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POLICY BRIEF

May 2020

Land Remediation for Achieving Global and National Targets: Case Study of Bundelkhand (India) through Capitals Approach

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Key messages

- Fulfillment of the Sustainable Development Goals (SDGs), National Biodiversity Targets (NBT), Land Degradation Neutrality (LDN) target of India and the INDC (Intended Nationally Determined Contribution) commitments of the country calls for informed decision making

- Formulated policies, associated programmes and interventions, that are carried out at both micro and macro levels by various stakeholders, need to follow a holistic evaluation framework for more effective fulfillment of local needs as well as national and global targets

- To make land remediation interventions effective and sustainable a holistic framework of impact evaluation needs to be adopted. The evaluation framework should consider various types of vital capitals

Summary of the study

Land degradation causes loss of biodiversity and productivity of a particular land. It affects the entire natural environment through disruption in the ecological process and has far reaching effects on human welfare and the economy of a country through decline in supply of vital ecosystem services. Several land and water based interventions have been initiated by the Development Alternatives Group through different programmes for land remediation in the semi-arid, erratic rainfall prone and economically backward Bundelkhand region of Madhya Pradesh, India. This study examined the costs and benefits of the implemented programmes by applying an extended ELD (Economics of Land Degradation) methodology in three districts of Bundelkhand viz: Datia, Shivpuri and Niwari. It compared both intervention and control villages in terms of the evolution of their natural, social and human capital based on multiple indicators. The outcomes were obtained through quantitative and qualitative analysis of primary survey data and applications of GIS tools and models using satellite data. The findings from the evaluations done through statistical methods, cost – benefit analysis and using different software like GLOBIO and INVEST highlighted the differences in performances of different forms of capitals across intervention and control villages for the selected years of study (2013 and 2018). The findings reflected that land use changes have taken place in the study area during this period. Major improvements in agriculture were reported. The cultivated area increased in the study site along with increased practices of double and multi-cropping. Better access to irrigation facilities in the intervention villages, as a result of the interventions, was found to be one of the major driving factors for this change. Gains in livestock benefits were observed in several intervention villages. Positive changes in other ecosystem services (e.g. forest ecosystem services, water etc.) also took place. Some improvements in species abundance and carbon sequestration were also observed through quantitative assessment. In terms of social, human and cultural capital differences between intervention and control villages were also estimated through quantitative and qualitative assessments. Along with that, some of the prevalent factors associated with the differences in benefits were highlighted. Finally, the benefits created through these interventions were mapped against the SDG framework to analyse the contribution to the National and global SDG indicators, NDC and National Biodiversity targets. The study also came up with the relevant policy recommendations that could be conducive for informed decision making at both micro and macro level.

Context of the study

Land degradation is conceptualised as the loss of productivity of land (Millennium Ecosystem Assessment, 2005). In most of the cases it is associated with drylands. The productivity loss of land is seen from both biological and economic perspectives. The factors causing land degradation include both natural or anthropogenic threats that adversely affect the land to function properly and result in deterioration of productivity of land, and hence disrupt the flow of ecosystem services . Land degradation currently affects 1.3 billion people directly worldwide and poses a threat to 3.2 billion more (Thiaw, 2019). Although it is often assumed that damaged land will heal with time if left alone, but that has not been the reality for many years now. Worldwide, drastic climate change is causing desertification, lack of availability and access to ground and surface water, diminishing soil nutrients and soil quality. As a result, especially in the developing countries, there is fall in agricultural productivity, impact on other land and water based livelihood activities and reduced access to potable water. This in turn causes uncertainty in income from the primary sector, lack of food security, indebtedness of the farming community and regional inequalities in income and human well-being. India is the 17th most water-stressed country in the world, with a share of 2.4% of the land mass of the world. As of 2019, 96.4 million hectares of land in India are already under land degradation and 83 million hectares are undergoing desertification, which amounts to about 30% of the land area of the country (CSE, 2019) as having already experienced significant loss of productivity. This loss has negative impact on both human well-being and carbon sequestration, and maintenance of biodiversity in the country.

A number of global studies (FAO, 2011) (Olsson, 2019) have also pointed towards several anthropogenic factors like high use of chemicals, incorrect farming practices (shifting cultivation, intensive irrigation, unsustainable farming, etc.) and unsustainable use of land (overgrazing, clearing of forests, conversion to agricultural lands, etc.) for adding to the increase in desertification at the global level. Some of the dominant land degrading factors existing in India are, increase in frequency and intensity of incidences of extreme events (e.g. drought and flood), soil erosion, depleting ground and surface water levels, vegetation degradation and wind erosion apart from anthropogenic factors (Issaka & Ashraf, 2017) (Kurrey, Singh, & Rajput, 2016) (Jia et al., 2019). In this regard, it is necessary to frame and implement efficient climate adaptation measures. Appropriate measures to deal with climate change in the form of strategies to build resilience for the coupled socio-ecological systems will lower the risks posed by climate change. It will also enhance adaptive capacities of the communities by strengthening livelihood opportunities, securing availability and access to food, water and other vital resources, build capacity of the communities to manage the resources as well as promote equity.

In this regard, for efficient management of the limited resources in the scenario of current and projected climate change impacts, the roles of the four vital capitals (i.e. Natural Capital, Human Capital, Social Capital and Cultural Capital) are found to be significant. The importance of this capitals approach is due to the fact that it deals with restoration and sustainability of the key forms of capitals mentioned above. It has been argued, for example, that loss of some forms of natural capital cannot be compensated for by an increase in financial capital. Apart from that, for a more participatory and inclusive land remediation measure and for sustainability in the management of natural capital, other intangible forms of capital e.g. human, social and cultural capital play a significant role.

These four types of capitals are defined in Table 1.

Table 1: Definition of major types of capital

Capital	Definition
Natural Capital	The stock of natural resources including all living organisms (Rajapaksa, Islam & Managi, 2017); (Costanza and Daly 1992)
Social Capital	Refers to the set of elements in a society that encourages collective action (Coleman 1988). Some of the components of social capital are trust and bond shared by people, performance of social network etc.
Human Capital	It incorporates health, education, skills and knowledge of the members of the society (Vemuri and Costanza 2006)
Cultural Capital	It refers to the cultural value systems and practices (Throsby 1999) that are carried over generations.

Therefore, the interconnection of these capitals plays a crucial role in bringing the community together to collectively act towards solving local developmental problems, and more specifically the issue of land degradation.

As already mentioned, environmental degradation is resulting in higher land replacement costs and affecting the poor and marginal communities to a large extent (Reddy, 2003) at the micro level. For sustainable management of land and other environmental resources, it is therefore, vital to adopt bottom-up approaches (Meli et al, 2019) to policy framing and implementation. To achieve economic and environmental sustainability and maintain human well-being it is vital to focus on strengthening of the relevant natural, human, social and cultural capital in a participatory way. It is also an urgent mandate to monitor and evaluate the effectiveness of the followed approaches and implemented programmes to meet the contextual and broader goals of sustainability.

Rationale and objectives

In this context, the rationale of the study emanates from the fact that it is increasingly important to evaluate (through a capitals approach) how the land remediation options have performed at the local level for addressing land degradation. A GIZ funded study was commissioned in Bundelkhand region of Madhya Pradesh in India during 2019- 2020 for this purpose.

The Bundelkhand region is located between the Indo-Gangetic Plain to the north and the Vindhya Mountains to the south. It comprises of 13 districts - six in the state of Madhya Pradesh (MP) and seven in the state of Uttar Pradesh (UP). The region had a culturally rich history and once there were fertile soils, juxtaposed forests, perennial rivers and streams. The region has slowly turned desertified due to unsustainable resource management practices and climate change impacts. It is a semi-arid and mainly rain-fed region with undulating topography and shallow red and black soil. Due to the saline and porous nature of soil and very less rainfall, the region has been suffering from recurrent droughts. Ten out of 13 districts are classified as backward and 70% of the population is rural. Its economy is largely agrarian with agriculture, livestock rearing and labour work as major sources of livelihood. In the early decades, there was also a heavy dependence on forest products especially for fuelwood but this has now drastically declined a lot due to reduction in the forest cover, introduction of technology, creation of alternative livelihoods as well as change in market demand. Increasing levels of poverty has also been experienced by the village communities in the region.

Being induced by these factors, Development Alternatives Group, a social enterprise, started its interventions in five districts of Bundelkhand region in 1985 to transform the lives of communities and the environmental situation in the area. With the support of local governments, national and international sources, the initiatives aimed at cocreating solutions with the community to enable development that is sustainable and inclusive. Although the interventions were done in several districts of Bundelkhand, but in this study only 3 districts (Datia, Shivpuri and Niwari) were considered. The three districts of Bundelkhand on which the study focuses (Datia, Shivpuri and Niwari) are areas falling under the rural region with major reliance on agriculture for a living. They experience high temperatures and recurrent periods of droughts experienced with high relative humidity during the monsoon. Communities from the villages mainly depend on groundwater for irrigation and for drinking water, but other small tanks, dams, canals and rivers are also present on which dependence is less due to problems of drying up (Development Alternatives, 2015). To overcome this, the interventions (Development Alternatives, 2019) revolved around land and water management and afforestation, following which clean technology- based livelihood options, capacity building of local institutions, enabling communities to access basic needs of drinking water sanitation, shelter and energy were supported through enterprise development and skill-building for job creation. Following land remediation and capacity building interventions were implemented in the intervention villages to improve the land and water in the area:

- Integrated watershed management programmes comprising of formation of watershed committees, construction of soil and water harvesting structures, drought resistant seed distribution, net-planning, promotion and training for maintenance of watershed structures and link to micro-enterprises.

- Capacity building of sustainable agricultural practices like agro-horti cultivation and double cropping as opposed to mono-cropping

- Formation of social institutions such as Self Help Groups, Farmers Producer Organisations, etc and capacity building for sustainable farming practices.
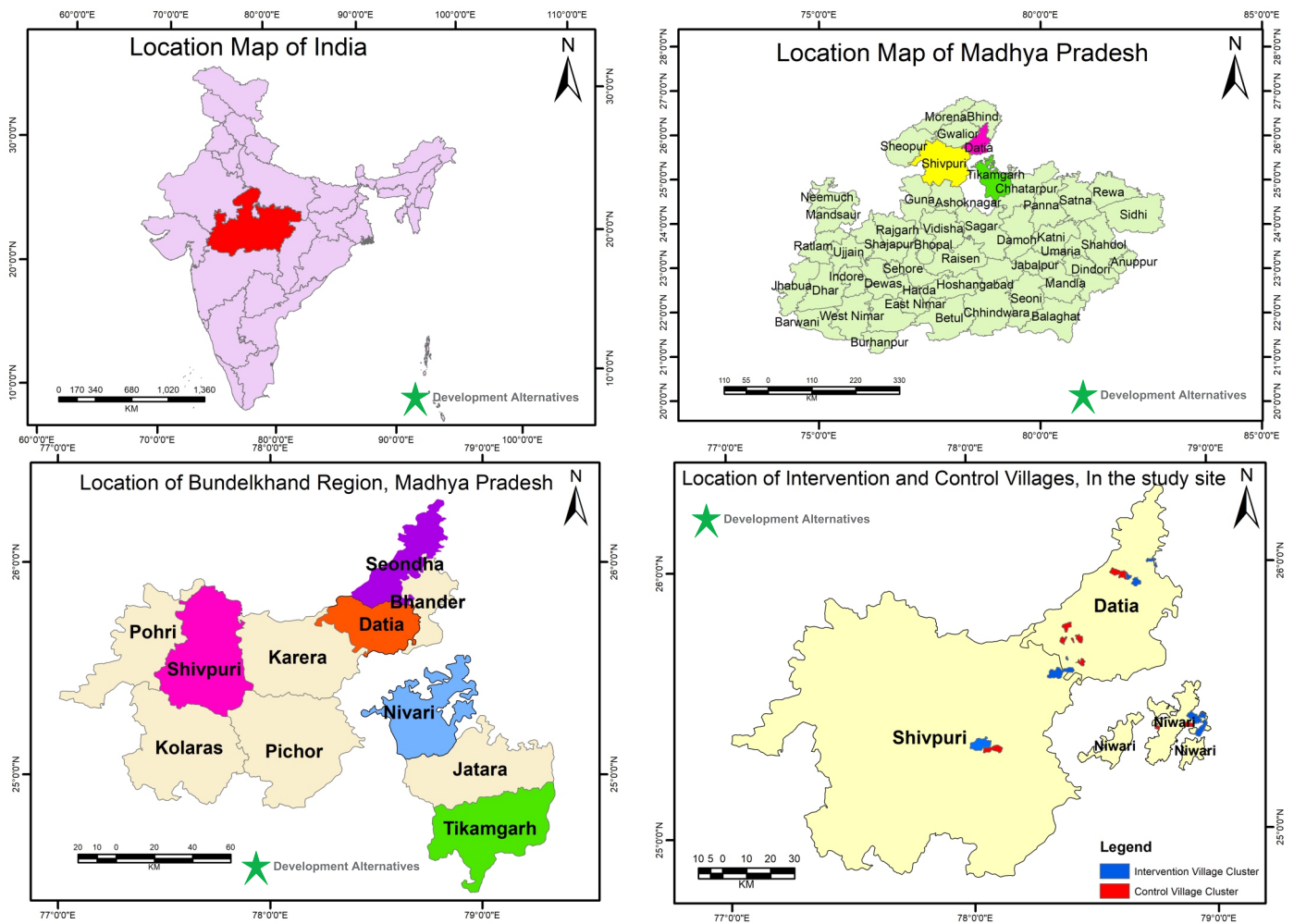
Figure 1: The Study Site in Bundelkhand, Madhya Pradesh, India

Since the semi-arid region of Bundelkhand is one of the most affected areas of India in terms of land degradation, and given that there have been several invention in the region to deal with that, as mentioned above, this study had been undertaken to evaluate both the net benefits and multi-faceted impact of land remediation measures in the region. Through this micro-level assessment, the study also intended to link the impacts of interventions with the relevant global and national goals, and contribute to policy formulation.

The specific objectives of the study were:

- To evaluate (using a capitals approach) the potential of land remediation activities as a beneficial and cost effective measure for combating desertification.

- To map the identified benefits of the reduction in land degradation with SDG indicators and other relevant goals as a result of the interventions.

Methodology

To accomplish the pre-mentioned objectives of the study, both qualitative and quantitative research methodologies have been adopted. The research framework combines the application of the Economics of Land Degradation (ELD) (as developed by GIZ) methodology using a capitals approach.

Primary data collection was done through structured questionnaire based interviews, informal interviews, Focus Group Discussion (FGD) with the local communities, internal field staff and government departments of the three districts of Bundelkhand. The data included information in different parameters of natural capital, human and social capital and cultural capital. Participatory Rural Appraisal (PRA) approach was also adopted to enable local people to share their knowledge. IUCN ecosystem assessment tool, remote sensing and GIS mapping were done for identifying ecosystem services. Secondary sources of data included reviewing online literature (including studies of ELD initiatives) on land degradation and ecosystem services; and use of the InVEST model subtypes.
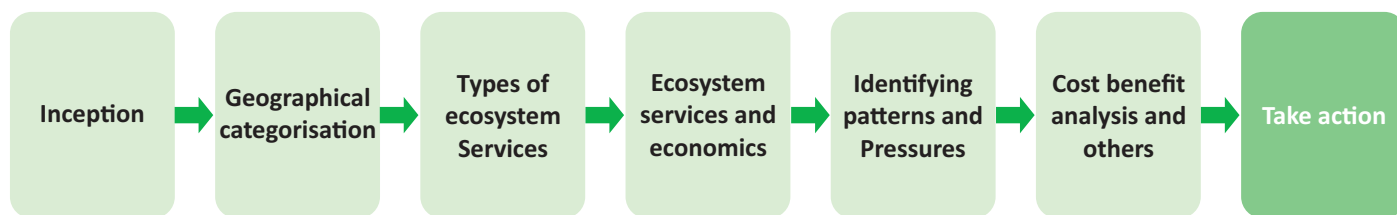
| Inception | → | Geographical categorisation | → | Types of ecosystem Services | → | Ecosystem services and economics | → | Identifying patterns and Pressures | → | Cost benefit analysis and others | → | Take action |

Figure 2: Steps of the ELD approach

Outcomes and findings from the study

With respect to the land remediation interventions carried out in thirty villages in the study site, the land use changes and benefits derived in terms of natural, human, social and cultural capital were assessed for the selected intervention and control villages in the three districts Datia, Shivpuri and Niwari of Bundelkhand for base year 2013 and study year 2018.

Table 2: Intervention and control villages in the study site

District	Intervention village	Control village
Datia	Chopra	Bijapur
	Govind Nagar	Ramnagar
	Kamhar	Samroli
	Pathari	Sarol
	Salaiya Pamar	Sonagir
	Jauri	Uprain
	Kherona	Kudari
	KheriDevta	Santri
	Parsonda Gurjar	
	Parsonda Baman	
Shivpuri	Manpura	Nandna
	Dulhai	Bhonti
	Piproniya	
Niwari	Patharam	Baman Naiguan
	Ubora	Tanicharkala
	Chachawali	
	Dhamna	
	Bamhori Sheetal	

The highlights of outcomes of LULC mapping (Table 3) for intervention and control villages in 2013 and 2018 are:

- Cropland was found to be the dominant land use category across all the three districts, and Niwari had the highest share (around 86% in 2018) of the total land area under cropland but it had no forest cover

- Cropland areas in intervention villages in all the three districts experienced a higher rate of increase compared to control villages during 2013- 2018.

- Some other land use categories like forest, grazing land etc. experienced decline in area during 2013-2018 in both intervention and control villages but intervention villages had a lesser rate of decline.

Table 3: Land use land cover and population in Intervention and Control villages in the study site of Bundelkhand in 2013 and 2018

	Intervention villages in Bundelkhand		Control villages in Bundelkhand	
	2013	2018	2013	2018
Total area (Hectares)	12,348	12,348	7,040	7,040
Agricultural land (Hectares)	7,966	8,191	5,510	5,564
Water bodies (Hectares)	6,829	593	163	145
Forest cover (Hectares)	2,012	1,929	175	149
Population (2011 census)	30,285	30,285	28,727	28,727
Total no. of households (2011 census)	6,238	6,238	4,966	4,966

Source: Land use data- GIS, Population data- Census of India, 2011.

These signify the positive impact of land remediation interventions and local level policies of the government to enhance benefits from farming and other land based livelihoods like livestock rearing, use of forest products etc. In case of certain land use types in the intervention villages requirement for additional intervention was also identified.

Those included fallow land, wasteland and waterbodies in Datia; grazing and habitation in both Shivpuri and Niwari.

Figure 3 shows the indicators undertaken for assessing the benefits using this capitals approach.

SOCIAL CAPITAL

- Rate of migration
- Social institutions
- Perception about ecosystem services

HUMAN CAPITAL

- Income
- Health
- Education

NATURAL CAPITAL

- Carbon storage and sequestration
- Mean Species Abundance
- Crop production
- Livestock production
- Forest products

CULTURAL CAPITAL

- Case study on medicinal plant and herbal healing
- Case study on local festivals around nature

Figure 3: Indicators undertaken for assessing the natural, human, cultural and social capitals

Collection of primary data on four capitals from the study site in Bundelkhand, Madhya Pradesh

Natural Capital

The overall strengths and weaknesses as found through the assessment of the interventions of the land remediation initiatives using capitals approach are mentioned in Table 4.

Table 4: Outcomes of natural capital assessment

Type	Datia Intervention Cluster – Strengths	Datia Intervention Cluster – Weaknesses	Datia Control cluster – Strengths	Datia Control cluster – Weaknesses	Niwari Intervention Cluster – Strengths	Niwari Intervention Cluster – Weaknesses	Niwari Control cluster – Strengths	Niwari Control cluster – Weaknesses	Shivpuri Intervention Cluster – Strengths	Shivpuri Intervention Cluster – Weaknesses	Shivpuri Control cluster – Strengths	Shivpuri Control cluster – Weaknesses
Land use categories	Less rate of decline in land use categories like forest, open forest and grazing land	High rate of decline in fallow land, wasteland and waterbodies	Less rate of decline in fallow land, wasteland and waterbodies	High rate of decline in land use categories like forest, open forest and grazing land	Less rate of decline in fallow land and waterbodies	High rate of decline in grazing and habitation	Less rate of decline in grazing and habitation	High rate of decline in fallow land and waterbodies	Less rate of decline in land use categories like fallow land, forest, open forest, trees outside forest and waterbodies	High rate of decline in grazing and habitation	Less rate of decline in grazing and habitation	High rate of decline in land use categories like fallow land, forest, open forest, trees outside forest and waterbodies
Crop production	Income per hectare increased over the period 2013 to 2018			Decline income per hectare over 2013 to 2018	Slightly higher income per hectare than control villages from 2013 to 2018	Slight decline in income per hectare from 2013 to 2018		Decline income per hectare over 2013 to 2018	Income per hectare increased over the period 2013 to 2018			Decline income per hectare over 2013 to 2018
Double cropping area	Increase in double cropping area from 2013 to 2018 and higher than control villages		Increase in double cropping area from 2013 to 2018	Lower than intervention villages	Increase in double cropping area from 2013 to 2018 and higher than control villages			Decrease in double cropping area from 2013 to 2018	Increase in double cropping area from 2013 to 2018 and higher than control villages		Increase in double cropping area from 2013 to 2018	Lower than intervention villages
Livestock production	Increase in income per household from 2013 to 2018 and higher than control villages		Increase in income per household from 2013 to 2018	Lower income gain as compared to intervention villages	Increase in income per household from 2013 to 2018 and higher than control villages		Increase in income per household from 2013 to 2018	Lower income gain as compared to intervention villages	Increase in income per household from 2013 to 2018 and higher than control villages		Marginal increase in income per household from 2013 to 2018	Lower income gain as compared to intervention villages
Forestry	Increase in income from 2013 to 2018		Higher increase in income than intervention villages							Decrease in income from 2013 to 2018	Smaller loss in income than intervention villages	
Biodiversity	Increase in MSA (implying improved biodiversity) from 2013 to 2018 and higher than control villages	MSA values near 0 implying lesser biodiversity	Increase in MSA (implying improved biodiversity) from 2013 to 2018	MSA near 0 (implying lesser biodiversity) and lower than intervention villages	Increase in MSA (implying improved biodiversity) from 2013 to 2018 and higher than control villages	MSA values near 0 implying lesser biodiversity	Increase in MSA (implying improved biodiversity) from 2013 to 2018	MSA near 0 (implying lesser biodiversity) and lower than intervention villages	Increase in MSA (implying improved biodiversity) from 2013 to 2018 and higher than control villages	MSA values near 0 implying lesser biodiversity	Increase in MSA (implying improved biodiversity) from 2013 to 2018	MSA near 0 (implying lesser biodiversity) and lower than intervention villages

(Row group: Natural Capital)

Net benefits from crop production increased over the period 2013 to 2018 in the intervention villages in Datia and Shivpuri but declined slightly in Niwari. However, in the control villages, the decline in income was sharper. It can be attributed to the interventions for land remediation and construction of watershed in the intervention villages. As, a result of the share of area under double cropping also increased (Figure 4 and 5).
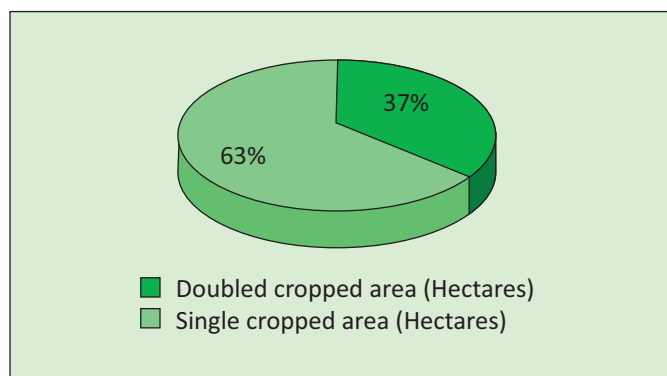

Figure 4: Cropping pattern of interevntion villages in 2013
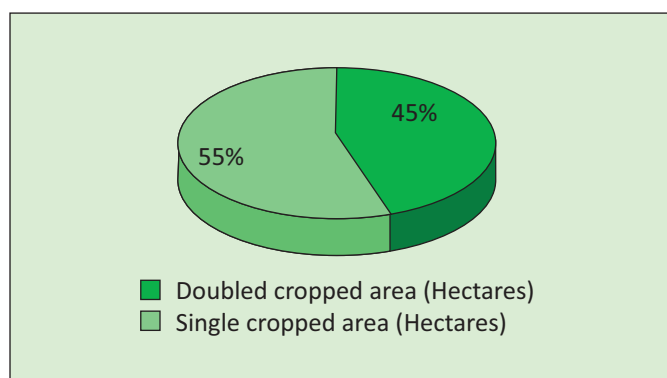
Figure 5: Cropping pattern of intervention villages in 2018

Net benefits from livestock increased over the period 2013 to 2018 in all the intervention villages. In the control villages, income increased in Datia and Niwari and marginally in Shivpuri.

Benefits from forest were derived based on only the use value of forest provisioning ecosystem services such as collection of fuelwood, wood for construction, leaves etc. The results showed in the intervention villages of Datia there was an increase in income between 2013 and 2018, but in Shivpuri, the village/community experienced a loss. Niwari has no forest areas. The major contributing factors for this were conversion of some forest land by the government to agricultural land, change in lifestyle practices in the communities leading to reduction in use of fuelwood.

Overall changes in monetary benefits from crop production, livestock and forest in the study site are shown in Figure 6, Figure 7 and Figure 8. It reflects a visibly positive impact of interventions for land remediation in the intervention villages.
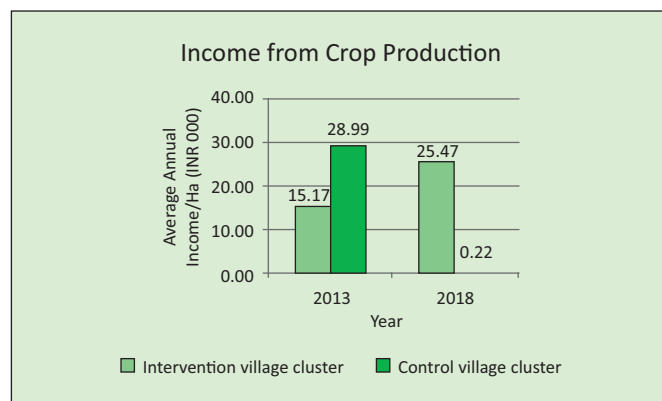
Figure 6
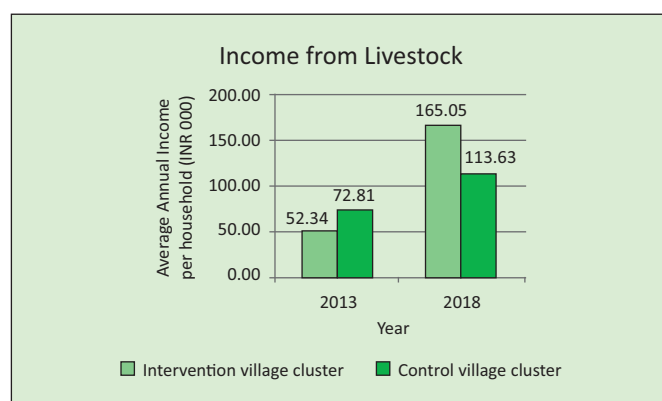
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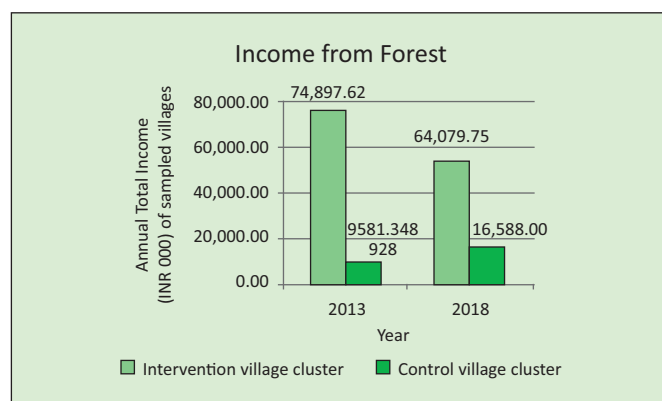
Figure 8

It has been revealed that the biodiversity (measured in terms of mean species abundance) has been improved in intervention villages from 2013 to 2018 but in the control villages it was not the case. Higher gains in the intervention villages in Shivpuri were mainly due to very small changes in land use land cover over time and the retention of natural water bodies owing to the land and water based intervention undertaken by DA group. While in Datia and Niwari districts, the increase in biodiversity could be attributed to the intensification of agriculture (low input) as picked up by GLOBIO again owing to the promotion of sustainable agriculture practices.

Carbon sequestered in the land was estimated using the InVEST model, taking account of different crops grown and taking account of different rates of carbon held in the ground both in the Kharif and Rabi seasons. The largest gain is in Datia, followed by Niwari and Shivpuri. But the overall carbon sequestration per hectare of land had remained almost unchanged in intervention villages and slightly declined in control villages.
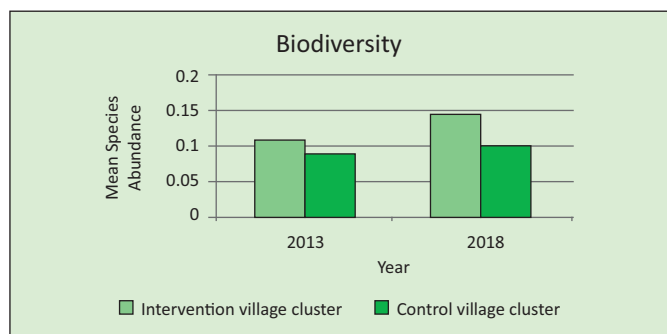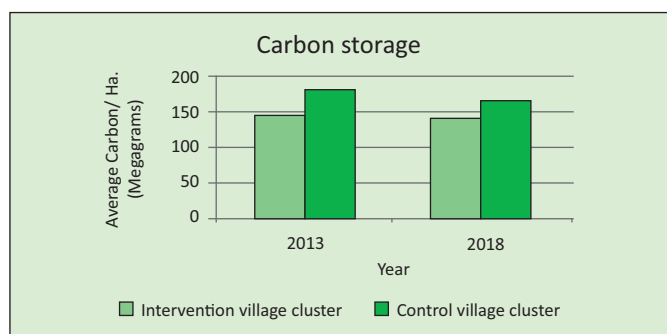

Figure 9

Figure 10

The cost benefit assessment of the interventions was done based on indicators like Net Present Value, benefit cost ratio and internal rate of return (IRR). It was found that in all the three selected districts benefits per unit of investment in interventions were positive with high values. This implies cost-effectiveness of the interventions in the long term.

Social, Human and Cultural Capital

Assessment of Social Capital was done based on quantitative indicators like number of social institutions and migration rate. On the other hand, mapping of perception about ecosystem services added to the assessment of social capital from a qualitative perspective. The outcomes reflected that intervention villages were better off by 2018, compared to the control villages in the three districts.

Human Capital was assessed based on household income, health and education. It was found that in terms of literacy rate (i.e. educational indicator), the intervention villages in Niwari had performed better than that of control villages and thus implying better strength in human capital. Health indicators also showed some changes. Income per household in intervention villages increased significantly in all villages, with the greatest increase in Niwari, followed by Shivpuri and Datia.

Table 5: Indicators of Social Capital

No. of social institutions		2018	2013
Intervention	Niwari	27	34
	Shivpuri	55	108
	Datia	-	87
Control	Niwari	10	0
	Shivpuri	44	0
% Adults migrating		**2018**	**2013**
Intervention	Niwari	14.9	57.2
	Shivpuri	14	26.9
Control	Niwari	39	75
	Shivpuri	9	57.1

Source: Calculations based on primary data collected from field by DA team

Table 6: Types of social institutions in intervention villages

District	2013	2018
Niwari	Watershed committee, SHG, FPO	Watershed committee, SHG, FPO
Shivpuri	Watershed committee, SHG	Watershed committee, SHG, Anganwadi
Datia	Data not available	Data not available

Source: Primary field survey

Table 7: Types of social institutions in control villages

District	2013	2018
Niwari	Data not available	SHG
Shivpuri	Data not available	SHG, Anganwadi
Datia	Data not available	Data not available

Source: Primary field survey by DA team

Cultural Capital assessment was done using a qualitative methodology through two case studies in Datia district. The case studies were collected to portray the strengthening of cultural capital in the intervention villages. It was found that, people were engaged in traditional cultural practices of the village, thus bringing social cohesion and enhancing collective decision making. Through these practices ecosystem health is also being maintained. Sustainability of ecosystem and ecosystem services also strengthens cultural and social capital at the micro level. Integrated watershed management projects have significant effects on land and water, which have not only enhanced the natural capital of the region but also have strengthened its ties to people.

Tracking benefits through the SDG, NDC and NBT lenses

The land remediation programmes in Bundelkhand were closely tied to the SDG indicators. Observations in the SDG assessment were in the form of higher positive changes in intervention villages over control villages during 2013- 2018.

SDGs 1, 2 and 8 are focused on ending poverty, hunger as well as promoting inclusive and sustainable agriculture, economic growth, full and productive employment and decent work for all within which national indicators on SHG formation (1.3.4), implementation of local disaster risk reduction strategies (1.5.2), expenditure on social protection (1.5.2.1.a.2), wheat and rice agricultural productivity (2.3.1), degraded land to net sown land proportion (2.4.1) and migrant workers (8.8) were addressed by the study. Setting up of a number of social institutions including SHGs has contributed towards social protection and protecting labour rights (national indicators 1.3.4, 1.5.2.1.a.2, 8.8) which has improved the social capital of the study area. The human capital has been improved in the form of increased income, betterment in health and education indicators through increased agricultural productivity by utilising drought-reducing approaches and strengthening of social capital by capacity building of the rural communities, formation of social institutions etc. (as mentioned above for 1.5.2, 2.3.1, 2.4.1 and 2.4.2). This resulted in increased resilience against adverse climatic conditions and other natural threats. Rise in income was directly associated with benefits from increased agricultural and livestock productivity. SDG 6 is about water and sanitation for all and the associated national indicators for that include river basins brought under integrated water resources management (6.5.1). SDG 12 is about ensuring sustainable production and consumption. The national indicators corresponding to that are- per capita use of natural resources (12.2.1) and per capita food availability (12.3.1). More than 15 soil and water harvesting structures were constructed in each of the intervention villages in the study site which have contributed towards integrated water resource management (6.5.1). Ensuring sustainable management and reducing food waste were addressed by this study by showcasing the change in income from agriculture as well as forestry sector (12.2.1 and 12.3.1).

Action towards climate crisis and it's impacts constitutes SDG 13 within which national indicators on strategies for climate adaptation (13.1.1), pre 2020 action regarding climate change (13.2.1) and integrating climate change in outreach programs (13.3.1) were addressed in the study. Overall assessment of the climate adaptation strategies in terms of natural, human and social capitals contributed towards strengthening climate resilience, adaptive capacity and reduction in impact of

hazards. The policy implications from the outcomes of the study have potential to contribute towards incorporation of the climate change measures into national policies, strategies and planning. SDG 15 incorporates protection, restoration and promotion of sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. Under SDG 15, national indicators on percentage of trees outside forest (15.1.2), net sown area (15.3.3), Aichi target 2 (15.9.1), expenditure on conservation and sustainable use of biodiversity (15.9.1.a.1) and expenditure on environmental conservation (15.9.1.b.1) were addressed in the study. Classification of different land use land cover categories showcasing the change over the years in the three districts contributed towards conservation, restoration and combating desertification on land affected by droughts (15.1.2, 15.3.3 description as above). Evaluation of the change in the mean species abundance in Datia, Niwari and Shivpuri districts over the years via the GLOBIO model for the purpose of this study, formulated a way for contributing towards integrating ecosystem and biodiversity into poverty reduction (15.19.1). The change in income during 2013- 2018 comparatively higher in intervention villages for all the three districts. By aiming at economic evaluation of the ecosystem services primarily important for the local communities, the study also highlighted the necessity of policy making for mobilisation of financial resources in terms of allocation of financial resources for strengthening natural, social and human capitals to conserve and promoting sustainable use of forest and biodiversity (15.9.1.a.1 and 15.9.1.b.1). This can act as important information for decision makers to prepare informed decisions for similar geographies in terms of climate change adaptation. SDG 17 is about strengthening the means of implementation and revitalisation of the Global Partnership for Sustainable Development under which 17.19 target (building on existing initiatives) was addressed. The tracking of each of the indicators and the outputs from the study is built upon existing initiatives that are being assessed in this study.

Furthermore, the impacts interventions made by Development Alternatives also contributed to the INDC on climate change. The economic evaluation of the climate adaptation initiatives undertaken in the last decade contributed to the above. Last but not the least, the interventions undertaken and the scope of the study were also expected to satisfy India's ratification of the Convention of Biological Diversity (CBD) by addressing National Biodiversity Targets 1, 2, 3, 5, 8 and 9 for India through biodiversity analysis with the help of the InVEST model, management of major natural resources as well as conservation of ecosystems and its services.

1 NO POVERTY	Global Targets 1.3, 1.5, 1.5.1.a; National Targets: • 1.3.4 : Number of Self Help Groups (SHGs) formed and provided bank credit linkage • 1.5.2 : Proportion of States that adopt and implement local disaster risk reduction strategies in line with national disaster reduction strategies
2 ZERO HUNGER	Global Targets 2.3,2.4; National Targets: • 2.3.1 : Agriculture productivity of wheat and rice (yield per hectare) • 2.4.1 : Proportion of degraded land to net sown area
6 CLEAN WATER AND SANITATION	Global Target 6.5; National Targets: • 6.5.1 : Percentage area of river basins brought under integrated water resources management
8 DECENT WORK AND ECONOMIC GROWTH	Global Target 8.8; National Targets: • 8.8.2 : Number of migrant workers
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	Global Target 12.2, 12.3; National Targets: • 12.2.1 : Percentage variation in per capita use of natural resources • 12.3.1 : Per capita food availability
13 CLIMATE ACTION	Global Targets 13.1, 13.2, 13.3; National Targets: • 13.1.1 : Number of States with strategies for enhancing adaptive capacity and dealing with climate extreme weather events. • 13.2.1 : Pre 2020 action achievements of pre 2020 Goals as per country priority • 13.3.1 : Number of States that have integrated climate mitigation and adaptation in education curricula and outreach programs
15 LIFE ON LAND	Global Targets 15.1, 15.3, 15.9, 15.9.a, 15.9.b; National Targets: • 15.1.2 : Percentage of Tree Outside Forest (TOF) in total forest cover • 15.3.3 : Percentage increase in net sown area • 15.9.1 : Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategies Plan for Biodiversity 2011-2020 • 15.a.1 : Official development assistance and public expenditure on conservation and sustainable use of biodiversity and eco system. • 15.b.1 : Percentage of fund utilised for environmental conservation.
17 PARTNERSHIPS FOR THE GOALS	Global Target 17.19

Figure 18: SDG goals and indicators covered by the study

Intended Nationally Determined Contributions

- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture and water resources period.

National Biodiversity Targets

- NBT 1: By 2020, the national planning process of Government of India considers biodiversity as a integral part of national development that is reflected by biodiversity and ecosystem related issues as a part of implementation strategies across sectors, ministries and programmes with adequate and where possible specific financial allocations.

- NBT 2: Specific programmes linking economic and social well-being based on conservation and sustainable use action combined with equitable sharing of benefits developed by 2015 and implemented by government agencies as well as all relevant stakeholder groups, including private sector, thereafter.

- NBT 3: Ecosystems and biodiversity goods and services maintained, translated into local livelihood security programmes that results in revival of at least 7-10 per cent of representative ecosystems by 2020.

- NBT 5: By 2020, achieve atleast 5% increase in agricultural production systems based on enhanced use of agrobiodiversity, participatory actions, public-private partnership and appropriate investments in inclusive development agenda besides developing better approaches for fisheries and livestock management.

- NBT 8: By 2015, establish national coordination mechanism(s) to deal with capacity building, sharing of information and knowledge, traditional knowledge, technology transfer and cooperation and access and benefit sharing (ABS) issues at State and National levels.

- NBT 9: Develop cooperative approaches for conservation that involves wider stakeholder groups based on commitments and awareness by 2015.

Figure 19: The link to INDC (Intended Nationally Determined Contributions) and NBTs (National Biodiversity Targets)

Policy recommendations

It is evident that the current climate crises and other pressures threaten biodiversity, land, water, air etc. along with human well-being through multiple chain effects. To combat climate change, occurrence of extreme events, ecosystem alteration coupled with multiple socio-economic challenges, global goals have been set. There are Sustainable Development Goals (SDGs), Convention of Biological Diversity (CBD) goals and Nationally Determined Contribution (NDC) targets, which led to respective national targets. For example, in India the SDG India index considers 62 SGD indicators corresponding to 17 global SDGs. India also has got National Biodiversity Targets (NBT) following the CBD objectives, and is also committed to UNFCCC for fulfilling its Intended Nationally Determined Contributions (INDC). Apart from that, the country has set the Land Degradation Neutrality (LDN) target during United Nations Convention to Combat Desertification (UNCCD) COP 14 at New Delhi to halt the process of land desertification and its consequences. To address the prevalent challenges and to meet the targets at the national and global level in India there have been efforts at various levels including public, private and civil society. Hence to achieve the targets more efficiently, it is imperative to track and evaluate the innumerous interventions carried out by different stakeholders and at various levels like local, regional and national. The findings of this pilot study carried out in Bundelkhand indicate the effectiveness of such interventions at micro level in bringing about change to meet the broader national targets. Such studies are important to learn what has been achieved from programmes devoted to land remediation. At the same time, it is also necessary to keep in mind, that holistic evaluation and tracking helps in efficient and effective allocation of limited financial resources. Box 1 highlights the key recommendations in this regard.

Box 1

Monitoring and Evaluation

- Schemes, Programmes and Projects commissioned by the government/ private agents/ civil society organisations to follow holistic monitoring and evaluation framework (for micro and macro levels) set through public consultation

- Focus on necessary qualitative information to address the gaps in quantitative evaluation

- Maintenance of baseline information based on a nationally accepted data framework to enable systemic evaluation

- Necessary tracking of the concerned activity to meet national targets and global commitments

- Individual project proponents can explore the scope for replication (through contextual modification) of the 'Capitals Approach' applied in the Bundelkhand case study for highlighting the holistic benefits of the concerned project

Financial Resource Allocation Strategy

- Criteria for financial resource allocation to take into consideration the monitoring and evaluation framework set for micro and macro levels and keeping record of baseline information

- To mandate commitment to contribute to national targets

- To consider both financial viability in short and long term and potential for long term socio-environmental impact

Environmental parameters in National Performance Estimation

- In the common estimation methods at the national level for tracking economic growth (e.g. Gross Domestic Product) and human development (e.g. Human Development Index) relevant environmental parameters need to be considered

- Reframing the widely and most commonly used national performance estimation methods through inter and intra country dialogues involving relevant stakeholders (e.g. administrative, academic and research, practitioner etc.)

Acknowledgements

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Development Alternatives (DA) is a premier social enterprise with a global presence in the fields of green economic development, social equity and environmental management. It is credited with numerous technology and delivery system innovations that help create sustainable livelihoods in the developing world. DA focuses on empowering communities through strengthening people's institutions and facilitating their access to basic needs; enabling economic opportunities through skill development for green jobs and enterprise creation; and promoting low carbon pathways for development through natural resource management models and clean technology solutions.