **Water security measures** (ridge-to-valley INRM, repaired and desilted check dams, micro-irrigation) will enable year-round cultivation, reduce crop losses, and support nutrition gardens. **Agroforestry and modified wadi plantations** will diversify farm outputs, including fruits, nuts, and fuelwood, thereby improving both household diets and income for food purchases. **Seed conservation** will ensure access to resilient local crop varieties, thereby preserving the nutritional quality and cultural diversity of local diets. **Dairy, poultry, and goat-based enterprises** will enhance access to protein-rich foods, while **community-based nutrition education** will promote healthy consumption patterns. Collectively, these interventions will improve both the

**availability** and **accessibility of** diverse, safe, and nutritious food, thereby reducing seasonal hunger and micronutrient deficiencies.

## 7.7. Ensuring Well-Being of Women Farmers, Small and Marginal Farmers

Efforts will be made to enrol women as members and directors in various community-based organisations (CBOs), such as cooperatives and Farmer Producer Companies (FPCs). The accompanying report on policy changes at the landscape level will outline further measures.

In most interventions, initial grants, in-kind support, and demonstration units will be made available to small and marginal farmers, as well as landless labourers.

The proposed interventions for Ahwa are designed to strengthen the economic, social, and ecological well-being of women farmers and small and marginal farming households, who form the majority of the agricultural workforce in the block.

### **Economic Empowerment:**

The formation and strengthening of **Cluster and Block-Level Farmer-Producer Organisations (FPOs)** with at least 50% women's representation in governance will ensure equitable decision-making and access to markets. Value chain development in millets, pulses, vegetables, dairy, goat, and poultry will improve income opportunities, reduce dependency on intermediaries, and secure premium prices for agroecologically produced goods. Revolving funds for livestock units, seed systems, and bio-input production will provide accessible credit and enterprise support to smallholder households, enabling them to invest in productive assets.

### **Access to Resources and Inputs:**

Activities such as **GPDP-based INRM planning and ridge-to-valley watershed development**, desiltation of check dams, irrigation system installations, and soil health rejuvenation will enhance land and water productivity, benefiting small and marginal farmers with limited holdings. **Seed conservation and community seed banks** will secure access to climate-resilient, locally adapted varieties, reducing input costs and ensuring consistent yields.

### **Workload Reduction and Energy Access:**

**Dairy-linked biogas units** will reduce the time and labour women spend on firewood collection, lower indoor air pollution, and provide nutrient-rich slurry for crops. Improved irrigation systems will lessen the drudgery of manual watering, freeing women's time for income-generating activities and leadership roles.

### **Capacity Building and Leadership:**

Training and mentoring through **Krishi Sakhis and Pashu Sakhis** will equip women with agroecological, livestock, and marketing skills, enabling them to enhance their livelihoods. Exposure visits, governance training, and business management support will improve their agency's capabilities in FPO decision-making, market negotiations, and resource management.

### **Nutritional Well-Being:**

Nutrition-sensitive interventions, such as **modified wadi plantations, nutrition gardens**, and diversified cropping systems, will enhance household dietary diversity. Meanwhile, **community-based nutrition education** will promote healthy food choices and reduce dependence on processed foods.

### **Climate Resilience and Risk Reduction:**

Diversified agroecological farming, livestock integration, and natural resource regeneration will protect livelihoods from climate shocks, ensure year-round food availability, and stabilise incomes. By reducing reliance on external inputs and enhancing self-sufficiency, these interventions directly contribute to the long-term resilience of small and marginal farmers.

Collectively, these measures will ensure that women farmers and smallholders in Ahwa have **secure livelihoods, equitable market access, reduced drudgery, improved health, and enhanced decision-making power**, laying the foundation for sustainable well-being.

## 7.8. Sustainable Development Goals

The following table illustrates the output of different interventions and their connection to the Sustainable Development Goals.

Note: 'Y' has been stated if the SDG is impacted, and 'N' has been indicated in case of no impact

	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
Domain/Sector-wise Interventions	No Poverty	Zero Hunger	Good Health and Well-being	Quality Education	Gender Equality	Clean Water and Sanitation	Affordable and Clean Energy	Decent Work and Economic Growth	Responsible Consumption and Production	Climate Action	Life Under Water	Life on Land	Peace, Justice & Strong Institutions	Partnership for the Goals
<b>Crops</b>														
Interventions aimed at enhancing seed access and diversity	Y	Y	Y	Y	Y	N	N	Y	N	Y	N	N	N	Y
Setting up the BRCs for ensuring access to high-quality bio-inputs	Y	Y	Y	Y	N	N	N	Y	Y	Y	N	N	N	N
Establishment of composting units	Y	Y	Y	N	Y	N	N	Y	Y	Y	N	N	N	N
PGS Certification for Organically Grown Vegetable	Y	Y	Y	N	Y	N	N	Y	Y	Y	N	Y	N	Y
Post-harvest processing of millets, pulses, and oilseeds	Y	Y	Y	N	Y	N	N	Y	Y	N	N	N	N	Y
Establishment of warehouses	Y	Y	N	N	N	N	N	Y	Y	N	N	N	Y	N
Setting up of Custom Hiring Centres (CHCs)	Y	Y	N	N	Y	N	N	Y	N	N	N	Y	N	Y
Promotion of green manuring practices	N	Y	Y	N	N	N	N	Y	N	Y	N	Y	N	N
<b>Agroforestry, Forest/Commons, NTFP</b>														
Agroforestry demonstration plantations (native species)	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	N	N
Promotion of NTFP value chains	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	Y
Community involvement in forest management	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	Y	Y	Y

Community-led plantation of forest and fodder species in commons	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	N	N
Value addition and marketing of forest products and minor millets through SHGs	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	Y
<b>Horticulture</b>														
Vegetable cultivation	Y	Y	Y	N	N	N	N	Y	N	N	N	N	N	N
<b>Animal husbandry</b>														
Improving livestock extension services through Knowledge Exchange, Learning Platform and incentivized payment systems for Pashu Sakhis	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	Y	N	Y
Dairy Promotion	Y	Y	Y	N	Y	N	N	Y	Y	N	N	Y	N	Y
Backyard poultry rearing for landless and marginal families	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	N	N
Goat Rearing	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	N	N
Installation of Bio Gas Units	N	Y	Y	N	Y	N	Y	N	Y	Y	N	Y	N	N
<b>Natural Resource Management</b>														
Water conservation interventions	N	Y	N	N	N	Y	N	N	N	Y	N	Y	N	N
soil health interventions	N	Y	N	N	N	Y	N	N	N	Y	N	Y	N	N
Intergrated Natural Resource Management Planning and Implementation under GPD	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Micro-irrigation to improve water-use efficiency	N	Y	N	N	N	Y	N	Y	N	Y	N	N	N	N
<b>GPD including MgNREGA</b>														

Intergrated Natural Resource Management Planning and Implementation under GPDP	N	Y	N	Y	Y	Y	N	Y	N	Y	N	N	Y	Y
<b>Convergence of Govt Programmes</b>														
Leverage and coordinate with KVK, NAU, ATMA, MGNREGA, GLPC/ATMA, Forest Dept., FPOs, SHGs	Y	Y	Y	N	Y	Y	N	Y	Y	Y		Y		
<b>Others</b>														
PGS Certification for Organically Grown Vegetable	Y	Y	Y	N	Y	N	N	Y	Y	Y	N	Y	N	Y
Inducting new Community Cadre & Capacity Building	Y	Y	N	Y	N	N	N	Y	N	N	N	N	N	Y
Building Capacities of Farmer Households	N	Y	N	Y	N	N	N	N	N	N	N	N	N	Y
Orientation of Government Line Departments and Relevant Agencies on Agroecological Practices	N	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
Promotion of enterprise and entrepreneurship	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N
Introducing agroecology in school curriculums	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
Creation of ICT platforms	N	Y	N	N	N	N	N	N	N	N	N	N	N	Y
Promotion of agroecology-oriented social events	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
Nutrition-related Intervention	N	Y	Y	Y	Y	N	N	N	Y	N	N	N	Y	Y

Table 7.10 – Interventions and the Sustainable Development Goals



## Consortium for Agroecological Transformations

Cultivating Sustainable Food & Farming Transformations

The Consortium for Agroecological Transformations (CAT) is a national ecosystem orchestrator advancing community-led, regenerative transitions across India's rural landscapes to strengthen both societal and ecological well-being. CAT brings together civil society organisations, technical experts, and farming communities to design and implement landscape-driven agroecological transformation. Its work focuses on generating evidence to inform policy change, enabling blended-finance pathways, and strengthening consumer demand for chemical-free food—advancing resilient, equitable, and sustainable food futures.