RESTORING LANDSCAPES IN INDIA FOR CLIMATE AND COMMUNITIES

Key Findings from Madhya Pradesh's Sidhi District

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ACKNOWLEDGMENTS

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FOREWORD

In its special report, *Climate Change and Land*, the Intergovernmental Panel on Climate Change spotlights the severe risks to humans, ecosystems, and species if the world fails to halt land degradation. If temperatures continue to rise, the damage to forests, agricultural productivity, food supply, and water sources could jeopardize the lives and livelihoods of millions of people. This will be tragic for countries like India where nearly 700 million people depend on forests and agriculture for their sustenance.

Investing in land restoration can be a spectacularly good investment, improving livelihoods, providing opportunities for agribusiness, fighting climate change, and making life better for all. India exemplifies this point.

This report could not have been better timed. *Restoring Landscapes in India for Climate and Communities: Key Findings from Madhya Pradesh's Sidhi District* provides rich information on planning and implementing landscape restoration. Its recommendations on inclusive, participatory, and equitable development provide guidance for other districts facing similar land scenarios.

Sidhi typifies the many resource-rich but financially poor districts in India. It is remote and highly exposed to climate change through droughts and other extreme weather events. It is also home to a large tribal and vulnerable population. Measures to protect and regenerate forest and agricultural lands in Sidhi could have a multiplier effect on job creation, food security, freshwater availability, and on mitigating the adverse impacts of climate change.
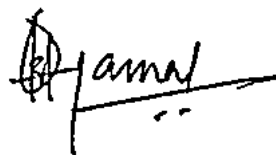
This report offers a roadmap for fulfilling Sidhi's potential and provides a scalable pathway for all of India. The report includes a *Restoration Opportunities Atlas* that identifies more than 140 million hectares that could be restored, benefiting people and biodiversity.

India has made significant commitments to the Bonn Challenge and the Paris Agreement. This report shows that these commitments are indeed achievable. With a robust policy framework in place, and proven success, India is now ready for coordinated landscape-level strategies between government departments, community-led businesses, and the private sector.

This report provides a roadmap for policymakers, civil society organizations, corporate leaders, impact investors, and development agencies to adopt landscape restoration approaches to help transform the rural economy. While the focus is on India, the approach applies in many countries. Smart landscape restoration can be a game-changer – in Sidhi, throughout India, and around the world.

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EXECUTIVE SUMMARY

The Government of India has committed to a landscape approach to restoration under various international initiatives. Under the Bonn Challenge, India aims to restore 21 million hectares by 2030 (Bonn Challenge 2017); India's nationally determined contribution to the 2015 Paris Climate Agreement commits to achieving an additional cumulative carbon sink of 2.5–3 gigatonnes of carbon dioxide equivalent ($GtCO_2e$) by 2030 (UNFCCC 2015). India has also set national targets to help meet the UN Sustainable Development Goals, and its National Mission for Green India aims to restore forests and enhance tree cover over 10 million hectares.

- The Government of India has committed to a landscape approach to restoration under several international agreements and national targets. To achieve these targets, a first step is to identify the potential for restoration and estimate the environment and development benefits that could follow.

- This report adapts an interdisciplinary, iterative, and participatory process called Restoration Opportunities Assessment Methodology, used in 40 countries since 2014, to the Indian context and presents the results of a pilot assessment undertaken in the Sidhi district of Madhya Pradesh state.

- The assessment combines technological advancements in GIS and remote sensing; emerging global knowledge on restoration; and local knowledge, particularly around resource use, tenure, and rights to develop a strategy for accelerating restoration in the district.

- This assessment identifies eight tree-based interventions on more than 363,000 hectares. We estimate that implementation of landscape restoration in Sidhi could generate wage opportunities of 3.75 million person-days and result in INR 710 million (US$10 million) in wage income over two years. Additionally, restoration could provide ecosystem benefits to residents such as secured access to fuelwood, fodder, and clean water, and improved food security.

- Recommended strategies for implementation focus on developing stakeholder-driven "accelerators" to address barriers in policy, knowledge, finance, technology, and markets and business development.

Background

Identifying restoration potential and the most suitable tree-based interventions in a landscape is a necessary first step to plan how these targets and commitments can be achieved. Landscape-based restoration recognizes the interactions between stakeholders and multiple land users by integrating them into a joint management process (GLF 2014). The landscape approach brings together actors who identify and implement practices to achieve an optimal balance of ecological, social, and economic benefits from forests and agricultural landscapes (GPFLR n.d.).

Why Focus on Sidhi District?

We chose to focus on Sidhi district because it is representative of the land use challenges and socioeconomic and environmental issues confronting other underdeveloped landscapes in India and around the world. Landscape restoration can improve local livelihoods in districts with few other opportunities. Another factor in our choice was the presence of local supporters to champion landscape restoration.

Sidhi is a remote district in eastern Madhya Pradesh in Central India that is highly vulnerable to climate change (Gosain et al. 2014). Much of the population is poor and economic opportunities are limited. Forests and agriculture are lifelines to Sidhi's population, more than half of whom live below the poverty line. The majority of people work marginal landholdings of less than one hectare. The landholding pattern is skewed in favor of upper-caste households who own large and medium-size holdings with access to irrigation. Changes in forest cover and composition (from mixed forest to primarily teak plantations) have reduced the availability of fuelwood, fodder, and minor forest products. Loss of forest and tree cover and declining soil fertility threaten the flow of critical biodiversity services and the livelihood base of local communities, particularly women, tribal peoples, and other marginalized groups that are heavily dependent on forests, common land, and marginal land for their subsistence.

This assessment identifies the potential to increase forest and tree cover in different land uses, including forest and agriculture, in Sidhi district. It suggests a range of interventions

including farmer-managed natural regeneration, mixed-species plantations, and agroforestry interventions like trees on boundaries and agri-horti-forestry/wadi. The report seeks to demonstrate that landscape restoration, when implemented at scale, can conserve biodiversity, improve water recharge, sequester carbon, enhance rural livelihoods, and spur rural development. Landscape restoration can both improve the lives of Sidhi's population and contribute to achieving India's climate and sustainable development goals.

The Sidhi district is a microcosm of land use challenges and mirrors the socioeconomic and environmental issues faced in other underdeveloped landscapes in India, such as the districts in the Son river basin of Madhya Pradesh—Singrauli, Shahdol, Umaria, and Anuppur—or the districts identified by the National Institution for Transforming India (NITI) Aayog[1] for transformative change under the aspirational districts program.[2]

The *Restoration Opportunities Atlas,* developed by the World Resources Institute India (WRI India) shows nearly 140 million hectares with potential for forest protection and landscape restoration (Chaturvedi et al. 2018). States like

Madhya Pradesh, Maharashtra, and Chhattisgarh have the best opportunity for establishing near-contiguous forests. Madhya Pradesh, Maharashtra, and Rajasthan have the best potential for mosaic restoration like agroforestry (WRI India 2018; Figure ES-1). The *Atlas* supports developing national and state pathways to meet India's nationally determined contribution and Sustainable Development Goals targets. Findings from this report showcase a path forward to accelerate restoration implementation in Sidhi district. A similar path could be followed by other districts of India and similar landscapes globally.

The audience for this report includes subnational government agencies, such as the zilla panchayat[3] (district council); state governments; state departments of forests, agriculture, rural development, and tribal development; financial institutions like the National Bank for Agriculture and Rural Development (NABARD); donor organizations; and civil society organizations involved in restoration decision-making or implementation. This report will also be of interest to researchers, media, and private sector entities involved in restoration.

Figure ES-1 | Landscape Restoration Opportunities in India
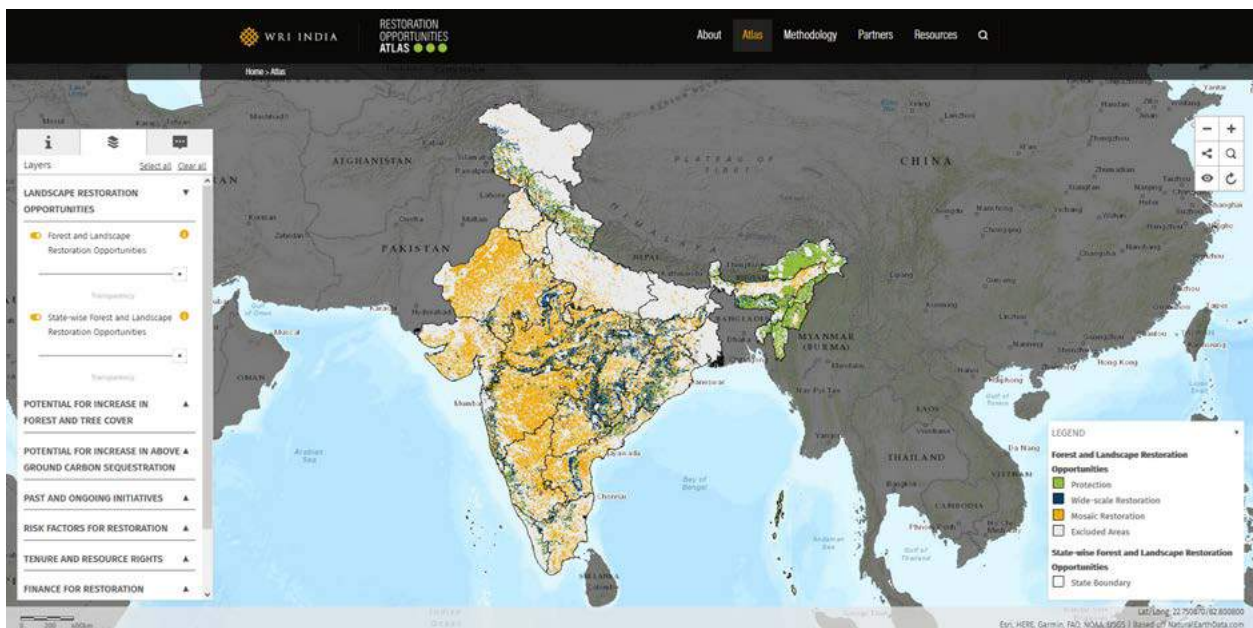
Source: WRI India 2018. Available online at https://india.restorationatlas.org.

Approach and Methodology

WRI India adapted the Restoration Opportunities Assessment Methodology (ROAM) developed by the International Union for the Conservation of Nature (IUCN) and WRI (IUCN and WRI 2014) to suit the local context in Sidhi district. We made four key additions to ROAM to underscore not only the environmental benefits of landscape restoration but also the development priorities that restoration can support.

■ A focus on multiple ecosystem services likely to be generated by landscape restoration and ways to manage the synergies and trade-offs between them.

■ A livelihood analysis that identifies potential value chains and lays out the short, intermediate, and long-term benefits that could flow to communities.

■ An enhanced focus on actors and networks to identify opportunities to build stronger networks of key actors and champions who can aid in implementing and scaling landscape restoration.

■ Integration of systemic structural issues around land tenure, governance, gender, and social inclusion.

The Sidhi ROAM assessment was undertaken between October 2016 and September 2017. Participatory tools such as the Restoration Diagnostic card game, the Ecosystem Services Diagnostic, social landscape analysis using Net-Map, and Collect Earth-Based Mapathon supported the opportunity assessment.

WRI India led the assessment with support from local partners, including the Institute of Livelihood Research and Training of Bhopal, and the Centre for Environmental Law at World Wide Fund for Nature India (WWF-India). Locally elected leaders, district and sub-district officers of various government departments, such as forests, horticulture, watershed, as well as the program Madhya Pradesh State Rural Livelihoods Mission, farmers, farmer producer organizations, nongovernmental organizations (NGOs), and the Rewa district NABARD development officer participated in stakeholder consultations.

The Sidhi district assessment focused on six principal questions:

- **Restoration potential**: Where is restoration socially, economically, and ecologically feasible? What is the extent of restoration potential? Which restoration interventions are suitable?

- **Ecosystem services analysis**: What ecosystem services and benefits can be derived from the identified restoration interventions?

- **Policy, legal, and institutional analysis**: What enabling conditions are in place or missing to achieve landscape restoration?

- **Social landscape analysis**: Who are the actors that can facilitate implementing landscape restoration?

- **Livelihood analysis**: What livelihood benefits could flow from the identified restoration interventions?

- **Cost analysis**: What is the financial cost of implementing the identified restoration interventions?

Key Findings

More than 363,000 hectares in Sidhi have potential for restoration

The 363,000 hectares with potential for restoration account for 75 percent of the total area of Sidhi district. We identified eight landscape restoration interventions as suitable for the district: assisted natural regeneration, mixed-species plantations, bamboo plantations, farmer-managed natural regeneration, riverbank plantation, trees on boundaries, agri-horti-forestry (a system called *wadi*),[4] and pastureland development (Figure ES-2).

There are several successful examples of landscape restoration activities in Sidhi that can be scaled up. For instance, communities restored more than 2,400 hectares of bamboo forests over four years in partnership with the forest department with a benefit sharing agreement. These bamboo forests continue being protected by the communities even though the project has ended and benefits have not been shared. Clarifying a benefit sharing mechanism and tenurial security aspects could enable scaling of these practices

in other parts of Sidhi. Farmers in Sidhi are also experimenting with different models of integrating trees on farms. Successful regeneration models from other parts of Madhya Pradesh and India can also be adapted and introduced in Sidhi to implement the identified restoration potential.

Restoration will provide critical ecosystem services to communities

Realizing Sidhi's restoration potential will support a flow of ecosystem services and provide direct benefits to communities including enhanced food and energy security, biodiversity conservation, and water recharge (see Figure ES-2). Ecosystem services are central to the lives of nearly 90 percent of the district's population.

In addition to the physical restoration interventions, policy interventions will be needed to address insecure land tenure, poor market access, and loss of common resources such as trees that provide food, fuel, and other products.

It is estimated that restoration of Sidhi's forests could sequester more than 7 million metric tons of carbon over 10–20 years and increase forest carbon stock by 37 percent (FSI 2015), based on forest type and species planted.

Figure ES-2 | Land-Use Challenges, Restoration Interventions, and Ecosystem Services in Sidhi
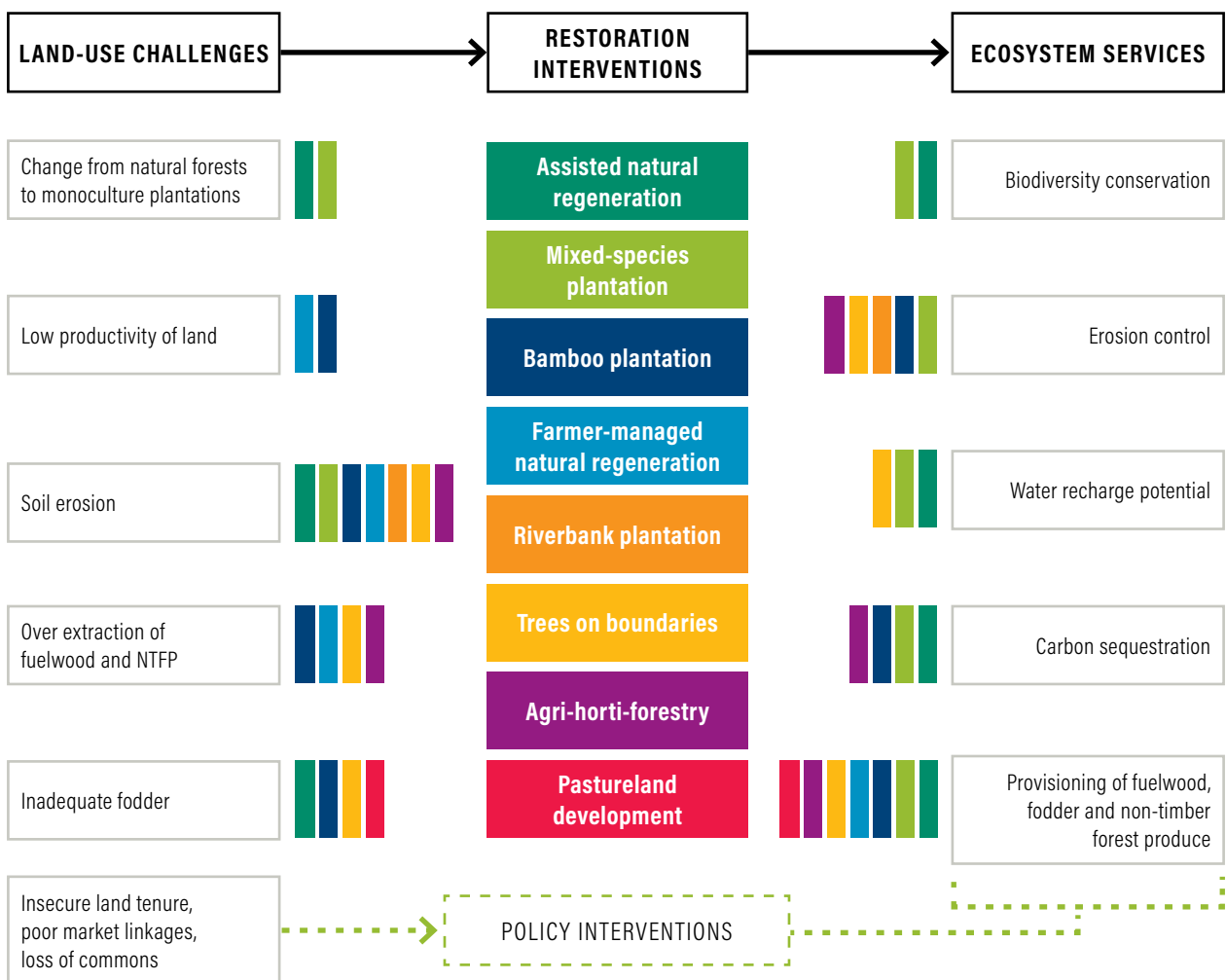
Note: The colored bars in columns one and three correspond to the colors of the interventions and indicate which intervention can address which type of land-use challenge or support which ecosystem service.

Source: WRI India.

Strengthening enabling conditions such as tenure and resource rights, institutional mechanisms, and market linkages will help realize the benefits of restoration

Local commitment to landscape restoration in the district can be seen in ongoing government initiatives and by the willingness to engage shown by farmers, champions, and local leaders. Laws, policies, and programs that can support restoration are in place but need strengthening and local actors and communities need to be more aware of them. For instance, agroforestry systems that support food security and livelihoods are core to implementing agroforestry (GoI 2014a) and could be popularized. Awareness of legislation and policies related to tenure and resource rights, for instance, Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights Act 2006;GoI 2006) need strengthening.

Local knowledge and management practices have already enabled regeneration of degraded bamboo forests. Governance and management of these regenerated degraded bamboo forests could be strengthened by clarifying benefit sharing mechanisms and the underpinning tenurial security aspects. Several local institutions, such as self-help groups and farmer producer organizations, could potentially provide support and channel restoration benefits to communities. However, most of these groups are inactive because of the absence of sustained benefits and a lack of projects with definitive action plans that could bring local user groups together. Additionally, Sidhi has poor market access and lacks infrastructure, such as cold storage for produce, which is a barrier to developing value chains.

Local champions and actors on the periphery of the Sidhi's social landscape can steer landscape restoration

Our social network analysis indicates that the district's network of actors is large but lacking in diversity. The district collector, the divisional forest officer, and the president of the zilla panchayat emerged as critical actors to implement and scale landscape restoration in Sidhi. Dissemination of information, which is currently scattered and haphazard, might be done more quickly through local champions, given the reach of their social networks. At the state level, several key actors—including research institutions, financial institu-

tions, NGOs, and the media—are at the periphery of Sidhi's network. Connecting them to core actors and to sources of finance, would create a cohort of stakeholders that could amplify successes and accelerate restoration.

Realizing Sidhi's restoration opportunity will generate additional employment for an estimated 30,000 persons and generate INR 710 million in wage income

Sidhi's livelihood analysis, undertaken by the Institute of Livelihood Research and Training, Bhopal indicates short-, medium-, and long-term benefits from implementation of landscape restoration. To achieve the full restoration potential, 39.5 million saplings would need to be planted, creating employment opportunities of 3.75 million person-days over two years. This would result in estimated wage income of INR 710 million ($10 million) and revenue of an additional INR 592.3 million ($8.46 million) from the sale of saplings.[5] Over the medium and long terms (five to seven years), value chain interventions could lead to development of microenterprises around six tree species: aonla, bamboo, jackfruit, mahua, moringa, and palash. These microenterprises could generate informal jobs for 30,000 people, including women, unemployed youth, and landless people.

The cost of landscape restoration can be met by consolidating funding streams and collaboration among agencies

Multiple existing and potential sources of financing exist but the current flow of funds for restoration is fragmented and may prove suboptimal for achieving environmental and development outcomes. Many government departments are structured in ways that inhibit consolidation of financial resources. However, it is critical that agencies collaborate to agree on common landscape restoration plans and look for possible synergies and cofunding opportunities.

We estimate that the costs of implementing the identified landscape restoration interventions in Sidhi are between INR 4.4 billion ($65 million) and INR 7.5 billion ($111 million) over 3 to 10 years. The wide cost and time range is explained by factors including the type of land ownership, the implementation agency, the type of intervention, and the tree species planted. Costs could be

met through a combination of public and private sources such as government budgetary allocations, multilateral and bilateral funding, commercial and development banks, and corporate social responsibility funds, as well as funds available from international climate finance sources such as the National Adaptation Fund for Climate Change.

Recommendations for Implementing Landscape Restoration in Sidhi

Our restoration opportunity assessment for Sidhi sets out a pathway but, to turn the assessment into action, we recommend a series of "accelerators" to bring together cohorts of actors who can catalyze successful implementation of landscape restoration.

Policy accelerators

Sidhi's restoration potential will require collaboration among government departments, including those managing forests; horticulture, farmer welfare, agriculture, rural development, and water resources, as well as panchayats (village councils). Additionally, there is a need for greater convergence of existing programs, namely the Mahatma Gandhi National Rural Employment Guarantee Scheme, the Madhya Pradesh State Rural Livelihoods Mission, the National Bamboo Mission, and the National Agroforestry Mission. These programs could support the development of project pipelines and help overcome the barriers of poor market access and the lack of infrastructure that stymie the development of product chains.

Land tenure and resource rights must be clarified and secured. For instance, Sidhi has 42,000 hectares of deemed-undemarcated forest where survey and settlement requirements are incomplete. Additionally, the buffer zone of the Sanjay Dubri Tiger Reserve has been expanded, which has curtailed forest access and resource rights for local communities. Community rights over forests and their resources have been recognized in legislation; however, the laws are not fully implemented in Sidhi. Clarification of tenure and resource rights would support implementation of the restoration interventions identified in this assessment. Policy accelerators in this area could target the forest, revenue, and tribal welfare departments of Madhya Pradesh.

Knowledge accelerators

Building local awareness and knowledge about laws, programs, and resource rights, strengthening network and peer-to-peer learning, and raising awareness of best practices from other parts of the state and country could foster implementation of landscape restoration in the district. The incentive for restoration is greater when tenurial rights and resources are clear, and local populations anticipate real livelihood benefits flowing from restoration activities. Thus increasing local knowledge about enabling policies, laws, and regulations; engaging local media in environmental reporting; and spreading best practices could provide a way forward for better management of resources by the local population.

Technology accelerators

Technology accelerators can build the technical capacities of farmers, user groups, and self-help groups in multiple aspects of landscape restoration, including tree nursery development, people-led restoration monitoring using state-of-the-art technological advances, landscape restoration techniques like farmer-managed natural regeneration. These accelerators should create a cohort of stakeholders who will build technical capacity to undertake restoration, strengthen mentoring and learning, and support the supply of high-quality planting material.

Market and business accelerators

Market and business accelerators can support development of value chains, address poor market access, and encourage the flow of restoration benefits to the local population. Many financial incentives for restoration depend on the development of markets for tree-based products. Value chains around the identified six tree species – aonla, bamboo, jackfruit, mahua, moringa, and palash— could be developed by nurturing micro-enterprises that trade, process, and retail products from these trees. There is potential to set up over 3,000 microenterprises, 65 cluster federations, and 5 farmer producer organizations in the district. Market accelerators could support these developments, but this report does not address the process of establishing revenue-generating models for local businesses.

If the restoration interventions identified in this assessment are implemented, they can strengthen the flow of ecosystem services and enhance the livelihoods of local communities, and particularly women, unemployed youth, landless people, and small and marginal landholders. Achieving these goals requires a strategic, collaborative plan of action along with a commitment to address issues of unclear tenure and resource rights, and poor market access. Continuing on a business-as-usual pathway is likely to leave the land and its people severely vulnerable to climate change impacts by mid-century. By contrast, investments in landscape restoration can put Sidhi on a development path that is inclusive and environmentally sustainable.

LANDSCAPE RESTORATION IN INDIA

More than 700 million people in India currently depend on forests and agriculture for sustenance (Census 2011a). Over 250 million people, including tribal communities, women, and marginal farmers[6] depend on forests for fuelwood, fodder, food security, and non-timber forest produce (NTFP; MoEF 2015). However, many forests and croplands are degraded, fragmented, and unproductive, posing risks to future development and environmental quality.

The Government of India supports a number of international targets that involve landscape restoration. India's contribution to the Bonn Challenge Commitment, for instance, aims to restore 21 million hectares of degraded and deforested lands by 2030.

Landscape restoration can improve the productivity of land and forests, with direct benefits to resource-dependent communities.[7] Initial estimates suggest that nearly 140 million hectares in India could benefit from a variety of restoration interventions (Chaturvedi et al. 2018). The outcomes could include increased food production; enhanced availability of fuelwood, fodder, and fruits; erosion control; improved water flows; and carbon sequestration (Figure 1). The beneficiaries of restoration would include large numbers of tribal people, women, and marginalized groups.

The Government of India supports a number of international targets that involve landscape restoration. India's contribution to the Bonn Challenge Commitment, for instance, aims to restore 21 million hectares of degraded and deforested lands by 2030 (Bonn Challenge 2017). This commitment is aligned with India's nationally determined contribution (NDC) under the Paris Climate Agreement to sequester an additional cumulative carbon sink of 2.5–3 gigatonnes of carbon dioxide equivalent (GtCO$_2$e) through improved forest and tree cover (MoEFCC 2015). Landscape management and restoration emerge as important elements in some of the UN Sustainable Development

Goals (SDGs), including those on poverty, hunger, clean water and sanitation, affordable and clean energy, and decent work and economic growth (Division for Sustainable Development 2017; UN 2016). See Figure 1 for a reference as to how the benefits of landscape restoration relate to the Sustainable Development Goals.

To meet these international commitments, India has set national targets such as restoring 10 million hectares of forests and enhanced tree cover through the National Mission for Green India (GIM; MoEF 2015). Restoration interventions on croplands are also vital to achieving the Government of India's vision to double farmers' income. Although the country does not have a consolidated policy for landscape restoration, the larger regulatory framework governing forests and agriculture provides the necessary support for realizing India's restoration targets.

India has a rich history of restoration interventions. Watershed projects implemented since the 1970s, for instance, aim to improve soil and water conservation across 45 million hectares of arable and nonarable land (Hanson et al. 2015). Social forestry programs in the 1980s formed a major part of India's wasteland development strategy and focused on improving availability of fuelwood and fodder for forest-dependent communities.

Past restoration interventions were mostly planned and executed within sectoral silos, that is, they considered forests, croplands, and other land uses in isolation. They also focused on site-level interventions—a forest division or a part of the arable land in a village. Landscape restoration, as the term implies, adopts a landscape approach in which different land uses are considered together, recognizing the dependencies and flows among them. Additionally, a landscape approach emphasizes the necessary integration of stakeholders and land uses in a joint management process (GLF 2014). While significant knowledge about restoration exists regarding sectoral interventions, experience with planning and implementing programs using a landscape approach is limited.

To address this gap, this report presents an approach to integrated landscape restoration planning for the district of Sidhi in eastern Madhya Pradesh state. The next section introduces the site where the restoration opportunity assessment was undertaken.

Figure 1 | Multiple Benefits from Landscape Restoration Related to Sustainable Development Goals

Helps mitigate climate change
Carbon stock of 7,082 million tonnes
SDG 13

Provides foods & forest products
250–300 million people dependent on forests for their livelihood
SDG 1, 2, 12

Improves air quality
SDG 3, 11

Improves biodiversity
India is one of the 17 mega-diverse countries with 7 to 8% of the world's recorded species
SDG 15

Creates recreational opportunities
SDG 3, 8, 11

Improves water quality
17,156 sq km of water bodies inside forests
SDG 6, 14

Provides sustainable timber, fiber, and fuel
Non-timber forest produce is the largest unorganised sector with a turnover of more than INR 5440 crore
SDG 2, 5, 10, 12, 16

Creates rural jobs
NTFP sector alone employs 250 million
SDG 1, 5, 10, 16

Improves soil health
SDG 12, 15

| 1 NO POVERTY | 2 ZERO HUNGER | 3 GOOD HEALTH AND WELL-BEING | 5 GENDER EQUALITY | 6 CLEAN WATER AND SANITATION | 8 DECENT WORK AND ECONOMIC GROWTH | 10 REDUCED INEQUALITIES |

| 11 SUSTAINABLE CITIES AND COMMUNITIES | 12 RESPONSIBLE CONSUMPTION AND PRODUCTION | 13 CLIMATE ACTION | 14 LIFE BELOW WATER | 15 LIFE ON LAND | 16 PEACE, JUSTICE AND STRONG INSTITUTIONS |

Note: SDG = Sustainalbe Development Goal, NTFP = non-timber forest produce.

Source: Adapted from Faruqi et al. 2018, p. 5.

1.1 Sidhi Typifies Environment and Development Challenges in India

The Sidhi district is part of the Son river basin in the central Indian state of Madhya Pradesh, which has an estimated restoration potential of more than 20 million hectares, the most of any state in India (Chaturvedi et al. 2018). The district comprises seven tehsils (units of land administration that comprise multiple villages) and five blocks (units of development planning that comprise multiple villages)[8] of which the Kusmi block is a Schedule V Area (with a predominant population of scheduled tribes).[9] Sidhi is predominantly rural, with only four urban centers: Sidhi, Churhat, Rampur Naikin, and Majhauli. Figure 2 shows the location of Sidhi within India and Madhya Pradesh state and its seven tehsils.

Sidhi exemplifies the land use challenges persistent across underdeveloped and poor districts in India. It is remote and climate-vulnerable and characterized by low energy access, household income, healthcare, clean water, and employment (Gosain et al. 2014).

Land use and restoration potential

Sidhi district is rich in natural resources, with large areas of forest (more than 37 percent of its total area) and three important rivers: the Gopad, the Banas, and the Son. Sidhi contains three protected areas: Son Ghariyal Sanctuary, Sanjay Dubri Tiger Reserve, and part of the Bagdara Wildlife Sanctuary. Forty-three percent of Sidhi's land is agricultural. Nine percent is "revenue lands"[10] that include "greenwash areas"— named for their depiction in a light green color on Survey of India toposheets that depict forests and woodlands as well as other common lands. Field surveys and results from participatory mapping exercises indicate that much of the revenue greenwash lands is being used for marginal, rainfed agriculture. These areas have good rootstock, which allows for natural regeneration of native species (particularly palash) following the rainy season.

Another 9 percent of land is categorized as "undemarcated" or "deemed" forests, meaning that it is neither reserved forest nor protected

Figure 2 | Sidhi District of Madhya Pradesh

India   Madhya Pradesh   Sidhi
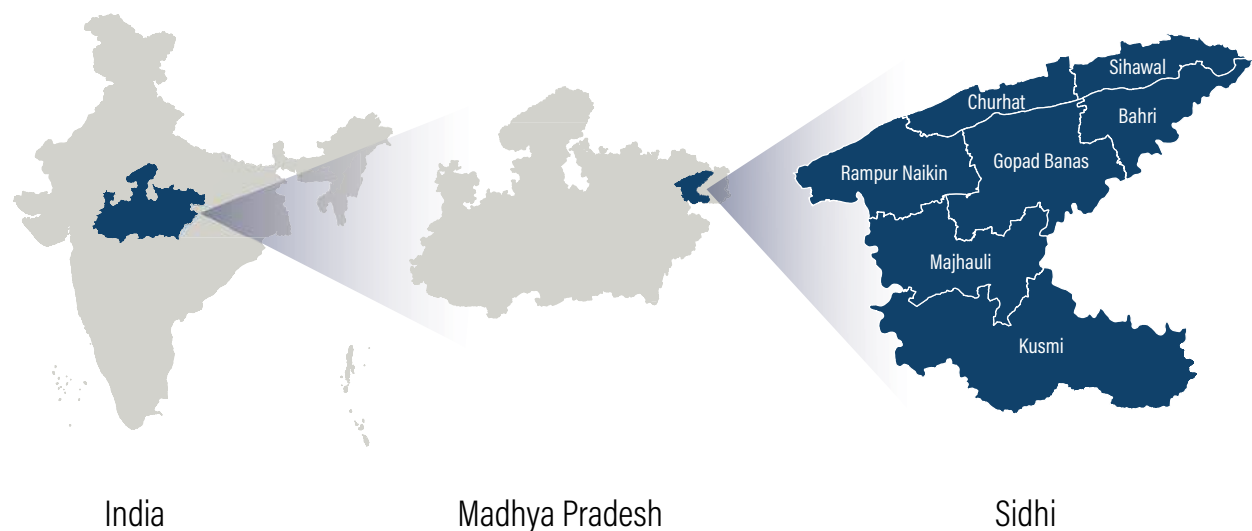
Source: WRI India

forest as outlined by the Survey of India. These lands, therefore, are not under the jurisdiction of the forest department. They are, however, included in the forest compartment[11] boundary as per the Sidhi forest working plan. The remaining 2 percent of the land area is surface water.

In Sidhi's agricultural areas, land use change has largely been in the form of intensification of irrigated agriculture as in Rampur Naikin, Churhat, Sihawal, Gopad Banas, and Majhauli. Parts of Churhat, Sihawal, and Rampur Naikin tehsils are irrigated because they fall within the jurisdiction of the Bansagar project. In Kusmi and Majhauli tehsils, marginal and small landholdings predominate, with limited irrigation facilities.

Inequity in land ownership

More than half the population of Sidhi district lives below the poverty line (Bhanumurthy et al. 2016) and forests and agriculture are a lifeline for the majority of people. Land holding in Sidhi is skewed in favor of the upper-caste households, who own large parcels of land that are mostly well irrigated and productive (Subdistrict consultations, January 7-11, 2017; field consultations, September 2017; see Appendix A). Although scheduled castes (SC) and scheduled tribes (ST) account for nearly 39 percent of the population, they own only 23 percent of land in the district (Census 2011b; NABARD 2016).[12]

Loss of natural forests

Forests in Sidhi include dense, moderately dense, open, and scrub forest (Figure 3).[13] Vegetation change analysis indicates that there has been considerable forest loss. Between 1989 and 1996, forest cover deteriorated from the classification of "moderately dense" forests to "open" forests. In the period 1996–2016, while overall forest cover deteriorated by 10,000 hectares, green cover increased by over 35,000 hectares (Global Land Cover Facility 2016). This increase was largely due to the establishment of monoculture plantations of teak (25,156 hectares), and bamboo (10,441 hectares). These changes in forest cover and composition affect the availability of forest services, which currently meet critical needs for fuelwood, fodder, and NTFP for many local people.

Figure 3 | Composition of Forest in the District of Sidhi, 2016

Legend

- Miscellaneous
- Monoculture Sal
- Monoculture Teak
- Bamboo
- Teak Mixed
- Sal mixed
- Open forest
- River
- Other Areas

Tehsil Boundary

0 5 10   20   30
Kms
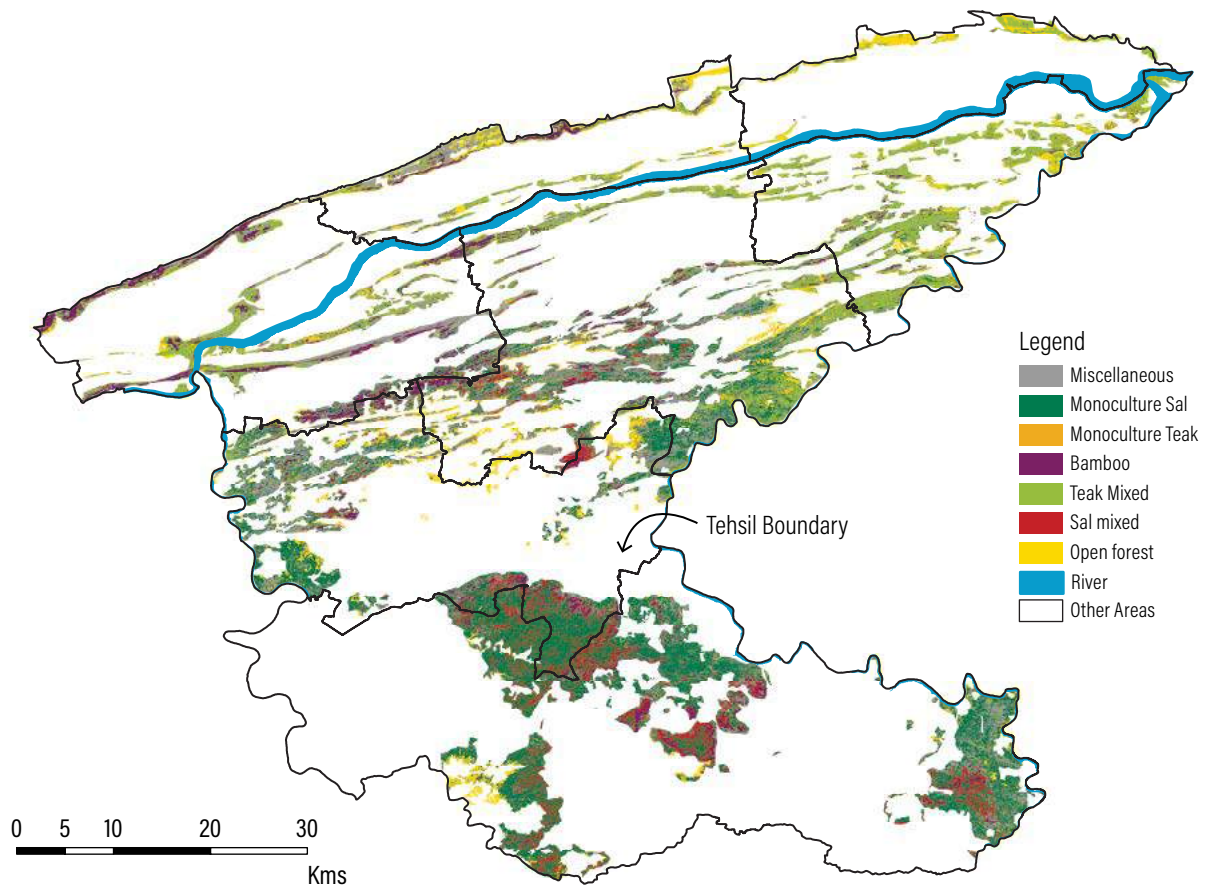
Source: WRI India

High dependence on fuelwood as an energy source

Fuelwood is the primary source of energy for poor and marginalized households in Sidhi and forests fulfill more than 80 percent of fuelwood requirements (GoMP 2012; Census 2011b; Survey of India 2011). Responsibility for fuelwood collection is not differentiated by gender in SC and ST households (field consultations, September 5, 6, 9, 2017).[14] According to Sidhi's forest working plan, the current shortage of fuelwood stands at 3 percent, for logwood at 70 percent, and for bamboo at 10 percent (GoMP 2012). A shift to cleaner cooking fuels like liquefied petroleum gas (LPG) cylinders was reported by a few large landholding upper-caste farmers.

Lack of pasture and common land

Open livestock grazing, a practice colloquially known as aira, is predominant in the district and is a challenge for sustainable land management. Grazing puts immense pressure on Sidhi's forests, with demand for fodder exceeding the sustainable supply capacity of forests by an estimated 350 percent (GoMP 2012). There is no designated pastureland land in the district. Most of the village common land designated as pastureland (gauchar land) has either been encroached on or redistributed in the course of Madhya Pradesh's various land redistribution schemes for poor and landless people (subdistrict consultations, January 7-11, 2017; see Appendix A).
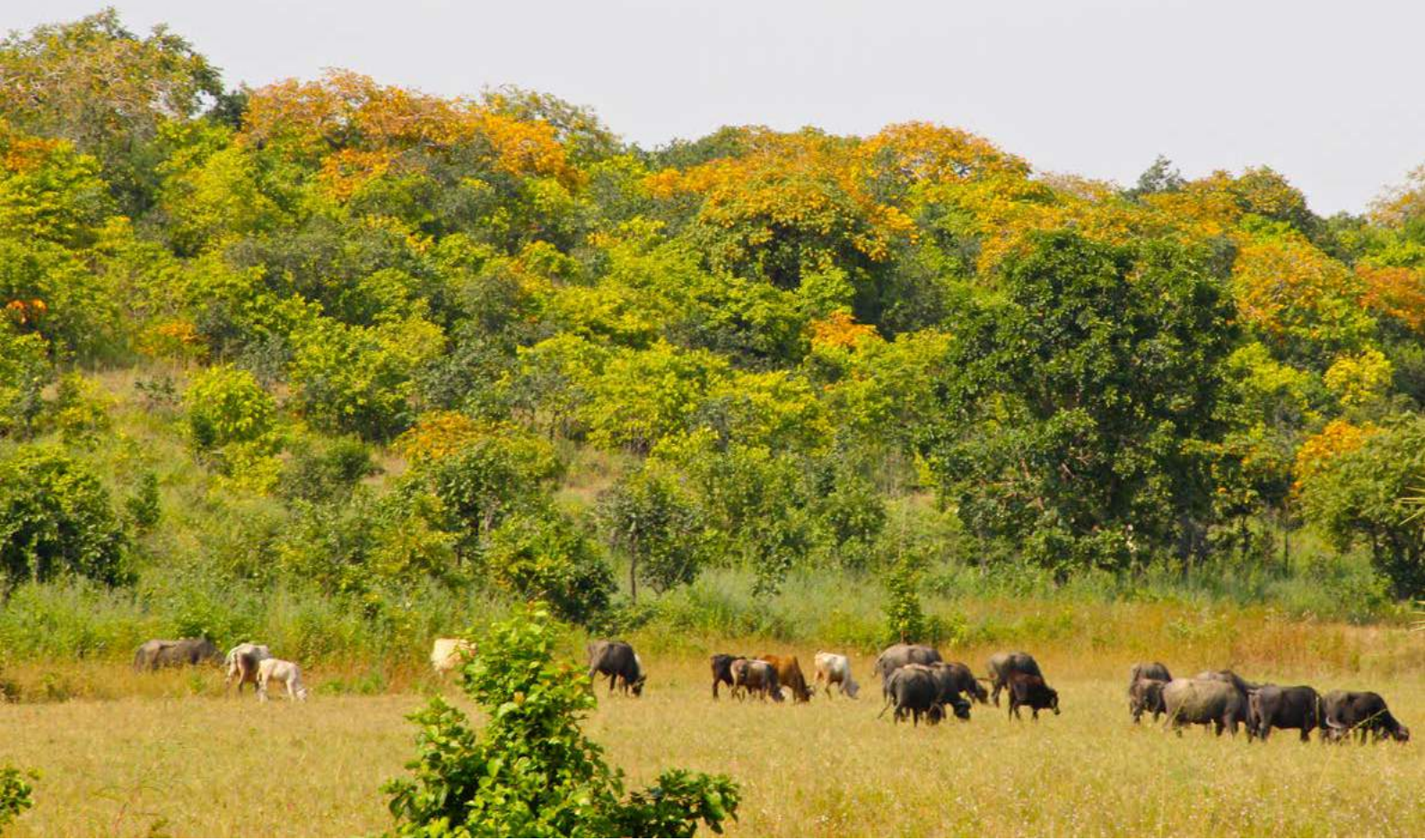
Declining productivity of agricultural land

The majority of landholdings in Sidhi (56 percent) are marginal (less than one hectare) or just homestead (GoI 2011). Because of intensive cultivation, the productivity of agricultural land is declining (Gosain et al. 2014). Stakeholder consultations indicated poor knowledge of new and sustainable agriculture practices among participants (subdistrict consultations, January 7-11, 2017; see Appendix A).

In addition to the threats posed by declining forest quality and agricultural productivity, the poor and marginalized population is highly vulnerable to extreme climate events like drought and frost (GoMP 2014).

If current practices continue, they could undermine conservation efforts in Sidhi's three protected areas–Son Ghariyal Sanctuary, Sanjay Dubri Tiger Reserve, and Bagdara Wildlife Sanctuary.
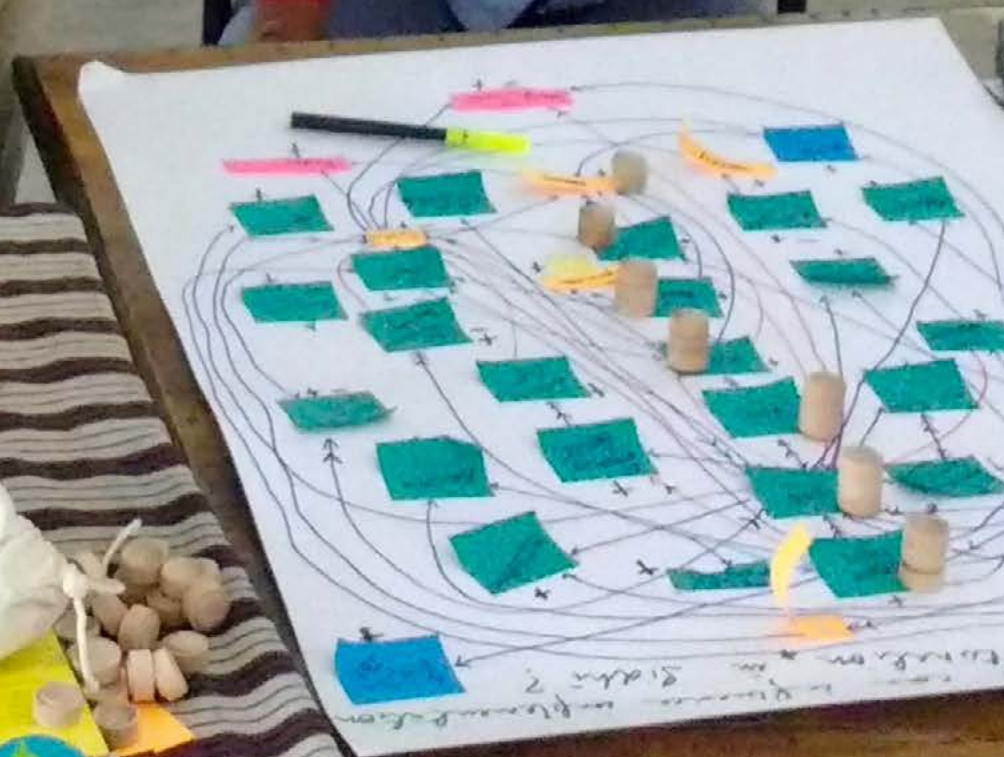
ASSESSMENT METHODOLOGY

We conducted this assessment by adapting the Restoration Opportunity Assessment Methodology (ROAM) for the district of Sidhi. ROAM estimates the potential for tree-based restoration using an interdisciplinary, iterative, and participatory process (IUCN and WRI 2014). The World Resources Institute (WRI) estimates that, since its launch in 2014, more than 40 countries have used the road-test edition of ROAM to assess their restoration potential.

When adapting ROAM for Sidhi, taking account of issues relevant to India, the research team focused on the environmental and socioeconomic benefits that can arise from landscape restoration. We made four modifications to the road-test version and added other tools to encourage participation of stakeholders. Figure 4 provides an overview of the ROAM component, data collection and analysis steps; our methodology and findings are discussed in Section 3.

The Sidhi ROAM assessment was conducted between October 2016 and September 2017. It was led by WRI India and supported by partners including the Institute of Livelihood Research and Training (ILRT), Bhopal, World Wide Fund for Nature-India (WWF-India), and local research assistants and facilitators with support from local champions.

2.1 Three Phases of Sidhi's Opportunity Assessment

The assessment included three phases: preparation and planning, data collection and analysis, and results to recommendations.

Phase I: Preparation and planning

As a first step, a team with interdisciplinary expertise in spatial analysis; governance and gender; forestry and ecology; and finance and economics was identified. We refer to this team as the Sidhi ROAM research team (research team).

Sidhi's ROAM assessment began with an inception workshop in Bhopal, the state capital of Madhya Pradesh, in July 2016. The purpose of the workshop was to outline key land use challenges in Madhya Pradesh and the Son river basin, identify potential restoration interventions, identify key actors and institutions, and analyze the presence or absence of enabling conditions. The inception workshop was attended by representatives from government departments, civil society organizations, research institutions, and private sector organizations in Madhya Pradesh (see Appendix A).

Phase II: Data collection and analysis

The research team identified priority restoration interventions best suited to the landscape, and undertook the following analyses:

- *Restoration opportunity mapping:* spatial analysis of restoration potential and the associated restoration interventions

- *Ecosystems services analysis:* examination of the multiple ecosystem services that could flow from the identified restoration interventions

- *Policy, legal, and institutional analysis:* diagnosis of the presence or absence of success factors for restoration

- *Stakeholder analysis:* social landscape analysis

- *Livelihood benefits analysis:* analysis of livelihood benefits associated with the identified restoration interventions

- *Cost analysis:* Identification of financing and resourcing options for implementing the priority restoration interventions

Data for these six components of analysis were collected using a mixed-methods approach (Table 1). Concerns around gender and social inclusion, tenure and resource rights, and governance were underscored as cross cutting across the six components (Appendix B). Data collection and interpretation followed a participatory process, with the emphasis on bringing together scientific and local knowledge and using innovative tools to assess the landscape restoration potential in Sidhi. The team assessed the data's relevance and robustness. For instance, data collected through a Collect Earth-Based Mapathon (ecological and spatial disciplinary lens) were viewed as secondary data whereas focus group discussions were viewed as primary data.

Restoration Potential
Similar to ROAM

▲ Participatory Mapping
▲ Collect-Earth

Cost Analysis
Similar to ROAM

Ecosystem Services Analysis

▲ Multiple ecosystem services considered
▲ Ecosystem Services Diagnostic tool

Livelihood Benefits Analysis

▲ Analysis of short, medium and long term benefits

Enabling Conditions Analysis

Similar to ROAM

▲ Restoration Diagnostic
▲ Restoration Diagnostic Card Game

Social Landscape Analysis

▲ Mapping Social Landscapes
▲ Net-Map

Spatial Analysis

Cost Analysis

Ecosystem Services

Sidhi's Restoration Opportunity Assessment

Livelihood Potential

Enabling Conditions

Social Landscape Analysis

Legend:

▲ Conceptual Enhancements

▲ Participatory Tools

Remote Sensed Imagery Analysis

Review of Secondary Data

Stakeholder consultation in workshop setting

Focus Group Discussion at Village Level

Household Survey

Validation of Findings in Workshop Setting

Source: WRI India

Phase III: Results to recommendations

This phase focused on identifying actions that could accelerate restoration in the district. Pre-validation and validation workshops were conducted in Sidhi to share the results of the assessments with key stakeholders such as government officials, financial institution representatives, civil society organizations, farmers, private sector representatives, the National Bank for Agriculture and Rural Development, and local community leaders (see Appendix A). The workshops helped develop "accelerators" on policy, knowledge, technology, and market and business, as recommended actions to operationalize the findings of the assessment.

2.2 Overview of Stakeholder Consultations Conducted during Three Phases of This Assessment

An overview of consultations with stakeholders to incorporate their feedback is outlined in Table 1. See Appendix A for more detail.

Selection of participants for consultation

In the tehsil consultations and the stakeholder mapping, prevalidation, and validation workshops, local partners made an exhaustive list of community leaders, farmers, elected leaders of local institutions, and NGOs in the district. Partners facilitated their participation in these

Table 1 | Type of Stakeholder Consultations Undertaken during the Assessment

PHASE OF ASSESSMENT	TYPE OF CONSULTATION	AIM OF CONSULTATION
Preparation and planning	Inception workshop	Understand the opportunities for and challenges to landscape restoration in Madhya Pradesh
Data collection and analysis	Subdistrict consultations[a]	Map additional opportunities for tree-based interventions in the district
		Set criteria for prioritization of restoration interventions
		Identify the enabling conditions that would underpin implementation of landscape restoration in the district
	Collect Earth-Based Participatory Mapathon	Collect data on a range of factors including tree cover, tree count, land use, patterns of existing tree-based restoration interventions in agricultural lands, and potential for increasing tree cover
	Mapping actors and networks through social network mapping[b]	Map key actors and networks who can enable implementing and scaling of landscape restoration in the district
Results to recommendations	Prevalidation workshop	Validate findings of the assessment, discuss synergies and trade-offs, and fill residual data gaps
	Way forward workshop	Discuss findings and strategies to operationalize the opportunity assessment
	Technical working groups	To ensure robustness, the methodology and findings from Sidhi's opportunity assessment were discussed at three national-level technical working groups: Landscape Restoration Opportunities Mapping and Monitoring; Land, Policy, Governance, and Gender; and Restoration Finance and Economics

Notes:
a. Four subdistrict (tehsil-level) consultations were organized with participants from the seven tehsils: Bahri, Churhat, Kusmi, Majhauli, Rampur Naikin, and Sihawal
b. Social landscape of Sidhi was mapped during three stakeholder convenings.
Further details of stakeholder consultations with information on the participants are available in Appendix A.

workshops. Information about the consultation was spread by word of mouth, WhatsApp, and text messages, and participants were encouraged to circulate the meeting date within their networks. All relevant government officials were also invited.

Feudal social structures are predominant in many parts of India, including Sidhi. These structures restrict women's mobility and consequently affected their participation in the consultations. Women were not represented in the mapathons conducted in Lucknow, Uttar Pradesh. The mapathons were conducted in Lucknow due to lack of infrastructure (computer lab with high speed internet connection) in Sidhi. We found it difficult to encourage women participants to travel to Lucknow for the mapathons. Participa-

tion of women and marginalized groups was also limited in the subdistrict consultations. To address this gap, we undertook additional field visits to conduct focus group discussions with women and marginalized groups. We did not consider it appropriate to do social network mapping during field visits because most responses were related to the local (village-level) network. Because the purpose of this assessment was to provide a landscape-level view of restoration potential and the associated actors and networks in the district, we did not map village-level actors. However, local mapping would be useful at the implementation stage.

KEY FINDINGS FROM SIDHI'S LANDSCAPE RESTORATION OPPORTUNITY ASSESSMENT

This section discusses the potential for landscape restoration in Sidhi district and the potential livelihood and environmental benefits for women, men, and marginalized groups if the identified restoration interventions are implemented.

3.1 Potential for Landscape Restoration in Sidhi

Sidhi has immense potential for landscape restoration. Spatial analysis shows that, of the total area of 476,812 hectares, more than 363,000 hectares (76 percent) offer potential for landscape restoration. We identified eight tree-based restoration interventions (others exist but were not explored) that could be implemented (Table 2).

Protected areas account for 89,876 hectares (19 percent) of Sidhi's land area, and include the Sanjay Dubri Tiger Reserve and Son Gharial Sanctuary. The assessment recommends prioritizing these areas for conservation. Further, 9,330 hectares (2 percent of total area) of existing forests outside protected areas have dense tree canopy cover (greater than 70 percent). These areas are prioritized for protection. Water bodies and built-up areas constitute 14,242 hectares (3 percent of total area) which are unsuitable for landscape restoration. The remaining 363,339 hectares are suitable for landscape restoration. The greatest potential for restoration in Sidhi is in the tehsils of Gopad Banas (22 percent), Majhauli (18 percent), and Rampur Naikin (16 percent). See Figure 5.

Table 2 | Potential Interventions for Landscape Restoration in Sidhi

RESTORATION POTENTIAL	
Analysis and Methodology	· Stakeholder Consultation in Workshop Setting · Remote Sensed Imagery Analysis · Review of Secondary Data · Validation of Findings in Workshop Setting
Objective	To identify landscape restoration potential and possible tree-based restoration interventions for Sidhi.
Key questions	How much land could potentially be restored? Which types of restoration intervention are suitable for Sidhi?
Key findings	**Key finding 1** We identified more than 363,000 hectares where trees can be integrated in different land uses. **Key finding 2** At least eight landscape restoration interventions are suitable in Sidhi: assisted natural regeneration, agri-horti-forestry/wadi, mixed-species plantations, trees on boundaries, bamboo plantations, riverbank plantations, pastureland development, and farmer-managed natural regeneration.
Method	We developed base layers on land use, land ownership, tree cover density, irrigation status, slope, occurrence of bamboo and riverbanks to enable identification of restoration potential in the district. Areas that did not have potential for tree-based restoration were excluded from the assessment. Suitable areas for intervention were identified using criteria including presence of root stock and area under irrigation, and consultation with stakeholders. For details see Appendix C.
Data collection and analysis tools	Using Collect Earth-Based Mapathon we collected data on variables including tree cover, tree count, land use, patterns of existing tree-based restoration interventions in agricultural lands, and potential for increasing tree cover in a landscape. We analyzed the data using digital and knowledge mapping. ArcGIS software version 10.5 was used for digital mapping. The final map of restoration opportunities for Sidhi can be zoomed with accuracy up to the tehsil level.

Source: WRI India

3.2 Types of Landscape Restoration Interventions

We focused on eight restoration interventions that could be implemented in Sidhi:

- Assisted natural regeneration (ANR)

- Mixed-species plantation

- Bamboo plantation

- Farmer-managed natural regeneration (FMNR)

- Pastureland development

- Riverbank plantation

- Agriculture-horticulture-forestry models (agri-horti-forestry or wadi)

- Trees on boundaries

More detail on these types of restoration is given in Table 3 and their possible locations are mapped in Figure 6. Table 4 gives a breakdown of the amount of land in each tehsil appropriate for each type of restoration.

Restoration on forest and agricultural lands

Potential for restoration intervention in Sidhi can be disaggregated into the two primary land uses of forestry and agriculture. The greatest potential is on agricultural land (57 percent), but significant potential also exists on forest land (35 percent) as shown in Figure 7. The remaining 7 percent is other land uses. Since land use and land ownership have immense impact on the implementation of activities, the restoration opportunity assessment considers both these key factors (Appendix C).

Figure 5 | Potential for Landscape Restoration
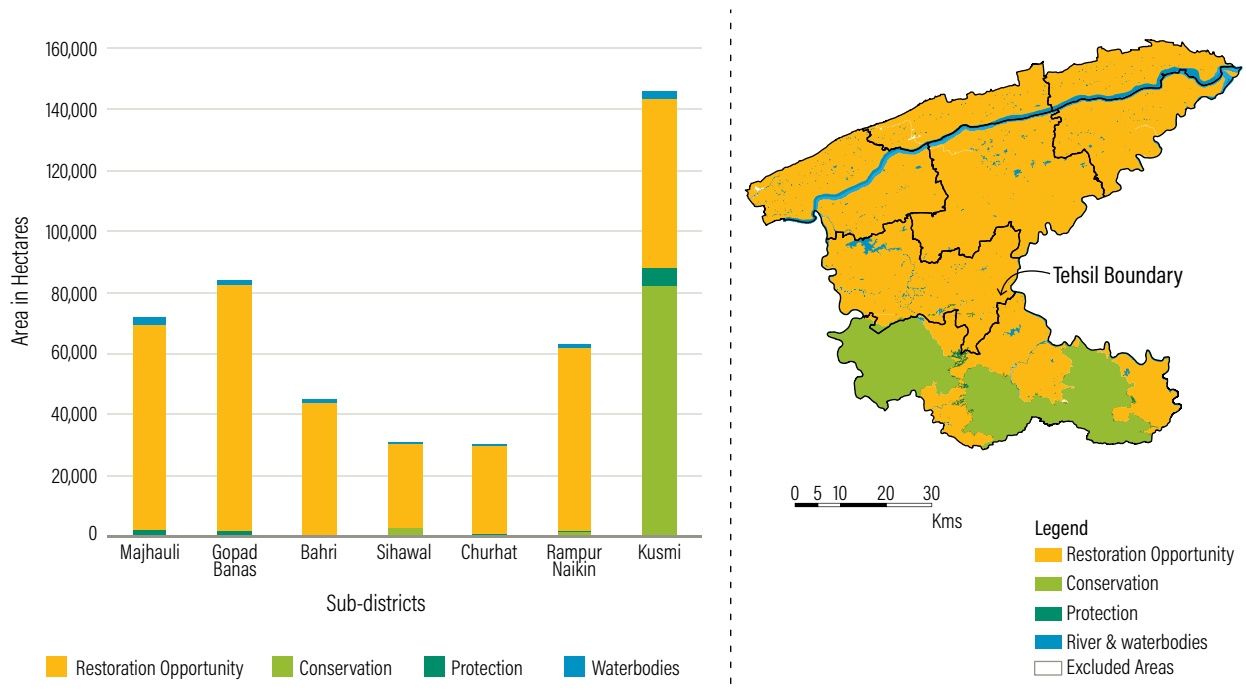
Source: WRI India

Figure 6A | Types of Potential Restoration Interventions in Sidhi: Map of Potential Restoration Interventions

Legend

- Assisted Natural Regeneration
- Mixed-species Plantation
- ANR/Mixed-species Plantation
- Bamboo Plantation
- Farmer-managed Natural Regeneration
- Trees on boundaries
- Agri+Horti+Forestry
- Pastureland Development
- Riverbank Plantation
- River

Tehsil Boundary

0 5 10 20 30 Kms
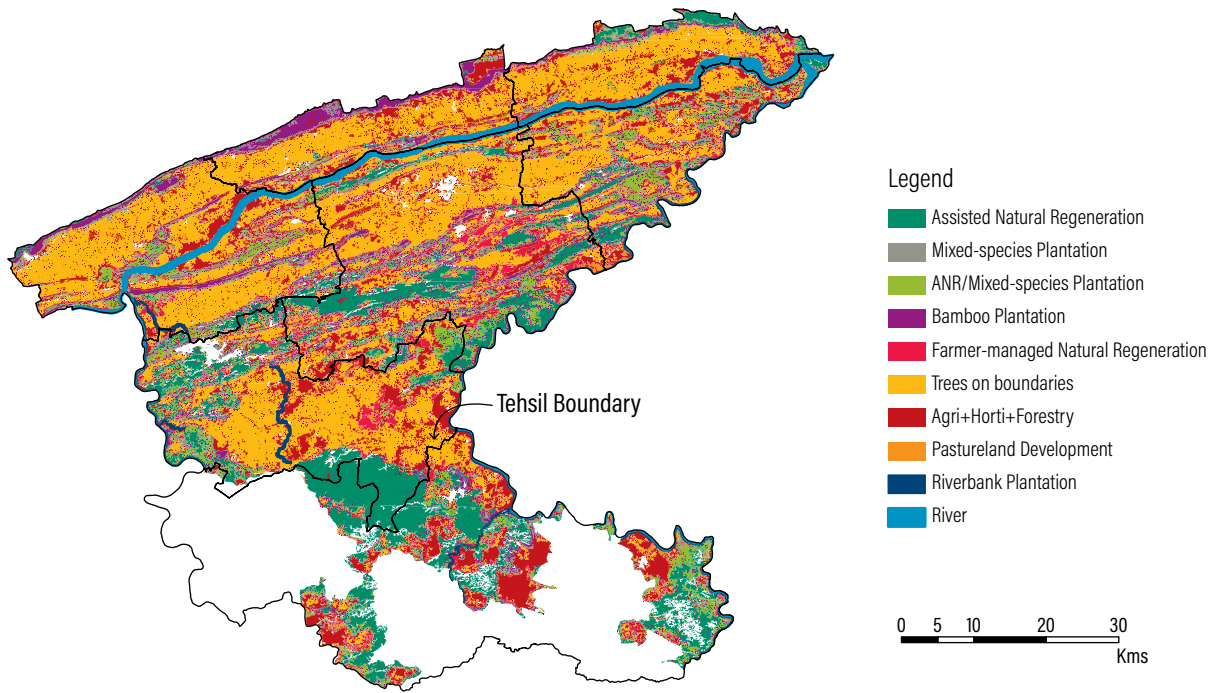
Source: WRI India

Figure 6B | Types of Potential Restoration Interventions in Sidhi: Percentage of Land Appropriate for Types of Restoration Interventions by Tehsil

- Assisted Natural Regeneration (ANR)
- Mixed-species Plantation
- ANR/Mixed-species Plantation
- Bamboo Plantation
- Farmer-managed Natural Regeneration
- Trees on Boundaries
- Agri-horti-forestry
- Pastureland Development
- Riverbank Plantation
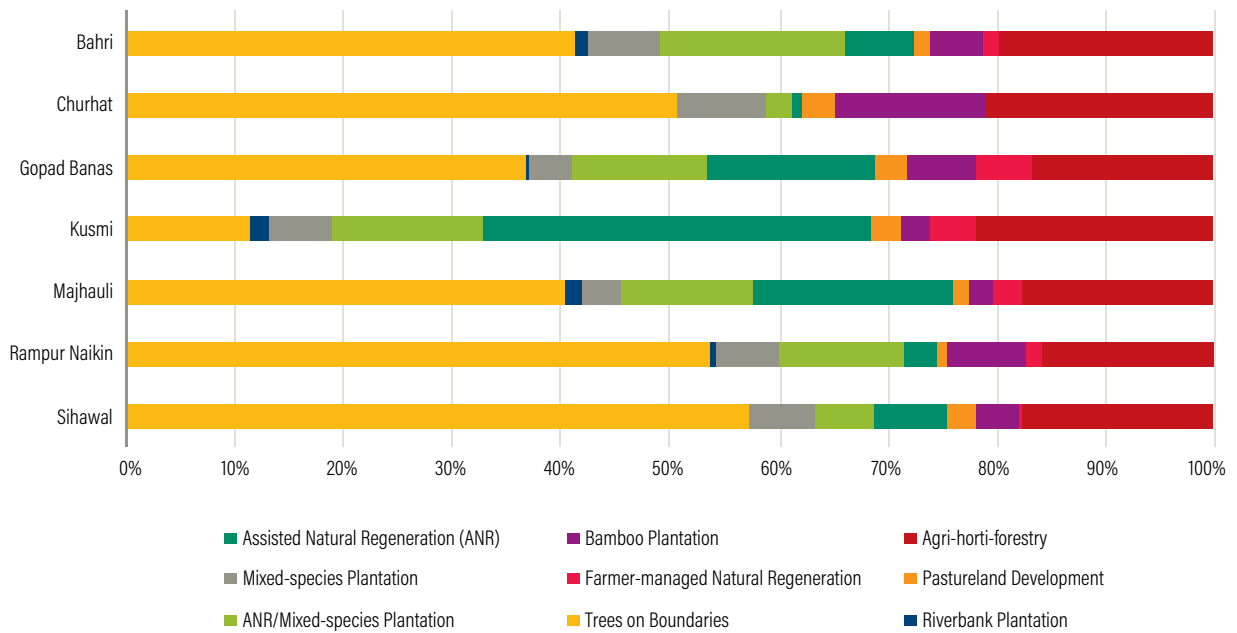
Source: WRI India

Table 3 | Landscape Restoration Interventions Identified for Sidhi

RESTORATION INTERVENTION	DEFINITION	OPPORTUNITY POTENTIAL, HECTARES (% OF TOTAL LAND AREA)
Assisted natural regeneration (ANR)	A forestry practice that focuses on regeneration using existing rootstock. ANR involves physical or social fencing to protect the regenerating area from grazing and fire.	51,375 (14%)
Mixed-species plantation	Planting a variety of tree species, preferably native species, in a single plantation.	19,285 (5%)
Mixed-species plantation/ ANR	Same as above.	42,131 (12%)
Bamboo plantation	Plantation of bamboo.	19,578 (5%)
Agri-horti-forestry/Wadi	An agronomy practice that integrates fruit trees and timber trees with crops.	66,210 (18%)
Trees on boundaries	Tree planting along raised bunds on agricultural land or along field boundaries. The trees can be for fruit, fodder, fuelwood, or timber, based on irrigation availability, soil type, and needs of farmers.	143,628 (40%)
Farmer-managed natural regeneration (FMNR)	A low-cost process in which farmers protect and manage the growth of trees and shrubs that regenerate naturally in their fields from root stock or from seeds dispersed through animal manure.	10,151 (3%)
Riverbank plantation	Planting trees along river banks to prevent soil erosion and provide secondary crops.	3,063 (0.84%)
Pastureland development	Protecting or regenerating pastureland to prevent overgrazing, promote soil conservation, and increase forage production, thus improving land management.	7,918 (2.18%)

Source: WRI India

Table 4 | Potential Area of the Eight Restoration Interventions in Sidhi, by Tehsil (hectares)

RESTORATION INTERVENTION	BAHRI	CHURHAT	GOPAD BANAS	KUSMI	MAJHAULI	RAMPUR NAIKIN	SIHAWAL	TOTAL
Assisted natural regeneration (ANR)	2,814	321	12,458	19,722	12,374	1,831	1,855	51,375
Mixed-species plantation	2,910	2,405	3,015	3,166	2,535	3,561	1,693	19,285
Mixed-species plantation/ ANR	7,312	645	10,163	7,715	7,971	6,848	1,478	42,131
Bamboo plantation	2,009	4,100	4,895	1,540	1,545	4,370	1,118	19,578
Agri-horti-forestry/wadi	8,548	6,132	13,411	12,005	11,802	9,426	4,887	66,210
Trees on boundaries	17,828	14,890	29,631	6,187	27,084	32,121	15,887	143,628
Farmer-managed natural regeneration	677	18	4,359	2,360	1,800	900	39	10,151
Riverbank plantation	521	0	302	979	963	298	0	3,063
Pastureland development	647	836	2,555	1,533	1,030	539	777	7,918
Total	43,266	29,347	80,789	55,206	67,104	59,893	27,733	363,339

Source: WRI India

Figure 7 | Restoration Interventions on Forest and Agricultural Land

Interventions on Forest Land

Interventions on Agricultural Land

Riverbank
Plantation 1%

Bamboo
Plantation 14%

Assisted Natural
Regeneration 39%

Assisted Natural
Regeneration/
Mixed-species
Plantation 32%

Mixed-species
Plantation 14%

Riverbank
Plantation 1%

Farmer-managed
Natural
Regeneration 4%

Agri-horti-
forestry (wadi) 30%

Trees on
Boundaries 65%
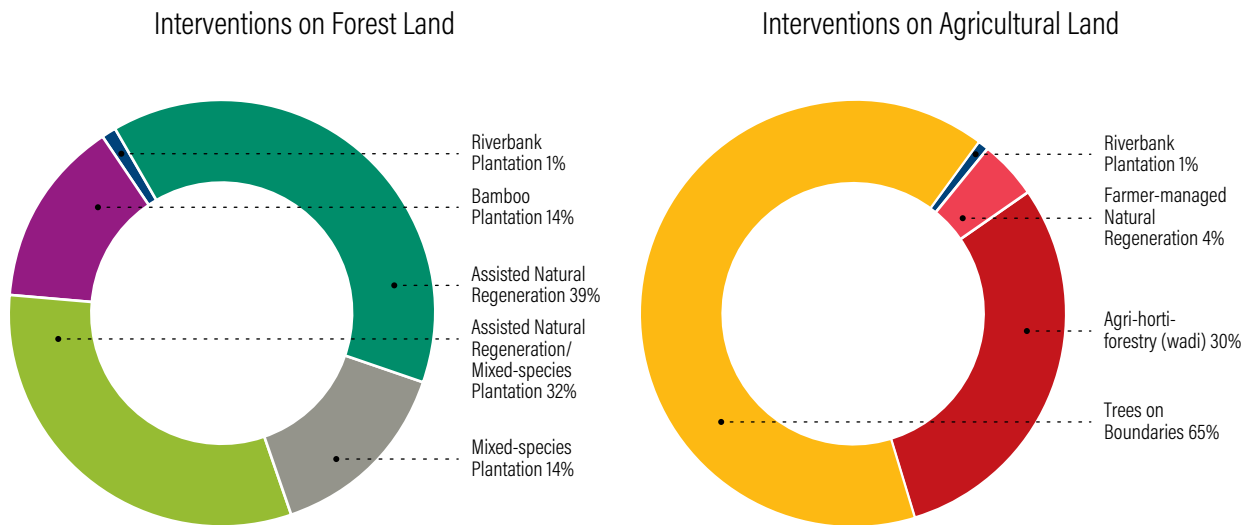
Note: On land uses other than forests and agriculture, the restoration practices of pastureland development (7,918 ha), riverbank plantations (431 ha), and bamboo plantation (546 ha) have been identified.

Source: WRI India

Spatial analysis indicates that multiple interventions are possible in the same area

We assessed interventions on the basis of both land use and land ownership. For instance, in areas delineated as recorded forest with the land use as forest, four types of interventions are possible: ANR, mixed-species plantations using native tree species, bamboo plantations, and riverbank plantations. In forest and tree cover areas where land ownership is private, ANR, bamboo, riverbank, or mixed-species plantations are possible. For agricultural areas with private land ownership, trees on boundaries, agri-horti-forestry/wadi, and riverbank plantations (based on proximity to the river) are suitable.

Agri-horti-forestry interventions, called *wadi*, is a common agri-horti-forestry model that can be implemented in specific land areas (1–5 hectares) for scheduled tribe (ST) populations. Wadi was identified by stakeholders in tehsil workshops as a key intervention in rainfed areas of Banas, Gopad, Kusmi, and Majhauli tehsils, which have extensive areas with higher scheduled tribe populations and land holdings of one to five hectares (Census 2011c). Consultation with farmers to select tree species is a key element of implementing wadi.

In agricultural revenue lands, planting trees on boundaries emerged as a key intervention for irrigated areas during tehsil workshops. The mapathon findings indicate a wide range in the number of trees that might be planted per hectare, with great potential for additional planting (Table 5).

Tenurial clarity emerged as essential to implementing some restoration interventions

In some parts of Sidhi, areas that are delineated as recorded forest appear to be under agriculture. Approximately 6,500 hectares of the total recorded forest area (179,721 hectares) and 8,400 hectares of undemarcated forest area (42,000 hectares) are under cultivation. Interventions such as agri-horti-forestry/wadi can help maintain forest cover while also supporting livelihoods of dependent communities. Prior to undertaking restoration activities in these areas, a case-by-case policy intervention to clarify tenurial rights is necessary. This emerged as a key discussion point during stakeholder consultations.[15]

Successful restoration will depend on creating awareness of policies that guarantee landowners secure tenurial rights to trees and land and access to benefits from restoration.

Table 5 | Potential for Planting Trees on Boundaries in Sidhi

TEHSIL	CURRENT AVERAGE TREES PER HA	POTENTIAL MAXIMUM NUMBER OF TREES PER HA
Bahri	10	66
Churhat	8	17
Gopad Banas	11	100
Kusmi	11	80
Majhauli	9	20
Rampur Naikin	13	90
Sihawal	10	48

Source: WRI India

3.3 Ecosystem Service Benefits from Identified Landscape Restoration Interventions

Our literature review indicates that landscape restoration can generate a range of regulatory ecosystem services (benefits obtained from the regulation of ecosystem processes such as biodiversity conservation and carbon sequestration) and provisioning ecosystem services (products obtained directly from ecosystems such as fuelwood, food, fodder, and timber) (Ding et al. 2017). On the basis of literature analysis and stakeholder preferences (using the Ecosystem Services Diagnostic Tool), we identified four key ecosystem services that could flow from landscape restoration interventions (Table 6).

Restoration for ecosystem services

Opportunities for landscape restoration interventions to enhance the four ecosystem services, and their spatial distribution in Sidhi, are discussed below.

Biodiversity conservation

The predominant type of land use in areas mapped as critical for biodiversity conservation is forest and tree cover. The restoration opportunities map identifies ANR and mixed-species plantation as the most appropriate interventions. There are, however, a few areas where agroforestry interventions are also identified. In these areas, use of native species can contribute to biodiversity conservation.

Most of the areas critical for biodiversity conservation are in the south of Sidhi, around Sanjay Dubri Tiger Reserve and 100 meters along the Son river which is designated as the Son Gharial Sanctuary (Figure 8; GoMP 2012).

Erosion control

Areas with high surface runoff due to steep slopes (above 15 percent), elevation, and negligible tree cover were identified as critical for erosion control (Figure 9). Stakeholders from the northern tehsils of Bahri and Sihawal identified erosion control and water recharge as priority ecosystem services. In these areas, the predominant land use

Successful restoration will depend on creating awareness of policies that guarantee landowners secure tenurial rights to trees and land and access to benefits from restoration.

Table 6 | Ecosystem Services Analysis

ECOSYSTEM SERVICES ANALYSIS	
Analysis and Methodology	• Stakeholder Consultation in Workshop Setting • Remote Sensed Imagery Analysis • Review of Secondary Data • Focus Group Discussion at Village Level • Validation of Findings in Workshop Setting
Objective	To identify the demand for ecosystem services and identify restoration interventions that can support the flow of these services.
Key questions	Which ecosystem services are critical for the population of Sidhi? Which ecosystem services (primary and cobenefits) can be generated through identified restoration interventions? How can synergies and trade-offs between ecosystem services be managed?
Key findings	**Key Finding 1** Landscape restoration in Sidhi can lead to: • Improved biodiversity conservation • Erosion control • Carbon sequestration • Fuelwood provisioning Stakeholders identified provisioning of fuelwood and fodder, erosion control, water recharge, and provision of food as critical ecosystem services required in Sidhi. Privileged men tended to prioritize regulatory services over provisioning services. Poor scheduled caste and scheduled tribe men and women prioritized provisioning services. **Key finding 2** Participants in consultations felt that implementing restoration interventions using appropriate native tree species can fulfill the primary ecosystem service needs of the local population and provide important cobenefits.
Method	*Biodiversity conservation:* Area was mapped on the basis of geospatial data on forest fragmentation (Global Land Cover Facility 2016) and buffer zones around protected areas that are legally designated for protection and conservation. *Erosion control:* Spatial layer on erosion control was developed using the Soil Conservation Service-Curve Number model (U.S. Soil Conservation Service 2004). *Carbon sequestration:* Estimates of potential carbon sequestration for forest areas based on Forest Survey of India (FSI). Note: Estimation of carbon sequestration through agroforestry interventions was not carried out. *Fuelwood provisioning:* Using the FSI data, biomass in forest areas was calculated to estimate supply of fuelwood.
Data collection and analysis tools	Following development of the spatial layers, the Ecosystem Services Diagnostic Tool enabled stakeholders to prioritize among competing demands and identify restoration interventions best suited for delivering the required ecosystem services.

Source: WRI India

Figure 8 | Critical Areas for Biodiversity Conservation

Legend

- Areas critical for biodiversity conservation
- Protected Areas
- River

Tehsil Boundary

0 5 10 20 30 Kms
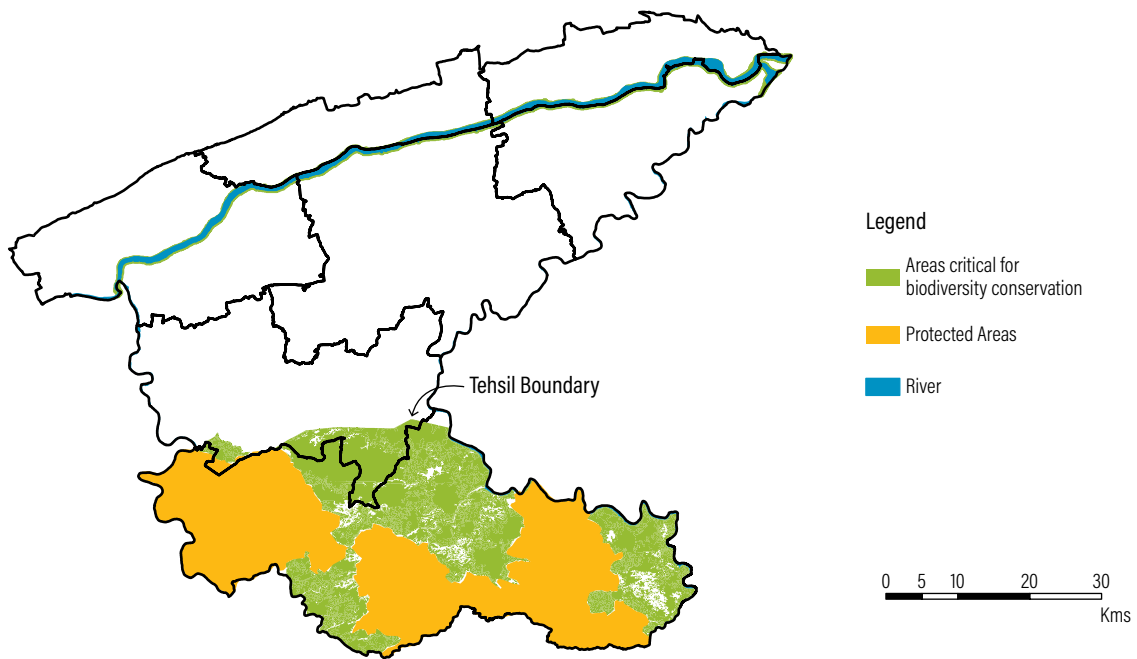
Source: WRI India

Figure 9 | Critical Areas for Erosion Control

Legend

- Areas Critical for Soil Erosion
- River

Tehsil Boundary

0 5 10 20 30 Kms
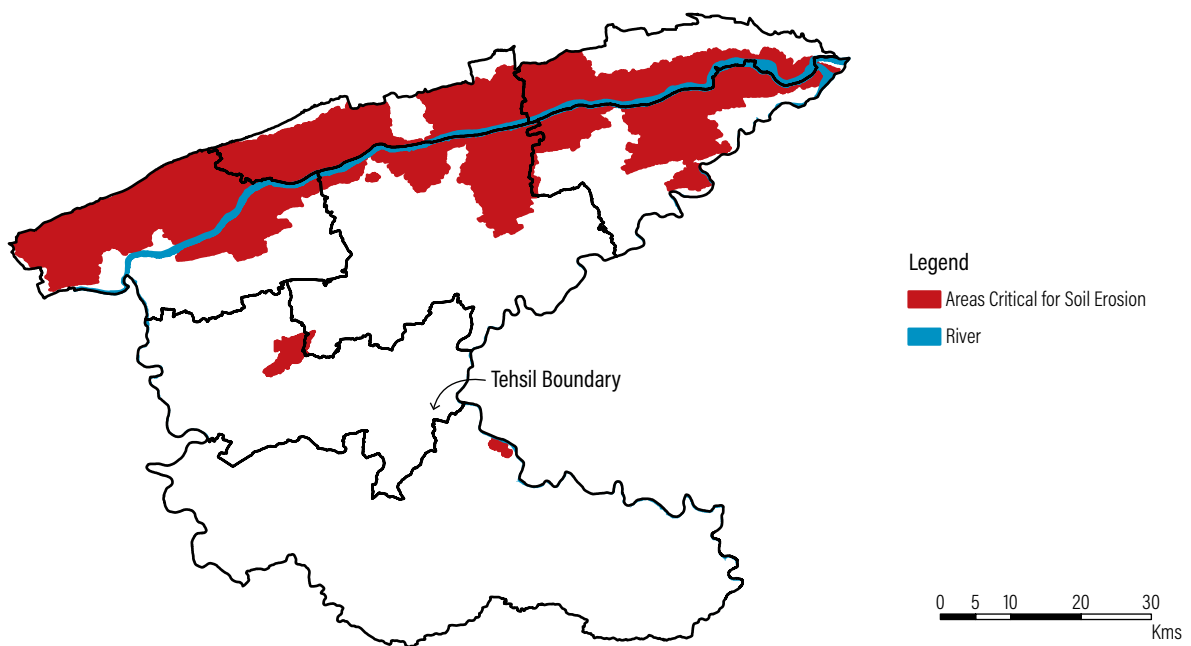
Source: WRI India

is irrigated agriculture and suitable restoration interventions identified are trees on boundaries, and agri-horti-forestry/wadi. Bamboo species are excellent for slope stabilization and can help address surface runoff. Bamboo could therefore be prioritized as the species to use on boundaries and for agri-horti-forestry.

Carbon sequestration

The amount of carbon that can be sequestered through restoration was identified only for areas in forest cover, using FSI's carbon stock data (FSI 2015). Our analysis indicates that restoration of Sidhi's forests could sequester 7 million metric tons of additional carbon over 10–20 years based on the species planted. This amounts to an increase in the carbon stock of 37 percent.

Fuelwood provisioning

The seven tehsils of Sidhi district are home to 238,474 households whose dependence on fuelwood to meet energy needs ranges from 78–97.5 percent. Stakeholder consultation suggests that average fuelwood consumption is between 5 and 10 kilograms per household per day. These data were extrapolated to the whole district and compared with the annual productivity of forests (Table 7). Analysis indicates that Kusmi is the only tehsil where productivity can satisfy the fuelwood demand whereas in the remaining six tehsils, demand exceeds annual productivity. Restoration interventions in these regions, both on forest and nonforest land, can prioritize fuelwood trees to help meet local demand.

The spatial distribution of opportunities for ecosystem service enhancement through landscape restoration interventions is shown in Figure 10.

Stakeholder preferences for different ecosystem services

We identified local stakeholder priorities across the seven tehsils in Sidhi using the Ecosystem Services Diagnostic Tool (Table 8).

Table 7 | Demand for and Availability of Fuelwood in Sidhi's Seven Tehsils

TEHSIL	NUMBER OF HOUSEHOLDS	NUMBER OF HOUSEHOLDS SOLELY DEPENDENT ON FUELWOOD FOR COOKING (PERCENT)	TOTAL FUELWOOD DEMAND, METRIC TONS/YEAR	AREA UNDER RESERVED FOREST, HECTARES	ANNUAL PRODUCTIVITY[a]
Churhat	25,054	19,578 (78)	35,730	7,449	14,898
Gopad Banas	56,716	47,186 (83)	86,114	39,405	78,810
Kusmi	18,865	18,400 (97)	33,580	39,989	79,978
Majhauli	38,217	36,514(95)	66,638	30,295	60,590
Rampur Naikin	44,804	41,156 (92)	75,110	18,560	37,120
Sihawal and Bahri[b]	54,818	45,882(84)	83,735	22,204	44,408

Notes:

[a]. The annual productivity of biomass in Sidhi is assumed to be two metric tons per hectare based on a literature review by Osuri (2016).

[b]. Bahri was carved out as a separate tehsil from Sihawal post Census 2011, hence is not listed as a separate tehsil in this table.

Source: Census 2011b and GoMP 2012

Figure 10 | Opportunities for Ecosystem Service Enhancement Determined by Ecosystem Services Diagnostic Tool

Legend

- Erosion Control & Water Recharge
- Provisioning of Fuelwood
- Food Security
- River

Tehsil Boundary

0 5 10   20   30
Kms
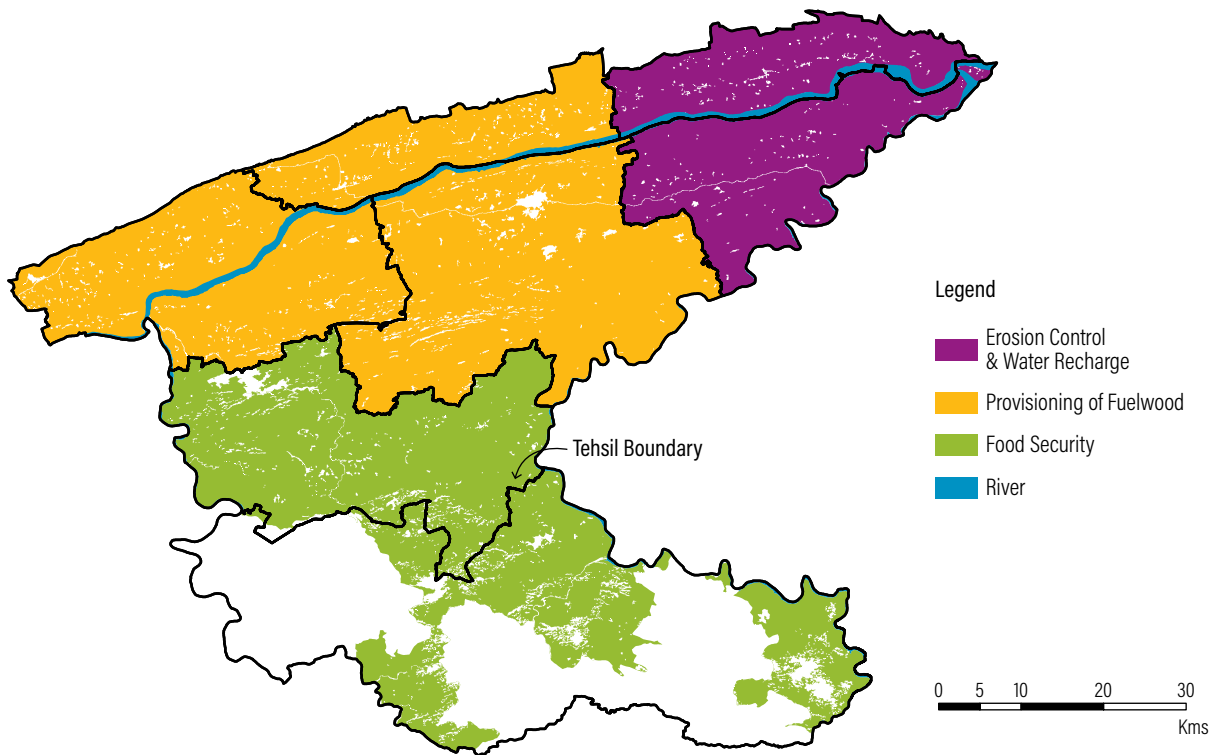
Source: WRI India

Table 8 | Ecosystem Service Preferences as Determined by the Diagnostic Tool

TEHSIL	ECOSYSTEM SERVICE PREFERENCE 1	ECOSYSTEM SERVICE PREFERENCE 2
Bahri	Water recharge	Erosion control
Churhat	Fuelwood	Fodder
Gopad Banas	Erosion control	Fuelwood
Kusmi	Provision of food	Erosion control
Majhauli	Water recharge	Provision of food
Rampur Naikin	Fuelwood	Fodder
Sihawal	Water recharge	Erosion control

Source: WRI India

3.4 Stakeholder Consultations and Data Analysis Yield Similar Priorities

Stakeholder consultations and our mapping analysis yielded similar results regarding the spatial distribution of preferences for enhancing different ecosystem services. For instance, upper-caste privileged male participants from Bahri and Sihawal tehsils prioritized water recharge and erosion control. Our analysis also indicates prioritizing erosion control measures in Bahri, Churhat, Sihawal, and northern regions of Rampur Naikin, given the high surface runoff caused by steep slopes, elevation, and negligible tree cover (see Figure 9).

In the northern part of Sidhi, Gopad Banas, Rampur Naikin, and Churhat tehsils, there is immense potential for planting trees on boundaries, and stakeholders expressed a preference for using fuelwood species in this intervention. This was emphasized especially by SC and ST men and women, because of the shortage of fuelwood in this region. These tehsils are largely agricultural, with relatively less forest and tree cover. More than 80 percent of the population depends on fuelwood for cooking (Census 2011c). Gopad Banas, Kusmi, and Rampur Naikin have the greatest potential to plant additional trees, according to mapathon results (see Table 6).

Common tree species that could provide fuelwood are babul and neem. Babul, saja, and dhawda are good providers of fodder (see Appendix D for scientific names). At the implementation stage, final selection of tree species selection should be based on the needs and requirement of men and women.

Gender and caste preferences for ecosystem services

During stakeholder consultations in Majhauli and Kusmi tehsils, upper-caste men identified water recharge and provision of food as key ecosystem services through the diagnostic tool (see Tables 8 and 9). In these tehsils, provisioning of fuelwood, fodder, and NTFPs was not prioritized because the areas have high forest cover and are perceived as self-sufficient. Participants emphasized that the region's reliance on rainfed agriculture means that food security is a primary concern. However, during focus group discussions with SC and ST women and men with no landholdings (except homestead land), fuel-wood and fodder provision emerged as a priority. A key finding of this assessment is that privileged men tend to value environmental regulatory services that support agricultural productivity more highly than they value provisioning services, whereas poor SC and ST men and women priori-tize provisioning services (Table 9).

Table 9 | Preferences for Ecosystem Services in Sidhi, Disaggregated by Gender

GENDER[a]	LAND OWNERSHIP[b]	PREFERENCE FOR ECOSYSTEM SERVICE
Upper-caste male	Large- and medium-size land holders	Erosion control, biodiversity conservation, water recharge, food provisioning
Upper-caste female	Not known	Food provisioning
SC and ST male	Marginal land holders or only homestead land	Fuelwood, non-timber forest produce, fodder, food provisioning
SC and ST female	No land titles. Homestead land	Fuelwood, non-timber forest produce, food provisioning

SC = scheduled caste. ST = scheduled tribe.

Notes:

[a] Gender - An intersectionality approach to gender has been used in this report. We believe, gender roles are socially constructed and accentuated by social inequalities, age, caste, marital status, class, race, etc.

[b] Marginal landholders – less than 1ha; small landholders – less than 2 ha; medium-size landholders – less than 10 ha.

Source: WRI India

The different preferences of men and women regarding ecosystem services can be explained by three factors that emerged during the stakeholder consultations in all tehsils.

- Men, mostly from upper castes/classes do not go to the forest themselves to collect fuelwood, and they perceived that resources are sufficient to meet their needs. Their responses stemmed from a broader resource availability perspective.

- Primarily poor SC and ST men and women revealed that they had no land title and that their access to forest lands had been restricted following creation of the buffer zone of the Sanjay Dubri Tiger Reserve. They perceived that their access to provisioning ecosystem services had declined.

- The differing responses of men and women also depended on their perceptions regarding access to land tenure and associated resource rights.

The larger implication of these differentiated preferences for the opportunity assessment is that such differences must be factored in when planning for implementation of restoration interventions.

ENABLING CONDITIONS AND BARRIERS

This section discusses the extent to which key enabling conditions are in place in Sidhi to facilitate implementation of landscape restoration, and identifies barriers to scaling.

Restoration interventions cannot be implemented successfully without recognition of the most important enabling conditions and barriers to progress (Table 10).

The factors deemed necessary for successful restoration are grouped under three themes—a clear motivation, enabling conditions in place, and capacity and resources for sustained implementation. The following discussion is based on the structure developed by the Restoration Diagnostic (Hanson et al. 2015).

4.1 Clear Motivating Factors

Key motivating factors for landscape restoration are summarized in Table 11.

Benefits

During the inception workshop in Bhopal, participants from Sidhi district, primarily upper-caste men, recognized the economic, social, and ecological benefits of landscape restoration. Male upper-caste farmers who work medium and large landholdings also showed interest in integrating restoration interventions into their agricultural practices.

Awareness

The level of awareness of local populations in Sidhi district about landscape restoration approaches and associated policies and regulations is limited. Upper-caste men, who have greater access to networks and information,

Table 10 | Enabling Conditions and Barriers

ENABLING CONDITIONS ANALYSIS	
Analysis and Methodology	· Stakeholder Consultation in Workshop Setting · Review of Secondary Data · Focus Group Discussion at Village Level · Validation of Findings in Workshop Setting
Objective	To identify key enabling conditions and barriers to implementation.
Key Questions	What are the key laws, policies, and attitudes that can enable implementation of landscape restoration in Sidhi? Which of these laws and policies are currently in place or missing?
Key Findings	**Key Finding 1** Existing programs, policies, and other enabling conditions need strengthening. Relevant stakeholders need greater awareness if Sidhi is to realize its restoration potential. **Key Finding 2** There is commitment to landscape restoration in the district from ongoing government initiatives and local champions. Leaders have shown willingness to take action.
Methods	Enabling conditions were identified by applying the Restoration Diagnostic developed by Hanson et al. (2015) at the inception workshop in Bhopal. Barriers to landscape restoration were identified during tehsil consultations and follow-up field visits. Enabling legislation for landscape restoration in Madhya Pradesh was identified through a legal mapping in collaboration with the Centre for Environmental Law (CEL), WWF-India. Ground truthing of the laws and policies applicable to Sidhi district was done through tehsil-level workshops, field visits, and interviews.
Data collection and analysis tools	A Restoration Diagnostic card game was developed based on Hanson et al. (2015) to identify enabling conditions, also known as key success factors, and barriers to restoration in Sidhi (see Appendix E). Desk review identified applicable laws, policies, and rules. CEL WWF-India undertook the ground truthing through interviews and during the tehsil workshops.

Source: WRI India

have relatively high awareness, whereas lower-caste poorer men and women are generally unaware of laws and policies related to restoration. Government officials and functionaries reportedly have mixed awareness of law and policy relevant to landscape restoration (see Appendix A).

4.2 Enabling Conditions in Place or Lacking

Key enabling conditions for landscape restoration are summarized in Table 12.

Table 11 | Motivating Factors for Successful Landscape Restoration in Sidhi

MOTIVATING FACTOR	IN PLACE?
Economic benefits	Yes
Social benefits	Yes
Environmental benefits	Yes
Communication of benefits	Partial
Identification of target areas for landscape restoration	No
Threat of disaster events	Yes
Presence of laws or policies for landscape restoration	Partial
Awareness of laws or policies for landscape restoration	Partial
Implementation of laws or policies for landscape restoration	Partial

Source: WRI India

Table 12 | Enabling Conditions for Successful Landscape Restoration in Sidhi

ENABLING CONDITIONS	IN PLACE?
Ecological conditions	Yes
Landscape is free of invasive plants	No
Landscape is free of invasive animals	No
Availability of seed bank, nursery, or underground root system	Yes
Availability of low-cost sources of native tree seeds and seedlings	Partial
Decline in competing demands	No
Presence of value chains	No
Right of access to benefits from landscape restoration	Partial
Laws and policies on landscape restoration are aligned and streamlined	Partial
Presence of laws and customary practices to restrict cutting or clearing of remaining natural forests	Yes
Laws and practices to restrict cutting or clearing remaining natural forests are adequately enforced	Yes
People living in and around target landscape are empowered to take decisions on landscape restoration	No
People living in and around target landscape enjoy the benefits of restoration	Partial
Roles, responsibilities, and rights clearly defined	Partial
Recognition of authority among stakeholders	Yes
Stakeholders sufficiently coordinated to design, implement, and monitor restoration	No

Source: WRI India

Ecological conditions

Sidhi's ecological conditions—soil, rainfall, temperature, and fire incidence—are conducive to implementing landscape restoration interventions. Sidhi has a variety of soils: alluvial, red sandy, red and yellow loamy, sandy, laterite, and loam. The district has a tropical climate and annual rainfall is 1,132.7 millimeters (CGWB 2013). No major natural fire incidents have been reported in the district.

Eight government nurseries operate in the district; five are run by the horticulture department and three by the forest department. These are not sufficient to implement the identified restoration opportunities. Our livelihood analysis (see Section 5), for instance, indicates that additional support is essential to develop approximately 65 community nurseries in Sidhi.

Underground root stock systems are present in the region and, according to our spatial analysis, would support ANR or FMNR depending on the land ownership and use. Farmers could be incentivized to support FMNR in revenue greenwash areas where agriculture is the predominant land use. Although areas have been delineated for ANR in undemarcated/deemed forest areas, policies to clarify land tenure must be enacted to enable successful regeneration of trees from the existing root stock.

Lantana and *Parthenium* are invasive plant species that commonly hinder restoration interventions throughout Madhya Pradesh and are also prevalent in the landscape. The forest department is involved in weeding out these species from the forest areas, but has not fully controlled the growth of invasive species.

Market conditions

Sidhi district is predominantly rural with farmers producing primarily for themselves or local markets. Farmers sell their vegetables in local markets or to local traders through weekly *haats* (local village markets) or block- or district-level *mandi*s (wholesale markets). Commercial farming that generates surplus production and achieves economies of scale is absent in the district. Markets for some of the minor forest products, like mahua (valued for its flowers and seeds), are moderately developed. Most of the traders control the local markets and trade to larger outside markets in Mandla, Ranchi, and elsewhere. The SC and ST population depends on collection of

mahua and other forest products for sustenance and they sell mahua and other produce to local traders at very low prices.

Field interviews undertaken as part of the livelihood analysis indicate that poorly developed markets in Sidhi are a disincentive for farmers to enhance their production. Small-scale entrepreneurial activities include some livestock rearing, fruit production, and bamboo crafts practiced by the Basod community, an SC artisan community traditionally dependent on bamboo for its livelihood. Recently, a few big landholders have planted orchards of a hybrid variety of mango, and fruits such as aonla, papaya, and lemon.

Postproduction processing facilities are limited in the district. Gandhigram, a state-owned enterprise facility center set up by the forest department, has the infrastructure to support processing. However, the facility has not functioned for the past few years due to lack of clear institutional direction (Box 1).

Overall, the district lacks market access and value chains to support livelihood opportunities from restoration. A major factor in Sidhi's undeveloped market structure is the lack of infrastructure, such as good storage facilities and a rail connection to larger markets in the region. The poor market structure is a financial disincentive for restoration in the district.

Policy conditions

CEL WWF-India mapped all relevant laws and policies related to landscape restoration in Madhya Pradesh. Although landscape restoration is not directly governed by a law or policy, it can be addressed through existing policy and legal frameworks, namely, the National Working Plan Code 2014, Panchayats (Extension to Scheduled Areas) Act, lower-caste poorer men and women 1996 (PESA), FRA 2006, and the Madhya Pradesh Lok Vaniki Act[16] 2001, among others (Figure 11).

Lack of tenurial clarity is a barrier to implementing landscape restoration interventions in the region. CEL, WWF-India's review of policies outlined FRA as one of the fundamental pieces of legislation that can enable successful community-led landscape restoration in the district on forest land, if community forest resource rights (CFRs) are recognized in the district (for details see Appendix F).

Assisted Natural Regeneration
- Madhya Pradesh Forest Rules 1960
- Madhya Pradesh Land Revenue Code 1959
- The Wildlife Protection Act, 1972
- Forest Rights Act, 2006
- The Indian Forest Act, 1927 (including state amendments)
- Madhya Pradesh Vrikshon ki Katai ka Pratishedh Ka Viniyam Niyam, 2007
- Madhya Pradesh Grazing Rules, 1986
- National Working Plan Code, 2014
- Panchayats (Extension to Scheduled Areas) Act, 1996

Mixed-species Plantation
- Madhya Pradesh Forest Rules 1960
- Madhya Pradesh Land Revenue Code 1959
- The Wildlife Protection Act, 1972
- Forest Rights Act, 2006
- The Indian Forest Act, 1927 (including state amendments)
- Madhya Pradesh Vrikshon ki Katai ka Pratishedh Ka Viniyam Niyam, 2007
- Madhya Pradesh Grazing Rules, 1986
- National Working Plan Code, 2014
- Panchayats (Extension to Scheduled Areas) Act, 1996

Riverbank Plantation
- Panchayats (Extension to Scheduled Areas) Act, 1996
- Madhya Pradesh Sinchai Prabandhan main Krishakon ki Bhagidari Adiniyam, 1999
- Madhya Pradesh Lok Vaniki, 2001

Laws, Policies, Codes Enabling Landscape Restoration in Sidhi

Pastureland development
- Madhya Pradesh Land Revenue Code 1959
- Madhya Pradesh Grazing Rules, 1986
- Panchayats (Extension to Scheduled Areas) Act, 1996

Bamboo Plantation
- Madhya Pradesh Land Revenue Code 1959
- Forest Rights Act, 2006
- National Working Plan Code, 2014
- Panchayats (Extension to Scheduled Areas) Act, 1996

Farmer-managed Natural Regeneration
- Madhya Pradesh Land Revenue Code 1959
- Madhya Pradesh Vrikshon ki Katai ka Pratishedh Ka Viniyam Niyam, 2007

Trees on Boundaries
- Madhya Pradesh Land Revenue Code 1959
- Madhya Pradesh Vrikshon ki Katai ka Pratishedh Ka Viniyam Niyam, 2007

Agri-Horti-Forestry (wadi)
- Madhya Pradesh Forest Rules 1960
- Madhya Pradesh Land Revenue Code 1959
- Forest Rights Act, 2006
- The Indian Forest Act, 1927 (including state amendments)
- Madhya Pradesh Vrikshon ki Katai ka Pratishedh Ka Viniyam Niyam, 2007
  Madhya Pradesh Lok Vaniki, 2001

Source: CEL WWF-India 2017.

We identified the relevance of policy to landscape restoration by considering the following factors:

- provisions and incentives that are mandated by law and their gender implications;

- institutional mechanisms that the policies/laws identified through various statutes for

enabling and implementing landscape restoration for different land uses; and

- governance mechanisms that are outlined in policy, for example, the gendered benefit-sharing mechanism, role of actors, and conflict resolution mechanism.

Stakeholder consultations, however, indicated that these laws, policies, and associated rules are poorly understood, which could impede the implementation of restoration initiatives and reduce their likely benefits (Table 13).

Limited awareness on transit permits and access rights

Laws and policies that restrict tree cutting are strictly enforced in the region. Transit permits (for hauling timber from one state to another) are required for most tree species, which can be granted by the gram panchayat (elected representatives of the gram sabha).[17] In Sidhi district, transit permits are de facto provided by the forest department. Legal mapping indicates that nilgiri, kaisurina, subabool, poplar, Israeli babool, vilayati babool, babool, and katang bamboo can be planted as trees on boundaries and bamboo plantations. These species do not require transit permits. Fruit bearing trees cannot be cut and their timber cannot be transported without a transit permit from the panchayat. However, harvesting fruits from standing trees is permitted (CEL WWF-India 2017).

Stakeholders have limited understanding of these policies, as evidenced by the implementation of the Sustainable Landscapes and Ecosystem Management (SLEM) project. The SLEM project worked with communities to restore more than 2,400 hectares of bamboo forests in the Sidhi district over four years in partnership with the forest department (Box 1).

Social conditions

Sidhi's population possesses the local knowledge and customary practices to support restoration in the district. However, communities' experience with the implementation of state programs, as well as with some private sector organizations, has bred distrust of new initiatives. During the tehsil workshops and focus group discussions, poor experience with a private company that persuaded people to buy seeds was highlighted. These pricey seeds turned out to be of very poor quality, resulting in skepticism regarding unknown private entities, especially those selling planting material.

Institutional conditions

There is immense potential to operationalize the Sidhi ROAM assessment through local institutions, if they are empowered and enabled to fulfill their mandates (see Box 1). Some of the local

Table 13 | Examples of Laws That Could Enable Landscape Restoration and Their Current Application in Sidhi

LAND USE	LAWS AND POLICIES SUPPORTING RESTORATION	RESTORATION INTERVENTIONS	CURRENT APPLICATION OF LAWS AND POLICIES
FOREST	Forest Rights Act 2006[a]	• For areas recognized under community forest resource rights (CFR): • Mixed-species plantation • Assisted natural regeneration • Bamboo plantation	There has been tardy implementation of Forest Rights Act 2006 in the district. No claims have been recognized under community forest resource rights under section 3(1)(i)(e). This legislation provides immense potential for landscape restoration in Sidhi. Approximately 90 percent of the recorded forest area under joint forest management in Sidhi is estimated to meet the minimum requirements for recognition under community forest resource rights in the district (See Appendix F).
		• For areas recognized under individual forest rights:[b] • Trees on boundaries • Agri-horti-forestry/wadi	As of March 2017, 1,331 individual forest rights had been recognized; the area recognized was less than the area claimed.
	National Working Plan Code (NWPC) 2014	• Mixed-species plantation • Assisted natural regeneration • Bamboo plantation	The working plan for Sidhi was developed in 2012, prior to enactment of NWPC 2014. The 2014 code will be followed for the working plan that will be developed in 2022.
	Madhya Pradesh Grazing Rules 1986	• Pastureland development	In Kusmi block, the rights of the community to the forest adjoining the village was restricted, after a few forest areas were notified as part of the buffer zone of Sanjay Dubri Tiger Reserve. There are restrictions on open grazing in forests, and accessing fodder and fuelwood in contravention to the Madhya Pradesh grazing rules.
	Madhya Pradesh Van Upaj Vyapar Viniyam Adhiniyam 1987	• Mixed-species plantation • Assisted natural regeneration	This act enables regulation of forest produce for the public interest. However, it has not been applied at its full potential because there are no incentives for farmers to undertake farm forestry due to poor institutional and market linkages, and absence of proper state-run markets in the district for forest produce except tendu leaves, which are nationalized produce.
AGRICULTURE	Madhya Pradesh Lok Vaniki Adhiniyam, 2001	• Mixed-species plantation • Assisted natural regeneration	There is lack of awareness about the legislation and poor political and institutional will to implement provisions of this act in the district which enables management of tree-clad in private and revenue areas. Notably, under the provisions of Lok Vaniki, in Dewas in western Madhya Pradesh successful regeneration has been undertaken and the local committee has obtained Forest Stewardship Council (FSC) certification and is managing 175 ha of certified forest (Raghavan and Srivastava 2002; FSC 2014). These models could be replicated in Sidhi.
	Madhya Pradesh Vrikshon ki Katai Niyam 2002	• Mixed-species plantation • Trees on boundaries	There is a lack of awareness about existing rules for cutting trees, and little political will to implement provisions of these rules in the district.

Notes:

a. This is the only legislation that has clearly stated gender benefits as well tenurial rights.

b. Forest Rights Act 2006 recognizes and vests individual land right titles to scheduled tribes and other traditional forest dwellers who can prove their cultivation of forest land on or before December 13, 2005. Other traditional forest dwellers must show proof of three generations of residence and their dependence on the forest or forest land for bona fide livelihood needs.

Source: GoI 2006; GoMP 1986, 1987, 2002, 2001, 2015; stakeholder consultations.

institutions that work in fragmented pockets of the district are self-help groups under the livelihood mission, midday meal schemes, gram panchayats, joint forest management committees/other forest committees, and water-user associations. Access to information; knowledge of laws, rights and entitlements; the role of leadership; and the flow of funds determine the functioning of these institutions. Token participation by women in the daily functions of local institutions is predominant.

In Sihawal and Majhauli, two farmer producer organizations (FPOs)—Sihawal Farmer Producer Company Limited and Majhauli Farmer Producer Company Limited—are supported by NABARD (SFAC 2018). Although these FPOs are at a nascent stage, with appropriate institutional and capacity-building support they could be important in the supply chain for implementing restoration interventions.

Greater coordination between key government departments is possible (see Figure 11). In policy, the roles and responsibilities of stakeholders involved in planning and implementing landscape restoration in an area are clearly defined.

However, in practice, stakeholder understanding of roles and rights is suboptimal. For instance, recognition of community forest resource rights under the FRA is limited (see Appendix F).

4.3 Capacity and Resources for Sustained Implementation

Key capacity and resource factors to enable implementation of landscape restoration in Sidhi are outlined in Table 14.

Leadership

Various government departments show commitment to landscape restoration, demonstrated by past or ongoing programs run by watershed development, horticulture, Madhya Pradesh Rural Livelihoods Mission (MPRLP), the forest department, and zilla panchayats. Local champions include the president of the zilla panchayat, a former member of the Madhya Pradesh state legislature assembly, the former head of the Gandhigram initiative, and the head of the Lok Vaniki Samiti, all of whom have expressed their support for restoration in Sidhi.

Table 14 | Capacity and Resource Factors for Successful Landscape Restoration in Sidhi

KEY CAPACITY AND RESOURCE FACTORS FOR LANDSCAPE RESTORATION	IN PLACE?
Charismatic, committed champion for restoration	Yes
Expressed, long-term commitment to landscape restoration	Partial
Local knowledge on implementation of landscape restoration	Yes
Local knowledge on restoration can be scaled up to national level	Partial
Extension services and other means of awareness-raising are adequately resourced	Partial
Existing landscape restoration interventions are based on best practices and climate-smart approaches	No
Measures to limit displacement of degradation to unrestored areas	No
Sufficient funds are available to promote landscape restoration	Partial
Sufficient incentive is available to promote landscape restoration	No
Financial incentives and funds are readily accessible	No
Presence of performance-monitoring system	No
Early restoration successes are communicated	No
Earlier successful landscape restoration interventions are implemented in other areas	No

Source: WRI India

Knowledge

Rural extension services for agriculture are partially in place in the district. There is potential for greater linkages between agricultural universities and Krishi Vigyan Kendra (KVK; agriculture science centers) to build capacity and knowledge on identified landscape restoration interventions.

Awareness of new agricultural practices among upper-caste relatively well-off men is high and they recognize the importance of market access and building sustainable value chains for tree-based produce from the region. However, they cautioned against developing a restoration intervention strategy that focused too much on timber as a benefit since this involves a longer gestation period and would also interfere with the biodiversity in the region. Awareness of new agricultural practices among women of all castes is low because women are primarily involved with ancillary agricultural activities. They also reported no access to agriculture extension and KVK workers.

Finance and incentives

Most of the funding for landscape restoration comes from state budgetary allocations, with the exception of work done under the SLEM project in the district. Access to benefits from restoration, however, is poorly defined, which affects local participation. For instance, benefits from the protection and rehabilitation of degraded bamboo forest under SLEM have been restricted due to stakeholders' lack of understanding of policies that could be leveraged to make this initiative a success story (see Box 1).

Feedback

No performance-monitoring system for restoration exists in Sidhi.

4.4 Key Actors and Networks that Can Enable Implementation of Landscape Restoration in Sidhi

A stakeholder assessment determined which stakeholders, institutions and networks might be mobilized to change business as usual in Sidhi and operationalize the findings of the Sidhi ROAM assessment (Table 15).

Ongoing landscape restoration-related activities

As described earlier, several laws, policy directives, and guidelines mandate landscape restoration as a priority. Consequently, landscape restoration in Sidhi emerges as a priority intervention for various district departments. The forest department, for instance, is mandated to manage the forest area in the distict with local stakeholders. As part of the restoration mandate, the forest department is responsible for establishing plantations through a participatory consultative process under a decadal working plan prepared using the National Working Plan Code 2014 guidelines (MoEFCC 2014). Additionally, the SLEM project was implemented by the district forest department with support of the United Nations Development Programme (UNDP; Laurie and Mathur 2016). The panchayat and rural development department are responsible for managing watershed-related work, initiating work under the employment guarantee scheme, housing and sanitation, and other rural development programs.

Work undertaken under the watershed programs, and the natural resource management component of the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) falls under the restoration mandate. Additionally, the Madhya Pradesh State Rural Livelihood Mission (SRLM) works under this department and overlaps with restoration initiatives on the ground in terms of livelihoods associated with restoration. Implementation of all these programs is supported through local institutions like joint forest management committees, gram panchayats, and watershed development committees.

In the Sidhi district, as part of restoration initiatives under SRLM, home gardens and agroforestry schemes have benefited thousands of participants. The horticulture department has also promoted home gardens and fruit orchards (Table 16). The state department of farmer welfare and agriculture development is responsible for supporting agricultural production through innovative agricultural practices, agroforestry, pest management, and activities under national watershed programs, among other things. Overall, this stocktaking of existing initiatives and institutions in the district indicates that most of the funding for restoration has been through ongoing government programs supported by central or state allocations.

Table 15 | Key Actors, Networks, and Activities for Successful Landscape Restoration in Sidhi

SOCIAL LANDSCAPE ANALYSIS	
Analysis and Methodology	• Stakeholder Consultation in Workshop Setting • Focus Group Discussion at Village Level • Validation of Findings in Workshop Setting
Objectives	Take stock of ongoing activities on restoration. Map actors and networks that need to be involved for implementing landscape restoration. Identify relationships that can be leveraged to implement and scale landscape restoration.
Key questions	What are the ongoing restoration-related activities in the landscape? Who are the actors that can enable implementation of landscape restoration in the Sidhi district? What is the functional state of local institutions in the landscape?
Key findings	**Key Finding 1** The social landscape analysis identified the divisional forest officer (DFO); the district collector, and farmers and local residents as key stakeholders in implementing and scaling landscape restoration in Sidhi. The social landscape analysis identified a lack of diversity among actors working on restoration, pointing to the need to encourage nongovernmental organizations (NGOs) to operate in the district and dedicate time to gaining the trust of the local community. **Key Finding 2.** Tapping into peripheral actors like NGOs and Krishi Vigyan Kendras (KVKs) to raise awareness about landscape restoration may help break the business-as-usual scenario.
Method	Stocktaking of ongoing activities was done by collecting secondary information on ongoing programs and activities and through subdistrict stakeholder consultations. Mapping of stakeholders and networks was done through participatory social network analysis using Net-Map—a methodology developed by Schiffer (2007) and adapted in Buckingham et al. (2018). An institutional checklist was applied at tehsil-level consultations (see Appendix E).
Data collection and analysis tools	Checklist for stocktaking, see Appendix E. Participatory social network analysis was conducted to identify actors and networks critical to implement restoration. Three social network maps were developed, one with stakeholders in Bhopal; one with representatives of key district stakeholders; and one with officials of the forest department. Findings from the three social network analysis mapping activities were merged to develop a social landscape opportunity map of Sidhi. The relationship maps are made with Kumu, a powerful, free, data-visualization software. The functional state of existing institutions was gauged through the institutional matrix checklist with participants in the tehsil consultations (see Appendix E).

Source: WRI India

Table 16 | Existing Restoration Programs in Sidhi and Beneficiaries, 2016

INTERVENTION BY	TYPE OF INTERVENTION	NUMBER OF VILLAGES	NUMBER OF SELF-HELP GROUPS	BENEFICIARIES	AREA
State Rural Livelihood Mission (SRLM)	Home gardens	416	3,095	23,770	na
SRLM	Agroforestry (trees on boundaries)	414	na	19,802	108,420 square meters
Department of Horticulture	Home gardens	na	na	1,846	398 ha
Department of Horticulture	Wadi	na	na	28,666	28,666 ha

na = not available.

Source: GoMP 2016.

Actors who can enable implementation of landscape restoration in Sidhi

Our social network analysis of the Sidhi district provides insights into the actors who need to be involved to operationalize Sidhi's landscape restoration potential. Key stakeholders are the forest department's divisional forest officer, the district administrator/collector, the zilla pan-chayat, farmers, and local residents. Of the above, the divisional forest officer, the current president of the zilla panchayat, local community members, and the collector emerged as the key actors for ensuring implementation of any restoration intervention as part of their mandated roles and responsibilities, and because of their linkages to the wider network (Figure 12 and Table 17).

Figure 12 | Social Network Map of Actors Who Could Support Implementation of Landscape Restoration in Sidhi
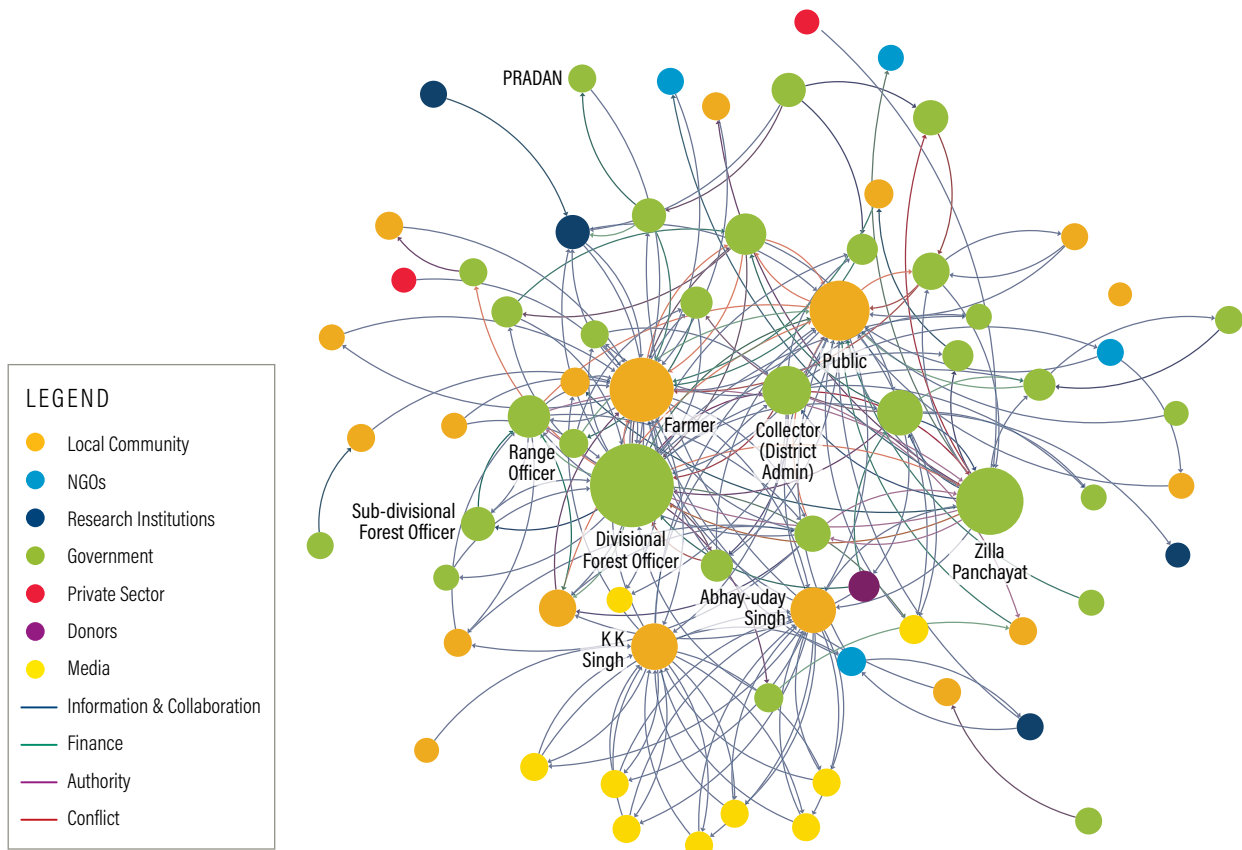
Source: Buckingham et al. 2018.

Table 17 | Findings Emerging from Social Network Mapping

CENTRALITY	WHO?
Connectors	Divisional forest officer, zilla panchayat, farmer, public, collector (district administration)
Spreaders	Divisional forest officer, zilla panchayat, public, farmer, former member of legislative assembly
Gatekeepers	Divisional forest officer, farmer, public, zilla panchayat president, zilla panchayat
Change champions	Divisional forest officer, subdivisional officer, forest range officer, zilla panchayat, farmers

Source: Buckingham et al. 2018.

Additionally, the media—though currently peripheral in the network—emerged as an important actor for disseminating information on landscape restoration. The media actively covered the assessment process and attended the consultative workshops. The social network map of Sidhi indicates that most of the media organizations and the local community are connected via a former member of the legislative assembly and president of the zilla panchayat. These two actors, given their reach and connectivity, can also be change champions. They could disseminate information quickly, given their connectedness within the network.

Functional state of local institutions

Several local institutions like the forest rights committees, joint forest management committees, and self-help groups, among others, can provide necessary support and channel benefits from restoration to communities. However, most of these committees are inactive because of an absence of sustained flows of benefits and lack of projects with definitive plans of action that can bring committee members together.

At the periphery of the social network are the research institutions in the district like KVK, the Indira Gandhi National Tribal University, Amarkantak, financial institutions like NABARD, print media representatives, and NGOs like Professional Assistance for Development Action (PRADAN). A key insight from the social landscape analysis is that Sidhi's social network is large, but lacks a common goal. Different entities work in their own silos, and coordination and convergence of activities is suboptimal, especially between the forest department and programs under the district administration. Tense relations between the forest department and other government departments and farmers were identified as a barrier to implementing potential interventions for landscape restoration. The forest department itself acknowledged tense relations when working with other stakeholders in the district.

The implications of these findings for operationalizing landscape restoration are immense. The restoration opportunity map identifies the region's biophysical landscape and the interventions suitable for addressing land use challenges. However, implementing the findings of our analysis requires tapping key institutions, nodes, and champions that can promote the restoration agenda. Mobilizing the help of change champions and peripheral actors like research institutions, KVK, and media representatives to raise awareness about landscape restoration is critical to changing the business-as-usual scenario. The peripheral actors can also contribute information about landscape restoration from other networks to which they are connected. The information, knowledge, and resources of peripheral actors could be leveraged to set up a collaborative platform with a common goal of accelerating landscape restoration in Sidhi and facilitating convergence of activities on the ground.

The social network in Sidhi could help overcome some of the barriers related to stakeholders' poor knowledge of laws and policies, and lack of knowledge or capacity to implement landscape restoration. It could also help to create a monitoring system. This collaborative platform driven by first-degree change champions (i.e., those most directly able to create change—primarily government officials and farmers) and second-degree change champions (primarily local elected leaders and champions), and peripheral actors like NABARD, the media, and NGOs could drive the landscape restoration agenda in the district. There is ample incentive to convene this collaborative platform given the multitude of livelihood benefits to be derived from implementing landscape restoration in the district.

LIVELIHOOD BENEFITS FROM IDENTIFIED RESTORATION INTERVENTIONS

The potential livelihood benefits that could flow from the identified restoration interventions are immense. We estimate that restoring more than 363,000 hectares in Sidhi district would have multiplier effects across sectors. The benefits of restoration could be especially high for agri-horti-forestry/wadi, which could improve food security while also diversifying income sources for landowners. More than 45 percent of ST landholders with less than two hectares could benefit from wadi.

Our livelihood analysis is outlined in Table 18.

Table 18 | Potential Livelihood Benefits from Successful Landscape Restoration in Sidhi

LIVELIHOOD ANALYSIS	
Analysis and Methodology	• Household Survey • Focus Group Discussion at Village Level • Validation of Findings in Workshop Setting
Objectives	Assess the livelihood potential from the identified restoration interventions in terms of enhanced productivity, enterprise development, and diversification. Identify likely short-, medium-, and long-term livelihood benefits, disaggregated by gender, following identified restoration interventions.
Key questions	What livelihood benefits could flow from the identified restoration interventions? What is the increase in enterprise development and economic diversification that could result from each intervention? How do these benefits differ by timeframes, gender, and class?
Key Findings	**Key Finding 1** Sidhi's livelihood assessment indicates the potential for at least eight types of tree-based interventions on more than 363,000 hectares. This will require an estimated 39.50 million plants, which could create wage opportunities of 3.7 million person-days over two years, resulting in INR 710 million (US$ 10 million) in wage income and an additional INR 592.3 million (US$ 8.5 million) from sale of saplings. **Key Finding 2** When developed, value chains for key tree species like aonla, bamboo, jackfruit, mahua, moringa, and palash could create additional employment opportunities for 30,000 persons over two to five years, including women, unemployed youth, and landless people.
Method	The livelihood analysis was led by WRI India's partner, the Institute of Livelihood Research and Training, Bhopal. Livelihood mapping of Sidhi involved livelihood profiling at the gram panchayat level. The lowest tier of governance, the gram panchayat comprises members elected by the gram sabha, the assembly of all adults in the village). To ensure a representative sample of the district, a multistage sampling technique was used to cover and ensure representation of different geographies such as plain and hilly terrain, forested and nonforested areas, concentration of tribal and nontribal populations, and livelihood patterns. Ten percent of the adults in each village were selected for a household survey, focus group discussions, and key person interveiws. Additional details on the methodology are outlined in Appendix G. The household survey also enabled creation of a socioeconomic baseline, and a baseline of landholding and land use for the district. The livelihood profiling of the district yielded a comprehensive list of interventions that could be pursued in Sidhi. These were matched with the identified restoration interventions and were shortlisted for further subsector analysis based on select parameters.
Data collection and analysis tools	Checklist for focus group discussion and household survey questionnaires for assessing livelihood potential and value chain analysis.

Source: WRI India

5.1 Enhance Wage Employment to Curb Migration

Planting approximately 39.5 million native trees would realize the identified landscape restoration potential. Tree planting would create additional wage employment of 3.95 million person-days, which would result in a total income of INR 710.76 million (US$10.15 million) for the working population.

Mainly poor tribal men and women migrate for up to three months to the wheat-growing belt of Uttar Pradesh and Madhya Pradesh to work in agricultural fields as wage laborers. The livelihood assessment indicates that seasonal migration from Sidhi during rabi cropping season (typically December to March) is prevalent. Longer migrations (three to nine months) to larger industrial centers like Mumbai, Surat, Ahmedabad, Bengaluru, and Delhi for employment is prevalent among men for skilled and unskilled work opportunities. Members of about one-fifth of the rural households in Sidhi district practice migration. An estimated 0.18 million of Sidhi's marginal workers (approximately 12 percent of the population) could benefit from additional days of wage employment in the district (Census 2011b), which could mitigate out-migration.

5.2 Enhance Livelihoods by Developing Value Chains for Six Tree Species

Value chains could be created for the tree species of aonla, bamboo, jackfruit, mahua, moringa, and palash, given implementation of the eight landscape restoration interventions. These value chains would aid in livelihood diversification in the district, increase income for the local population, and generate opportunities for those seeking wage employment. In addition to these species, mango, guava, papaya, and lime have high potential for livelihood enhancement; however, due to paucity of time we could not do a full value chain assessment for them.

Business sectors around the six tree species would need to be developed. We estimate that creating the new value chains would require setting up approximately 3,153 microenterprises (trading, processing, and retailing), 65 cluster federations, and 5 producer companies. The livelihood

Value chains could be created for the tree species of aonla, bamboo, jackfruit, mahua, moringa, and palash, given implementation of the eight landscape restoration interventions. These value chains would aid in livelihood diversification in the district, increase income for the local population, and generate opportunities for those seeking wage employment.

assessment indicates that establishing these enterprises and companies could directly provide about 30,985 jobs for women, unemployed youth, and landless people in the district. Setting up 65 community nurseries could generate additional income of INR 592 million from the sale of approximately 39 million saplings. In addition, we anticipate that primary producers could increase their gross income by up to 300 percent from bulk sales in bigger markets and value-added production at the local level. Potential tree-based enterprises that could be set up in Sidhi include oil extraction, cattle feed production, and handicrafts (Table 19).

Table 19 | Potential for Tree-Based Enterprises in the Sidhi District

TREE SPECIES	ENTERPRISE	RURAL POPULATION THAT COULD BENEFIT
Mahua	Oil extraction (mahua and other seed)	Non-timber forest produce (NTFP) collectors[a] and women
	Cattle feed and pesticides enterprise[b]	NTFP collectors and women
	Mahua[c] collection net-making enterprise	NTFP collectors and women
Bamboo	Bamboo basket-making enterprise (domestic use products)	Basod population and rural poor
	Incense making	Rural poor and women
	Handicrafts	Rural poor and women
	Furniture making	Rural poor and women
	Charcoal making	Rural poor and women
	Retail marketing enterprise of bamboo products	Rural poor and women
Palash	Lac[d] production enterprise (in areas where palash is in abundance, at least one enterprise in each village could be set up)	Rural poor and landholders
	Lac processing enterprise-(seedlac and shellac at cluster level)	Rural poor including landless
	Fuel production and sale enterprise at cluster level	Rural poor including landless
	Organic dye-making enterprise at cluster level	Rural poor including landless
	Vermi-compost making and sale enterprise at cluster level	Rural poor including landless

Notes:

a. NTFP collectors are tribal and other forest-dependent people living in the vicinity of the forest and collecting minor forest produce.

b. The mahua seed cake is reported to have insecticidal and pesticidal properties and used as organic manure in crops like rice and sugarcane.

c. Mahua tree (*Madhuca indica*) is native to the Indian subcontinent and grows on rocky and sandy soil in deciduous forests. Mahua is used for several purposes such as food, edible oil, wood, fodder, liquor making, and medical purposes.

d. Lac is a natural resin secreted mainly by the Indian lac insect (*Kerria lacca kerr*), which thrives on the tender twigs of specific host trees such as palash (*Butea monosperma*), ber (*Ziziphus mauritiana*), and kusum (*Schleichera oleos*). Raw lac is a source of resin, dye, and wax.

Source: ILRT 2018.

When planning restoration interventions, selecting native tree species that complement agricultural production is crucial. Palash was identified as a versatile species for agroforestry during consultations. Because it does not shade crops, palash could be intercropped (stakeholder consultations January 7–11, 2017). Production of lac, a natural resin secreted by an insect associated with palash trees, could supplement farm income and generate alternative livelihood opportunities.

5.3 Encourage Other Benefits from Restoration Interventions

Pastureland development to increase the availability of fodder, forage, and green manure is a key restoration intervention in Sidhi. Together with other types of restoration, pastureland improvement would reduce soil erosion and improve soil nutrition and health. Our livelihood analysis indicates that increased fodder supply would raise the productivity of allied sectors such as dairy farming and goat rearing. The livelihood analysis also indicates that a 10 percent increase in production of the kharif crop (cropping season

is typically June to September depending on the southwest monsoons) would provide an income gain of INR 438.5 million. A 20 percent increase of the rabi crop would lead to an income enhancement of INR 786.4 million.[19]

5.4 Barriers to the Development of Value Chains in Sidhi

The livelihood analysis of Sidhi indicates that to realize the full potential of value chains for the six identified tree species, several constraints need to be addressed at four stages.

- *Preproduction stage*: lack of availability and access to good quality saplings, planting material, and other inputs.

- *Production stage*: inadequate extension services, poor knowledge of good production practices, limited or no access to advanced production technologies, lack of skilled workforce.

- *Processing stage*: inadequate processing facilities and enterprises to add value to tree-based products.

- *Postproduction stage*: inadequate market development and inequitable pricing due to trade practices including the strong nexus of local traders, inadequate participation of primary collectors and producers in the existing value chain, and poor access to outside markets.

Market structure

Necessary changes include adjusting existing market relationships, which are skewed in favor of traders who control the value chain and pricing mechanism in the district. Figure 13 illustrates a potential new institutional structure for the Sidhi value chain. It involves the network of primary collectors and their self-help groups, cluster-level federations, producer organizations, and a district union.

Figure 13 | Potential Structure for Value Chain Development in Sidhi
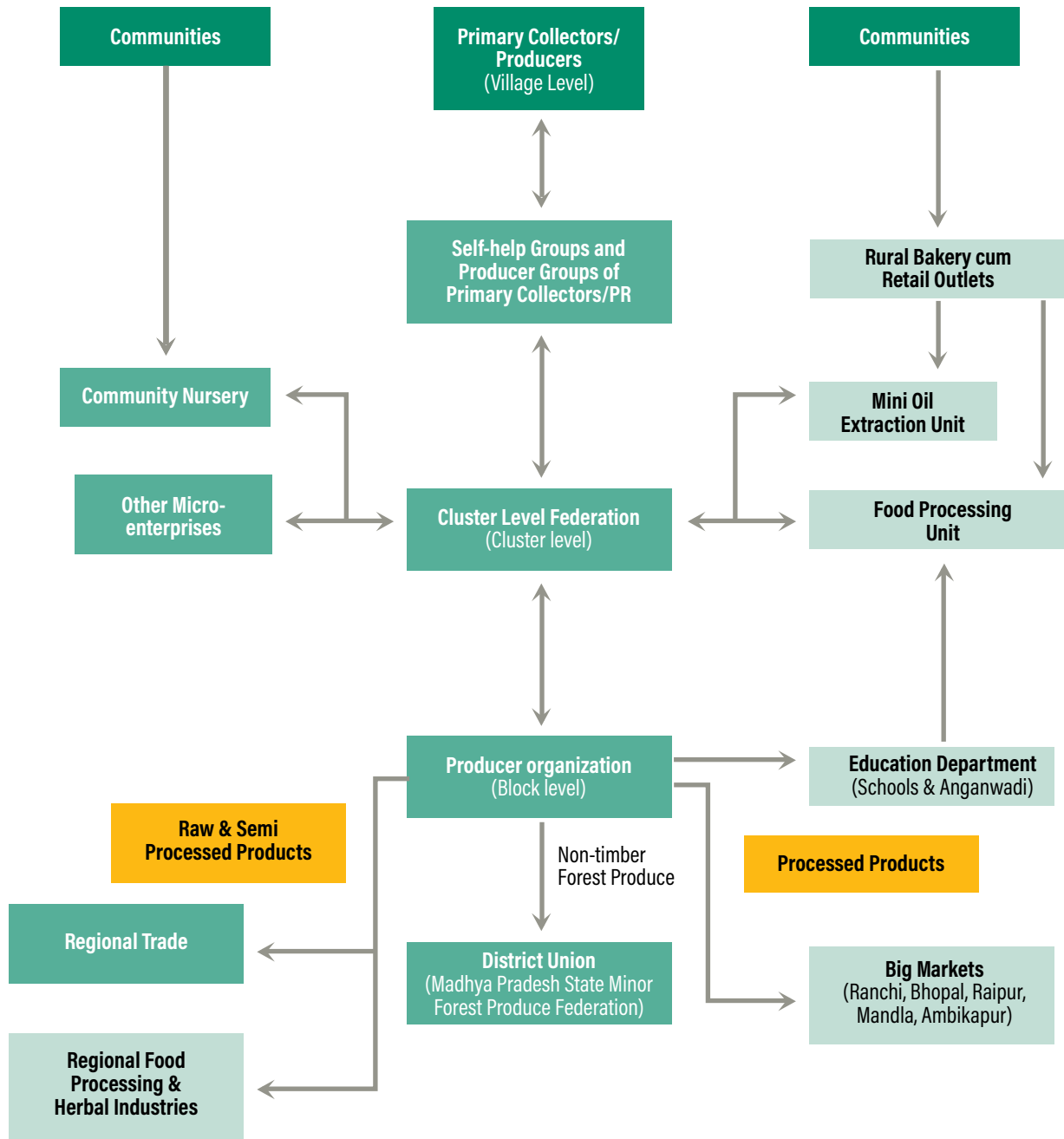
Notes:

a. Cluster-level federation—a secondary-level federation of self-help groups, covering a cluster of villages, generally about one-fourth of a block.

b. Producer organization—a legal entity formed by primary producers, such as farmers, milk producers, fishermen, weavers, rural artisans, and craftsmen. It can be a producer company, a cooperative society, or any other legal form that provides for sharing profits or benefits among the members.

c. District union—implements state government policies on the trade of the minor forest produce.

Source: ILRT 2018.

Livelihoods in Sidhi could be enhanced by creating new opportunities through value chain interventions at the preproduction, production, processing, trading, and marketing stages. For instance, the now-closed processing unit at Gandhigram initiated under the SLEM project could be revived, and similar processing units could be set up by the government or businesses to enhance production in the region. Additionally, farmer producer organizations in Sidhi that are in the initial stages of development could flourish if adequate institutional support is provided.

Distribution of benefits

Landscape restoration focuses on tree-based interventions to achieve development and environmental outcomes. Unfortunately, the benefits of landscape restoration may be skewed in favor of upper-caste men who are titleholders, have larger landholdings, and enjoy greater access to information and resources in the district. The majority of farmers in Sidhi are poor: 20 percent have one to two hectares, and another 57 percent have less than one hectare (Census 2011b).

Due to this skewed land ownership pattern, the practice of sharecropping[20] is predominant. The tenant (*bataidar*) and the owner (*bhumiswami*) share the cost of the seeds, fertilizers, and the profits from the output. However, because the rights to the trees on farms are reserved for the owner, tenants have no incentive to plant or protect trees (field consultations, September 5, 6, and 9, 2017). Implementing restoration interventions will require innovative mechanisms designed to steer benefits to women and other marginalized groups.

The value chain structure we propose (see Figure 13) could help build these mechanisms by encouraging formation of self-help groups, producer groups, community nurseries, and other such initiatives involving women and other poor and marginalized groups. This kind of initiative will be critical in Sidhi as our findings indicate that understanding of access to resources available for restoration is strongly differentiated by gender (see Box 2).

BOX 2 | GENDERED UNDERSTANDING OF ACCESS TO RESOURCES, RULES, AND ACCEPTABLE SOCIAL NORMS AMONG WOMEN IN SIDHI

During focus group discussions, a stark contrast emerged between women from upper-caste households and women from scheduled caste (SC) and scheduled tribe (ST) households regarding access to resources and understanding of their rights in decision-making. The SC and ST women want a greater role in the gram sabha (village assembly) but lack access to information on when the gram sabha meetings are scheduled. In contrast, upper-caste women members who were part of the gram panchayat (lowest tier of governance, composed of members elected by the gram sabha) tended not to participate in those meetings, and their husbands fulfilled their responsibility. Institutional mechanisms will be necessary to ensure that landscape restoration initiatives are implemented in a more inclusive way.

Women play a prominent role in agriculture among SC and ST households in the district whereas upper-caste women are predominantly engaged in household chores and have limited decision-making power. Women from SC and ST households work as agricultural laborers and spend considerable time collecting fuelwood to meet household energy requirements, which limits their time for other activities.

COST OF FINANCING THE IDENTIFIED RESTORATION INTERVENTIONS

This section explores the cost of implementing the identified restoration interventions, potential sources of public and private finance, and mechanisms for channelizing funds.

Implementing landscape restoration in Sidhi district will require unlocking public and private sector investments (Table 20).

6.1 Costs of Restoration in Sidhi

We estimate the costs of fully implementing the restoration activities identified in the ROAM assessment at between INR 4.37 billion (US\$65 million) and INR 7.46 billion (US\$ 111 million) over 5 to 10 years (Table 21). The cost of restoration has been presented as an upper and lower limit, because our estimated cost per hectare is based on different government estimates used by different government departments and NABARD. The varying estimates take into consideration the type of land ownership, the implementing agency, and the type of intervention. These varying factors explain why different restoration projects require a timeframe of between 5 and 10 years to implement.

We emphasize that the objective of our cost analysis is not to present a detailed financial mapping of expenditures and allocations to support restoration activities in Sidhi. This would require additional resources and is highly recommended for prospective implementing agencies.

Table 20 | Estimated Cost of Financing Restoration in Sidhi

COST ANALYSIS	
Analysis and Methodology	· Review of Secondary Data · Validation of Findings in Workshop Setting
Objectives	Map the types and sources of finance available and most suitable to support implementation of restoration interventions. Estimate the costs associated with implementing the identified restoration interventions.
Key questions	What are the per hectare costs for implementing each of the interventions emerging from the assessment? What are the current and potential sources of funding for restoration in the district? What are the funding mechanisms and the terms on which the money is allocated to those involved in implementing restoration? What are the channels through which the money physically reaches those implementing restoration?
Key findings	**Key Finding 1** The total estimated cost of implementing landscape restoration in Sidhi is between INR 4,372 million (US\$ 65 million) and INR 7,463 million (US\$ 111 million) over 5 to 10 years. The costs will vary depending on the form of land ownership, the implementation agency, and the type of interventions. **Key Finding 2** Though there are multiple existing and potential sources of financing, the current flow of funds is fragmented and may prove suboptimal if financial resources are not consolidated at the district level by the state government.
Method	We based our cost estimates on the cost norms available from local sources in the district. These costs norms and emerging results were discussed with National Bank for Agriculture and Rural Development officers. Additionally, fund flows in the district were assessed and mapped through social network analysis.
Data collection and analysis tools	Data for cost norms were collected through a stocktaking checklist (Appendix H).

Source: WRI India

The cost of restoration per hectare in Sidhi which is around INR 12,500 to INR 21,000 aligns with the Government of India estimates of INR 20,000 per hectare when adjusted for inflation for the year 2018 (GoI 2014b; MoEF 2009) for the duration of the project.

Notably, the cost of restoration in areas with unclear tenure has not been estimated. Undertaking restoration intervention in these areas would first necessitate policy intervention to clarify land ownership, and the implementation costs could only be estimated once this is done. Adding the cost of clarifying tenure could lead to much higher costs associated with restoration, and hence should not be overlooked (Ding et al. 2016).

When our cost estimates for restoration interventions were based on cost norms that span a period of years, we adjusted the per hectare costs for inflation to arrive at current (2018) costs using the formula $P_n = P(1 + i)^n$ where:

Pn = Total inflated estimated cost

P = Base estimated cost

i = 8 percent (average inflation as measured by the consumer price index between 2008-18 by the World Bank [2019])

n = Difference between base year and selected year.

The budget for the district development plan in Sidhi was INR 4,583 million in 2015. The costs of restoration estimated by this study are comparable to those of the district development plan. `

6.2 Financing Restoration in Sidhi

Our cost analysis indicates that the financial landscape of Sidhi is diverse and, if tapped, could contribute to realizing Sidhi's restoration potential. Restoration costs can be met through a combination of public and private investment by unlocking finance through mechanisms such as loans, grants, and incentives.

Funding for current restoration initiatives is usually channeled through ongoing central and state government schemes. For instance, the forest department established 23,845 hectares of plantations between 2011 and 2015, primarily ANR, mixed-species plantations, teak plantations, pasture development, and bamboo plantations under the National Bamboo Mission.

Sidhi district has a low credit absorption capacity (ability to access and use finance in the form of a loan and to repay the debt). This is demonstrated by a negative trend in the credit flow in the district since 2014-15 in loans and advances and a low credit-to-deposit ratio as indicated by the potential linked credit plan for the district prepared by NABARD for 2017-18 (NABARD 2016). Figure 14 illustrates existing and potential financing mechanisms to spur restoration in Sidhi.

Discussions with NABARD and other government stakeholders indicate that multiple mechanisms could be used to diversify the channels through which funds flow in Sidhi district. Examples include NABARD's potential linked credit plan, the rural infrastructure development fund, and international climate finance like the Adaptation Fund.[21] Corporate social responsibility funds could also be tapped.

Despite, or perhaps because of, the multiple funding sources and financial channels that exist or might be developed, the current flow of funds is fragmented and may prove suboptimal for achieving environmental and development outcomes. More collaboration among government departments and programs is crucial to realize the full benefits of the eight landscape restoration interventions we have identified.

Table 21 | Estimated Costs of Landscape Restoration in Sidhi

LAND WITH POTENTIAL FOR RESTORATION INTERVENTIONS (HA)	LAND UNDER VARIOUS FORMS OF OWNERSHIP (HA)[a]	COST PER HECTARE, 2018 ESTIMATES (INR)	COST OF RESTORATION IN 2018-19 (MILLION INR)		DATA SOURCES
			Lower Limit	Upper Limit	
Assisted natural regeneration (ANR) (51,374)	Recorded forest area (47,925)	13,000	623	623	TFRI 2007
	Revenue greenwash / revenue other / private (3,449)	13,000	45	45	TFRI 2007
Mixed-species plantation (19,285)	Recorded forest area (6,904.80)	29,000	200	200	GoMP 2012
	Revenue greenwash / revenue other / private (10,451.78)	29,000	303	303	GoMP 2012
ANR/Mixed-species plantation (42,131)	Recorded forest area (31,336)	13,000 to 29,000	407	909	GoMP 2012, TFRI 2007
	Revenue greenwash / Revenue other / Private (10,795)	13,000 to 29,000	140	313	GoMP 2012, TFRI 2007
Bamboo plantation (19,578)	Recorded forest area (16,952)	36,000	610	610	GoMP 2012
	Revenue greenwash / Revenue other / Private (2,626)	88,000	231	231	NABARD 2016
Farmer-managed natural regeneration (FMNR) (10,151)	Revenue greenwash (2,537)[b]	850 –1,050	2	3	Reij and Garrity 2016
Agri-horti-forestry (66,210)	Recorded forest area (14,944)	14,500 –51,000	217	762	GoMP 2016
	Revenue greenwash / Revenue other / Private (51,265)	14,500 – 51,000	743	2,614	GoMP 2016
Trees on boundaries (143,628)	Revenue greenwash / Revenue other / Private (143,628)	5,300	761	761	GoMP 2016
Riverbank (3,063)	Recorded forest area (806.39)	29,000	23	23	GoMP 2012
	Revenue greenwash / Revenue other / Private (2,256)	29,000	65	65	GoMP 2012
Total land 355,420			4,370	7,462	

Recorded forest area = areas owned and managed by the forest department and recorded as "forests" in government records. Revenue greenwash = land governed by the revenue department that could have forests as land use. Revenue other = land governed by the revenue department that could have agriculture or wasteland as per government categorization. Private = land owned by private holders.

Notes:

[a.] The potential area of restoration will not be the sum of the potential areas under different types of land ownership. Refer to Appendix H for details.

[b.] Since the land ownership for FMNR is revenue greenwash and land use is agricultural, we are assuming costs for only 25% of the potential area.

Source: WRI India.

SOURCES

- ✓ Government Funding
- ✓ Development Banks
- ✓ Retail Banks
- ✓ Private Funding
- ✓ Multilateral Funding
- ➕ Bilateral Funding

CHANNELS

- Government Agencies
- Research and Extension
- Private for profit
- Non-profit intermediaries

MECHANISMS

- ✓ Public Expenditure
- ✓ Grants
- ✓ Loans
- ➕ Tax Incentives
- ➕ Guarantees
- ➕ Bonds
- ➕ Market Payments

INTERVENTIONS

- Mixed-species Plantation
- Assisted Natural Regeneration
- Bamboo Plantation
- Agri-Horti-Forestry (wadi)
- Trees on Boundaries
- Riverbank Plantation
- Pastureland development
- Farmer-managed Natural Regeneration

Legend:
- ✓ Existing sources and mechanisms
- ➕ Potential new sources and mechanisms
- ● Interventions with current funding
- ● Interventions that are not funded

Source: WRI India

A WAY FORWARD FOR SIDHI

This assessment identifies opportunities to implement landscape restoration in 76 percent of Sidhi's land area. Restoration could provide a range of ecosystem services and developmental benefits including creation of 30,000 jobs. However, barriers to implementation include a lack of technical knowledge about restoration practices such as farmer-managed natural regeneration; lack of nursery development; low awareness of policies, laws, and regulations; lack of infrastructure such as cold storage; and poor market linkages. The path forward for operationalizing Sidhi's opportunity assessment requires addressing these barriers and leveraging the actors and networks, financial institutions, and local champions identified in our analysis.

7.1 Accelerators

An accelerator is a structured, time-bound program that simultaneously builds the capacity of a specific group of stakeholders through rapid and intense knowledge-sharing. For example, WRI's Land Accelerator is bringing together 15 African businesses from nine countries for training, mentoring, and networking with the goal of building their business and technical capacity and connecting them to finance.

We propose four types of accelerators for Sidhi—policy, knowledge, technology, and market and business—to address the barriers described earlier (Table 21). These accelerators will create a cohort of stakeholders including farmers, local entrepreneurs, businesses, and media that can spur restoration and help develop restoration value chains, spark new economic opportunities, protect the environment, and support the flow of ecosystem benefits. This process is visualized in Figure 15.

7.2 Policy Accelerators

Policy accelerators bring together decision-makers including representatives from the National Bamboo Mission, the Madhya Pradesh State Rural Livelihoods Mission (MPSRLM), the district collector, zilla panchayat, departments of agriculture, horticulture, and tribal development, and the forest department. According to our findings, these stakeholders are already working on restoration-related activities, albeit in fragmented ways. A greater initiative to share mandates and the experiences of different departments is needed. Increased collaboration can identify synergies in terms of goals and actions, and joint application for public funds, for example, from MGNREGS.

In Madhya Pradesh and Uttarakhand, innovative policymakers have mainstreamed adaptation by using sectoral budgets (Dinshaw et al. 2018). This approach could be adopted for restoration in Sidhi. Key schemes and programs that might be targeted to identify possible funding synergies or closer working relations include MPSRLM, state allocations under the GIM, MGNREGS, allocations under the Compensatory Afforestation Fund Management and Planning Authority, the tribal development fund, the watershed development fund, the rural infrastructure development fund, the producers' organization development fund, formation and promotion of joint liability groups, self-help groups, and FPOs.
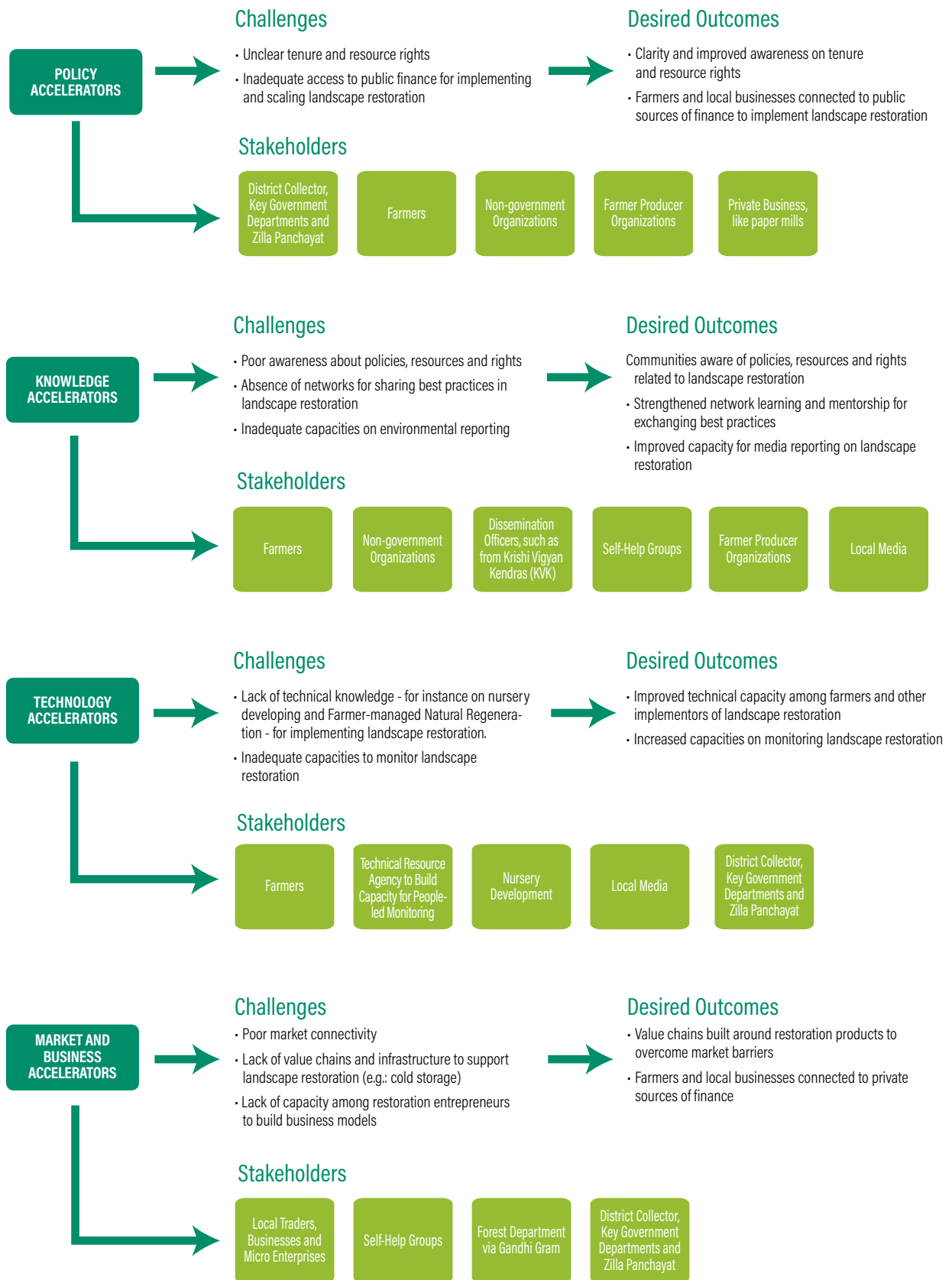
This report has highlighted the multiple benefits that could flow from implementing landscape restoration in Sidhi. Operationalizing these benefits requires the development of project pipelines. This could be undertaken with support from financial institutions like NABARD or tapping international climate finance, and implemented by a technical agency with support from farmers, local civil society organizations, and FPOs.

The policy accelerator would also address barriers for implementing restoration. Key barriers include issues of transit permits, harvesting rights, and weak and unclear tenure and resource rights under FRA. The policy accelerator could focus on clarifying, for instance, rights of the local population in the buffer zone of Sanjay Dubri Tiger Reserve. Efforts could be made to revive the Gandhigram enterprise facility that has been nonfunctional for the past few years because of a lack of clear institutional direction from the forest department.

Defining interventions for each type of land use will aid in identifying actors, institutions, and programs to implement interventions. For instance, 16,080 hectares of forests under private ownership have restoration potential and are suitable for ANR, mixed-species plantations, riverbank planting, and bamboo planting. The forest department could work with landowners to implement these types of restoration projects. Mixed-species plantations, bamboo plantations, ANR, or riverbank plantations could be supported through enabling policies such as the Madhya Pradesh Lok Vaniki Act 2001.

Ways to operationalize the findings of our opportunity assessment were discussed at the "Way Forward" workshop in Sidhi on February 3, 2018 (see Appendix A). The workshop revealed unanimous support for the findings, where state and district officials, civil society organizations, and other participants discussed pathways to implement restoration opportunities. One outcome was the formation of a high-level expert consultative group, which could take forward the discussion. This group has representation from state leadership, change champions, and organizations that are in the periphery of the network.

POLICY ACCELERATORS

Challenges
- Unclear tenure and resource rights
- Inadequate access to public finance for implementing and scaling landscape restoration

Desired Outcomes
- Clarity and improved awareness on tenure and resource rights
- Farmers and local businesses connected to public sources of finance to implement landscape restoration

Stakeholders

| District Collector, Key Government Departments and Zilla Panchayat | Farmers | Non-government Organizations | Farmer Producer Organizations | Private Business, like paper mills |

KNOWLEDGE ACCELERATORS

Challenges
- Poor awareness about policies, resources and rights
- Absence of networks for sharing best practices in landscape restoration
- Inadequate capacities on environmental reporting

Desired Outcomes
- Communities aware of policies, resources and rights related to landscape restoration
- Strengthened network learning and mentorship for exchanging best practices
- Improved capacity for media reporting on landscape restoration

Stakeholders

| Farmers | Non-government Organizations | Dissemination Officers, such as from Krishi Vigyan Kendras (KVK) | Self-Help Groups | Farmer Producer Organizations | Local Media |

TECHNOLOGY ACCELERATORS

Challenges
- Lack of technical knowledge - for instance on nursery developing and Farmer-managed Natural Regeneration - for implementing landscape restoration.
- Inadequate capacities to monitor landscape restoration

Desired Outcomes
- Improved technical capacity among farmers and other implementors of landscape restoration
- Increased capacities on monitoring landscape restoration

Stakeholders

| Farmers | Technical Resource Agency to Build Capacity for People-led Monitoring | Nursery Development | Local Media | District Collector, Key Government Departments and Zilla Panchayat |

MARKET AND BUSINESS ACCELERATORS

Challenges
- Poor market connectivity
- Lack of value chains and infrastructure to support landscape restoration (e.g.: cold storage)
- Lack of capacity among restoration entrepreneurs to build business models

Desired Outcomes
- Value chains built around restoration products to overcome market barriers
- Farmers and local businesses connected to private sources of finance

Stakeholders

| Local Traders, Businesses and Micro Enterprises | Self-Help Groups | Forest Department via Gandhi Gram | District Collector, Key Government Departments and Zilla Panchayat |

Source: WRI India

7.3 Knowledge Accelerators

Our assessment revealed significant gaps in awareness of policies, regulations, and best practices related to restoration. Knowledge accelerators could be planned that will bring together cohorts of restoration practitioners including farmers, FPOs, SHGs, KVK, and community leaders from other parts of Madhya Pradesh and India. These accelerators will connect stakeholders, support mentoring, and exchange information such as the experience of chemical free, natural and organic farming.

Overall, a series of knowledge-building initiatives in the district could create an enabling environment for adaptive learning and pave the way for landscape restoration. For example, discussions could accelerate knowledge about the appropriate tree species to use and about related policies and laws, and on disseminating information on restoration through the media. Since farmers and the public emerged as crucial change agents in Sidhi in our social network analysis, knowledge accelerators should be organized in the local language.

A knowledge accelerator to highlight the benefits of a diverse range of trees, especially native species among the farmers emerged as crucial. The selection of tree species should account for gender- and class-disaggregated benefits expected from planned restoration interventions. As elsewhere in India, Sidhi consultations revealed differences in tree preferences among men and women: while men preferred cash crops or commercial trees, women were keen on trees that would provide fuelwood and fodder. This difference was reflected along caste lines as well, with people from tribal communities preferring trees that provide provisioning services—specifically food, fuelwood, and fodder.

Another important focus area is to improve community awareness of laws, policies, and legislation related to restoration. Accelerators could also create a cohort of media actors to enhance environment reporting and amplify the successes of landscape restoration.

7.4 Technology Accelerators

Technology accelerators would build capacities for implementing and monitoring restoration by developing a learning platform that should be available in the local language in mobile form to enable widespread access. The accelerator could bring together resource agencies, KVK, and the local population to develop knowledge and skills in nursery development to ensure a good planting stock of native species. There are eight government nurseries in Sidhi, five of which are run by the horticulture department and three by the forest department. Community-led nursery development could accelerate the number of trees available for restoration.

Access to the extension services of KVK, improved knowledge of innovative restoration practices like farmer-managed natural regeneration, and greater capacities for monitoring restoration interventions are all important target areas. The accelerator will build capacity, support stabilization and strengthening of the network of nurseries, and encourage increased investment by creating conditions that enable investors to plan and operate on multiyear time horizons.

7.5 Market and Business Accelerators

Market-oriented accelerators seek to spur development of value chains, improve market access, and ensure that livelihood benefits from restoration flow to dependent populations. Poor market access is the result of the district's remote location, with poor rail, road, and air connectivity. Our opportunity assessment found that value chains can be developed around six key tree species: aonla, bamboo, jackfruit, mahua, moringa, and palash. Market and business accelerators would focus on overcoming demand and supply side barriers to scaling landscape restoration. For example, business accelerators would bring together private sector companies, such as Orient Paper Mills, NGOs with experience in this sector, local leaders, and community members to establish agreements between the community and the private sector and operationalize value chains, for instance, around bamboo. The processing facility in Gandhigram which is equipped to develop bamboo-based products such as agarbatti and jewelry, among others, could also be leveraged.

APPENDIX A. STAKEHOLDER CONSULTATIONS

The ROAM research team held numerous consultations with stakeholders, workshops, meetings of three working groups, and reviews of work produced throughout the three phases of the program. These consultations are listed in Table A1.

Table A-1 | Restoration Opportunities Assessment Methodology Stakeholder Consultations over Three Program Phases

FOCUS	STAKEHOLDER CONSULTATION	OBJECTIVE
ROAM PHASE I. Preparation and Planning	Inception workshop— Landscape Restoration for Climate and Communities: Understanding the Opportunities and Challenges in Madhya Pradesh Total participants: 52 July 22–23, 2016, Bhopal	Identify pathways to scale-up landscape restoration as a strategy for climate, with direct benefits to local communities in Madhya Pradesh. Introduce the Restoration Opportunities Assessment Methodology (ROAM) developed by the International Union for Conservation of Nature (IUCN) and WRI, and discuss its adaptation and implementation in India.
ROAM PHASE II. Data Collection and Analysis	Tehsil workshops to stock-take restoration opportunity interventions in the district. Four subdistrict (tehsil-level) consultations were organized with participants from all the seven tehsils in the Sidhi district Total participants: 82 January 7–11, 2017 in the Bahri-Sihawal, Kusmi, Majhauli, and Rampur Naikin, tehsils of district Sidhi, Madhya Pradesh.	Engage a diverse group of stakeholders to stock-take opportunities and challenges, and identify institutional capacity and suitable interventions to scale landscape restoration in Sidhi.
	Participatory mapathon on Collect Earth Total participants: 22 Farmers, youth, and students from Sidhi, as well as students and young professionals well versed in the Collect Earth tool, GIS and remote sensing. March 27-31, 2017 at the Banker's Institute of Rural Development, Lucknow.	Set a baseline of tree cover and tree count for Sidhi. Identify the current status of interaction between trees and farmlands in Sidhi. Identify potential for increase in tree cover in Sidhi. Leverage local knowledge to gain better understanding of high-resolution satellite imagery. Create awareness of landscape restoration among local stakeholders.
	Focus Group Discussions Total participants: 85 September 5, 6, and 9, 2017 in the tehsils of Churhat, Kusmi, Majhauli, and Rampur Naikin of the Sidhi district in Madhya Pradesh.	Provide a more nuanced understanding on social inclusion and gender relations to inform our analysis of the restoration opportunity in the Sidhi district.

PARTICIPANT AFFILIATIONS	TYPE OF CONSULTATION
Sidhi Zilla Panchayat, Umaria Zilla Panchayat, Madhya Pradesh Forest Department, Centre for Environment Law, WWF- India, Centre for Advanced Research & Development (CARD), Forest-PLUS, Barkatullah University, Bhopal, Ultratech Cement Limited, Mahindra and Mahindra, Institute of Livelihood Research and Training, Center for Land Governance, NR Management Consultants (NRMC), Ekta Parishad, ITC -Social Investments Program, Manipal University, CARE India, Artison Agrotech Company, Action for Social Advancement (ASA), Foundation for Ecological Security, Manipal University, Indian Institute of Forest Management (IIFM), Jawaharlal Nehru Agricultural University, Environmental Planning And Coordination Organization (EPCO), and WRI India.	Opening plenary on the key building blocks of landscape restoration at scale in Madhya Pradesh chaired by the state election commissioner, MP, followed by plenary discussions to outline the design principles to be considered for landscape restoration in context of the changing climate concerns in the state and discussions with local political leadership on their experience and perception of landscape restoration. Break-out groups did stock-take on restoration activities in Madhya Pradesh, to identify the key land use challenges in the state and to conduct the social network mapping and the Restoration Diagnostic.
Farmers; locally elected leaders of panchayat and water-user associations; representatives of the zilla panchayat, departments for rural development, watershed, and forests; civil society organizations, and representatives from farmer producer company.	WRI India explained to the participants in each workshop the objectives of these group discussions as well as the concept of landscape restoration, its benefits to communities, and the ROAM approach. An open floor discussion was held on the dependence of fuelwood in the district, types of trees found in the district and the potential for landscape restoration. A detailed participatory mapping was conducted to identify areas of high soil erosion, potential restoration interventions, canals, and other land use activities. An institutional stocktaking was also conducted to identify the presence or absence of key institutions critical to scaling landscape restoration.
Farmers, youth, and students from Sidhi, as well as students and young professionals well versed in the Collect Earth tool, GIS and remote sensing.	WRI India conducted a week-long mapathon using data collection tool Collect Earth, and very high-resolution satellite images, to study land use in Sidhi district. The data was collected by 10 young professionals and 10 locals for an area of around 380,000 hectares (1,470 sq. miles) to study potential for landscape restoration and sustainable land use with the objective of improving livelihood opportunities in the district.
Eight focus group discussions were conducted either with women or with men and women.	WRI India conducted field visits in the district to glean perceptions of the local communities who were not represented in the subdistrict consultations.

FOCUS	STAKEHOLDER CONSULTATION	OBJECTIVE
ROAM Phase II. Data collection and analysis: Livelihood benefits analysis	Livelihood assessment was conducted between May 2017 and January 2018. 40 gram panchayats and 75 villages were selected by sampling techniques to conduct household surveys, focus group discussions, and key person interviews by the Institute of Livelihood Research and Training (ILRT), Bhopal, which led the livelihood assessment.	Assess the livelihood benefits from the identified restoration interventions for enhanced productivity, enterprise development and diversification. Identify likely short-, medium-, and long-term gendered livelihood benefits through identified restoration interventions.
ROAM PHASE II. Data Collection and Analysis: Stakeholder analysis	Social Network Analysis in Sidhi District, Madhya Pradesh Total participants: 12 April 18, 2017, Sidhi	Understand who can help implement and scale landscape restoration in Madhya Pradesh for the identified target landscape, and the pilot district of Sidhi.
	Social Network Analysis – Forest Department Total participants: 12 September 7, 2017, Sidhi, Madhya Pradesh	Reveal important local insights into the role and working of the district forest department in landscape restoration.
ROAM STAGE III. Results to Recommendations Restoration opportunities mapping + Ecosystem Services Diagnostic tool	Assessing the Landscape for restoration opportunities in Sidhi: A Prevalidation Workshop Total participants: 106 September 8, 2017, Sidhi, Madhya Pradesh	Share the emerging narrative from the restoration opportunities assessment for the Sidhi district including the fuelwood potential.
Restoration opportunities mapping + Ecosystem Services Diagnostic tool	Landscape Restoration in Sidhi: The Way Forward Total participants: 214 February 3, 2018, Sidhi, Madhya Pradesh	Present findings from the ROAM assessment undertaken in Sidhi between October 2016 and September 2017. Discuss the way forward to operationalize Sidhi's landscape restoration opportunity assessment findings.
ROAM STAGE III. Results to Recommendations: Restoration opportunities mapping	National Technical Working Group Meeting on Landscape Restoration Opportunities Mapping and Monitoring Total participants: 20 August 23, 2017, Bengaluru	Present the progress on spatial assessment at the landscape level along with the proposed restoration interventions. Discuss the methodology and initial findings on prioritization of restoration opportunity for ecosystem services.

PARTICIPANT AFFILIATIONS	TYPE OF CONSULTATION
Officials from the forest department; Madhya Pradesh Minor Forest Produce (Trading & Development) Cooperative Federation Ltd; horticulture department, Krishi Vigyan Kendra; Krishi Upaj Mandi; State Rural Livelihoods Mission; Integrated Watershed Management Program; zilla panchayats, Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS); Khadi and Village Industries Department in Sidhi. Managers and members of Processing Units in Bharatpur, Gandhi Gram, Kuan Gram, Songarh and Thadipathar; mahua collectors, growers of aonla, bamboo, jackfruit and moringa including aonla growers at Mauganj, Rewa District; CEO, Son Tati Farmer Producer Company; petty traders (Kochiyas), small and big traders of aonla, bamboo, jackfruit, mahua, and moringa at village, haat-bazar, block, and district levels. Big traders of mahua at Sarai, Singrauli District and jackfruit at Mauganj, Rewa District; representatives of NGO-Sarvodaya Samaj Kalyan Samiti implementing River Revival Project in Sidhi block; Mahua Oil Extraction Units, Sidhi; Orient Paper Mill, Amalai, Shahdol.	Household survey, focus group discussions, key-person interviews.
Representatives from department of rural development, zilla panchayat, and watershed; locally elected leaders of panchayat, and water-user associations, farmers, local champions and local NGOs.	Participatory social network analysis was conducted by mapping connectivity between actors as outlined in the guidebook, Mapping Social Landscapes: A Guide to Identifying the Networks, Priorities, and Values of Restoration Actors (Buckingham et al. 2018, p 28).
Sidhi Forest Department	Participatory social network analysis was conducted by mapping connectivity between actors as outlined in the guidebook, *Mapping Social Landscapes: A Guide to Identifying the Networks, Priorities, and Values of Restoration Actors* (Buckingham et al. 2018, p 28).
Farmers, Sarpanch (head of the gram panchayat), representatives of the zilla panchayat, Sidhi forest department officers, civil society organizations, local political leaders, and representatives of a farmer producer company.	WRI India presented the emerging restoration opportunities analysis to the participants for comments and feedback. The Ecosystems Services Diagnostic was also tested at the workshop.
Sidhi zilla panchayat officials, farmers, NABARD, CARD, ASA, The Corbett Foundation, Orient Paper Mills, Madhya Pradesh State Rural Livelihoods Mission, Bamboo Mission, Chief Election Commissioner and former Chief Secretary of the state of Madhya Pradesh, ILRT, Madhya Pradesh Vigyan Sabha, BASIX, Foundation for Ecological Security (FES), WWF-India, Bharatiya Agro Industries Foundation, Srijan, Samarthan, the horticultural department of Sidhi and WRI India.	WRI India presented the landscape restoration opportunity for the Sidhi district to the participants. Post presentation, a high-level panel discussion on the way forward to operationalize the findings was chaired by Mr. Parasuram, Chief Election Commissioner, MP. Thereafter, the chair and the panel received comments and feedback from local communities. As next steps, WRI India offered to convene the planning and technical expert consultation to take forward the discussion from the way forward workshop.
Bharati Vidyapeeth, International Growth Research and Evaluation Center (IGREC), IIFM, WWF-India, Strand, Gujarat Institute of Desert Ecology (GUIDE), MS Swaminathan Research Foundation, Indian Institute of Science (IISC), FES, French Institute of Pondicherry (IfP), Technology for Wildlife, Vindhya Environment and Livelihood Trust (VELT) and WRI India.	The findings of Sidhi's restoration opportunity potential emerging from the spatial analysis component of the project were presented for comments from the technical working group members, which were incorporated into a revised restoration opportunity map for the Sidhi district.

FOCUS	STAKEHOLDER CONSULTATION	OBJECTIVE
ROAM STAGE III. Results to Recommendations: Integrating gender, tenure, and resource rights, and governance considerations within the opportunity assessment	National Technical Working Group Meeting on Land, Policy, Governance and Gender Total participants: 11 March 14, 2018, New Delhi	Discuss how ROAM has been adapted to the Indian context to enable landscape-level planning taking into consideration gender, governance, tenure and resource rights. Present findings from WRI India's assessment of restoration opportunities in Sidhi district and highlight how gender, tenure, and governance were incorporated in the assessment.
ROAM STAGE III. Results to Recommendations: Livelihood benefits analysis + cost analysis	National Technical Working Group Meeting on Restoration Finance and Economics Total participants: 15 July 5, 2018, New Delhi	Discuss the estimated cost of restoration, and the livelihood analysis. Gather input on the key factors for successfully scaling landscape restoration in India.

APPENDIX B: CROSS-CUTTING ISSUES OF GENDER AND SOCIAL INCLUSION, TENURE AND RESOURCE RIGHTS, AND GOVERNANCE

In this assessment, gender and social inclusion, tenure and resource rights, and governance were underscored as cross-cutting issues across the six components of analysis (Table B1).

Table B-1 | Integrating Cross-Cutting Issues in the Sidhi ROAM Assessment

COMPONENT OF ANALYSIS	GENDER AND SOCIAL INCLUSION	TENURE AND RESOURCE RIGHTS
Restoration Opportunities Mapping	Not applicable for biophysical mapping.	Land ownership used as a base layer for determining the most suitable landscape restoration interventions.
Ecosystem Services Analysis	Delineated differentiated ecosystem service priorities for men and women and marginalized groups.	Differentiated ecosystem service priorities based on presence or absence of tenurial security.
Policy, Legal, and Institutional Analysis	Delineated key success factors and barriers for landscape restoration for men, women, and marginalized groups.	Tenure emerged as a key enabling condition for successful landscape restoration.
Stakeholder Analysis	Incorporated perceptions of women and marginalized groups during stocktaking regarding existing interventions	Created socioeconomic baselines and baseline of land holding and land utilization patterns for the district.
Livelihood Benefits Analysis	Examined potential livelihood benefit in the medium and long terms for land holders, women, youth, and landless people.	Examined potential livelihood benefits in the short, intermediate, and long terms for different land holders and landless people.
Cost Analysis	Estimated costs based on state policy guidelines on flow of funds to women, scheduled caste, scheduled tribe, and marginal groups.	Delineated cost of restoration for different land uses.

PARTICIPANT AFFILIATIONS	TYPE OF CONSULTATION
The Energy and Resources Institute (TERI), WWF-India, Indian Institute of Technology (IIT) Bombay, former Indian Statistical Institute (ISI) professor, IUCN, Vasundhara and WRI India.	The methodology and findings from incorporating gender, tenure and landscape governance within ROAM for India was presented for comments. CEL, WWF-India presented the legal mapping methodology and findings. The findings and work were appreciated by the technical working group which then discussed a way forward for operationalization of these findings.
IUCN, National Institute of Public Finance and Policy (NIPFP), WWF-India, Wildlife Institute of India (WII), Hindustan Unilever Limited (HUL), ILRT, NABARD Consultancy Services (NABCONS) and Infrastructure Development Finance Company Bank.	The methodology and findings of estimating the cost of implementing landscape restoration in the Sidhi district was presented for inputs. The methodology for estimating cost was found to be appropriate. ILRT presented the livelihood assessment methodology and findings. The assessment report was circulated to the technical working group for further comments.

GOVERNANCE		
Actors	Rules	Practices
Actors mapped key interventions suitable in a landscape.	Mapped rules and regulations that can support identified restoration interventions.	Stakeholders aided in understanding interventions and tree species suitable in an area, given the existing local practices.
The actors aided in delineating the desired ecosystem services and prioritized interventions based on the synergies between different ecosystem services.	Rules did not play any role in delineating ecosystem services. Stakeholders have limited awareness of policies related to restoration.	Differentiated prioritization of ecosystem services by stakeholders based on who has access to resources. Local practices outlined.
Identified key actors and their role in enabling landscape restoration.	Identified key policies and their role in enabling landscape restoration.	Identified how policies are implemented on the ground, and barriers to restoration.
Mapped key actors in a landscape.	Mapped enabling rules and regulations related to landscape restoration	Learned how existing institutions function.
Identified key actors and institutions that can enable livelihood promotion in the district.	Identified key enabling laws and policies that could support meeting the livelihood potential in the landscape.	Delineated existing practices related to the value chain and livelihood enhancement that are barriers to landscape restoration.
Identified key actors and their role in financing restoration interventions.	Mapped key policies that can support financing of landscape restoration interventions.	Identified policy interventions (clarity of tenure) needed prior to implementation of restoration plans.

APPENDIX C: BACKGROUND ON RESTORATION OPPORTUNITIES MAPPING

Restoration opportunities mapping of Sidhi district required four steps: data collection; preparation of base layers; classification of restoration opportunities and estimation of areas under different restoration interventions; and development of the map of landscape restoration opportunities for Sidhi.

Step 1. Data collection

Data for spatial analysis were collected through stakeholder consultations and literature review. Consultations included the Restoration Opportunities Assessment Methodology (ROAM) inception workshop held at Bhopal in June 2016, tehsil consultations in January 2017, a participatory mapathon using Collect Earth held in March 2017 and a prevalidation workshop in September 2017 (see Appendix A).

The following information was gathered from the consultations: land use challenges; list of potential restoration interventions; baseline of trees outside forests; areas with potential to increase tree cover; interventions that can promote soil and moisture conservation; and prioritization of restoration interventions based on flow of ecosystem services. A literature review included data from secondary sources such as remote sensed images, toposheets, and government reports, which provided information on boundaries (Sidhi tehsil boundary, forest compartment boundary, Sidhi reserve and protected forest boundary); biophysical aspects (elevation, slope, soil, soil texture, soil type and depth); land use (land use and land cover, tree cover, protected areas, bamboo); land ownership; and irrigated and rain fed areas.

Step 2. Preparation of base layers

Following data collection, seven base layers were developed that could enable identifying restoration potential for the district. These base layers were finalized through consultation with the Technical Working Group on Landscape Restoration Opportunities Mapping and Monitoring, and representatives from local communities. The base layers were used to identify areas for exclusion, conservation, protection, or restoration.

The base layers, their sources and descriptions are presented in Table C1.

Based on the classifications in Table C1, the areas with no potential for tree-based restoration or that were unsuitable for tree-based restoration were excluded from the restoration opportunity assessment. These primarily included the waterbodies and the built-up areas. Protected areas were delineated as areas for conservation. Forests with more than 70 percent tree canopy cover were classified for protection. The remaining area, after excluding the area of protection, conservation, and exclusion was categorized as area available for restoration.

Table C-1 | Details of Base Layers Used For Spatial Analysis

BASE LAYER	SOURCE	DESCRIPTION
Land ownership	Survey of India Toposheet	Classification based on whether the land is owned by the forest department, revenue department, or private owners. The classes identified were: recorded forest area, undemarcated forest area, private land, revenue – greenwash, revenue – other, and waterbodies.
Land use/land cover	National Remote Sensing Centre (NRSC)	The classes identified were forest and tree cover, cultivated lands, wastelands, built-up areas and waterbodies.
Tree cover density	Global Landcover Facility	Classification based on tree canopy cover. The classes identified were dense forests, moderate dense forests, open forest, and scrublands.
Irrigation status	Normalized Difference Vegetation Index Analysis	Classes are: irrigated cultivated lands and rainfed cultivated lands.
Slope	Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) digital elevation model	Classified regions into slope greater than 15° and less than 15°.
Occurrence of Bamboo	Sidhi District Working Plan, field observation, stakeholder input (tehsil consultation)	Areas with historical occurrence of bamboo identified.
Riverbanks	NRSC	Riverbanks (500 m buffer on both sides of the river) in all the major and minor rivers.

Step 3. Classification of restoration opportunities and estimation of areas under different restoration interventions

After identifying the total area suitable for restoration, on consultation with stakeholders, criteria were set up for suitable restoration interventions in each area. For instance, assisted natural regeneration was an intervention suited to areas where the land use is forest and tree cover and forest/tree cover density is between 40 and 70 percent (see Table C2). Stakeholder consultations aided identification of the assumptions about different land uses that helped determine the best interventions.

Step 4. Developing the map of landscape restoration opportunities for Sidhi

The individual layers of restoration interventions were combined to form the map of restoration opportunities for Sidhi. The mapping was carried out using ArcGIS software version 10.5. The datasets collected were of different scales and resolution (ranging from 30 to 56 meters). The scale of final output is 1:40 kilometers. The final map of restoration opportunities for Sidhi can be zoomed with accuracy to the tehsil level.

Table C-2 | Criteria for Establishing Most Appropriate Restoration Intervention Based on Land Use

RESTORATION INTERVENTION	CRITERIA (LAND OWNERSHIP, LAND USE, AND FOREST AND TREE COVER)	ASSUMPTION AS TO WHY THIS INTERVENTION IS BEST SUITED FOR THIS LAND USE	SOURCES
Assisted Natural Regeneration (ANR)	All land ownership (recorded forest area, deemed forests, revenue greenwash, revenue others, and private lands) where the land use is forest and tree cover and forest/tree cover density are between 40 and 70 percent (moderately dense).	The identified areas have rootstock that would allow natural regeneration of forests.	Based on the working plan for Sidhi forest division and consultation with forest department officials (GoMP 2012).
Mixed-species plantations	Areas under all types of land ownership, where the land use is forest, tree cover, and forest/tree cover density are less than 10 percent (scrublands) and slope is less than 15°.	These areas have negligible rootstock.	Based on the working plan for Sidhi forest division.
Mixed-species plantations/ANR	Areas under any type of land ownership where the land use is forest and tree cover, forest/tree cover density is between 10 and 40 percent (open) and slope is less than 15°.	The decision between ANR and mixed-species plantation may be made after ground truthing for presence of root stock.	Based on the working plan for Sidhi forest division and consultation with forest department officials.
Bamboo plantations	Areas under all types of ownership where the land use is forest and tree cover, forest/tree cover density is less than 40 percent and slope is greater than 15° and/or there is presence of bamboo. Areas where the land use is wasteland and slope is greater than 15 degrees and/or there is presence of bamboo.	Areas identified for bamboo would have historically grown bamboo. It is assumed that bamboo will effectively control soil erosion in areas with slope greater than 15°.	Historical occurrence of bamboo was identified from the working plan for Sidhi forest division as well as field observation during the WRI team visit July to October 2016. The use of bamboo for slope stabilization was suggested by stakeholders at the prevalidation workshop in September 2017.

RESTORATION INTERVENTION	CRITERIA (LAND OWNERSHIP, LAND USE, AND FOREST AND TREE COVER)	ASSUMPTION AS TO WHY THIS INTERVENTION IS BEST SUITED FOR THIS LAND USE	SOURCES
Agri-horti-forestry/wadi	Areas (under all types of ownership) where the land use is agriculture and the land is rainfed. Additionally, in private lands where the land use is wasteland and in areas classified as "revenue-other" and the land use is agriculture.	It is assumed that during implementation, irrigation would be arranged for this intervention.\n\nSome of the areas identified for agri-horti-forestry would need clarification on tenure through policy interventions before implementing interventions.	Literature review and consultation with experts from National Bank of Agriculture and Rural Development (NABARD) showed that agri-horti-silviculture interventions are suitable for areas that are currently under rainfed agriculture and the soil does not provide good yield. In such cases, trees would improve soil quality and diversify sources of income to farmers.
Trees on boundaries	Areas (all land ownership) where the land use is agriculture and the areas are irrigated.	Farmers who participated in the 2017 mapathon noted that trees on bunds and boundaries in irrigated land are useful for demarcation of boundaries, stabilization of bunds, and provisioning services. Literature review and consultation with stakeholders substantiated the same.	The participatory mapathon held in March 2017 showed that trees were already being used on bunds and boundaries in the irrigated northern tehsils of Sidhi.
Farmer-Managed Natural Regeneration (FMNR)	All revenue greenwash areas where the land use is agriculture, and root stock is present for natural regeneration.	These areas have good rootstock and natural regeneration of native species (particularly palash) can provide extra income to farmers for a low investment.	Field observation during visits in July to October 2016 and June 2017 showed that there was ample natural regeneration (specifically of palash) on revenue lands that were being cultivated for one season and left fallow thereafter. During stakeholder consultation, local communities expressed interest in maintaining the trees and benefiting from their produce. Literature review was also done to identify areas suitable for FMNR.
Riverbank plantation	A buffer of 500-meters along rivers (for all types of land ownership).	It is assumed that this intervention will aid in arresting soil erosion on the riverbanks.	Literature review and stakeholder consultation showed that riverbanks require at least a 500-meter buffer of trees to prevent soil erosion and sustain the flow of water.
Pastureland development	Areas (under all types of ownership) where the land use is wasteland and slope is less than 15°.	In some of the areas identified for pastureland development, marginal agriculture, or other land uses may be present. In such instances, tenurial clarity is required before implementing this restoration intervention.	Stakeholder consultation and discussion during the Ecosystem Services diagnostic showed the need for pastureland development to fulfill the fodder requirements in Sidhi.

APPENDIX D: COMMON AND BOTANICAL NAMES OF TREE SPECIES

A species may have different common names in different places, but the botanical names remain the same. Table D1 gives the common and botanical names of trees mentioned in this report.

Table D-1 | Common and Botanical Names of the Tree Species in this Report.

COMMON NAME	BOTANICAL NAME
Aonla (or Indian Gooseberry)	*Emblica officinalis*
Bamboo	*Dendrocalamus sp. and Bambusa sp.*
Jackfruit	*Artocarpus heterophyllus*
Moringa (or drumstick tree)	*Moringa oleifera*
Mahua	*Madhuca indica*
Palash (or flame of the forest)	*Butea monosperma*
Nilgiri	*Eucalyptus globulus*
Kaisurina	*Casuarina equisetifolia*
Subabool	*Leucaena leucocephala*
Poplar	*Populus sp.*
Israeli Babool	*Vachellia tortilis*
Vilayati Babool	*Prosopis juliflora*
Katang Bamboo	*Bambusa bambos*
Neem	*Azadirachta indica*
Saja	*Terminalia tomentosa*
Tendu	*Diospyros melanoxylon*
Dhawda	*Anogeissus latifolia*
Mango	*Mangifera indica*

APPENDIX E: BACKGROUND ON ENABLING CONDITIONS ANALYSIS

The Restoration Diagnostic identifies the presence of key success factors and supplements the ROAM (Hanson et al. 2015). The diagnostic is designed to help decision-makers, managers, analysts, and other stakeholders identify which key success factors for landscape restoration are in place, which are partially in place, and which are missing within a country, state, or landscape being considered for restoration.

The diagnostic was prepared by Hanson et al (2015) by assessing more than 20 examples from around the globe of landscape restoration over the past 150 years to identify key factors that contribute to successful landscape restoration. The Restoration Diagnostic tool consists of a set of questions that evaluate in a rapid yet structured and comprehensive manner the status of each key success factor in the target landscape.

WRI India adapted the Restoration Diagnostic to suit the Indian context in its Restoration Diagnostic Toolkit. The toolkit, developed in consultation with stakeholders, consists of a set of questions based on key success factors that motivate, enable, and implement landscape restoration. The questions help decision-makers and stakeholders analyze the existence of the key success factors within a current or future restoration project.

Implementation of institutional checklists during tehsil workshops provided information on which local institutions could be leveraged to operationalize Sidhi's opportunity assessment.

Participants color coded responses on the status and functioning of local institutions using four options: not present, present but not active, present and active, and do not know. Focus groups discussed the institutional status of some institutions.

A stocktaking checklist was used to collect secondary data from government departments. Indicative questions are shown below:

Forest department

■ What are the restoration interventions planned and/or being implemented?

■ Where are the seed banks, nurseries, and underground root systems?

■ What would local knowledge on landscape restoration look like? Any site-specific examples?

■ Can you give details of NTFPs and their value chains?

■ Are there ways in which invasive plants are being made use of?

■ What are the financial incentives for restoration?

■ What are the existing committees (JFMs, BMCs, etc.) and their relationship to each other?

■ Has the forest department encouraged or supported participation of women?

■ Can you provide information on working plans?

Agriculture and horticulture department

■ Are you using nurseries available to support restoration? Can you give details on agri-entrepreneurship activities that could double as restoration interventions?

■ What programs are currently disseminating information on better cropping practices in the region?

■ Can you provide information on various crops, fruiting trees, spices, oilseeds grown in Madhya Pradesh?

■ Can you provide information on agriculture or schemes targeting marginal lands, where soil is poor, there is no irrigation, and shifting cultivation may be practiced?

■ Are there specific schemes for marginalized groups like SC/ST/ other backward classes (OBC)/women farmers?

■ What different agroforestry systems are being promoted in the region?

■ Are there specific ecological conditions (e.g., soil type) where these systems are being promoted?

Figure E-1 | Institutional Stocktaking Checklist Matrix

Institutional stocktaking

🟥 Not present   🟩 Present and active   🟨 Present but not active   🟦 Do not know

S. No	Committee Name	Response	Comments
1.	Join Forest Management Committee		
2.	ग्राम वन समति		
3.	सार्वजनकि संपदा समति (under lok vaniki)		
4.	Eco Development Committee		
5.	Biodiversity Management Committee		
6.	Village Watershed Committee		
7.	Water User Association		
8.	Village Development Committee		
9.	Forest Rights Committee		
10.	SHG - watershed		
11.	SHG – rural livelihoods		
12.	SHG – horticulture		
13.	SHG – agriculture		
14.	SHG – irrigation		

SHG = Self-help group.

Revenue department

- Is there any instance where crop/farmland boundaries have shifted? (Please provide details of areas if available.)

- What is the status of land? (What are the types of ownership?)

- What are the types of formal and informal mechanisms for settling land disputes (let this topic emerge from discussion)?

Rural development

- Can you provide details of the Madhya Pradesh Rural Livelihoods mission?

- What is the status of the watershed programs?

- What are the social incentives and government subsidies for restoration, if any?

- What are the funding opportunities from cooperative banks and regional rural banks in tribal areas?

Department of Tribal Affairs

- Are there funding opportunities from cooperative banks in tribal areas?

- What is the status of the Scheduled Tribes and Other Traditional Forest Dwellers Act, 2006 (FRA) in the region - number of individual forest rights (IFR) and community forest resource rights (CFR) claims filed/recognized?

- Can you give details of convergence for those whose IFR/CFR claims have been recognized?

Checklist questions for focus group discussions: Key guiding questions discussed during the focus groups.

- What are the roles of men, women and youth in forest use and management? In agricultural and livestock management?

- What are the gender differences in access and control over resources and knowledge, land tenure and tree tenure, and decision-making within households related to resource management?

- How does the distribution of resources and cultural norms and priorities impact landscape restoration practices in the region?

- Is there a gendered access to infrastructure, banks, participation in local committees, etc.?

- Who do the participants approach for any land-related decision?

- What is the perceived impact of landscape restoration on different socioeconomic groups?

APPENDIX F: POTENTIAL FOR IMPLEMENTING LANDSCAPE RESTORATION INTERVENTIONS THROUGH THE FOREST RIGHTS ACT OF 2006 IN SIDHI

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 (FRA) is a key act that provides immense potential to implement the identified restoration interventions in the district. FRA provides the forest dwelling scheduled tribes (STs) and other traditional forest dwellers tenurial security through recognition of individual forest rights (IFRs).

IFRs recognize joint titles to ensure that patriarchal norms and existing gender differences don't curtail women's access to property rights and forest resources. Additionally, community forest (CF) rights can be procured over common amenities and sites of cultural, religious, or other significance and community forest resource rights (CFRs) give gram sabhas (village assemblies) the right to protect, conserve, regenerate, and manage their community forest resources (GoI 2006, 2008, 2012). Overall, FRA provides a unique opportunity for sustainable livelihoods, asset creation, and improved standards of living for some of the poorest and most marginalized populations in the country.

Tribal livelihoods and culture have been closely tied with forest resource use. However, multiple deficiencies in rights and settlement process and poor implementation of FRA in India have been identified by a number of researchers (GoI 2010; Samarthan 2011; Vasundhara and Kalpvriksh 2012; Kalpvriksh and Vasundhara 2015; Kumar, Singh, and Rao 2017; Ramanujam 2017; Sahu, Dash, and Dubey 2017).

Customary patterns of use have rarely found legal recognition through the forest department's "settlement of rights" process. For instance, nearly 83 percent of the forest blocks in undivided Madhya Pradesh had not completed their settlement processes as of December 2003 (Prabhu 2005). It is noteworthy that both during the land survey and settlement process and during the forest settlement process, rights— especially collective rights— have been ignored (Sarin 2014).

A review of legal and policy instruments that provide opportunity for restoration in Madhya Pradesh highlights that FRA is critical because it recognizes gender considerations in participation and governance of institutions.

Potential for recognition of community forest resource rights in Sidhi

The Rights and Resources Initiative (RRI) with partners has developed a methodology that estimates potential for CFR recognition in India based on data from the Forest Survey of India (FSI 1999) and the national census (RRI, NRMC, and Vasundhara 2015). RRI's conservative estimate for CFR recognition in Madhya Pradesh is 3.2 million hectares based on forest land within village boundaries. In Sidhi district, the forest area within village boundaries is estimated to be 10,643 hectares (Census 2011c). Notably, in Sidhi most of the forests are not within village boundaries due to some changes to the settlement-of-records process over the years. Additionally, this estimate does not include forest dwellers' customary boundaries for use of the forest for their livelihood, cultural, and spiritual needs. Hence, the actual estimate is higher.

Furthermore, customary areas of traditional forest dwellers living in reserved, protected forests and national parks and sanctuaries, for instance in Sanjay Dubri Tiger Reserve, Son Gharial Sanctuary, and Bagdara Wildlife Sanctuary could be recognized under CFR. This would include, at bare minimum, areas under joint forest management committees as these areas are already protected by committees (CFR-LA 2016). Currently, these committees cover nearly 90 percent of the recorded forest area, which is the minimum CFR potential in the district. Most of the IFR areas for recognition would also fall within these broader estimates as IFR areas would be de jure recorded as forest, though de facto they are used for nonforestry purposes by rights holders (CFR-LA 2016).

Status of implementation of the Recognition of Forest Rights Act

FRA is poorly understood and implemented. Awareness is poor among potential rights holders about FRA and its rules and regulations (subdistrict consultations, January 7-11, 2017; field consultations, September 2017). Forest rights committees, which must be constituted by the gram sabha under Rule 3 of the FRA Rules of 2007, have not been formed in most instances, or if formed, are inactive.

Individual forest rights claim recognition status

Under FRA, between 2008 and 2017, 1,331 individual forest rights claims were recognized in Sidhi district. Only three claims have been recognized since the rules were amended in 2012 (GoI 2012; 2008).

The 1,331 claims recognized for 675 hectares represents 12 percent of the 10,610 IFR claims filed in the district (Tribal Development Department 2017). Most of the claims were rejected without any reason or a sufficient reason given, which is required by the FRA (Field consultations, September 2017). There is weak institutional and political willingness to implement FRA in Sidhi.

Community forest rights and community forest resource rights claim recognition status

Status of recognition of CF/CFR rights is very poor in Madhya Pradesh (RRI, NRMC, and Vasundhara 2015; CFR-LA 2016). Only community forest rights to places of worship, footpaths, and so on have been recognized in Sidhi. Data on the total number of CF claims is not readily available; 560 titles have been recognized for 9 ha. No CFR claims have been recognized in Madhya Pradesh or Sidhi district.

Additionally, there are contraventions to FRA in terms of the rights recognition process that has been followed. For instance, in the village of Dewa in Kusmi tehsil the CF/CFR claims have been recognized for individuals rather than for gram sabhas. And these rights have been restricted to specific minor forest produce, rather than all minor forest produce. Furthermore, although the CFR right to protect, conserve, regenerate, and manage the forest resources is addressed in FRA Section 3(1)(i)(e), it is not clear whether this right is over village forest areas or reserve forest areas. The lack of willingness to recognize community forest rights is also evident from the eviction threat that the villagers in protected areas like Sanjay Dubri Tiger Reserve are now facing (Field consultations, September 2017).

Additionally, the Panchayats (Extension to Scheduled Areas) Act, 1996 (PESA) and other laws and policies to address overgrazing and promote tree planting (Lok Vaniki) have not been fully applied in the district. Overall, consultations with CEL WWF-India and field consultations indicate a deficiency in implementation of these laws and policies in Sidhi district (CEL WWF-India 2017).

APPENDIX G: LIVELIHOOD ANALYSIS

1. Sampling Methodology for Undertaking Livelihood Mapping

The livelihood assessment was led by WRI India's partner, the Institute of Livelihood Research and Training (ILRT), Bhopal. To ensure adequate representation of the entire district, representative sampling techniques were applied. Multistage sampling techniques—purposive, cluster, and stratified random—were used to ensure representation of different geographies such as plain and hilly terrain, forested and nonforested areas, concentration of different segments of communities, and different livelihood patterns.

Selection of blocks: The universe was the entire district of Sidhi including all five development planning blocks—namely, Kusmi, Majhauli, Rampur Naikin, Sihawal, and Sidhi.

Selection of gram panchayats and villages: Under the study, 10 percent of the district's gram panchayats were selected as a sample. The selection of gram panchayats from the blocks was done applying cluster and stratified random sampling techniques. Various parameters were used such as: (1) remoteness of a gram panchayat from the block headquarters; (2) vicinity with the forest areas; (3) geographic features such as plains or hilly terrain; (4) concentration of tribal and nontribal population, and (5) livelihood patterns such as agriculture and forestry. A list of gram panchayats by block was prepared and meetings were held with senior officials of zilla panchayat who coordinated projects and schemes such as the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), the Integrated Watershed Management Program (IWMP), Madhya Pradesh State Rural Livelihoods Mission (SRLM), rural enterprises, and others to identify 10 percent of the gram panchayats in each block based on the criteria mentioned above.

Table G1 shows by block the number of gram panchayats and villages that were sampled for further study.

2. Sampling Methodology for Value Chain Analysis

Selection of potential subsectors: The livelihood mapping produced a comprehensive list of different livelihood activities being pursued by the rural population in Sidhi. Their linkages with the landscape restoration interventions were identified with the spatial analysis component of this study.

Areas with tree species such as aonla, bamboo, jackfruit, mahua, moringa, and palash, which have strong linkages with identified landscape restoration opportunities, were shortlisted. This was based on parameters such as: scope for plantation and production under identified landscape restoration areas; scope for involvement of communities; contribution of food and nutritional security; scope for commercialization; engagement of women and poor; existing demand; scope for livelihood diversification and entrepreneurship promotion; scope for income enhancement; and scope for scalability.

Six subsectors were selected by ILRT in consultation with the WRI India team for value chain analysis.

To conduct the value chain analysis, the study locations/samples for different subsectors were identified based on the following parameters:

- Representation of villages from different blocks as well as different social communities

- Representation of areas that are the least accessible and most highly accessible to market, communication, support services

- Intensity and prevalence of the subsector activities

- Representation of villages where different players engaged in the subsector activities (Intervention villages of the forest department, horticulture department, MGNREGS, IWMP, SRLM, KVK and NGOs)

- Representation of forest and nonforest villages

- Consultation and interviews with value chain actors including government officials within and outside the district who are engaged at different stages of the value chains of selected subsectors

The subsector analysis was undertaken using the standard methodology (Haggblade and Gamser 1991):

- Select subsector

- Introduce team to the subsector

- Draw preliminary subsector map

- Specify environment (social, economic, cultural, institutional) affecting the key players

- Refine subsector map

- Quantify overlays of particular interest

- Analyze dynamics between different overlaid interests

- Identify sources of leverage for developing the subsector

- Explore opportunities for leveraging particular subsector intervention/ Choose intervention point

The data collection used the following approach: focus group discussions; individual interactions with the progressive people of the subsector (for instance, farmers who have taken up diversified agricultural practices like horticulture, farm forestry, best practices); drawing and refinement of subsector map; stakeholder consultations, interviews, and discussions; transect walks at subsector locations (primary production, processing and packing, marketing, and so on).

Key informants interviewed: While studying the subsectors, the team consulted diverse stakeholders to understand the value chain, draw a value chain map, identify key components of the value chain and its functions, and estimate the value added and the costs and benefits at each stage, as well as opportunities and challenges for involvement of primary collectors and producers. Focus group discussions and consultations were held with stakeholders including local traders and businesses in Rewa engaged at various stages ranging from preproduction, production, value addition, trading, and marketing in the subsectors.

Table G-1 | Block-Wise Sampling Frame.

BLOCK	TOTAL GRAM PANCHAYATS	NUMBER OF SAMPLE GRAM PANCHAYATS[a]	NUMBER OF SAMPLE VILLAGES
Kusmi	42	5	12
Majhauli	55	5	7
Rampur Naikin	89	9	15
Sihawal	100	10	14
Sidhi	115	11	27
Sidhi District	401	40	75

Note:
[a] Approximately 10 percent of the total number of gram panchayats/villages were selected

Source: WRI India.

APPENDIX H: COST ANALYSIS

The cost analysis and the finance requirements to meet Sidhi's restoration potential were identified through four steps:

- Estimating restoration costs for each of the interventions emerging from the assessment through review of the cost norms available from local sources in the district.

- Identifying the current and potential sources of funding for restoration in the district by reviewing ongoing government programs and schemes related to restoration.

- Identifying the current and potential mechanisms of funding and the terms by which money is allocated to those involved in implementing the restoration strategy.

- Identifying the current and potential channels through which money physically reaches those implementing the restoration strategy.

The cost estimation does not focus on private investment because the stocktaking analysis revealed that most of the current interventions are through state or centrally funded programs and the enabling conditions for private sector investments are meagre.

The total restoration potential in Sidhi is more than 363,000 hectares and costs have been estimated for 355,420 of these hectares.

- For mixed-species plantations on lands where the forest and tree cover is mainly scrub,[22] we estimated costs for 90 percent of the area.

- Since the land use for farmer-managed natural regeneration is irrigated agricultural land, we estimated costs for only the 25 percent of the potential area that has root stock.

- Since pastureland development does not require planting trees, we did not make an estimate for this intervention.

The cost estimates were based on ongoing government restoration programs based on land ownership and use. The types of land ownership are listed below.

- *Recorded forest area.* These are areas marked as protected forest (PF) or reserved forest (RF) in the toposheets. They include Sanjay Dubri Tiger Reserve and Son Ghariyal Sanctuary which are protected areas. Recorded forest area is owned and governed by the forest department.

- *Undemarcated forest area.* These are areas that are neither RF nor PF in the Survey of India (SoI) toposheets but are included in the forest compartment boundaries of the Sidhi district working plan (GoPM 2012). The analysis shows that undemarcated or "deemed" forests are areas where survey and settlement requirements are incomplete.

- *Private land.* These areas, marked in yellow in the SoI toposheets, represent land that is privately owned. They are predominantly agricultural.

- *Revenue–greenwash.* This consists of greenwash (marked as forested on the topographical map) areas that are outside the RF and PF designations but are classified as revenue land. Analysis shows that these areas contain revenue forest and have potential to support good tree cover.

- *Revenue–other:* These are revenue lands that fall outside of revenue greenwash.

Additionally, fund flows in the district were assessed and mapped through social network analysis (SNA) and stocktaking in the district as part of the larger ROAM analysis and interactions with NABARD. The stakeholders in the SNA included representatives from the forest department and zilla panchayat, watershed directorate, NGOs, farmers, representatives of local institutions like panchayats, water-user associations, and local champions critical to implementing restoration in Sidhi.

ABBREVIATIONS

ANR	assisted natural regeneration
CEL	Centre for Environmental Law
CFR	community forest resource rights
DFO	divisional forest officer
FMNR	farmer-managed natural regeneration
FPO	farmer producer organizations
FRA	The Scheduled Tribes and Other Traditional Forest Dwellers Act, 2006, referred to as the Forest Rights Act
FSI	Forest Survey of India
GiZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IFA	Indian Forest Act, 1927
IFR	individual forest rights
IIRS	Indian Institute of Remote Sensing
ILRT	Institute of Livelihood Research and Training
INR	Indian Rupee
IUCN	International Union for the Conservation of Nature
KVK	Krishi Vigyan Kendra
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MFP	minor forest produce
MoEFCC	Ministry of Environment, Forest, and Climate Change
MP	Madhya Pradesh
MPSRLM	Madhya Pradesh State Rural Livelihoods Mission
NDC	nationally determined contribution
NGO	nongovernmental organization
NITI Aayog	National Institution for Transforming India
NTFP	non-timber forest produce
NWPC	National Working Plan Code, 2014
PESA	Panchayats (Extension to Scheduled Areas) Act, 1996
RDBF	rehabilitation of degraded bamboo forest
ROAM	Restoration Opportunities Assessment Methodology
SC	scheduled caste
SDGs	Sustainable Development Goals
SLEM	Sustainable Landscapes and Ecosystem Management Project
ST	scheduled tribe
WWF-India	World Wide Fund for Nature India

ENDNOTES

1. The NITI Aayog (National Institution for Transforming India; *aayog* is Hindi for policy commission) is a policy think tank of the Government of India, established to achieve the Sustainable Development Goals and to enhance cooperative federalism by fostering the involvement of state governments of India in the economic policymaking process using a bottom-up approach.

2. The Transformation of Aspirational Districts Program aims to accelerate improvement to the socioeconomic indicators of 117 poorly developed districts across 28 states in India.

3. Panchayats are three-tier locally elected bodies at the district, block, and panchayat (cluster of villages) levels. Panchayats are the lowest tier of self-governance in India according to the Article 243G of the Panchayati Raj Act, 1992.

4. An agronomy practice that integrates fruit trees and timber trees with crops.

5. The exchange rate used to convert INR to $ was INR 71.

6. Marginal farmers are those with landholdings below one hectare. Small-holder farmers hold one to two hectares and semi-medium farmers hold two to four hectares as per the Agricultural Census in India.

7. While there are multiple definitions of landscape restoration, in this report we use the term to refer to a range of tree-based interventions undertaken at scale on land under forests, agriculture, or other uses where scientifically feasible.

8. The Sidhi district comprises seven tehsil—Bahri, Churhat, Gopad Banas, Kusmi, Majhauli, Rampur Naikin, and Sihawal—and five blocks—Kusmi, Majhauli, Rampur Naikin, Sihawal, and Sidhi.

9. Under Schedule V of the Constitution of India, special provisions are in place for administering areas where the population is predominantly scheduled tribes, which receive special protections.

10. Land ownership and governance in India operates through an extensive legal framework that determines the management of revenue territory. In India, land ownership and land use must be understood as two separate frameworks of governance but with multiple overlaps. This means that forest land is land under the jurisdiction of a state forest department but could be used for agricultural or industrial purposes. Similarly, land governed by a revenue department could be agricultural, have forests, or be common/nistar land. Each department also maintains a territorial organization to govern its land. Both revenue and forest lands are governed by separate laws under the Indian constitution.

11. Territorial units of a forest permanently defined for the purpose of administration and planning of silvicultural interventions.

12. The census shows that 77.3 percent of farmers are marginal and small land holders. The number of marginal farmers (with less than one hectare of land) is 78,115 out of a total of 136,731 farmers. The number of small farmers (one to two hectares) is 27,601 (20 percent of all farmers) (Census 2011b).

13. As per the Forest Survey of India, forest cover is placed in four classes: (1) very dense forest (tree cover, including mangroves, of canopy density of 70 percent and above); (2) moderately dense forest (tree cover, including mangroves, of canopy density 40–70 percent); (3) open forest (tree cover, including mangroves, of canopy density 10–40 percent); and (4) scrub (all forest lands with poor tree growth mainly of small or stunted trees having canopy density less than 10 percent).

14. Gender roles are socially constructed and accentuated by social inequalities, age, caste, marital status, class, race, and so on.

15. In areas where individual forest rights (IFR) under FRA have been recognized, agri-horti-forestry/wadi interventions could be undertaken. In areas that may be eligible for recognition for IFR under FRA, the rights recognition process would have to be completed prior to implementation of wadi as an intervention. Alternatively, rights could be recognized under the provisions of the Panchayats (Extension to Scheduled Areas) Act (PESA) 1996 where applicable. Implementing wadi in these areas can be undertaken once the rights recognition process has been completed. Delineating interventions for each land use can help identify the actors, institutions, and programs that can support identified restoration interventions. For instance, 16,080 hectares of forests under private ownership have restoration potential are suitable for ANR, mixed-species plantation, riverbank plantation, and bamboo plantation. For implementation of restoration in these areas, stakeholder consultations indicated that the forest department could work with landowners and these interventions could be supported through enabling policies like the Madhya Pradesh Lok Vaniki Act 2001.

16. Legislative framework for management of trees on private land and government lands not managed by the forest bureaucracy in the central Indian state of Madhya Pradesh.

17. A transit permit can be granted by the panchayat on the recommendation of the panchayat committee for the following species: siris, ber, palas, jamun, reunjha, neem, aam, khamer, and bamboo other than katang bamboo (except in the districts of Khandwa, Betul, Hoshangabad, Harda, Chhindwara, Seoni, Balaghat, Jabalpur, Katni, Mandla, Dindori, Shahdol, Umaria and Sidhi); for all other species, the transit permit is granted by the forest officer appointed by the district forest officer (CEL WWF-India 2017).

18. A problem with monetary incentives to individuals to protect community forest is that if the community is not in agreement with the idea of protection and management in general, they might stop protecting the resources once the incentive for protection is over. For long-term sustainability, programs should be designed not only with economic incentives, but also with a focus on principles of long-term sustainability, equity, and ownership.

19. The household survey that was undertaken to estimate the livelihood potential and benefits from landscape restoration estimated income from agri-allied sectors for a 10 percent sample of villages. This estimated income has been extrapolated for the whole district with the assumption that the potential increase in incremental income would happen through planned landscape restoration interventions. An increase of 10 percent was assumed for kharif crop and 20 percent for rabi crop.

20. Bhumiswami is a type of tenure ownership mentioned in the MP Land Revenue Code of 1959. As per an agreement between the Bataidar (tenant) and the Bhumiswami (landlord), the Bataidar gives money or a share of the crop to the Bhumiswami.

21. The Adaptation Fund is an international fund set up under the Kyoto Protocol of the United Nations Framework Convention on Climate Change. It provides funding for projects and programs intended to help developing countries adapt to the impacts of climate change.

22. All forest lands with poor tree growth, mainly with small or stunted trees having a canopy density less than 10 percent, is classified as scrub by the Forest Survey of India.

GLOSSARY

TERM	DEFINITION
Accelerator	An accelerator builds the capacity of multiple stakeholders at the same time through a rapid and intense program. Engaging cohorts of 8–15 stakeholders, accelerators connect stakeholders to each other, to sources of finance, and to mentors.
Agri-horti-forestry	An agronomy practice that integrates fruit trees and timber trees with crops.
Assisted natural regeneration (ANR)	A forestry practice that focuses on regeneration through existing rootstock. ANR involves physical or social fencing to protect the regenerating area from grazing and fire.
Block	Development planning unit within a district. Blocks typically comprise clusters of villages.
Collect Earth	Collect Earth is a data collection tool where users can analyze high- and very-high-resolution satellite imagery to monitor the state of and change in land cover.
	Collect Earth is a part of the Food and Agriculture Organization of the United Nations' (FAO's) Open Foris initiative that provides a set of free and open-source software tools to facilitate flexible and efficient data collection, analysis, and reporting for field and satellite data.
Community forest rights	A community can be given community forest rights over common amenities and sites of cultural, religious, or other significance under the Forest Rights Act of 2006.
Community forest resource rights	The right of a community to protect, regenerate, conserve, or manage any community forest resource they have been traditionally protecting and conserving for sustainable use, under Sec 3(1) of the Forest Rights Act of 2006.
Ecosystem services	Ecosystem services are the benefits that people obtain from natural ecosystems. These include provisioning services such as food, fuelwood, fodder, and non-timber forest produce; regulating services such as biodiversity conservation, water regulation, and carbon sequestration; and cultural services, including recreational, aesthetic, cultural, and educational benefits.
Farmer-managed natural regeneration	A low-cost process in which farmers protect and manage growth of trees and shrubs that regenerate naturally in their fields from root stock or from seeds dispersed through animal manure.
Gram sabha	Village assembly that comprises all adults of the village. This is the foundational tier of the Panchayati Raj system for decentralized governance in India (See Panchayati Raj System).
Gram panchayat	The executive committee of the gram sabha is known as the gram panchayat, which consists of the executives elected by the gram sabha (See Panchayati Raj System).
Greenwash	Light green areas of toposheets prepared by the Survey of India that depict forests and woodlands.
Krishi Vigyan Kendra	Agricultural institutions set up by the Government of India through the Indian Council for Agricultural Research to disseminate improved practices and technologies in agriculture and provide critical input support to farmers through a multidisciplinary approach.
Mapathon	Mapathon is an intensive, multiday event focused on the collection and interpretation of spatial data.
Mixed-species plantation	Type of plantation where more than one native species of trees is grown.
Minor forest produce	Section 2(I) of Forest Rights Act, 2006 defines minor forest produce as all non-timber forest produce of plant origin including bamboo, brush wood, stumps, tussar, cocoon, honey, wax, lac, tendu or kendu leaves, medicinal plants, and herbs, roots, tubers, and the like.
Panchayati Raj System	The Panchayati Raj System of local governance in India has three levels: gram panchayat (village level), janpad panchayat (block level), and zilla panchayat (district level). It was formalized in 1992 by the 73rd amendment to the Indian Constitution. A gram panchayat is the executive committee of a gram sabha which comprises all the adults of a village.

TERM	DEFINITION
Protected forests	Any forest land, waste land, or any other land that is not included in a reserved forest, but which is the property of government, or over which the government has proprietary rights, or is entitled to the whole or any part of the forest produce, and which is notified in a government gazette as "protected forest" under relevant sections of Indian Forest Act, 1927. In such forest, most activities are allowed unless prohibited.
Recorded forest	All the geographic areas recorded as "forests" in government records. It consists of reserved forests and protected forests constituted under the provisions of the Indian Forest Act, 1927.
Restoration interventions	These are strategies to improve the productivity of forest and agricultural lands. They often involve improving vegetation cover, planting appropriate native tree species, or improving soil, water, and land management.
Reserved forests	Any forest land or waste land which is the property of government or over which the government has proprietary rights, or rights to the whole or any part of the forest produce, and which is notified in government gazette as "reserve forest" under relevant sections of Indian Forest Act, 1927. In such forests, most of the activities are prohibited unless allowed.
Restoration Diagnostic	A participatory tool developed by WRI to identify the presence of factors that increase the likelihood of successful restoration.
Scheduled castes	Castes, races, or tribes or parts of such social groups who form a category defined as "backward classes" or socially deprived people for whom the Constitution of India, under Article 341, has made separate provisions for upliftment and protection.
Scheduled tribes	Tribes or tribal communities deemed as "scheduled tribes" under Article 342 of India's Constitution. The constitution makes special provisions for the protection of these communities, and the state is expected to execute schemes for their welfare and upliftment.
Social network analysis	A methodology to investigate social structures using networks and graph theory.
Tehsil (subdistrict)	A unit of land administration that comprises multiple villages in a district.
Trees on boundaries	Tree plantations along raised bunds in agricultural land or along the boundaries. The trees can provide fruit, fodder, fuelwood, or timber based on irrigation availability, soil type, and needs of the farmer.
Undemarcated/ Deemed forest area	All forest land (other than demarcated forest) which is the property of the government and is not appropriated for any specific purpose. These are also known as deemed forests.
Wadi (also see agri-horti-forestry)	Wadi is a comprehensive program for improving living standards of marginalized families in remote areas, developed by BIAF, an NGO in India. It is a family-based program implemented through a cluster-based approach. The core component involves development of agri-horti-forestry on small plots of underutilized lands. This component is designed to meet the immediate as well as long-term livelihood needs of the families owning the plots.
Working plan	These statutory documents for forest management aim at continuity of policy and action, both prescribing and controlling basic operations in a forest estate over a 10-year period.
Zilla panchayat	The third tier of the Panchayati Raj Institutions in India. Members of the zilla panchayat are elected from the district based on adult franchise for a term of five years (see Panchayati Raj System).

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ABOUT WRI INDIA

WRI India is a research organization that turns big ideas into action at the nexus of environment, economic opportunity, and human well-being.

Our Challenge

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our Vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT

We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

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