

“ Sustainable development is the peace policy of the future. ” –Klaus Topfer¹

3



TOWARDS SUSTAINABILITY: CLIMATE ACTION AND NATURAL RESOURCES MANAGEMENT

The risks posed by climate change are numerous and critical—be it extreme weather events such as excess or scanty rainfall, reduced rainy days, frequent droughts, land degradation, diminished crop yields, or drying up of water resources—and agrarian and marginalised populace usually bear the brunt. These risks are exacerbated by poor farming conditions, increased input costs, inefficient land use, and falling incomes among other factors. It is therefore crucial for development programmes to be designed to focus on sustainability and inclusivity along with efficient management of natural resources.

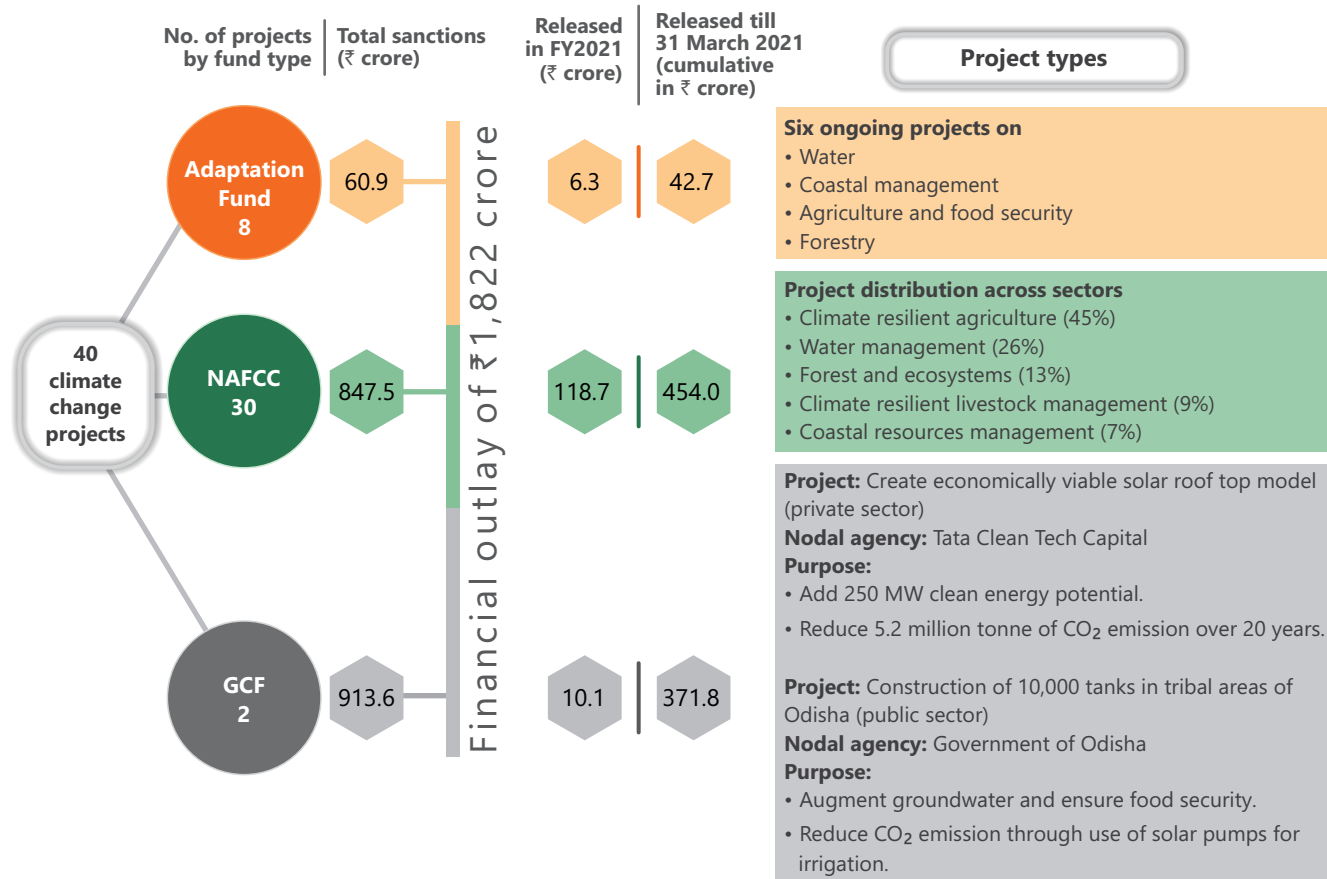
NABARD has been initiating and implementing programmes to achieve ‘sustainable and equitable rural prosperity,’ in line with its development agenda of inclusive and sustainable management of natural resources while improving rural lives and livelihoods. This chapter presents NABARD’s major initiatives in this sphere.

3.1 Climate change initiatives for sustainability

NABARD has played a pivotal role in implementing climate solutions, as the National Implementing Entity (NIE) for the Adaptation Fund (AF)² under the United Nations Framework Conventions on Climate Change and the National Adaptation Fund for Climate Change (NAFCC) of Government of India; it is also the Direct Access Entity to the Green Climate Fund.

It has been working in tandem with the goals of National Action Plan for Climate Change and State Action Plan for Climate Change to address the challenges, assess vulnerable areas and sectors for prioritisation of climate actions, and develop climate action strategies. Currently, there are 40 climate change projects underway with a total financial outlay of ₹1,822 crore (Figure 3.1).

FIGURE 3.1: Overview of climate change initiatives by fund type



Notes:

1. AF = Adaptation Fund; GCF = Green Climate Fund; NAFCC = National Adaptation Fund for Climate Change.
2. Projects under the Adaptation Fund include South-South Cooperation Grant for supporting National Implementing Entity accreditation in Afghanistan and Readiness Grant for development of the environmental, social, and governance framework.
3. Figures in parentheses against NAFCC project types represent share of the sector in total number of NAFCC projects.

The NAFCC-supported projects in 130 districts across 25 states and 2 UTs addressed adaptation requirements of communities vulnerable to climate change impact (Showcase 3.1). Such interventions aimed at engaging and training the members in protecting natural

resources, say by reviving natural water resources to counter rainfall deficit, and increasing green cover through better farming practices like integrated mountain farming and climate-resilient crop cultivation and livestock rearing (Showcase 3.2).

SHOWCASE 3.1: Model carbon-positive eco-village in Phayeng, Manipur

Situated at the foothills of Kangchup hill range, Phayeng village is inhabited by Manipur’s indigenous Chakpa community that is both culturally and economically dependent on agriculture and animal husbandry. The village, which once had over 76% forest cover, is now seeing alarming levels of deforestation due to increased anthropogenic activities resulting in rainfall deficit, which, in turn, has led to shrinking water resources, decrease in crop yield, crop damage, etc.

With support from the National Adaptation Fund for Climate Change, Phayeng village has developed a carbon-positive eco-model by undertaking adaptation measures to enhance greenhouse



(Continued)



gas sequestration through various initiatives such as promoting integrated mountain farming, introducing climate-resilient crops, and replacing biomass as cooking fuel with renewable energy source. In addition, innovative measures included regeneration of lost springs, maximising green cover, and protection of natural resources.

Project outcome

- Planting of 60,000 fruit-bearing plants in 65 hectares of degraded forest catchment area
- Recharging of underground water for reviving natural springs, traditional ponds, etc.
- Securing irrigation facilities by constructing check dams to restrain speed of water flow in upper catchment areas
- Introducing modern irrigation facilities like sprinklers in 500 hectares of agricultural land
- Training 500 farmers in adopting climate-resilient agriculture systems
- Supplying potable water collected from springs through pipelines
- Establishing traditional village knowledge centres to promote conservation and development of community-based eco-health resort
- Creating self-help groups of women to help generate alternate livelihood

SHOWCASE 3.2: Climate-resilient livestock rearing

NABARD sanctioned ₹17.4 crore over a five-year project period (ending in December 2020) to the Punjab State Council for Science and Technology for 'Climate Resilient Livestock Production in Punjab'. The project, spanning the districts of Bathinda, Ludhiana, and Tarn Taran, aims to develop an integrated livestock farming model incorporating climate considerations, promotion of indigenous breeds, and income enhancement of small and marginal farmers. Salient features of the project are enumerated below.

- *Weather-linked insurance:* For the first time in India, a weather-linked insurance product is being developed to compensate for income losses due to reduction in milk yield owed to heat and humidity variations. Now at the final stages of development and testing, the insurance product will link milk production with a temperature humidity index.
- *Promotion of indigenous breeds:* Indigenous breeds are being promoted through artificial insemination (3,000 procedures targeted) and oestrus synchronisation (6,000 procedures targeted).
- *Climate resilient and tick-free sheds:* Key determinants of animal health, namely, ventilation, moisture, and storage of animal feed, are being factored in for the preparation of sheds.
- *Automated weather stations:* These are providing weather- and feed-related advisories to farmers.

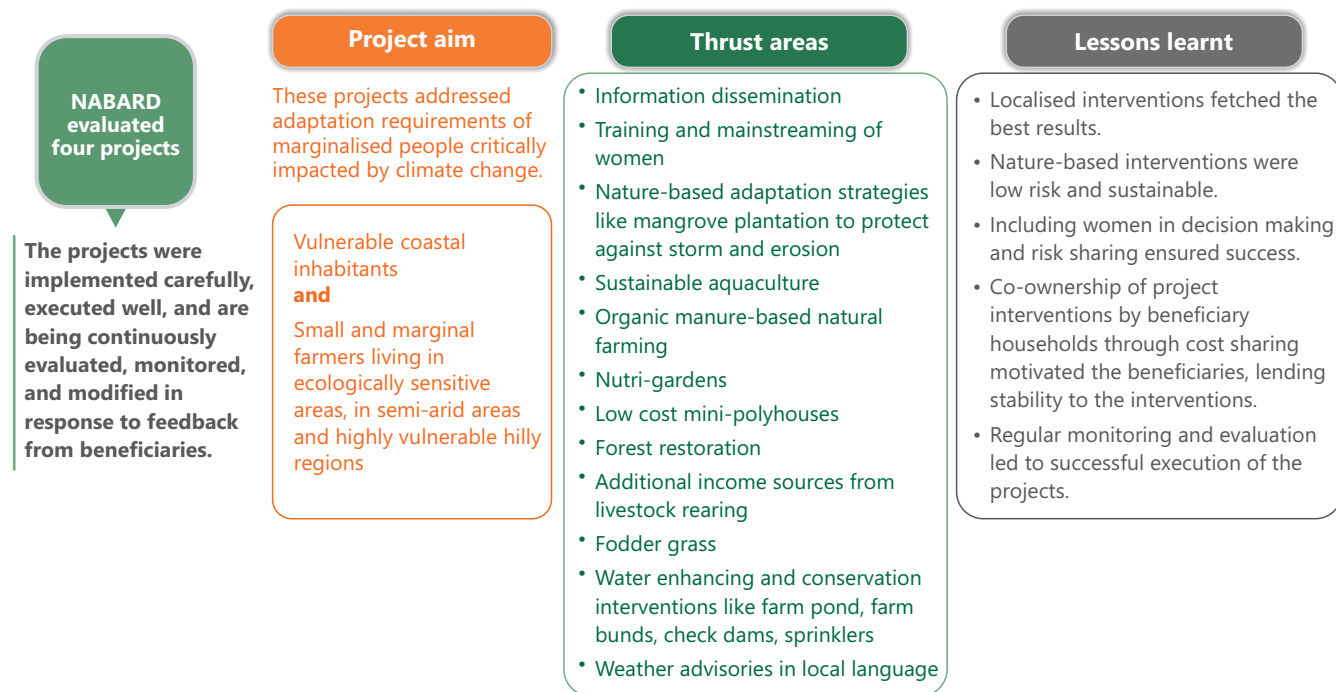
As on 31 December 2020, a cumulative amount of ₹12.5 crore has been released by NABARD under the project, securing its benefits for over 6.5 lakh farmers. The State Level Steering Committee on the National Adaptation Fund for Climate Change has recommended extension of the project by 18 months.

***For the first time in India,
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Midterm evaluation of AF-supported projects of NABARD pointed to the importance of factors such as localising interventions, ensuring women in decision making, and regular monitoring in successful climate interventions (Figure 3.2).

Utilising ₹97.2 lakh from the Climate Change Fund,³ NABARD also co-sponsored the World Sustainable Development Summit 2021; funded installation of customised automated weather stations in Nagaland; and supported online training programmes on climate finance by the Bankers Institute of Rural Development, Lucknow during FY2021.

FIGURE 3.2: Midterm evaluation of NABARD projects supported by the Adaptation Fund



Source: Saudamini Das (2021), Midterm Evaluation of AF-supported Projects by NABARD, Institute of Economic Growth, New Delhi (sponsored by NABARD).

3.2 Watershed development

NABARD has been engaged in watershed development since 1992, starting with the Indo-German Watershed Development Programme in Maharashtra. The GOI instituted the Watershed Development Fund (WDF) in NABARD in FY2000 with the corpus of ₹200 crore. NABARD has been making significant progress in its watershed development initiatives across the board.

While covering more area was the priority in the initial years, consolidating the gains through sustainable development plans, climate proofing, and soil restoration initiatives has been the focus during the later years as described in Figures 3.3–3.7. Figure 3.8 displays our efforts in rejuvenating springs in Himalayan and hill areas through the springshed development programme.

FIGURE 3.3: Utilisation of Watershed Development Fund (cumulative till 31 March 2021)

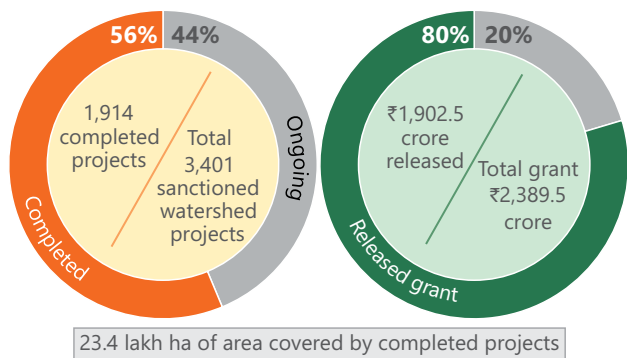


FIGURE 3.4: Participatory Watershed Development Programme

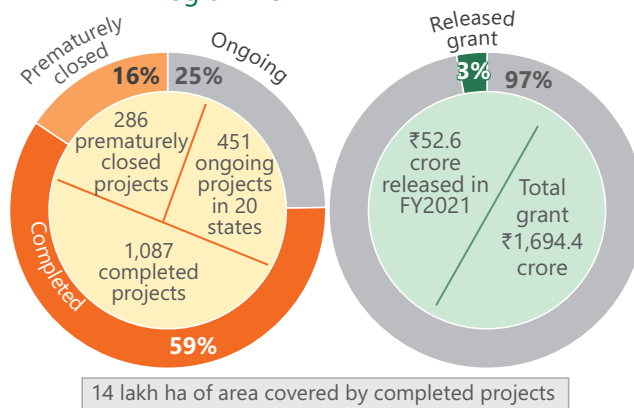
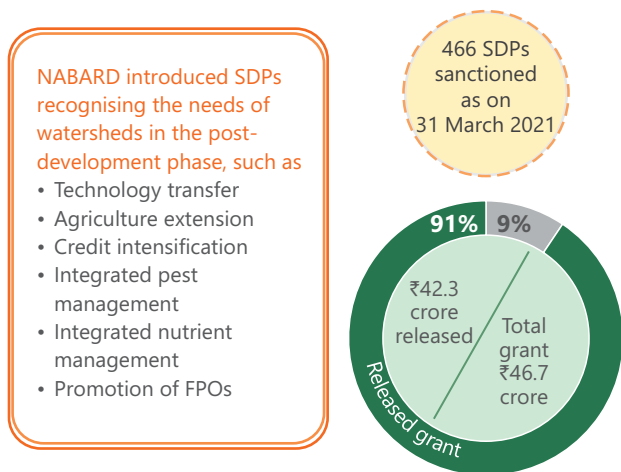


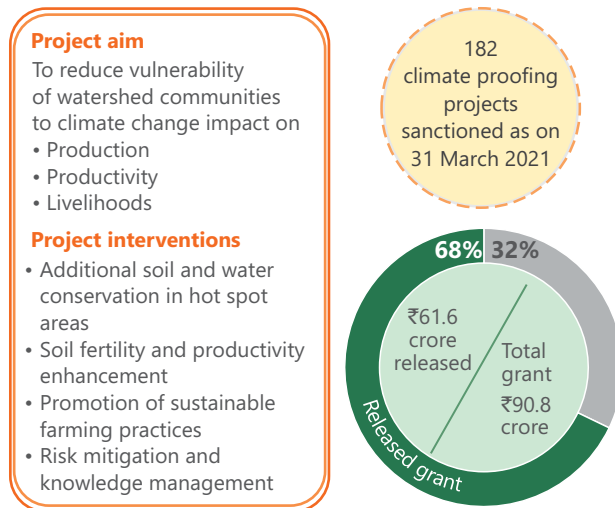


FIGURE 3.5: Sustainable development plans for watershed projects



Notes: FPO = Farmer Producers' Organisation; SDP = Sustainable Development Plan.

FIGURE 3.6: Climate-proofing of watershed projects



Note: WDF = Watershed Development Fund.

FIGURE 3.7: Overview of the Soil Restoration and Rehabilitation Project under KfW

	Phase I	Phase II 2019–2022	Phase III Initiated in 2020
States covered	Karnataka Telangana Andhra Pradesh Odisha Chhattisgarh	Kerala (43 projects) Jharkhand (12 projects)	Bihar (10 projects) Maharashtra (13 projects) Tamil Nadu (25 projects)
Total grant	€10 million (₹70 crore) for 32 districts	€5 million (₹35 crore)	€4.5 million (₹38.6 crore)
Disbursed	₹65.5 crore	₹17.7 crore	
No. of projects	123 projects under WDF	55 ongoing projects	

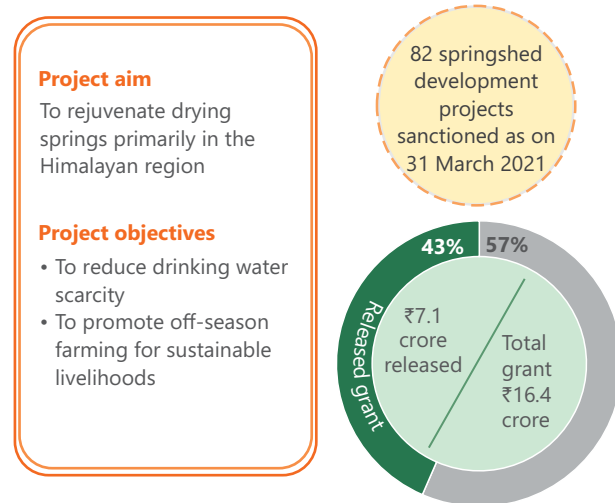
Phase I completed

Notes:

1. WDF = Watershed Development Fund.
2. KfW Germany is supporting this initiative under the 'One World, No Hunger' programme of the German Federal Ministry for Economic Cooperation and Development.

NABARD leveraged geospatial technology for better outcomes in ongoing watershed programmes. The NABARD-Bhuvan web portal, mobile app, and the

FIGURE 3.8: Springshed Development Programme



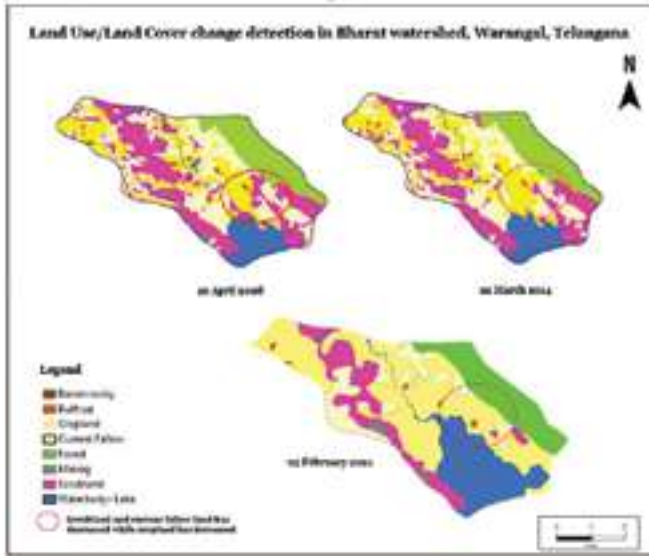
Note: WDF = Watershed Development Fund.

latest in-house Remote Sensing Cell (RSC) initiative together facilitate web-based monitoring and evaluation of 627 ongoing projects by capturing pre- and post-development satellite images, eventually leading to better implementation of projects (Showcase 3.3). As on 31 March 2021, RSC is hosting 39 ongoing projects under WDF on the NABARD-Bhuvan portal.

SHOWCASE 3.3: Land-use change detection in watersheds using remote sensing and Geographic Information System

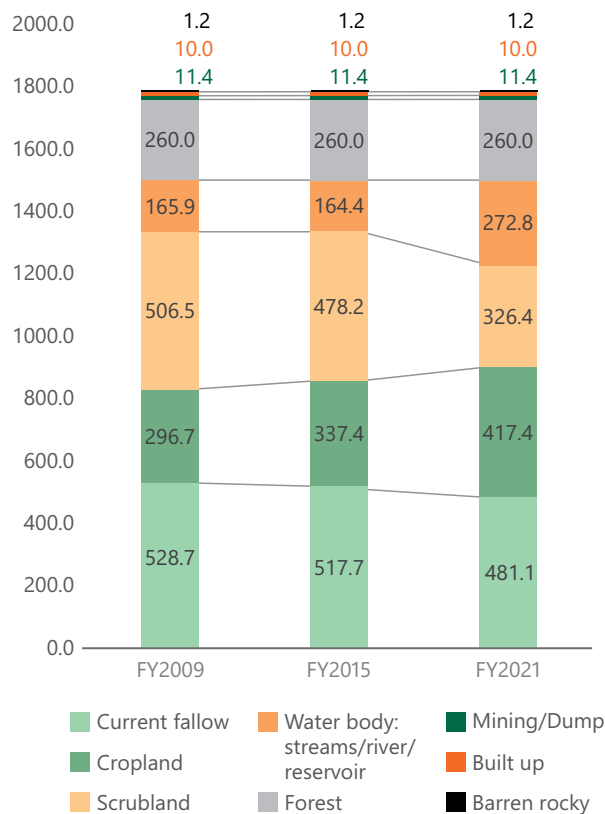
Bharat watershed in Warangal district of Telangana was supported under the Indo-German Watershed Development Programme from 2007 to 2013. Satellite images for the years 2008, 2014, and 2021 were analysed to study the impact of watershed interventions on land use/land cover changes in the watershed. The changes are depicted in the images below.

FIGURE S3.3.1: Land-use change detection



The analysis of satellite data shows that implementation of various watershed interventions under the project led to significant conversion of fallow and scrub land (indicated by decrease in area) to crop land and water bodies (indicated by increase in area).

FIGURE S3.3.2: Impact analysis of Bharat Watershed (area in hectare)





3.3 Towards remunerative farming systems

Despite making great strides over the past four decades, Indian agriculture is still beset with problems such as falling productivity, increasing input costs, low profits, emergence of climate risks, and volatile prices, which render farming unremunerative. Marginalisation of farm holdings has aggravated the situation further. A large section of farmers is still deprived of the benefits of promising research findings for poverty alleviation and income generation.

NABARD has constantly endeavoured to enhance farmers' incomes through multi-pronged strategies. One such initiative is reclamation of saline and alkaline soils through rainwater management wherein NABARD has sanctioned four pilot projects in Punjab and Haryana with an initial grant of ₹0.1 crore as on 31 March 2021. The programme integrates a watershed/

landscape approach and is supported by the Central Soil Salinity Research Institute, Karnal as the technical partner. The programme aims to cover a total area of 3,000 hectare (ha) in Punjab and Haryana (2,000 ha alkaline soils and 1,000 ha of saline soils) with an outlay of ₹20.4 crore. The Centre for Research in Rural and Industrial Development, Chandigarh conducted a study in Haryana to suggest the most remunerative crop-combination in the region, the major recommendations of which are given in Box 3.1.

Livestock rearing plays an important role in diversified farming systems, to which fodder shortage poses a major constraint, especially in arid areas. In search of solutions, NABARD sponsored two successful pilot projects between 2015 and 2021 which established the efficacy and viability of cactus as an alternative source of fodder. Armed with the lessons from the pilots, NABARD's Madhya Pradesh regional office too implemented a similar project in collaboration with

Box 3.1: Remunerative farming systems in Haryana

The Centre for Research in Rural and Industrial Development, Chandigarh conducted a study on identifying the most remunerative crop-combination in Haryana and made recommendations on both crop area management and institutional arrangements.

- Crop area management
 - » Prepare plans to promote area-specific cropping and processing units to mitigate the issues in procurement and minimum support prices (MSPs).
 - » Extend adequate MSPs to crops outside the rice–wheat system to encourage crop diversification.
 - » Encourage demand-driven crop calendars considering the edaphic, physiographic, and climatic conditions to increase farm income.
 - » Promote agro-forestry to tackle water logging and salinity problems.
- Institutional arrangements
 - » Develop a 'single window' system for effective delivery and implementation of agricultural schemes.
 - » Encourage contract farming practices and setting up of farmer producers' organisations on principles of cooperative development to safeguard farmers' interests.
 - » Enact a 'Long-term Lease/Rent Act' to instil confidence regarding land security among farmers when they lease land for long-term contract farming or cooperative farming.
 - » Enact a law to prevent groundwater depletion.

Source: Vikash Kumar and Jatinder Singh (2020), Identifying the Most Remunerative Crop-Combination Regions in Haryana: A Spatial-Temporal Analysis, NABARD Research Study - 7 by Centre for Research in Rural and Industrial Development (CRRID), Chandigarh supported by NABARD.

the International Center for Agricultural Research in the Dry Areas, Beirut (Box 3.2).

NABARD also commissioned Xavier Institute of Management, Bhubaneswar to do an Action Research on Sustainable Agricultural System (SAS)

with a grant assistance of ₹34.2 lakh to understand the interconnectedness of various factors affecting sustainable agriculture and to develop a sustainable farming operation manual. The major findings and recommendations of the research are given in Box 3.3.

Box 3.2: Spineless cactus as a promising fodder alternative

Fodder shortage is common and often acute in arid and semi-arid areas. BAIF Development Research Foundation, Pune, with financial assistance from NABARD, conducted a research trial during 2015–2017 on the spineless cactus (*Opuntia ficus indica*, also known as prickly pear or cactus pear) as a source of fodder. NABARD also supported BAIF in 2019–2021 for taking the technology to the farmer's field after standardisation.

The spineless cactus can potentially serve as forage while generating a host of ecological benefits. It is extremely water-use efficient and thus strongly suited to water-stressed conditions. The cladodes (modified leaf/pads) are highly succulent (comprising about 85% water) and can keep foragers well hydrated for long periods. Besides having industrial and medicinal uses, the cactus is also climate change-resilient.

During the first phase of the study, goats in Barmer (Rajasthan) and Nanodara (Gujarat) that fed on the cactus were seen to gain weight. The study inferred that the cactus as a green fodder for goats could easily replace 30% dry matter without any adverse health impact thus establishing the financial viability of cactus cultivation.

During the second phase, 600 demonstrations (300 each in Kutch, Gujarat and Barmer, Rajasthan) were conducted at farmers' fields covering 29 villages to promote the cactus on large scale. It was observed that

- over 88% plants survived and adapted well (in terms of growth and yield) to the region;
- farmers fed the harvested cladodes to their goats and cattle during the fodder scarcity in summer with good results;
- acceptance and palatability of cactus among lactating cows was high and its inclusion in their diet led to improvements not just in total body weight and average daily gain in body weight but also milk production, without any adverse effects; and
- water-use efficiency of cactus was higher than crops like rice and pearl millet.

Based on the various study outcomes in support of the cactus as green fodder, NABARD collaborated with the International Center for Agricultural Research in the Dry Areas (ICARDA) (headquartered in Beirut, Lebanon) to promote the spineless cactus among farmers, farmer producers' organisations, and beneficiaries of NABARD's watershed and wadi (orchard) projects in Madhya Pradesh. During FY2021, 200 farmers received onsite exposure and handholding by scientists and experts of the ICARDA under five Capacity Building for Adoption of Technology programmes.



Cactus fruiting



Goat feeding on cactus

Sources:

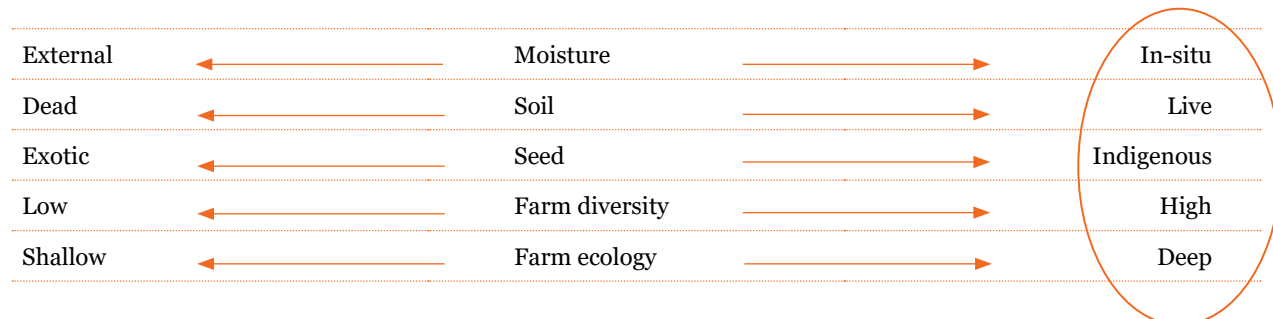
1. BAIF (2017), Study on Standardization of Nursery and Production Technology of Spineless Cactus for Livelihood Development in the Arid and Semi-Arid Regions, BAIF Development Research Foundation, Pune, (sponsored by NABARD).
2. BAIF (2021), Study on Introduction of Cactus Pear (*Opuntia ficus indica*) as a Source of Fodder in Dry Areas of Rajasthan and Gujarat, BAIF Development Research Foundation, Pune, (sponsored by NABARD).



Box 3.3: Action Research on Sustainable Agricultural System

The focus of the Sustainable Agricultural System (SAS) action research (conducted in Liligada in Gajapati district, Nunagada in Rayagada district, and Pilheri in Kandhamal district of Odisha) is summarised in Figure B3.1.

FIGURE B3.1: Unsustainable versus sustainable agricultural systems



Major findings of SAS action research

- **Water:** Despite the topography and slope of the land, the water level improved in the fields (across all three sites) within two years of intervention and sufficient water was available through open wells.
- **Soil health:** Soil health on a farm showed some improvement by end of Year 1.
- **Farm forestry:** Farm forestry as a live infrastructure has been built in the three sites. The benefits and significance of this will be visible by Year 4 of the intervention.
- **Seeds:** The team is trying to grow indigenous seeds to wean the farmers away from their reliance on market-supplied expensive seeds.
- **Farm agricultural diversity:** Farming at the study sites became more climate-resilient with improved soil health, in turn increasing both productivity and yield.



Farmers' training session on SAS with late Deepak Suchde



Plantation activities to deepen farm ecology

(Continued)

Policy recommendations for large scale SAS replication

- Ensure capacity building of farmers by demonstrating SAS.
- Promote common cattle grazing and fodder cultivation at Gram Panchayat (GP)/Ward level.
- Develop physical infrastructure for water harvesting and in-situ water conservation on the fields.
- Develop seed banks in every GP through the support of the farmer producers' organisation (FPO).
- Facilitate establishment of optimally designed GP-level farmer institutions and collectives.
- Integrate various agricultural extension services of the district/state at the GP-level FPOs.
- Channel bank credit through GP-level FPOs to farmers to ensure timely and speedy delivery of credit.

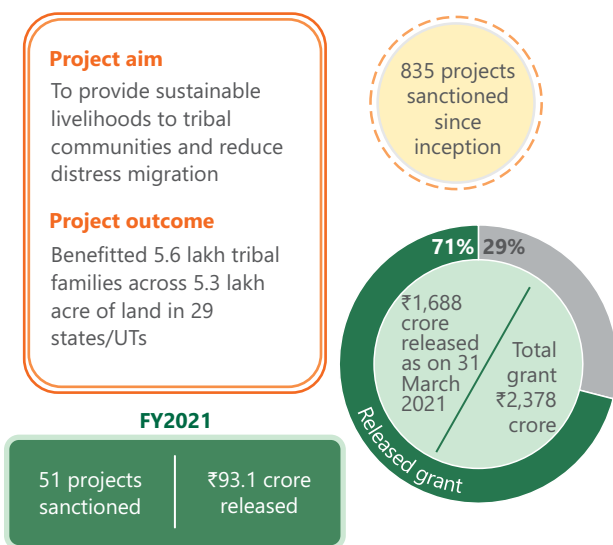
Source: Amar K.J.R. Nayak (2021), Action Research on Sustainable Agricultural System, NABARD Research Study-14, by Xavier Institute of Management, Bhubaneswar (sponsored by NABARD).

3.4 Tribal Development Fund

The Tribal Development Fund (TDF), created in FY2004 with an initial corpus of ₹50 crore, aims to provide sustainable livelihoods to tribal households across India (primarily through *wadi* development)⁴ to reduce distress migration (Figure 3.9).

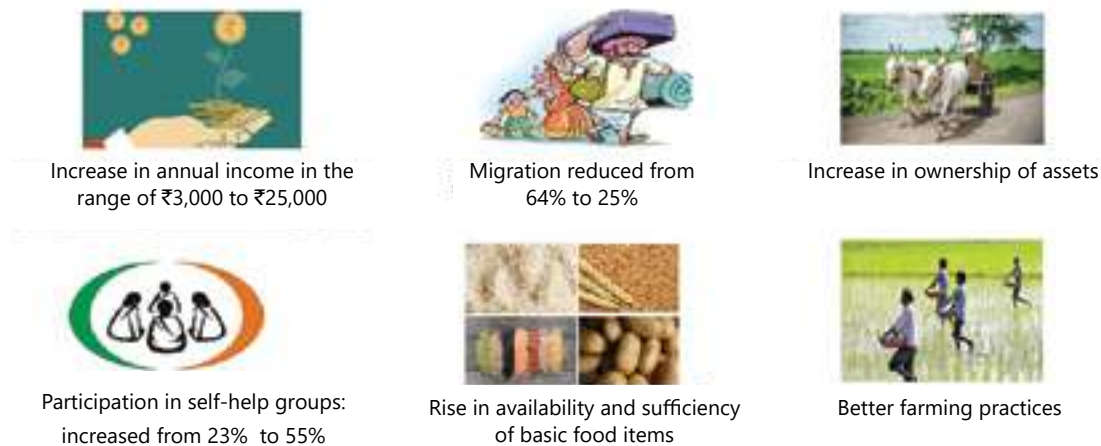
Since FY2021, NABARD also extended support to other (non-wadi) projects to cover agri-allied activities such as sericulture, apiculture, animal husbandry, and micro-enterprise development, to include more landless tribals and tap the potential of other income generation activities. During FY2021, four agri-allied (non-wadi) TDF projects have been sanctioned in Chhattisgarh (apiculture), Tamil Nadu (animal husbandry), Telangana (micro-enterprise development) and West Bengal (pig and goat rearing) (for impact of TDF project in Junnar, Maharashtra see Figure 3.10).

FIGURE 3.9: Tribal Development Fund: Wadi projects



Note: UT = Union Territory.

FIGURE 3.10: Impact of Tribal Development Project in Junnar, Maharashtra



Source: Debdulal Thakur, Deepa Gupta, and Varun Miglani (2019), Impact Evaluation of Tribal Development Fund: A Study of Selected Villages in Junnar – I (Pune), Symbiosis School of Economics, Pune (supported by NABARD).



3.5 Umbrella Programme for Natural Resource Management

NABARD has demonstrated successful business models through a variety of initiatives under the Umbrella Programme for Natural Resource Management (UPNRM) including System of Rice Intensification, Sustainable Sugarcane Initiative, Better Cotton Initiatives (using drip irrigation), integrated biogas, ecotourism, sustainable agriculture practices, fisheries, cultivation of medicinal plants with primary processing, soil and water conservation in tank-based irrigation in dryland areas, vermi-compost production, horticulture and plantation crop, organic farming, crop waste management, community drinking water, and installation of automated weather stations.

Though the programme ended in December 2017, the disbursement for sanctioned projects continues as per the phasing. As on 31 March 2021, there are 334 sanctioned projects with a loan of ₹738.6 crore and grant support of ₹45.4 crore; cumulative disbursement stood at ₹577.2 crore, including grant assistance of ₹31.5 crore.

Projects under UPNRM have had deep and long-term impact on their beneficiaries including

- increase in credit absorption capacity of beneficiaries;
- empowerment of women (constituting 40% of beneficiaries);
- empowerment of excluded or marginalised communities (with members of Scheduled Castes/Scheduled Tribes/Other Backward Classes constituting 80% of beneficiaries);
- increased average annual income (in more than 98% projects);
- benefits such as introduction of new technologies, promotion of good agricultural practices, integrated approach, capacity building of farmers, and collectivisation of produce for reaching better markets; and
- addressing of climate change risks by contributing to annual carbon sequestration, saving fuel wood (trees), and water and energy conservation, among other measures.

3.6 India towards 'net zero'

NABARD's contribution towards climate action needs scaling up given the immensity of the problem. India's

per capita emissions are among the lowest in the world. It is the only country that has kept its commitments as per the 2015 Paris Accord, even among the G20 countries which account for more than 80% of the global GDP.

At the same time, per capita emissions vary widely by income class and degree of urbanisation.

[Carbon footprint] CF reduction policies within India need to target high-expenditure households which are responsible for nearly seven times the carbon emissions than low-expenditure households (living on \$1.9 consumption a day)...Per capita carbon emissions in India [also] vary greatly within and between urban and rural areas, whilst residents in mega districts such as Mumbai (1.76 ton CO₂/capita), New Delhi (0.98 ton CO₂/capita), Bangalore (1.13 ton CO₂/capita), Chennai (1.11 ton CO₂/capita), or Kolkata (1.56 ton CO₂/capita) have a carbon footprint above the national average (0.56 ton CO₂/capita). Almost a tenfold difference is observed between the highest CF district, Gurgaon (2.04 ton CO₂/capita), and the lowest CF district, Baudh (0.21 ton CO₂/capita)...These vast disparities between the carbon footprint of citizens in India highlights the need to differentiate individual responsibilities for climate change in national and global climate policy.⁵

India is thus yet to reach its peak and once it does so, it would need to drastically cut down on emissions to reach 'net zero' or 'near net zero' level. Commitment to net zero—impacting livelihoods, employment, and consumption, and thus, the entire economy—demands a two-pronged approach: (i) scaling up climate-friendly interventions such as watersheds, wadis, mitigation measures, and adaptation projects; and (ii) adopting new techniques and shifts in paradigm towards agro-ecology. Such an approach for India would no doubt entail huge investments in natural resource management and people. NABARD's best efforts in this direction could be integrated with mainstream programmes for large scale impact.

Notes

1. Institute of Advanced Sustainable Studies, Germany.
2. The Adaptation Fund was set up under the Kyoto Protocol of the United Nations Framework Convention on Climate Change. It finances concrete projects and programmes that help vulnerable communities in developing countries to adapt to climate change. NABARD has graduated to facilitating the accreditation of an NIE in the Islamic Republic of Afghanistan and received \$50,000

- (₹36.6 lakh where conversion rate is \$1 = ₹73.206 as on 31 March 2021) under South–South Cooperation.
3. The Climate Change Fund was created in-house in FY2017 with a corpus of ₹4.3 crore to promote and support activities that can address climate change impact, adaptation and mitigation measures, awareness generation, knowledge sharing, and facilitating sustainable development.
 4. A *wadi* is a small orchard.
 5. Jemyung Lee, Oliver Taherzadeh, and Keiichiro Kanemoto (2021), The scale and drivers of carbon footprints in households, cities and regions across India, *Global Environmental Change*, Volume 66, January, 102205. Elsevier.