**Title: Livelihood security policy can support ecosystem restoration**

**Running head: MGNREGA and ecosystem restoration**

**Authors and addresses**

1. Ekaterina Lengefeld, Amrita School for Sustainable Development, Center for Research in Analytics and Technologies for Education (CREATE), Amrita Vishwa Vidyapeetham, Amritapuri 690525, India

   ealengefeld@am.amrita.edu
2. Lindsay C. Stringer, Department of Environment & Geography, University of York, York, United Kingdom
3. Prema Nedungadi, Center for Research in Analytics and Technologies for Education (CREATE), Department of Computer Science and Engineering, Amrita Vishwa Vidyapeetham, Amritapuri 690525, India

   prema@amrita.edu

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## Abstract

Earth faces an unprecedented ecological crisis: the destruction of its ecosystems. Despite increasing interest in restoration, including through the UN Decade on Ecosystem Restoration (Decade), lack of financing and resources mean efforts to reverse degradation have advanced slowly. Restoration efforts require new approaches to ensure the needs of different stakeholders are met. However, analyses of policies and opportunities that help to finance restoration while improving socio-ecological outcomes, are lacking.

This paper analyzes livelihood security funding and opportunities for ecosystem restoration, drawing on India's Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), the world's largest livelihood security program. The paper analyzes MGNREGA's performance between financial years 2013 - 2021, focusing on the financing of ecosystem restoration related works, community mobilization and policy implementation in the early part of the COVID-19 pandemic. Then the paper reflects on the benefits and shortcomings of MGNREGA and considers wider lessons for the Decade. MGNREGA generated significant funding flows and numbers of projects nationally, which can contribute to ecosystem restoration. Policy design enabled the continuation and increase of works even during the first year of the COVID-19 pandemic. Our findings demonstrate the potential of linking ecosystem restoration with development policies to unlock funds, on a national scale. To maximize contributions to ecosystem restoration nevertheless requires capacity building, inclusion of environmental indicators and integration of best ecosystem restoration practices.

**Key words**: community, COVID-19, development, environmental, funds, UN Decade of Ecosystem restoration, capacity, socio-ecological outcomes

## Implications for practice:

- Integration of rural development policy and national environmental objectives can improve environmental quality by unlocking new funds for restoration, while simultaneously addressing poverty reduction, offering lessons for other developing countries.
- Linking ecosystem related works with existing national policy instruments can help in scaling restoration efforts on national level.
- Mahatma Gandhi National Rural Employment Guarantee Act's policy design demonstrates useful mechanisms as to how to continue restoration-related works even under pandemic conditions.

## Introduction

Scientific reports increasingly indicate that we are exceeding planetary boundaries (Steffen et al. 2015), drastically altering the benefits people obtain from ecosystems (IPBES 2019). The poorest, most marginalized groups often depend directly on the environment for their survival and lose out the most from this degradation (Barbier & Hochard 2018). The United Nations (UN) has responded to calls for urgent action by declaring 2021-2030 the UN Decade on Ecosystem Restoration (Decade). While such Decades offer a valuable opportunity to accelerate progress in addressing environmental degradation, it remains vital to converting the momentum into action (Stringer 2008). New policies, institutional arrangements, and restoration approaches are required, ensuring different stakeholders' needs are met, alongside adequate funding to cover restoration costs (Chapman & Lindenmayer 2019). Lack of funding remains a key reason that restoration efforts are advancing slowly (Matzek 2018), while information on viable and effective funding models for environmental protection and ecosystem restoration remains sparse. Accelerating restoration efforts will require out-of-the-box thinking to compensate for a lack of comprehensive Payment for Ecosystem Services (PES) schemes and shrinking public funds (Martin 2016). Addressing this issue is especially important in light of the coronavirus pandemic's economic consequences.

Large-scale restoration can offer important livelihood opportunities for people living in affected areas (Favretto et al. 2018), but requires consideration of locations, types, and scales of restoration, while reconciling local and national goals to achieve suitable outcomes for all stakeholders. It involves understanding local decision-making contexts and preferences, acceptance of trade-offs between ecosystem services resulting from restoration, market dynamics, and agricultural production (Lamb 2018). Discussions of policies and payment opportunities that help finance restoration while supporting development and livelihood opportunities are critical (Aronson et al. 2010), but remain underexplored.

Historically, one of the most prominent programs that has addressed the dual challenge of repairing environmental damage and creating jobs on a national scale was the Civilian Conservation Corps (CCC), introduced by President Franklin D. Roosevelt in 1933. The CCC program is considered one of the most successful public programs in the USA (Misicka 2020), and was created in response to the Great Depression when major environmental disasters such as floods and prolonged drought created a "dust bowl" in the Great Plains. The CCC provided unemployment relief, while reversing and repairing the environmental damage caused by ecosystem overexploitation by farmers, miners, ranchers and settlers (Huizinga 2012). The program laid the foundation for various restoration initiatives. Most notably, scientists created a traditional horticultural collection of trees and plants with labor from the Civilian Conservation Corps, leading to a novel approach to the recreation of native ecosystems (Court 2012), and enabling the establishment of the work of Aldo Leopold and colleagues.

More recent programs from around the world also provide rich lessons. Efforts in China under the Grain for Green program (1999-2020) sought to restore the environment through PES approaches that aimed to reduce flooding and soil erosion (Hua et al. 2016; Bryan et al. 2018). Another example from China is the Sloping Land Conversion Program, which uses public payments for forest restoration and converting marginal croplands into forests (He 2014). In South Africa, the Working for Water Programme (WfWP) began in 1995 and aimed to reduce problems with invasive alien plants which were increasing water stress and reducing delivery of other ecosystem services. The WfWP provided local people with employment contracts and training to restore degraded landscapes through the use of biological control methods, while also reducing levels of poverty (Van Wilgen et al. 1998). These efforts in China and South Africa took environmental improvement as the starting point.

Our paper analyzes the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) - a flagship program of the Government of India (GOI) introduced in 2005 to address social, environmental,

infrastructural challenges in rural areas (Natesan & Marathe 2017). Experiences from the MGNREGA suggest how restoration challenges can be addressed at a national level, targeting both livelihood security and environmental improvement. As the world's largest social welfare and workfare program (Pratap et al. 2017), MGNREGA addresses poverty reduction and rural development, integrating socio-economic and ecological approaches, considering water, soil, and land (Jha et al. 2017). MGNREGA's approach therefore offers opportunities to simultaneously target environmental restoration and poverty reduction (Singh 2016). Socio-economic aspects of the program have been extensively studied (Tripathy 2015). However, little is known about whether MGNREGA is supporting ecosystem restoration, and how these efforts were affected during the first year of the COVID-19 pandemic. This paper addresses that knowledge gap, advancing debates on policy and financial mechanisms to integrate restoration activities with existing rural development policies at national and community levels through engagement of local people. We ask:

- How can MGNREGA's design provide a financing opportunity and mobilize wider society for ecosystem restoration?
- Has MGNREGA's design allowed works to continue during the COVID-19 pandemic?
- How can lessons from this case be applied in the upcoming UN Decade on Ecosystem Restoration and beyond?

# Methods

## Salient features of MGNREGA

Our case study policy focus is MGNREGA, India's flagship policy that aims to enhance rural livelihood security by providing guaranteed wage employment to households for 100 days minimum in a fiscal year. It also offers a daily unemployment allowance if employment cannot be provided within 15 days of a job

application (GOI 2005). Up to 50 additional workdays per year can be provided to members of Scheduled Tribes and inhabitants of areas affected by drought or natural hazards. MGNREGA engages participants through directly addressing the rural population's needs, providing employment opportunities outside the agricultural season and in regions lacking other options (GOI 2014), thus offering a safety net in times of need (Fischer & Ali 2019).

The scheme aims to reduce disparity in gender remuneration (Reddy et al. 2014), paying equal wages to men and women. Childcare provisions are made for women accompanied to work by five children under six years of age (GOI 2005) alongside the involvement of Women's Self-Help Groups (Peedikakandi et al. 2015). This has resulted in high female participation (Arya et al. 2017), sometimes resulting in more than 80% participation in regions like Tamil Nadu (Carswell & De Neve 2014) or Kerala (Peedikakandi et al. 2015).

One of MGNREGA's key objectives is to strengthen participatory local governance by empowering village institutions (Gram Panchayats (GP)) to plan and execute works (GOI 2014), and by involving communities in decision-making, through a decentralized, community-based planning process (Fisher 2020). The process involves the Central, State and three tiers of local governments (Natesan & Marathe 2017): districts (Zilla Parishad), blocks (Panchayat Samiti) and village (Gram Panchayat) institutions. Through village governance institutions (GP), communities can be mobilized and directly involved in project recommendation, planning and execution. MGNREGA's provisions empower GPs to decide on required works, work locations, required resources, and timing of works in collaboration with key actors and stakeholders from local government and civil society experts (GOI 2014). Community involvement takes place through an Intensive Participatory Planning Exercise (IPPE). The IPPE helps to identify current community assets, establish current needs, and to understand the community problems across environmental, livelihood, and infrastructure perspectives. This mechanism allows direct community participation in establishing the presence and state of natural resources in the community, the feasibility

of planned works, and provides an understanding of seasonal fluctuations in work demands. Focus group discussions and site visits are conducted to increase the participation of communities that are commonly excluded (Ahuja 2016). MGNREGA requires restoration works to be provided within five km of the place of residency so that local environmental challenges can be addressed on public and individual lands. Public works are carried out on wastelands, degraded forest lands, community and public lands, and pasture lands. Works can also be carried out alongside rivers, canals, roads, and embankments etc. On private lands, works are allowed on homesteads or lands owned by socially and economically disadvantaged groups, with members of Scheduled Tribes and Scheduled Casts, small/marginal farmers, and families below the poverty line given priority (GOI 2012). Landowners should be qualified for MGNREGA works (be a job cardholder), engaged in work on the project, and take responsibility for it. Projects receive prior approval by the community through the Gram Panchayat (https://nrega.nic.in). Work planning should take into account regional objectives (e.g. for the watershed) and in the case of parallel operation with other schemes, the annual plan should be linked with State Convergence Plans (GOI 2014).

## Data collection and analysis

To understand how MGNREGA can generate financing opportunities for ecosystem restoration, we used official Ministry of Rural Development data on natural resource management (NRM) across all Indian States, retrieved from official Management Information System (MIS) reports from April 2013 to March 2021 (http://www.nrega.nic.in/) in line with financial year (FY) reporting. The starting period FY 2013-14 allows consideration of comparable data with appropriate accuracy, up to 2020-21 financial year end, to incorporate completed budget years.

To establish the true growth of expenditures between FYs 2013-21, we adjusted the base FY 2013-14 for inflation. We took the historic inflation rates for the respective period from the Reserve Bank of India

(RBI), calculated the average, and applied it in the Time value of money method (Gopanagoni & Velpula 2020). The formula used for calculation of normalized value was: $FV = PV (1 + i)^n$, where FV = Future value of money, PV = Present value of money, i = Average inflation, n = Number of years. For the conversion of INR to US$, we calculated an average exchange rate for each respective financial year, based on historic data from the RBI (https://rbi.org.in).

In this paper we use the Decade's definition of ecosystem restoration: "The process of reversing the degradation of ecosystems, such as landscapes, lakes and oceans, to regain their ecological functionality, and to improve the productivity and capacity of ecosystems to meet the needs of society. This can be done, for example, by allowing the natural regeneration of overexploited ecosystems or by planting trees and other plants" (UNEP 2021; IUCN 2019).

" We identified 262 types of permissible works under MGNREGA where 182 works are classified as NRM works (https://rural.nic.in). MIS reports commonly combine these works and report across 17 MGNREGA categories. We used the works descriptions from the MGNREGA guidelines and analyzed works under each of 17 categories in the MIS reports. Then we compared them with Decade's types of ecosystem restoration under following ecosystem types: farmlands; forests; freshwaters; grasslands, shrublands and savannahs; oceans and coasts. Eight MGNREGA categories most closely matched the Decade's definitions of restoration under the ecosystem types of focus: (i) coastal areas, (ii) drought proofing, (iii) flood control and protection, (iv) land development, (v) micro irrigation works, (vi) renovation of traditional water bodies, (vii) water conservation and water harvesting, and (viii) works on individuals' lands - category IV under MGNREGA, and were used in this paper. MGNREGA categories aggregate different types of works and may include multiple elements of the Decade's ecosystem restoration types under one category. While every restoration project requires multiple tasks, which may be used across different ecosystem restoration types and fit into different categories, e.g. composting can be used in land development, but

also afforestation projects] double-counting is not permitted under MGNREGA. Although they may be of the same type, all works are allocated and accounted for under each ecosystem restoration type separately. We provide selected examples to illustrate the range of MGNREGA works, but exclude those that may appear under multiple categories or go beyond the scope of a restoration project. We combined types of works most closely matching Decade's definitions as works "potentially aiding ecosystem restoration" (PAER). We acknowledge the subjectivity in matching MGNREGA and the Decade's categories, and informally sense-checked it with an expert in MGNREGA. Table 1 shows how MGNREGA-funded works correspond to the Decade's ecosystem restoration types.

To analyze financing, we applied and extended the methodology of Bhaskar et al. (2016), focusing on total expenditure and number of works; linking them to the PAER categories, and included "completed", "ongoing/suspended", and "approved, and not in progress" datasets. We established net change of total expenditure and the number of works for MGNREGA and PAER works in line with data representation in MIS datasets, and compared cumulative data between years at national scale, observing distribution patterns and trends in completed budget years.

For performance under COVID-19, we analyzed works in FY 2020-21 which were carried out during the pandemic. The fiscal year runs April 1-March 31. Works in this period were therefore carried out after official lockdown in India (March 24, 2020). State governments and advisory committees extended lockdown until May 31, 2020, followed by 10 gradual unlocking stages (https://www.mha.gov.in), to 31 March 2021.

Qualitative analysis complemented governmental statistics to better understand implementation. Policy documents, governmental reports, MGNREGA and the Ministry of Rural Affairs websites were used to understand and describe the mechanisms and provisions of the MGNREGA. We followed Levy & Ellis (2006), generating a list of key-words and searching the Scopus database for academic articles with no

time filter. 'MGNREGA and restoration' returned one article; 'MGNREGA and ecosystem' returned four articles; whereas 'MGNREGA OR mahatma AND gandhi AND national AND rural AND guarantee AND act' returned 163 articles. We excluded 122 studies focusing purely on socio-economic issues, following review of titles, abstracts, and keywords Studies linking MGNREGA with restoration and environmental issues, natural resource management, climate change and agro-ecological aspects were retained. We grouped the remaining articles according to their major concepts (Webster & Watson 2002): NRM; Community; Governance; Finance, and used these to explain our results. To identify studies not in Scopus, but relevant to the COVID-19 period, we searched Google Scholar and drew on press and governmental reports covering MGNREGA's performance during the pandemic.

Finally, we summarized qualitative findings of MGNREGA's strengths and weaknesses based on our literature review. We identified the most frequently discussed improvements and challenges, and considered the top five in our discussion; linking them to the objectives of the upcoming Decade, and identifying gaps and avenues for further research.

# Results

## Financing opportunity and mobilization of wider society in ecosystem restoration through MGNREGA

MGNREGA creates 'green jobs' for hundreds of thousands of workers through engagement in the restoration of rural areas, as well as in aftercare and maintenance works, paying for maintenance of species-dependent afforestation works for three to five years (GOI 2019a). Following the approach described in the methodology section, Table 2 presents the number of generated works and allocated funding specific to PAER categories nationally, between FYs 2013-2020.

Table 2 demonstrates that both number of works and allocated funding rose between FYs 2013-20. Number of works across all completion stages rose by 45%, totaling 27 million in 2020. Applying an average inflation rate of 5.2% for the period of 2013-2020 (https://rbi.org.in) and the Time Value of Money method, the normalized base rate for FY 2013-14 accounted for INR451 billion (US$7.5 billion), thus the funding rose by 33%, reaching INR598 billion (US$8.4 billion) in FY 2019-20. The percentage of PAER works rose 68%, reaching 21.5 million in FY 2019-20. Normalized PAER funding rose from INR 279 billion (US$4.6 billion) in FY 2013-14 to INR468 billion (US$6.6 billion) in FY 2019-20, accounting for 68 % growth (Average annual RBI exchange rate US$1 = 60.49 INR for FY 2013-14; US$1 = 70.88 INR for FY 2019-20).

Table 3 shows the percentage of PAER works and funding in total MGNREGA works/expenditure by categories for FYs 2013-20.

Table 3 shows that between FYs 2013-20, PAER works accounted for 74.5% of total MGNREGA works and attracted 69.0% of funding. While remaining works such as rural infrastructure, rural connectivity, rural sanitation etc. accounted for 25.5% of all works and 31.0% of all funding over the years. Though infrastructure-related works don't overshadow PAER works, construction of roads and buildings can contribute to environmental damage (Bhaskar et al. 2016). Most PAER works are carried out on individual lands, engaging private landowners. This is unsurprising, as this is an umbrella category introduced by the GOI to increase area of cultivatable lands and to improve green cover through afforestation activities beyond common lands (GOI 2012), covering water, land development, drought proofing, etc. Water-related works, combined, attract most funding. Groundwater depletion seriously threatens rural agricultural communities. Jain et al. (2021) Current trends may cause a 20% reduction of yields nationwide by 2025, and a 68% decline in regions where groundwater depletion has already begun. MGNREGA works thus help mitigate this risk, reflecting government-priorities (http://moef.gov.in). Figure 1 demonstrates

the breakdown of works and expenditures by PAER on private and individual lands between FYs 2013 and 2020.

Works on private land outnumber those on public lands (Fig. 1); yet also receive lower investment. This is because works on private lands are funded up to INR 150K for each job cardholder. Funds cover labor costs but do not permit employment of contractors or purchasing of machinery. Special permission is needed for works exceeding that amount or which can be planned as part of other schemes (GOI 2012). Furthermore, the Government of India allows works on public as well as selected private lands that are owned by socially disadvantaged groups, such as Schedule/Scheduled Tribes, Small and Marginal farmers, to maximize the number of people involved and scale the coverage of environmental works (GOI 2012).

This analysis demonstrates that a rural development policy can be used to finance ecosystem restoration-related activities on public and private lands, engaging the local workforce and simultaneously supporting their livelihoods. MGNREGA's provisions address a pressing question on how to engage members of vulnerable strata of society and to increase female participation (Broeckhoven & Cliquet 2015) . However, data mapping female participation onto different PAER works categories is not available.

Integrating restoration works into existing policy mechanisms can not only combat degradation, but also reduces costs and restoration inputs (Singh et al. 2021). Such policy design would be especially helpful in developing countries that suffer from disparities between localities where restoration works happen and where they are most needed (Aronson et al. 2010). This policy example also demonstrates the potential for co-benefits across existing rural development policies and ecosystem restoration efforts on a local and national scale.

## MGNREGA and COVID-19

Since the beginning of the COVID-19 pandemic, MGNREGA played a crucial role in providing needed employment, especially for migrant workers returning from the cities to their villages (Balwinder-Singh et

al. 2020; Vasudevan et al. 2020). The Government of India increased the minimum wage under MGNREGA from April 1, 2020 and expanded the program around May-July 2020 (Sengupta & Jha 2020). In response to increased demand, government allocated INR1.1 trillion (US$15 billion for FY 2020-21 under the scheme). According to the Ministry of Rural Development 3.9 billion-person days had been generated by the end of FY 2020-21, 47% higher than in the previous year. Employment was provided to 75.6 million households (112 million people). Among them, 75% were women, 21% came from Scheduled Casts, and 16% from Scheduled Tribes.

MGNREGA has seen a 28% overall increase from the previous year, reaching 35 million works in the FY 2020-21. The inflation total normalized expenditure on MGNREGA works, applying the average RBI rate of 6.2% for FY 2020-21 (https://rbi.org.in), rose by 69% from INR635 billion (US$9 billion), reaching INR1.1 trillion (US$14.5 billion). In PAER categories, expenditure rose 65% from INR497 billion (US$6.7 billion) reaching INR821 billion (US$11 billion). Works rose 41%, reaching 30 million works in FY 2020-21. Table 4 demonstrates PAER works and expenditures in the first year of pandemics in comparison to a year before.

As illustrated in Table 4, all categories of PAER works could continue despite the pandemic and even rose, both in terms of expenditure and works. Categories representing a lower percentage of the total in previous periods, such as coastal areas, micro-irrigation works and land development, also experienced growth in funding and number of works. Increases were nevertheless uneven across categories. The rise is mainly driven by the number of ongoing/suspended works and works that were approved but are yet to commence. As MGNREGA is demand-driven, this could be seen as a snapshot of local priorities in terms of potential ecological improvements during the pandemic.

Works on both individual and public lands grew during the COVID-19 period under study, by 20 % and 13 %, respectively. However, with the allocated funding, the situation reversed, showing 18 % growth in expenditure on individual lands versus 35 % growth on public lands.

MGNREGA provided numerous examples of how payments and labor could be channeled towards ecosystem restoration during the pandemic, including: the restoration of the Dodda Kere Lake in Karnataka employing 91 villagers, including 60 women (Shiva Kumar 2020); a large watershed and land restoration project in Chhattisgarh, encompassing 26 blocks of 12 districts (Nanda & Kaushal 2020); planned plantation works on over 40 000 ha in Odisha (PTI 2020); restoration of the Kalyani River in Uttar Pradesh, demanded for 30 years but only started recently, generating employment for more than 800 people (Karelia 2020), among others. Some districts are planning to further expand MGNREGA works in PAER categories, e.g., to restore one water body in every village in the district of Udhampur in Jammu and Kashmir in FY 2021-22 (Cross Town News 2021).

While many business activities and projects had to be stopped or reduced during the pandemic's first year, MGNREGA was able to both continue works and mobilize local communities for ecological improvements, growing during this time. MGNREGA demonstrates that integration of rural development policy and natural resource management works can be crucial for the continuation of works during disaster events, when environmental restoration requires quick action.

## Discussion and conclusion

Ecosystem restoration can be expensive and requires urgent mobilization of funding and local resources. Examples of national or regional schemes such as MGNREGA and CCC, aiming to harness ecological, economic, and social benefits, are of paramount importance. The CCC was part of national policy, targeted a broad public and was initiated quickly, directing funding and labor resources toward reforestation, soil conservation, fire prevention, flood control, infrastructure improvements and much more. The program provided meaningful employment to three million young men between 1933 and 1942 (Merrill 1981). They restored degraded lands, repaired wetlands and degraded streams, planted more than 3 billion trees, built infrastructure, and were instrumental in creating the National Parks system (Huizinga 2012).

The CCC considered not only material gains, but social aspects. As President F.D. Roosevelt (1933) stated, the spiritual and moral value of these works, combating idleness and bringing moral and spiritual stability to the people in a time of crisis, provided important social benefits.

MGNREGA shares many similarities with the CCC. It offers unemployment relief in a time of seasonal unemployment and natural disasters; supplementary wage employment that does not interfere with existing income generation activities; and a wide scope of works nationwide to restore natural resources, while creating and improving infrastructure. However, there are also many differences.

MGNREGA's design is unique, targeting rural populations through a demand-driven and rights-based approach. Its employment guarantee mechanisms and legal provisions promote inclusion of women and marginalized groups, and it considers a variety of ecosystem restoration types. Our analysis indicates MGNREGA has been able to direct growing budgets towards works aiding restoration, mobilizing millions of people and generating growing numbers of works on public and individual lands. MGNREGA's design and investment levels during COVID-19 demonstrate that a livelihood security policy can help support the flow of finances and resources towards restoration, even during unprecedented conditions.

MGNREGA has produced various socio-ecological benefits. We identified the five most discussed benefits during our literature review. MGNREGA led to improved water availability (Mandla et al. 2020; Fischer 2021), increased income (Prasanna et al. 2014; Peedikakandi et al. 2015), increased agricultural productivity and improved land fertility (Esteves et al. 2013) reduced vulnerability to climate risks (Godfrey-Wood & Flower 2018; Fischer 2020), and increased employment (Upendranadh & Subbaiah 2016; Reimingam 2016). Thus, MGNREGA offers good potential to halt ecosystem degradation and biodiversity loss, while simultaneously reducing livelihood vulnerability. It also provides much needed mechanisms for including women, Scheduled Casts and Tribes, landless farmers, and other marginalized groups (Lal et al. 2019; Dhaktode 2021): gains that are vital to consider, as the poor often suffer from low-

literacy and economic status and inadequate awareness of social considerations (Nedungadi et al. 2018; Rajeevan et al. 2020). However, the efficiency of MGNREGA is often limited through deficiencies in planning and execution. Studies report several implementation challenges such as lack of technical and managerial capacities for implementation (Reddy 2012; Sharma et al. 2015), low daily wage rates (Ghosh 2018; Mohanakumar & Kumar 2018), rising labor costs and resulting scarcity of labor (Upendranadh & Subbaiah 2016; Jayasankar et al. 2019), low quality of assets created (Reddy 2012; Bhaskar et al. 2016), and insufficient design and scope of works (Sebastian & Azeez 2014; Ranaware et al. 2015). These areas need further consideration in future analyses of win-wins from MGNREGA for environment and society.

Similarly, while the socio-economic contribution of MGNREGA has been extensively studied, understanding of its environmental impact remains limited. For MGNREGA to meaningfully contribute to ecosystem restoration, works need to be better aligned to international restoration methodologies and practices. For example, measurement of environmental indicators is lacking in the planning, execution, and evaluation process. This calls for technical and scientific assessment, as well as systematic monitoring of environmental outcomes. For instance, panchayat biodiversity registers could be prepared to support biodiversity conservation (Sebastian & Azeez 2014). Restoration efforts should also be better aligned with national ecological policies (Singh et al. 2021). MGNREGA offers potential for India to advance towards Prime Minister Modi's international pledge to restore 26 million hectares of degraded land by 2030 (GOI 2019c). However, alignment with the environmental metrics and indicators is needed to monitor and meet international reporting demands. For this, closer collaboration between science and policy is required to ensure integration of best practices, alongside scientific knowledge of how to restore ecosystems following a sustainable process, while not losing the opportunity for local community innovation and buy-in. The IUCN guidance (Keenleyside et al. 2012) called for a flexible, holistic viewpoint on restoration, encouraging broader collaborations, thoughtful implementation and planning. The current definition of ecosystem restoration used by the Decade also includes a wide range of ecosystem

management interventions, “from reducing societal impacts in production landscapes to fully recovering native ecosystems” (UNEP 2021), allowing the balance between socio-economic and ecological goals to be considered. The ecological restoration field has started to recognize the importance of integrating socio-economic thinking into restoration projects (Higgs et al. 2018; Lengefeld et al. 2020). The second edition of the Society of Ecological Restoration Guidelines (Gann et al. 2019) took a major step in this direction, establishing stakeholders as integral to the process. However, for effective involvement of communities in the areas suffering from degradation, addressing livelihood security is a crucial factor. There is a need for integrative policy frameworks which can help to support the costs of restoration, create a restoration economy, and contribute to the overall social well-being of communities (Priyadarshini & Abhilash 2020). Simultaneously, investments are needed to reduce the drivers of and pressures from degradation to stop it occurring in the first place.

Restoration in developing countries and rural settings brings its own challenges. Often restoration has to take place in heavily modified landscapes. Current ecological restoration theory and practice was developed in protected areas of North America and Europe, isolated from human populations and governed by strict regulations. In rural, highly modified environments, restoration is often a tool to improve resilience, stabilize production, and secure livelihoods (Hartman & Cleveland 2018). Therefore, poverty alleviation, community development and the creation of livelihood opportunities linked to ecosystem service improvements are important factors to consider in such scenarios (Olesen et al. 2021). This opens the scope for policy design such as MGNREGA to harness synergies between ecosystem restoration and local economic development (Hartman & Cleveland 2018). MGNREGA provides lessons that can help to achieve the objectives of the Decade, halting and reversing degradation globally while helping to combat poverty, climate change and biodiversity loss. First, provision of a minimum guaranteed income for restoration works can help address poverty and create local restoration-related jobs. This is important, particularly in the context of developing countries. Outscaling these kinds of efforts to other

places will require examination of existing national level livelihood programs and their potential to deliver on ecosystem restoration objectives, alongside other co-benefits. Second, lessons can be learned from MGNREGA's ability to finance restoration on the ground. MGNREGA's design shows how government funding can be utilized to restore diverse types of biomes across a country based on local needs.

In this paper we have drawn on comparison with the CCC example, because of its historic significance to the ecological restoration field. Future research is needed to understand the full potential of livelihood supporting programs to contribute to ecosystem restoration. To advance these lessons on a global scale we call to learn from past and current policies. It will help to develop approaches that can facilitate the inclusion of livelihood considerations into restoration activities, and better integrate livelihood/development policies with restoration practices.

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Table 1. Category mapping for MGNREGA works and UN ecosystem restoration types.

| MGNREGA work category/ PAER | MGNREGA work examples | Types of Ecosystem (UN Decade) |
|---|---|---|
| Coastal Areas | Belt vegetation; Construction of drain for coastal protection; Repair and maintenance of coastal drain; Storm water drains for coastal protection | Oceans and coasts |
| Drought Proofing | Block –plantation farm forestry in fields; Canal line plantation of forestry and horticulture; Eco-restoration of forest; Forest protection; Lining of distribution canal renovation of fishery ponds; Raising of nursery; Renovation of feeder canal; Repair and maintenance of minor canals; Repair and maintenance of water course canal; Road line plantation of forestry trees | Farmlands Forests, Freshwaters |
| Flood Control and Protection | Deepening and repair of flood channels; Desilting; Drainage in waterlogged areas; Renovation of flood/ diversion channels; Repair and maintenance of coastal protection drain; Spurs and torrent control measures | Freshwaters, Forests |
| Land Development | Block plantations-bio drainage wastelands; Development, reclamation, shaping and levelling of land; Development of fallow land, saline/alkaline wasteland, waterlogged lands, wastelands; Development of silvipasture and grasslands; Reclamation and drainage of waterlogged land; Wasteland block plantation farm forestry and sericulture | Farmlands, Forests, Grasslands, Shrublands, Savannahs |
| Micro Irrigation Works | Creation, renovation, rehabilitation and maintenance of irrigation canals and drains; Lining of canals | Farmlands |
| Renovation of traditional water bodies | Conservation of old step wells/baolis; Renovation of community ponds; Renovation of traditional water bodies including desilting of irrigation tanks and other water bodies | Freshwaters, Farmlands |
| Water Conservation and Water Harvesting | Afforestation; Block plantation in horticulture and farm forestry in fields, Construction of upland bench terrace; Construction of water absorption trench; Construction and renovation of community water harvesting ponds | Freshwaters, Forests, Grasslands, Shrublands, Savannahs |

| | | |
|---|---|---|
| Works on Individuals Land (Category IV) | Block plantation farm forestry; Compost pit; Construction of Berkley compost pits; Development of silvipasture, grasslands for individuals; Development of waste-fallow land; Horticulture; Line-plantation and wasteland block plantation of horticultural-trees; Liquid bio-manures; Reclamation of saline-alkaline lands; Wasteland block plantation bio-drainage in fields; Wasteland block plantation farm forestry | Farmlands, Freshwaters, Forests, Grasslands, Shrublands, Savannahs |
| **The UN definition of types of Ecosystem Restoration** | | |
| Oceans and coasts | Restoring oceans and coasts means reducing the pressure on those ecosystems so they can recover, both naturally and by re-seeding or transplanting key species. It also means understanding how to make both ecosystems and communities more resilient in the face of global change. For instance, governments and communities need to make fishing sustainable. Pollutants must be treated before they reach the ocean, and solid waste like plastics kept out completely. Growing coastal cities should protect, not replace, coastal ecosystems. And coral reefs, mangroves and seagrasses must be carefully managed and actively restored so that oceans continue to support billions of livelihoods globally. | |
| Forests | Restoring forest ecosystems involves returning trees to former forest land and improving the condition of degraded forests. As well as planting native tree species, it can include conserving wild plants and animals and protecting the soils and water sources that are part of the forest ecosystem. Land cleared for farming that falls into disuse is ideal for forest restoration. In existing forests, native species can be planted to regenerate the tree cover. In some cases, forest trees will re-grow naturally. Forest restoration can also mean nurturing patches of forest and woodland in landscapes that also include busy farms and villages. | |
| Freshwaters | Protecting and restoring freshwater ecosystems can involve improving water quality, for instance by treating all waste water before it is discharged. Fishing and mining must be controlled. Dams can be removed or better designed to restore river connectivity, while water extraction can be managed to maintain minimum flows. Returning water flows in peatlands and other wetlands to nature levels restores their ability to prevent stored carbon from reaching the atmosphere. | |
| Grasslands, Shrublands, Savannahs | Restoring shrublands, grasslands and savannahs means working with those using the land – pastoralists or others. The extraction of resources such as water and wood, wildlife, minerals, or non-timber forest products, needs to remain sustainable. Strengthening governance systems, such as secure tenure and participatory rangeland | |

| | |
|---|---|
| | management is equally important |
| Farmlands | Scientists are helping rural communities restore agricultural ecosystems by using nature to boost farm productivity. Some farmers are reducing tillage and adopting natural fertilizers and pest control. Using crop rotations, and growing more diverse crops, including trees, and integrating them with livestock-rearing can restore biodiversity and provide more nutritious diets. Alliances between farmers and pastoralists are being formalized to allow the sharing of resources with livestock being grazed on cropland after harvest. All these steps can revive the land, rebuilding the organic carbon stores and microorganisms that soak up water and maintain the natural fertility of our soils |

Sources: MGNREGA reports (GOI 2017; GOI 2019b; GOI 2020) and MIS reports and the UN Decade for Ecosystem restoration website (https://www.decadeonrestoration.org).

Table 2. Number of works and allocated expenditure under MGNREGA, covering the FYs 2013-20.

| Year | Number of works and expenditure (INR 100K) | MGNREGA works | | | | PAER works | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Completed | Ongoing/ Suspended | Approved not in progress | Total | Completed | Ongoing/ Suspended | Approved, not in progress | Total |
| 2013-2014 | Number of works | 2,182,792 | 8,975,387 | 7,673,195 | 18,831,374 | 1,208,301 | 5,927,146 | 5,679,541 | 12,814,988 |
| | Expenditure | 1,861,265 | 1,468,793 | 0 | 3,330,058 | 1,210,444 | 845,234 | 0 | 2,055,678 |
| 2014-2015 | Number of works | 3,369,956 | 5,048,413 | 904,563 | 9,322,932 | 1,669,152 | 3,348,080 | 229,760 | 5,246,992 |
| | Expenditure | 2,862,378 | 60,804 | 0 | 2,923,182 | 1,812,354 | 12,976 | 0 | 1,825,330 |
| 2015-2016 | Number of works | 3,181,631 | 7,294,516 | 1,739,072 | 12,215,219 | 2,033,529 | 5,519,677 | 854,450 | 8,407,656 |
| | Expenditure | 3,607,165 | 117,608 | 0 | 3,724,773 | 2,390,272 | 31,173 | 0 | 2,421,445 |
| 2016-2017 | Number of works | 6,109,039 | 8,241,017 | 2,865,222 | 17,215,278 | 4,415,078 | 6,153,078 | 1,490,296 | 12,058,452 |
| | Expenditure | 4,611,293 | 241,991 | 0 | 4,853,284 | 3,133,482 | 102,164 | 0 | 3,235,646 |
| 2017-2018 | Number of works | 5,818,227 | 11,062,171 | 4,396,681 | 21,277,079 | 4,181,921 | 9,235,885 | 2,727,188 | 16,144,994 |
| | Expenditure | 5,068,904 | 700,390 | 0 | 5,769,294 | 3,549,221 | 353,849 | 0 | 3,903,070 |
| 2018-2019 | Number of works | 8,088,658 | 10,964,247 | 5,651,767 | 24,704,672 | 6,978,450 | 9,495,444 | 3,798,223 | 20,272,117 |
| | Expenditure | 4,601,608 | 1,576,774 | 0 | 6,178,382 | 3,512,013 | 958,800 | 0 | 4,470,813 |
| 2019-2020 | Number of works | 6,804,091 | 12,668,744 | 7,851,501 | 27,324,336 | 6,085,945 | 11,037,688 | 4,342,218 | 21,465,851 |
| | Expenditure | 3,626,488 | 2,355,512 | 0 | 5,982,000 | 2,950,494 | 1,725,907 | 0 | 4,676,401 |

Source: Official Website of MGNREGA, Ministry of Rural Development, Government of India, MIS reports (https://www.nrega.nic.in), accessed on 26.01.2021 for FYs 2013-20. Total works include the works across all MGNREGA categories for 34 states and union territories of India.

Table 3. PAER works under MGNREGA, FYs 2013-20.

| PAER works under MGNREGA | Percentage of funding | Percentage of number of works |
|---|---|---|
| Works on Individual lands | 20 | 50 |
| Water Conservation and Water Harvesting | 15 | 8 |
| Renovation of traditional water bodies | 10 | 2 |
| Land development | 7 | 4 |
| Drought proofing | 6 | 7 |
| Micro-irrigation Works | 5 | 2 |
| Flood control and protection | 4 | 1 |
| Coastal areas | 0.04 | 0.003 |

Source: Official Website of MGNREGA, Ministry of Rural Development, Government of India, MIS reports (https://www.nrega.nic.in), accessed on 26.01.2021 for FYs 2013-20.

Table 4. PAER works and expenditures, FY 2019-20 vs FY 2020-21.

| Financial year | Number of works and expenditure (INR 100K)* | Coastal Areas | Drought Proofing | Flood Control and Protection | Land Development | Micro Irrigation Works | Renovation of traditional water bodies | Water Conservation and Water Harvesting | Works on Individuals Land (Category IV) | Total MGNREGA | Total PAER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2019-2020** | Number of works | 572 | 1,552,898 | 364,718 | 805,896 | 503,253 | 306,815 | 1,756,037 | 16,175,662 | 27,324,336 | 21,465,851 |
| | Expenditure | 106 | 415,782 | 289,412 | 359,484 | 343,868 | 429,493 | 1,236,552 | 1,601,705 | 5,982,001 | 4,676,401 |
| **2020-2021** | Number of works | 952 | 1,991,255 | 609,036 | 1,636,463 | 820,172 | 401,320 | 2,256,024 | 22,612,433 | 34,966,624 | 30,327,655 |
| | Expenditure | 236 | 687,210 | 534,552 | 954,782 | 654,407 | 638,253 | 2,255,633 | 2,481,174 | 10,731,938 | 8,206,249 |

Source: Official Website of MGNREGA, Ministry of Rural Development, Government of India, MIS reports (https://www.nrega.nic.in), accessed on 26.01.2021. Data for FY 2020-21 accessed on 01.04

Figure 1. Distribution of PAER works/expenditure on individual vs. public lands FYs 2013-20.