Ecosystem Restoration for Land Degradation Neutrality:

The Economic Valuation of Watershed Development in Eastern Madhya Pradesh and Western Maharashtra

March 2021

Key Messages

Key Message 1:
Watershed development (WSD) implemented from 'ridge to valley' with afforestation is effective in reversing land degradation. The appropriate treatment of upper catchments—forest and private lands—is essential to protect against erosion.

Key Message 2:
Well implemented WSD enhances the provisioning of ecosystem services. Managing ecosystem as a common pool resource benefits large numbers of people. Treating forests, common lands, and water resources as a commons helps to generate livelihoods, meet domestic and livestock needs, and conserve nature.

Key Message 3:
WSD restores the ecosystem. The benefits of ecosystem services (particularly livelihood generation) are maintained and enhanced by climate adaptive measures such as water use management and climate resilient agricultural practices.

Key Message 4:
Building up the capacities of local governing bodies through effective mechanisms enables communities to safeguard their regenerated watersheds and meet emerging challenges.

Key Message 5:
Investment in ecosystems restoration and climate change adaptation contributes tangibly to land degradation neutrality, sustainable development goals and Paris Agreement targets.

Introduction

The United Nations Decade on Ecosystem Restoration 2021–2030 encourages us to breathe new life into our country's ecosystems for a future of health and well-being. Over the last two decades, 4% of India's land has become degraded, particularly in semi-arid regions (SAC, 2016). Land degradation costs the country 2.5% of its GDP (TERI, 2016). Timely ecosystem-based land restoration will cost less than the possible damage if land is not restored (IPBES, 2008).

Madhya Pradesh and Maharashtra are major land degradation hotspots in India. Despite the watershed management programmes in Madhya Pradesh, land degradation has accelerated in the state (UNDP, n.d.). The degraded land in Maharashtra adds up to 16.7% of the country's total degraded land. In both states, vegetation degradation and water erosion are the two most important processes of degradation and desertification (SAC, 2016). With the climate change processes of changing rainfall patterns and rising temperature, agriculture has become less rewarding, particularly for a large number of small and marginal farmers. Distress migration for earning a basic income is the norm, as was observed during the COVID-19 pandemic. Madhya Pradesh is ranked low in overall Human Development Index (HDI) with high levels of hunger and malnutrition. In Maharashtra, there is disparity within different regions in terms of development indicators like food and nutrition security, water security, and agriculture (Sahni & Viswanath, 2005; Srivastava 2009).

The Study Area

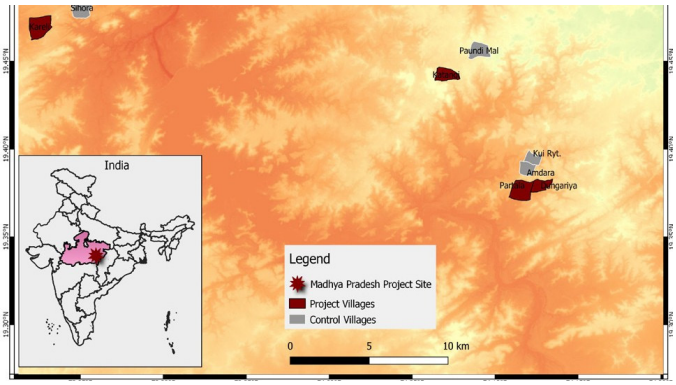

Fig 1: Location Map of the study villages in east Madhya Pradesh

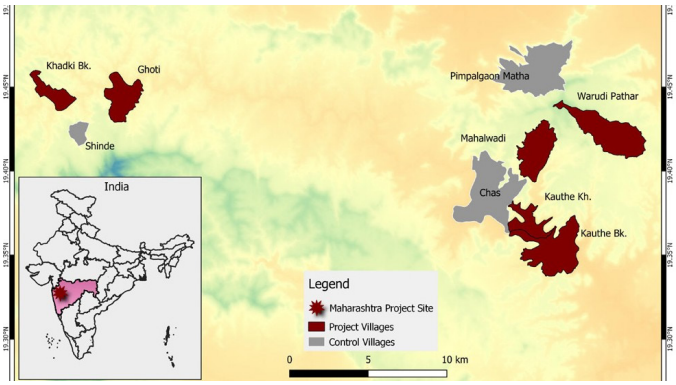

Fig 2: Location Map of the study villages in west Maharashtra

A study was conducted in eastern Madhya Pradesh (MP) and western Maharashtra (MH) where participatory watershed development (WSD) was implemented.

The MP study sites (Fig 1) fall in two agro-ecological zones: 1) Northern Hill Region of Chhattisgarh (Jabalpur district) and the 2) Kymore Plateau and Satpura Hills (Mandla district), where the average rainfall is 1400 mm and 1200 mm respectively (Envis CAMP, n.d.). The study sites in MP consist of four watershed development (WSD) treated villages2, each with their respective control villages. In MP villages, WSD was implemented from 2008 to 2011 followed by one government funded watershed project from 2014 to 2018 only for Partala and Amdara. WSD in all the four villages were implemented by WOTR whereas the government funded watershed project i.e. the Integrated Watershed Management Programme (IWMP) was implemented in Partala and Amdara village by PRADAN and WOTR respectively.

In MH sites WSD was implemented in two ecological zones: 1) Akole block on the Sahyadri ranges (Western Ghats) with an average rainfall of 1800 mm1 and is endowed with forest cover, and 2) the adjacent Sangamner block located in a rain shadow with an average rainfall of 560 mm that has plateau and rivulet villages. All the study villages are located in Ahmednagar district. In addition to WSD (Fig2), adaptation measures related to groundwater management and climate

resilient agriculture (CRA) were also implemented. The study villages are located in the (a) Hilly terrain (Akole block), (b) Plateau villages with an undulating terrain, and (c) Rivulet villages (Sangamner block). Each terrain is represented by two treated villages and one control village. The WSD and climate change adaptation interventions including climate resilient Agriculture (CRA), water stewardship and water budgeting were implemented. In MH, WSD was implemented from 2010 to 2014.

[1] Average rainfall of 2011 to 2020

[2] WSD was implemented by WOTR in a ridge-to-valley approach

Methodology

Our study was conducted between June 2019 and August 2020, based on a combination of Land Degradation Neutrality (LDN) and economic indicators. The impacts of participatory watershed development i.e. sustainable land management (SLM) practices implemented from ridge-to-valley in the study villages on soil erosion, soil organic carbon (SOC), land productivity dynamics and land use/land cover (LULC) changes was assessed. The impacts are observed on the provisioning ecosystem services of cropping intensity, crop productivity, household water availability, on distress migration (migration was assessed only for MP study) and agricultural benefit (MP ELD Report, WOTR 2020; MH CBA Report, WOTR 2021).

Key Message 1:
Watershed development (WSD) implemented from 'ridge to valley' with afforestation is effective in reversing land degradation. The appropriate treatment of upper catchments—forest and private lands—is essential to protect against erosion.

Findings

(a) A systematic 'ridge-to-valley' approach to soil and water conservation (SWC) with afforestation increases soil accumulation (Das et al., 2020; Golechha et al., 2021). In the MH villages, greater soil retention and increase in vegetation cover was observed in the upper catchments of the plateau and rivulet villages as compared to the control villages (Table 1). In Maharashtra sites, the Forest Department treated its lands in project villages, and entered into a benefit sharing and protection arrangement with the villages under the Joint Forest Management Committee (JFMC) policy (MFD, 1992; de Condappa et al., 2021). In the MP villages, the forest department had implemented minimal soil and water conservation (SWC) interventions on forest lands, yet greater soil retention and soil accumulation were observed in the project villages as compared to the control villages, because forest cover had been maintained. However, in the hilly villages of MH, there was loss of vegetation both in the project and control villages (Table 1).

(b) A trade-off was observed between conserving the forest cover and the Forest Rights Act (FRA) at the MH study sites. Land given to tribals had been terraced for agricultural expansion, resulting in a reduction of tree cover in the hilly region (Table 1) (De Condappa et al., 2021).

Table 1: Land Use Land Cover difference in the MH study villages between the pre and post project period

Land Use Land Cover change				Plateau Region			Rivulet Region		
	Ghoti	Khadki Budruk	Shinde	Warudi	Mahal-wadi	Pimpalgaon Matha	Kauthe Khurd	Kuthe Budruk	Chas
Agriculture	13.65	27.71	5.5	65.36	41.01	1.04	25.31	24.84	28.4
Fallow land	-48.13	-93.26	-49.21	-41.27	-44.46	-3.79	-86.65	-51.13	-43.89
Vegetation	-4.88	-6.45	-7.25	5.87	2.58	-8.58	-0.78	7.3	-8.46

Recommendations

(i) For effective impacts, a ridge-to-valley approach to WSD should be emphasised, even when convergence with/funding from MGNREGS and/or other funding sources is achieved.

(ii) Implementation of sustainable land management (SLM) with afforestation on forest lands and private upper catchments will enhance soil retention and soil organic carbon (SOC) accumulation. In the MH sites, the joint effort for land management with the forest department and the local projects is facilitated by a Government Resolution (MH GR 1992). The Joint Forest Management Committee (JFMC) and the Gram Panchayat (GP) should play an active role in this process as indicated. Joint implementation with the Forest Department in other locations of MH and MP will benefit land restoration and forest protection.

(iii) In the fragile upper catchments of the Western Ghats as well as on the hills and forest buffer zones in MP, well stabilised terraces and farm bunds on private lands with agro-forestry can maintain the canopy cover, reduce soil erosion, increase SOC, and provide income for people.

Key Message 2:
Well implemented WSD enhances the provisioning of ecosystem services. Managing ecosystem as a common pool resource benefits large numbers of people. Treating forests, common lands, and water resources as a commons helps to generate livelihoods, meet domestic and livestock needs, and conserve nature.

Findings

(a) Expansion of agriculture was observed in all villages of both geographies. In the MP villages, the gross cropped area increased by 32% in project villages and 25% in the control. The corresponding figures for MH are 44% and 30% respectively. The expansion of agricultural land indicates dependence on it as a primary source of livelihood. An increase in cropping intensity and allied livelihoods in both MP and MH project villages was observed, with a significant decrease in distress migration in MP. In the WSD treated villages, this indicates an increase in the provisioning services of soil and water conservation that aids livelihoods and enhances food and water security (de Condappa et al., 2021).

(b) Implementation of water stewardship and budgeting in the MH WSD project villages promotes groundwater as a community good, although farmers do own private wells and borewells In its water budget plans, the community prioritises water for domestic use and livestock, after which agriculture is planned based on water availability (Kale & D'Souza, 2019). During the drought year 2018–19, project villages in the plateau (water scarcity zone) of MH required tankers of water for a few days as compared to some months in the control villages. Due to water conservation in MP, women faced a reduced burden to fetch water, even during the drought year.

(c) Benefits from the regenerated forests are visible in both the MP and MH project villages, except where forest lands were alienated under the FRA. These organised villages have an active Gram Panchayat, Village Development Committee (VDC) and JFMC, and are better equipped to manage their forest resources (De Condappa et al., 2021).

Recommendations

(i) The Atal Bhujal Yojana under the Jal Shakti Ministry promotes community management of groundwater and aquifers. The benefits of water stewardship as a community effort were observed in the MH study villages as well as in other districts in MH (D'Souza et al., 2019; Kale & D'Souza, 2019) where it was implemented. The water stewardship methodology can be implemented in individual villages as well as those that share an aquifer, and is encouraged by the MH Groundwater Act 2009. Water budgets and audits prioritise water for domestic use and nature, in addition to that for agriculture. Water for household use is managed more efficiently when women's self-help groups consider it their responsibility.

(ii) Water accessibility is a sensitive issue. Treating groundwater as a common good leads to more equity. When groundwater governance is implemented well in a village or in villages that share an aquifer, the Pradhan Mantri Kisan Sinchayi

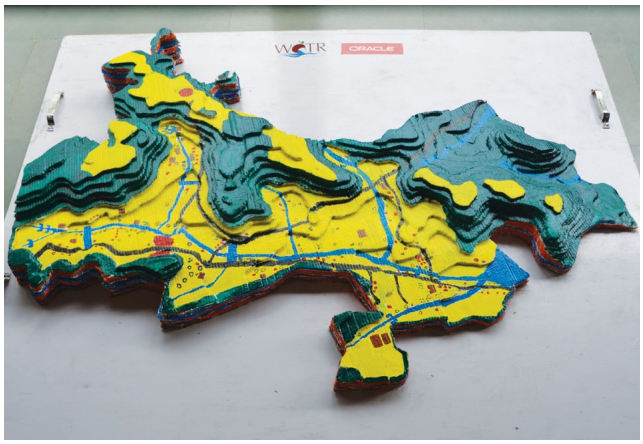

Fig 3: CDVI 3D model for the promotion of Water Stewardship Initiative

Yojana and other agricultural schemes of the state and central governments can provide benefits for a larger number of households, similar to a group model of irrigation (Golecha et al., 2019). Crop planning based on water availability ensures more equitable access to water.

(iii) The benefits of forests should be quantified to aid their conservation and enhance their diverse ecosystem services. Other studies are also required to assess the dynamics of these various ecosystem services including regulation, support, as well as cultural and other provisioning services.

Key Message 3:
WSD restores the ecosystem. The benefits of ecosystem services (particularly livelihood generation) are maintained and enhanced by climate adaptive measures such as water use management and climate resilient agricultural practices.

Findings

(a) The MP project villages implemented WSD only, whereas the villages in MH also implemented climate change adaptation measures that focused on capacity building for climate resilient agriculture (CRA) practices and water use management. The impact of water management with CRA (promotion of organic formulations, crop selection, locale specific crop weather advisories) on agriculture productivity was observed during drought years. In MP, losses were observed across all villages, though less in the project villages as compared to the control (Das et al., 2020). During 2018–19, a severe drought year, crop productivity in the project villages in MH ranged from 45% to 80% above that during the 2008–09 base year. Farmers in the project villages benefitted from much higher crop productivity than those in the control villages (Golecha et al., 2021).

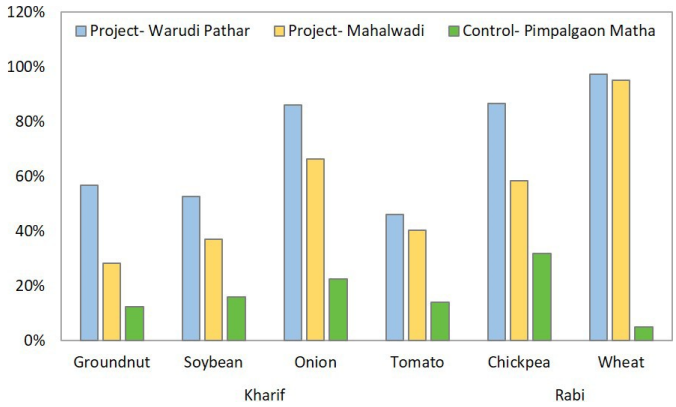

Fig 4: Percentage change in the productivity of main crops in the MH Plateau Region villages during the drought year 2018-19, compared to the 2008-09 base year

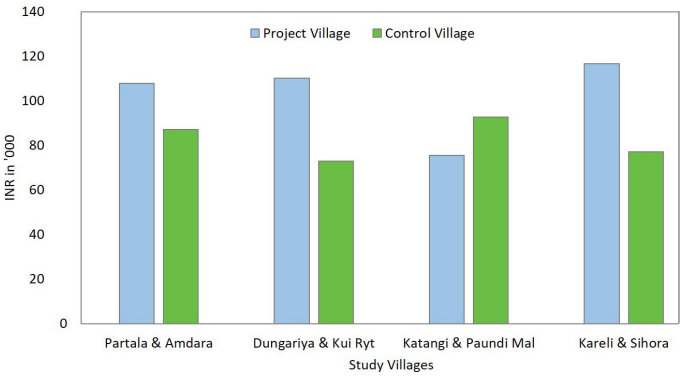

Fig 5: The Net Present Value (in INR) per household for the study villages of MP for the period 2008 to 2018

The benefits accruing to agricultural livelihoods indicate the vital services and contributions made by regenerated ecosystems. A comparison of the Net Present Value per household in the project villages with that in the control villages both in MP and MH clearly demonstrates the benefits of WSD in MP (Fig 5) (Das et al., 2020) and of WSD with water management and CRA practices in MH (Fig 6) (Golecha et al., 2021).

The control village Paundi Mal in MP shows higher

(b) benefits per household. Paundi Mal is a market place village which benefitted from government schemes like piped household drinking water supply and several others. By way of comparison, fewer schemes were implemented in remote Katangi. However, the income from agriculture in Katangi (a project village) is higher than in Paundi Mal, thus establishing the benefits of WSD. A similar situation is observed in Chas (MH). A minor dam was constructed in this control village half a decade

ago. Despite this, the NPV per household in Chas is far less than in the project villages where WSD and CCA were implemented.

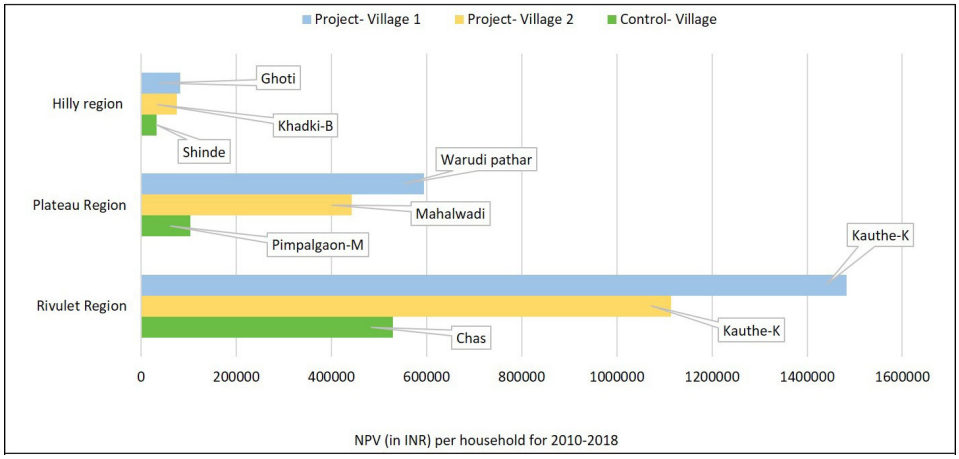

Fig 6: The Net Present Value (in INR) per household for the study villages of MH for the period 2010 to 2018

Recommendations

(i) A review of the WSD structures and interventions for land management is required to make these more responsive to climate change e. For example, structures to address both floods and droughts are required, along with community-based flash flood management. It is particularly important to implement these measures on farmlands and in low-lying areas.

(ii) The benefit to farmers from linkages with government schemes and markets only is limited. The implementation of WSD along with water management as well as climate resilience and CRA practices yield far greater returns even during drought years, while protecting the ecosystem. Benefits will be further enhanced when market linkages are established.

(iii) Capacity building plays a crucial role in community management of the resource base, particularly in addressing climate events related to rainfall and rising temperature. Engaging women actively in decision-making bodies (Gram Panchayat, Village Development Committee, Water Management Team, etc.) will strengthen their capabilities to continue to play a crucial role in agriculture and development.

(iv) Action research is required with a focus on enhancing the income of tribal populations both in MP and MH. Research on the promotion of indigenous crop varieties and their responsiveness to climate change events is also crucial.

Key Message 4:
Building up the capacities of local governing bodies through effective mechanisms enables communities to safeguard their regenerated watersheds and meet emerging challenges.

Findings

(a) Repair and maintenance are required from time to time as structures get silted or damaged, which reduces their effectiveness. Villagers seek guidance and external support for this purpose (Das et al., 2020, Jabalpur village). The MH villages benefitted from convergence with the forest and agricultural departments and the contribution of community labour (Golechha et al., 2021) through which repairs of structures and plantations were carried out.

(b) Although the water stewardship and CRA interventions were initiated during the project period in the MH villages, guidance to address climate change CC, water management and linkages to government schemes continued for a couple of years beyond the project period. This benefitted the MH project villages (Fig 5).

Recommendations

(i) Guidance is required so that the Village Development Committee / Gram Panchayat monitor the structures as well as maintain and repair them in a timely manner. Water stewardship offers an integrative approach for this purpose (Kale & D'Souza, 2019). Besides *shramdaan*, funds may also be availed of through MGNREGS and the Maintenance Fund if available.

(ii) Information about new government schemes, working with neighbouring villages on a wider Landscape (e.g., a shared aquifer), addressing climate extremes, market stresses and other externalities is ongoing. When leadership changes, new members need the knowledge and skills to protect and enhance ecosystem services. Hence a mechanism is required to build regular capacitation of local leadership (GP/VDC) to ensure continuity of governance and benefits.capacitation of local leadership (GP/VDC) to ensure continuity of governance and benefits.

Key Message 5:
Investment in ecosystems restoration and climate change adaptation contributes tangibly to land degradation neutrality, sustainable development goals and Paris Agreement targets.

Findings

(a) The 'ridge-to-valley' approach in WSD and other SLM practices have increased soil retention and vegetative cover (Key Message 1). Inputs from CRA practices and community water management (Key Message 3) protect and improve soil health. Both these interventions make a quantifiable contribution to reduction of land degradation while still maintaining its productivity, and thus contribute to meeting India's Land Degradation Neutrality targets.

(b) Enhancement of ecosystem services contributes to meeting food, water and livelihoods security (Key Message 2) of the local populating, bringing them monetary gains (Key Message 3).

Recommendations

(i) Investments in ecosystem regeneration and adaptation to climate change managed by the local community are urgently required for India to meet its Nationally Determined Commitments and other international commitments. Interventions such as WSD along with CCA (as implemented in the MH villages) have the potential to contribute to these targets: SDG 1 – No Poverty; SDG 2 – Zero hunger; SDG 5 –Gender equality; SDG 6 – Clean water and sanitation; SDG 8 – Decent work and economic growth; SDG 13 – Climate Action; SDG 15 – Life on land. When well implemented and managed, the returns are far greater than the investments made (Das et al., 2020; Golechha et al., 2021). Hence, wherever possible, projects should utilise financial resources from various donors together to address the various components of CCA and to thus enhance resource sustainability and economic returns.

(ii) In designing projects, it is important to ensure that environmental and societal 'low and no regret interventions' are implemented so as to obtain the benefits of WSD and CCA activities together for the majority of households.

Conclusion

India faces a severe crisis of land degradation which is worsening with climate change and global warming. Urban-to-rural migration observed during the COVID-19 pandemic highlighted the dearth of land-based livelihoods in rural areas. The studies which have contributed to this policy brief showcase how land management and climate change adaptation measures, with the active involvement of local communities, can both safeguard ecosystem services as well as enhance economic returns. WSD practices on landscapes need to be upscaled urgently based on the current ecosystem characteristics, accompanied by nature-friendly and efficient agricultural and water use practices. In addition, scientific principles of ecosystem and their topographical features need to be incorporated. It is equally important to promote and upscale climate adaptive practices together with community management of the ecosystem in order to enhance and sustainably harness it for the benefit of all.

This UN declared 'Decade of Ecosystem Restoration' and the 'Decade of Action' are a strong incentive for India to adopt an Ecosystem-based Adaptation approach in order to meet our critical target commitments to the UN Sustainable Development Goals (SDGs), Land Degradation Neutrality (LDN) as well as Nationally Determined Contributions (NDCs) to the Paris Agreement.

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About WOTR

The **Watershed Organisation Trust (WOTR)** is a not-for-profit NGO founded in 1993, operating currently in eight Indian states—Maharashtra, Telengana, Andhra Pradesh, Madhya Pradesh, Rajasthan, Jharkhand, Orissa, and Bihar. WOTR is recognized widely as a premier institution in the field of participatory Watershed Development and Climate Change Adaptation. Its unique strength lies in its on-field experience and in a systemic, participatory approach.

The **WOTR Centre for Resilience Studies (W-CreS)** aims to provide evidence-based responses to mitigate the impacts of climate change on ecosystems, water resources, agriculture, food and nutrition, health, livelihoods, gender, governance and local institutions. The Centre conducts inter and trans-disciplinary research to contribute grounded insights and learnings towards policy formulation, programme design and implementation, capacity building as well as behavioural change processes.

About ELD

The Economics of Land Degradation (ELD) Initiative works at the science-policy interface, bringing a large global network of scientists, academics, business leaders, politicians, decision-makers and other relevant stakeholders together to identify solutions for land management. It mobilises different kinds of expertise ranging from ecosystem services to economics, stakeholder participation, communications and other topics related to land management and policy. The Initiative provides economic information on the benefits of sustainable land management to interested parties, capitalising on intellectual capital to promote better land management.

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