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Harnessing employment-based social assistance programmes to scale up nature-based climate action

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As the severity of the triple challenges of global inequality, climate change and biodiversity loss becomes clearer, governments and international development institutions must find effective policy instruments to respond. We examine the potential of social assistance policies in this context. Social assistance refers to transfers to poor, vulnerable and marginalized groups to reduce their vulnerability and livelihood risks, and to enhance their rights and status. Substantial public funds support social assistance programmes globally. Collectively, lower- and middle-income countries spend approximately 1.5% of their GDP on social assistance annually. We focus on the potential of paid employment schemes to promote effective ecosystem stewardship. Available evidence suggests such programmes can offer multiple benefits in terms of improvements in local ecosystems and natural capital, carbon sequestration and local biodiversity conservation. We review evidence from three key case studies: in India (the Mahatma Gandhi National Rural Employment Guarantee Scheme), Ethiopia (the Productive Safety Nets Programme) and Mexico (the Temporary Employment Programme). We conclude that, to realize the potential of employment-based social assistance for ecosystem benefits it will be necessary to address two challenges: first, the weak design and maintenance of local public works outputs in many schemes, and second, the concern that social protection schemes may become less effective if they are overburdened with additional objectives. Overcoming these challenges requires an evolution of institutional systems for delivering social assistance to enable a more effective combination of social and environmental objectives.

This article is part of the theme issue 'Climate change and ecosystems: threats, opportunities and solutions'.

1. Introduction

Two recent authoritative reports by UN bodies have combined to create heightened public awareness of what has been termed the 'planetary' or 'ecological' crisis: the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5°C (SR15) [1], and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) global assessment report [2]. The former highlighted the urgency of the climate crisis. It underlined the compelling need to bring global greenhouse gas emissions to net zero by 2050 and to speed up efforts at supporting local adaptation and resilience, particularly in more vulnerable countries. The latter outlined the shocking scale of biodiversity loss. It also provided disturbing evidence that 0.5–1 million plant and animal species will go extinct over the coming decades. Such a loss, the report concluded, would severely impact prospects of sustainable development.

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Therefore, there is an urgent need for policy communities to find instruments that effectively address the multiple dimensions of planetary crises at scale. This Opinion piece highlights the potential of social assistance instruments to enhance global efforts for environmental action [3,4]. It also identifies the need for better evidence on their potential, and suggests specific actions that can help realize this potential.

Substantial public funds support social assistance globally. Social assistance refers to transfers to poor, vulnerable and marginalized groups to reduce their vulnerability and livelihood risks and to enhance their rights and status [5]. In lower- and middle-income countries (LMICs), social assistance includes programmes such as cash and in-kind transfers and initiatives to create public infrastructure by offering employment to those looking for jobs. Collectively, social assistance in the LMICs adds up to approximately 1.5% of their GDP [6,7]. Investments in social assistance are far higher in richer countries [8]. Iconic social assistance programmes such as the *Progresa* and *Opportunidades* in Mexico and *Bolsa Familia* in Brazil have made such interventions familiar across the world [9–11]. Here, we focus in particular on social assistance programmes that focus on employment guarantees and public works creation. We refer to them collectively as employment schemes [12]. They cover more than 100 million people in the LMICs.

Interventions designed to support climate action and the protection of biodiversity are, in contrast, struggling to reach the scale of delivery needed to address the scope and extent of challenges societies face. In the LMICs, these interventions need to focus fundamentally on delivering development and tackling poverty while transforming ecosystem stewardship and supporting effective climate action.

This paper focuses on employment schemes [13,14] rather than more widely implemented cash and in-kind transfer initiatives [15,16] because of their potential to create assets that support collective ecosystem stewardship. Employment schemes provide recipients the opportunity to work on creation of natural or built infrastructure and can also incorporate elements such as strengthening of local institutions and provision of new skills. Cash and in-kind transfers are simpler in conception and implementation—they essentially transfer specified amounts of money or in-kind resources such as food to beneficiaries targeted because of the poverty of the households or their stage in the life cycle (children and the elderly). Employment schemes incorporate a larger number of policy tools for decision-makers, including improving collective decision making at the local level. The availability of multiple tools requires more coordination by implementing agencies, but also offers greater potential for flexibility and targeting in comparison with a simple cash or in-kind transfer when policy responses need to be modulated to different kinds of environmental crises.

Employment schemes can achieve both socioeconomic and ecosystems-related goals as several existing assessments already show [17,18]. Despite their greater complexity in comparison with programmes that transfer resources in cash or kind, most assessments of these programmes suggest that they enable positive social and economic outcomes [19–21]. The experience of employment schemes in countries such as India, Ethiopia and Mexico—the three countries on which this paper focuses given their high levels of poverty, threatened ecosystems and exposure to climate risks—suggests they also hold promise in relation to ecosystem objectives. The larger-scale development and deployment of their employment schemes can help realize environmental protection objectives set out in the climate and other environmental plans of these countries. Assistance to poor families through these programmes often incorporates actions on ecosystems and natural resources. This is unsurprising because many employment schemes trace their origins to hydro-meteorological disasters such as droughts, famines, flooding and storms, and the shortfalls in consumption that such disasters precipitate [22].

Our focus on the employment schemes in India, Ethiopia and Mexico to illustrate the relevance of these programmes is important for other reasons as well. All three countries, in common with other LMICs, have made substantial international commitments for emission reduction, protection of vulnerable ecosystems and communities, and biodiversity conservation in support of biodiversity targets and the Paris climate agreement [23–26]. In each of these countries, large-scale employment schemes already contain environmental objectives such as ecosystem protection, conservation of land, water and soils, and recovery from climate-related disasters. More deliberate and careful coupling of social, economic and environmental objectives through social assistance can also help them meet their international commitments.

Social assistance schemes can have ecosystem stewardship objectives integrated in their core delivery systems—but to realize these objectives they also need to be resourced with the necessary technical skills and financial means. Alternatively, governments and implementing agencies can seek to bring together distinct social assistance and ecological stewardship schemes for greater socio-ecological effectiveness: with one providing the expertise and the budget for materials, the other providing a workforce. Indeed, technical skills needed for careful design, durable construction and long-term maintenance of environmental assets in public work schemes have often been missing [27–29]. And although ecosystem stewardship schemes are often technically robust, their geographical reach is generally limited, with the exception of some programmes in China and Brazil [30]. Bringing the strengths of both together could offer value in responding to the global challenges we are currently facing.

The idea of using public funds at scale to mobilize labour through employment guarantees and achieve environmental goals is also gaining some support in higher-income countries. An important example is the Resolution submitted to the US Congress by Congresswoman Ocasio-Cortez on the 'Green New Deal'.[1] The proposal is wide-ranging, and includes ambitious goals to decarbonize the energy system of the USA, to preserve ecosystems, to reduce inequality, to create green jobs and to broaden access to higher education [31]. The Resolution proposes both a 'jobs guarantee' and widespread action to restore ecosystems through 'locally appropriate and science-based projects that enhance biodiversity and support climate resiliency'. Critics of this proposal, especially in the popular press, have raised concerns about feasibility and costs of such public mobilization of resources even as others have analysed how to pay for it [32].

Here, we highlight that employment schemes are already being implemented at a vast scale. One of the world's largest social assistance programmes—the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) in India—includes 120 million active workers and generated upwards of 2.5 billion person days of work in 2018 [33]. A

substantial part of the labour supported through this intervention is directed at environmental objectives of soil and water conservation, ground water recharge, tree plantations and land improvement [33,34].

In more than 80 nations, similar programmes reach 20 million households with a resurgence of such programmes in sub-Saharan Africa [21, pp. 7–10]. Governments in these countries spend upwards of US$20 billion on employment schemes annually to create household and community-level infrastructure [6,7]. These investments in employment schemes rival total annual global expenditures on conservation—currently estimated as US$21.5 billion [35]. Through investments in public works, governments have supported initiatives to protect ecosystem services, govern land and water, and improve soil conservation. They have done so by spending on labour for local environmental public works and also by providing incentives for better natural resource management, e.g. by allowing programme funds to be used for water conservation and flood control infrastructure improvements on private lands as is the case for MGNREGS in India [36].

Drawing upon the experience of existing social assistance programmes that seek to mobilize labour for socioeconomic and environmental goals, we suggest that employment schemes social assistance has the potential for better stewardship of ecosystems on a large scale. Increased investments in employment schemes social assistance can enhance natural capital and improve the provision of ecosystem services. Benefits from such provision potential include greater local resilience to the impacts of climate change and disasters, improved conservation of local biodiversity, and reduction of climate change risks via enhanced carbon sequestration, reduced exposure and improvements in adaptive capacities. But achieving both social and environmental goals will require changes in how employment schemes are implemented. In most cases, it will also necessitate some changes in design and in partners to align objectives with impact pathways. But the payoff to such revisions can be substantial when it comes to securing positive outcomes for socioeconomic and ecosystems.

The political logic of combining social policy with ecosystem stewardship and climate adaptation objectives is compelling—the very poorest will be hardest hit by the climate and biodiversity crises and will need ever greater support social assistance if these challenges remain unaddressed. It is indeed a common thread between such seemingly different initiatives as the Green New Deal proposal in the USA and MGNREGS in India. After providing a bird's eye view of social assistance in the lower- and middle-income world since the 1990s, we provide a more detailed consideration of investments in employment schemes in India, Ethiopia and Mexico. Then we examine the steps needed to increase further the potential of social assistance interventions to support the management of resilient ecosystems for sequestering carbon, supporting biodiversity and securing the flow of ecosystem services.

2. Social assistance and employment schemes

Social assistance has been variously defined by researchers and practitioners across fields, such as disaster studies, development studies and international aid, and across rights and growth orientations [37]. Broadly, social assistance can be viewed as public actions in response to socially unacceptable levels of vulnerability, risk and deprivation [5,38]. Informal social assistance remains critical for many households, especially in poorer parts of the world [5,38,39]. But formal social assistance has grown rapidly in LMICs to help allay the worst effects of acute poverty and open pathways towards higher incomes where feasible.

Table 1. Estimated social assistance (SP) expenditures in lower- and middle-income countries (LMICs) (based on [6]; GDP data from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD and https://data.worldbank.org/indicator/SP.POP.TOTL).

region	total GDP (US$10^12)	% GDP on SP	amount on SP (US$10^9)
E. Asia and Pacific	14.7	1.1	162.0
Europe and C. Asia	3.3	2.2	72.6
L. America and Caribbean	5.9	1.5	89.6
Middle East and N. Africa	3.3	1.0	32.8
S. Asia	3.3	0.9	29.6
Sub-Saharan Africa	1.7	1.5	25.1
total LMICs	32.2	1.5	483.6

Shifts in levels of expenditures and coverage of people through social assistance are occurring even in the context of continuing debates over how much to allocate to social assistance, how effective social assistance is in achieving its aims, and what forms of social assistance are the most effective [40]. Such urgency stems from both the extent to which the impacts of climate change and biodiversity loss [41] may undermine past achievements of poverty reduction, and the limited knowledge about how to structure social assistance for greater effectiveness.

Table 1 provides estimates of expenditures on social assistance by major regions in the lower- and middle-income world. Aggregate expenditures on social assistance in 2017 were nearly US$500 billion dollars and increased by more than a US$100 billion from 2014 to 2017 [6,42].

In higher-income countries, employment schemes fall into three different categories: employment services which help job seekers find jobs, training schemes which help in the reskilling and training of potential employees, and subsidies to support those who are not working but undergoing training or actively seeking employment [43,44]. By contrast, in poor and middle-income countries, employment benefits often occur as provision of work for a specified number of days, or, as in the case of India, a specified number of days guaranteed as a right (see table 2 for the largest employment schemes in LMICs). Such benefits are typically coupled with the development and creation of infrastructure, with protection of natural capital and ecosystems, and at times with training programmes and efforts at strengthening local institutions. In some countries, employment schemes are targeted to the poorest, based on a means-test of those with incomes below a specified level. But enforcing means-testing and ensuring that the poorest are aware of their rights is both challenging and costly [45]. Setting wages below market rates in such situations leads to self-targeting by poor households that have surplus labour, but also means that labour-constrained or better-off households are less likely to benefit from the employment schemes.

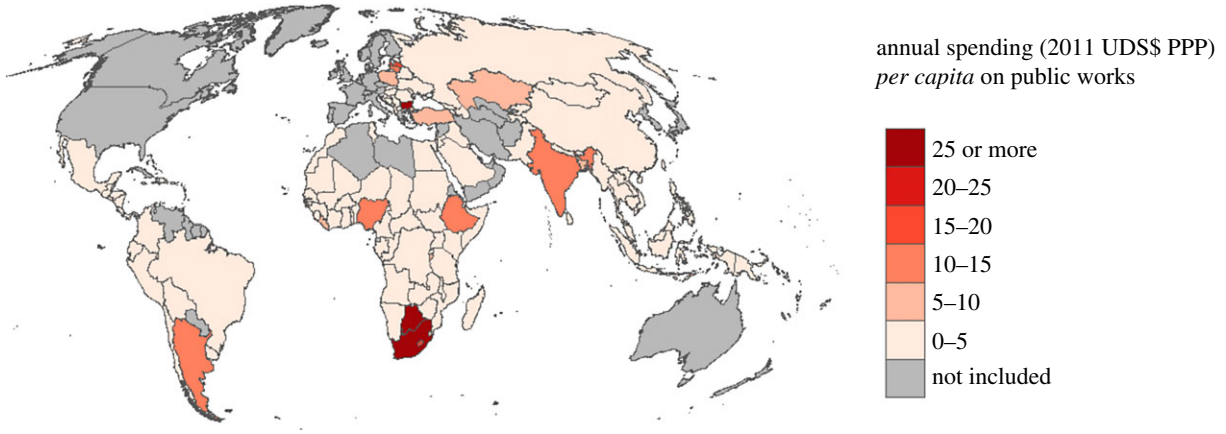

Figure 1. *Per capita* spending on employment schemes across the Lower and middle-income countries. PPP, purchasing power parity.

Table 2. Lower- and middle-income countries with employment schemes (threshold of 250 000 people receiving benefits) [6].

country	programme name	no. people covered ($\times 10^3$)	year
Bangladesh	Employment Generation Programme for the Poorest	1400	2014
Brazil	Economia Solidaria	534	2012
Congo (DRC)	Economic Recovery Project	588	2016
Ethiopia	Productive Safety Net Programme	7997	2016
Haiti	National Project of Community Participation	450	2009
Hungary	Public Works Programme	329	2015
India	Mahatma Gandhi National Employment Guarantee Scheme	75 287	2016
Kenya	Cash for Assets	300	2016
Madagascar	PUPIRV	377	2013
Malawi	Public Works Programme	2623	2014
Mexico	Programa de Empleo Tempral Ampliado	1441	2014
Mozambique	Productive Social Action Programme	283	2015
Nepal	Karnali Employment Programme	323	2104
Nigeria	Input for Works Programme	720	2015
Pakistan	Community Physical Infrastructure	3118	2016
Russia	Organization of Temporary Employment	812	2013
South Africa	Extended Public Works Programme	350	2013
Yemen	Labour Intensive Works (Social Fund for Development)	400	2017
Zimbabwe	Food Deficit Mitigation Programme	756	2015

A number of schemes not represented in the list above also involve ecosystem stewardship—such as South Africa's Work for Water scheme, where the watersheds of towns and cities are protected while providing work and new skills for the unemployed [46–48]. Figure 1 provides a graphical representation of how similar programmes, albeit at a smaller scale, are distributed across another 80 countries in the LMICs based on *per capita* spending for the country's population.

3. Employment schemes in India, Ethiopia and Mexico

The three countries with the highest coverage of beneficiaries across Asia, Africa and Latin America through employment-based social assistance are India, Ethiopia and Mexico. Each has high levels of poverty and substantial inequalities. They are vulnerable to climate impacts. Their forests and grazing ecosystems are threatened. Water scarcity is already or becoming urgent in many parts of these countries. And in addition, declining productivity and soil losses adversely affect agriculture. We discuss the history, core components, outcomes and, where evidence is available, the potential for ecosystem protection through employment schemes in each.

(a) MGNREGS in India

The origins of employment programmes in India can be traced to famines during the colonial period and earlier when colonial and precolonial governments used public works as a means to offer employment to those rendered destitute and hungry during famines [49]. The Indian government today implements a variety of social assistance

initiatives to address the poverty and vulnerability of a large number of marginal and disadvantaged households in the country. Perhaps the best known and certainly the largest in scale and scope is MGNREGS, launched in February 2006. The programme guarantees 100 days of unskilled wage labour employment to all Indian households whose adult members are willing to work. Verified households are entitled to receive work close to their village. Women receive priority, with a minimum of 33% of those receiving employment, and receive equal wages to the men—effectively setting a minimum wage and transforming employment norms. More than 261 million individuals in 130 million households are registered in the programme [33]. The programme supports more than 2.5 billion person days of employment annually, estimated to constitute about 2.5% of total rural employment in India.

In addition to guaranteed employment, MGNREGS has three other components: infrastructure creation, skills development and institutional strengthening. Those who are employed in the programme work on local infrastructure creation. Infrastructure products can be classified into three types. These include: natural resource management infrastructure (e.g. small dams, ponds and trenches); land development and agricultural infrastructure (plantations, irrigation channels, livestock and fisheries, and water and grain storage); and other infrastructure (roads, footpaths, sanitation and community buildings). The programme has created more than 46 million infrastructure assets. Through its skills development efforts, the programme seeks to enhance the range of tasks rural residents can perform. The programme has also attempted to increase the capacity of rural institutions such as village panchayats or councils to make informed decisions for the selection of infrastructure projects.

A growing literature highlights the ecosystem and environmental impacts of MGNREGS [50–52]. According to the Government of India, 8.9 million public and private infrastructure works were completed under MGNREGS in 2018: of these, approximately 1.3 million focused on natural capital improvements projects for soil and water conservation, groundwater recharge, drainage improvement and tree plantations [33]. A persistent criticism of MGNREGS-supported asset development is their quality. But there is at least some evidence from independent studies that MGNREGS users find MGNREGS assets to be useful and of adequate quality or higher [34,36,53].

These aspects of MGNREGS, despite criticisms about its politics [54], are clearly responsive to urgent ecosystem and climate change-related challenges that India faces. For example, the Green India Mission seeks to meet the country's goal to bring a third of its area under forest cover. It seeks to bring 5 Mha under trees and additionally improve the quality of forests and land cover for another 5 Mha. Afforestation and ecosystem restoration with diverse species are central elements of India's emissions reductions goals. At the same time, these nature-based solutions also aim to increase the adaptive capacity of India's poor by focusing on ecosystems that can provide material benefits to people without undue exploitation.

There is clearly variability in MGNREGS outcomes across India depending on the local capability to design and place assets and the timing of demand for labour in relation to the timing for asset development. But the large body of programme evaluations for MGNREGS paints a generally positive picture when it comes to improvements in wellbeing and nutrition, poverty reduction, increased wage rates and positive health, educational and environmental effects [55,56]. With an outlay of more than US$7 billion annually, the programme has also made a major impact on rural incomes, both directly and by raising the wage rates of unskilled and skilled labour, and has contributed to household resilience [57]. In states where there has been significant investment in technical skills for local government in watershed approaches, MGNREGS appears to provide better outcomes [58].

India is seeking to ensure convergence between MGNREGS and its climate missions—with MGNREGS providing the labour and the climate missions providing technical expertise and budget for materials. Some of the potential strategies under consideration or already being implemented include: consideration of climate risks and natural resource management in the selection, design and maintenance of rural infrastructure; expansion of employment to 150 days during periods of droughts; the use of climate vulnerability mapping tools; and the use of new technologies such as drones, geospatial mapping and social audits to improve the quality of infrastructure assets. Other strategies include efforts to develop greater convergence between MGNREGS and related policies for solid waste management, rural energy guarantees, and missions for livelihoods and tree planting. Convergence with these efforts holds the promise of more climate-resilient and lower-carbon pathways out of poverty [18]. At the same time, the government may need to invest additional resources to meet the goals of greater climate resilience through its flagship public works programme.

(b) Productive Safety Net Programme, Ethiopia

The main motivation for Ethiopia's Productive Safety Net Programme (PSNP) was to alleviate food insecurity. The Government of Ethiopia launched PSNP in 2005. The programme replaced earlier near-annual appeals by the government for emergency food aid, and sought—with help from donors—to provide food to chronic food deficit households in food deficit areas so as to prevent loss of household assets and enable the creation of community assets [59]. The goal of PSNP was to relieve chronic food insecurity for recipients by enabling them not to rely on emergency food aid. To do so, the programme provides employment on public works projects to food insecure households that have able-bodied individuals. The programme supports households that do not have adult able-bodied individuals through transfers that do not require a household member to work. The number of days of employment varies depending on availability of financial resources. Communities are involved in choosing who takes part in the programme, as well as selecting the types of activities promoted by the project.

From the very beginning, PSNP has been implemented at scale. The number of people covered by the programme rose from 5 million in 2005 to 8 million in 2006 [60]. The government, together with donors, committed an annual budget of US$500 million to the programme in an effort to make a major difference in prevailing levels of food insecurity. Similar to other employment schemes, PSNP also attempted to increase the level of asset holdings for beneficiary families through an explicit link to improvements in agricultural

productivity through its Household Asset Building Programme (HABP) from 2009 [59].

PSNP is estimated to create roughly 40 000 community-level assets annually. Selection of community-level projects and asset development under PSNP follows a set of six criteria. Assets should be productive, labour-based, gender-sensitive, predictably scheduled, close to beneficiaries and integrated into local development plans. In addition, they should support community participation, provide benefits to the community and follow a watershed approach. Assessments of the programme highlight its evident social and climate adaptation contributions [61]. But many of the projects under PSNP have also supported land restoration, replenished soil fertility, improved water management and expanded irrigated area—in short, providing a whole range of ecosystem services that were in danger of being lost [12,62].

Although most assessments of PSNP focus on human wellbeing outcomes, a number of studies have tried to identify its environmental impacts as well. In an early study of Food for Work programmes that predated the current PSNP, Holden *et al*. suggest that they supported improvements in ecosystem services through public investments in tree planting and conservation in northern Ethiopia in addition to 'crowd[ing] in private investment in soil and water conservation' [63, p. 22]. Two later studies similarly find that PSNP improved tree planting activities among beneficiaries [64] and that households provided labour both through PSNP and as voluntary uncompensated labour to build community assets for soil and water conservation [65]. Perhaps the most direct evidence about the contribution of the PSNP's land management to climate goals comes from Woolf *et al*., who estimate that the programme reduced net GHG emissions at the national scale by 3.4 million Mg CO_2e per year, contributing '1.5% of Ethiopia's Nationally Determined Contribution to the Paris Agreement' [66, p. 1260].

Indeed, Ethiopia's Nationally Determined Contribution for the Paris climate agreement focuses, in common with that of India, on the need to enhance the adaptive capacities of ecosystems, communities and infrastructure through rehabilitation. It recognizes that such rehabilitation of 'degraded ecosystems and lands will also increase the resilience…to droughts and floods' [24]. Ethiopia's adaptation plan also highlights the potential of nature-based solutions such as agroforestry, sustainable afforestation and biodiversity corridors for improving the incomes and material wellbeing of poor and vulnerable peoples (see Nature-based Solutions Policy Platform: www.nbspolicyplatform.org).

(c) Temporary Employment Programme (PET), Mexico

Mexico's Temporary Employment Programme is an important example of a labour focused programme that has sought to couple a government's response to climate or environmental disasters with social assistance. The key element of the programme is to support households on public works programmes for infrastructure or for environmental and sustainable agricultural development [67] in an effort to reduce exposure to disasters that cost Mexico more than US$1.0 billion annually.

The origins of PET can be traced to the Special Employment Programme launched by the Government of Mexico in 1995. In this early version, the focus of the programme's employment provision was mainly on development of infrastructure through labour-intensive projects. The Ministry of Social Development was in charge of implementation. But the repeated exposure of a large part of Mexico's population to different kinds of disasters, including droughts, cyclones, storms and high-intensity rainfall events contributed to the programme's evolution towards collaboration with other ministries. Initially, the new partners for the programme were the Ministry of Agriculture and Rural Development and the Ministry of Natural Resources and Environment. Programme implementation is now collaborative with the Ministries of Labour and Communications.

As part of its evolution, PET developed a new component focused on emergency support during disasters to households and areas affected directly by such disasters. With a relatively low level of investment of around US$5 million annually, this component is adequate to cover only small losses households incur. It will require higher levels of investment to help households cope with substantial losses and the impacts of larger disasters. The main focus of PET is on employment directed towards health, education, nutrition and climate adaptation at the household level [68], and environmental conservation, roads, historic preservation and infrastructure improvement at the community level.

Key design features of PET include targeting towards poorer and more vulnerable households within municipalities that are more exposed to disasters such as droughts and high rainfall events. Beneficiaries, who receive wages equalling 99% of the minimum wage rate, are expected to register with PET [69]. Disbursements of earned income occur within a week of work having been carried out. Data on programme implementation are collected and managed through an electronic database, with particular attention to grievances and accountability. Programme evaluation is mainly available in the form of feedback by beneficiaries and tends to be high—but external evaluations have not yet been carried out. As a result, only limited generalizations can be made about the effectiveness of PET, especially when compared with Mexico's flagship *Oportunidades* programme and despite the fact that PET is the largest employment scheme in Latin America.

In some contrast to the examples of India and Ethiopia, the relationship between Mexico's PET and natural capital outcomes is less clear. For example, Mexico has committed in its Nationally Determined Contribution to the UNFCCC that it will bring deforestation down to 0% by 2030, reforest watersheds, guarantee food security through integrated watershed management, conserve and restore ecosystems, and increase carbon capture through a system of conservation and recovery of marine ecosystems (see Nature-based Solutions Policy Platform: www.nbspolicyplatform.org). Despite their strong Payments for Ecosystems Services programme [70,71], it is unclear how funding, resources and actions will be scaled to the level needed to meet these ecosystem goals. In this context, public works and employment guarantees provide an attractive avenue to meet simultaneously the social goals of reducing vulnerability and the ecosystem goals of restoration and carbon sequestration.

There is some evidence that the Temporary Employment Programme has been used in protected areas to support rural livelihoods and undertake tree planting and maintenance [72]. But on the whole, information on impacts of PET, particularly its natural capital effects, remains limited [67]. Several lessons still emerge from its experience. Careful coordination across

Table 3. Comparison of the employment schemes in India, Ethiopia and Mexico. NDC, nationally defined contribution.

	India (MGNREGS)	Ethiopia (PSNP)	Mexico (PET)
origins	disaster relief	disaster relief	disaster relief
resource allocation	substantial (more than US$7 billion)	medium (more than US$500 million)	low (<US$10 million)
institutional coordination	across multiple agencies	limited	limited
attention to ecosystem goals	high	medium	low
outcomes	ecosystem and natural capital: documented improvements in emissions: positive but no reliable estimates	ecosystem and natural capital: documented improvements in emissions: approximately 2.5% of Ethiopia's NDC	unclear

ministries, integration of disaster risk management in the provision of employment benefits and infrastructure, a focus on conservation and climate adaptation instruments, local assets to support greater resilience, and a database on beneficiary registration and programme implementation are important design features that could be deployed to help structure the provision of employment more effectively towards ecosystem and environmental benefits.

(d) Comparing employment schemes in India, Ethiopia and Mexico

The brief review of the three large-scale employment schemes reveals a number of common threads across their origins and implementation. Equally, the comparison highlights some lessons they offer about the role of social assistance in supporting improved environmental outcomes (table 3).

All three programmes were born out of a concern to support citizens affected adversely by different kinds of environmental disasters. MGNREGS in India and PSNP in Ethiopia were a direct response to experiences of famines and food insecurity—especially for the most vulnerable. Mexico's PET aims to support households negatively impacted by disasters more broadly, including cyclones, storms and high rainfall.

With their roots in environmental threats to livelihoods and food security, each of these three programmes also exemplifies efforts to conjoin the goal of reducing social vulnerability with the goal of improving natural capital and ecosystem services. All three employ labour to manage and improve the utilization of land and water resources. They aim to support the creation of infrastructure that would guard against soil erosion. They dedicate resources to improving land cover. And importantly, each of the three is making serious efforts to improve coordination across government ministries and departments to reduce the probability of working at cross purposes and improve programme outcomes by strengthening technical support during implementation.

The three programmes dedicate different levels of resources and are heterogeneously attentive to the improvement of institutional capacities at the local level. While MGNREGs in India explicitly states institutional strengthening at the local level as one of its four major goals, PSNP and PET have invested less in doing so.

As a large body of work on the role of local institutions and governance has pointed out, greater local capacity to manage natural resources held in common—from water bodies to grazing areas, woodlots and forests—has the potential to yield substantial improvements in the provision of ecosystem services and in the sustainability of their utilization [73,74]. Social assistance programmes focusing on employment and public works creation offer a fruitful avenue to explore such possibilities. But to take advantage of local, user-group-based organizations in supporting natural capital-based solutions, it is also clear that employment schemes must invest in strengthening their fiscal and institutional capacity.

4. The challenges and promise of employment schemes for ecosystem stewardship and building climate resilience

This paper suggests that employment-based social assistance programmes have the potential to restore and protect ecological integrity at relatively large scales. This is because employment schemes are politically attractive and hence sustainable at scale in many contexts. At the same time, it is clear that the quality of implementation in many existing employment schemes is weak. Some of the weaknesses include limited provision of labour opportunities in comparison with demand, seasonal variations in demand for employment to which governments are inadequately responsive, insufficient transfers through wages compared with nutritional and basic needs of recipient households, and leakages and corruption because of which funds spent on the programmes do not find their intended households but instead end up with rural or administrative elite. Some of these weaknesses can be addressed with greater accountability, improved fiscal capacity and better implementation.

But when it comes to the environmental outcomes of employment schemes, two challenges need particular attention for sustainable and equitable ecosystem stewardship: firstly, the poor design and maintenance of local public works outputs in many schemes and secondly the concern that social assistance schemes will be overburdened with additional objectives.

The poor quality of assets generated by public works schemes is a consistent theme in the literature [75,76]. Most of the evidence relates to small-scale infrastructural works (rural roads, construction of local public facilities such as clinics), rather than environmental assets. Reasons include problems of scale (programming that is over-ambitious for the time, labour and capital that is available), weaknesses

of local planning, inability to match inputs other than local labour (skilled labour, machinery, materials, etc.) to the time frames needed, and inadequate attention to the ownership of the asset created and therefore responsibility for maintenance. The weaknesses of planning and organization that characterize local infrastructural work likely also apply to investments in environmental assets. Woodlots are a common output from public works schemes in Africa, for example. They tend to involve single species and hence have low resilience to climate change impacts. Also they often are intended to supply either fuel or construction materials rather than providing a broader set of valuable ecosystem services. In addition, they have often been implemented without due concern for the economics of the enterprise, or for issues of ownership and benefit distribution.

Issues of achieving functional complementarity between social and environmental objectives are complex and challenging. At the institutional level, social welfare ministries often charged with running social assistance programmes are generally not equipped with the technical expertise necessary to identify appropriate projects with environmental goals [30]. There may also be significant trade-offs between social and environmental goals. If, for example, the poverty reduction goal is to provide work and income in the dry season in an agricultural area with a unimodal rainfall pattern (when there is a surplus of unused labour), that may not allow support to be provided to certain kinds of activities essential to the stewardship of the local ecosystem that might be best carried out either in, or shortly after, the rainy season.

The challenge therefore is to develop employment schemes that enable local communities to gain access to information and expertise enabling effective action for stewardship of ecosystems for both social and environmental goals [77]. This would involve a step change from the cultural models for local environmental stewardship which have tended to predominate (for example, single species woodlots) to approaches that build local institutions that are capable of regular engagement with the range of perspectives of community actors to tackle trade-offs and prioritize investments that respond holistically to multiple objectives. These holistic responses would seek to reduce poverty and hunger, promote local biodiversity, increase the provision of ecosystem services, strengthen resilience to climate change impacts, and increase and secure carbon storage and sequestration in local landscapes.

5. Conclusion

This Opinion piece highlights the potential of employment schemes to tackle important elements of the crises of inequality, biodiversity loss and climate change. Available evidence in the case of both MGNREGS in India and PSNP in Ethiopia suggests that these programmes help reduce social vulnerability by making available wage-based incomes for household wellbeing. At the same time, by channelling labour in infrastructure projects—many of them involving ecosystem restoration and strengthening of natural capital, and terrestrial sequestration through tree planting and ecosystem restoration—they also have the potential to support the achievement of national environmental and climate goals. In Mexico's case, although there is some suggestive evidence on the potential of PET, it is too preliminary and the programme is too small to make a difference in environmental outcomes at the national level. At the same time, it is important to acknowledge that at least Mexico is a middle-income country, and both India and Ethiopia have enjoyed sustained rates of high economic growth in recent decades. Creating similar programmes in terms of scale and coverage will require both political institutionalization and economic investments that may take time to achieve—particularly in sub-Saharan Africa.

Overall, the available evidence suggests that employment-based schemes, if implemented well, have the potential to address both social and environmental challenges jointly rather than through the siloed implementation of distinct programmes whose objectives may be viewed as being in conflict. Such schemes can accomplish their conjoint goals by unleashing finance at scale for employment alongside technical expertise to ensure sound local action and create working landscapes to conserve biodiversity, sequester carbon, and help communities adapt and thrive in a rapidly changing climate [78].

But considerable challenges prevent the realization of this potential. It would require an evolution of institutional systems for delivering social assistance to enable them to combine social and environmental objectives more effectively. In doing so, they would need to work on evolving local cultural models for environmental action away from models reflecting technical understandings of the mid twentieth century (such as exclusionary woodlots or ecological spaces protected from local communities), towards effective approaches to ecosystem stewardship that reflect the scale of current challenges.

Doing so will require multiple approaches to bringing programmes with objectives of poverty reduction, climate change and biodiversity together—either integrating objectives into one programme and investing in strengthening local technical expertise, or though convergence between programmes, such that technical expertise and materials is provided through one programme and labour through another. An assessment of the comparative benefits of programmes that focus individually on social versus ecological and climate goals is beyond the scope of this paper. But regardless of whether governments pursue these goals jointly through social assistance programmes, or seek to add to social assistance programme effectiveness through additional investments in environmental planning and Geographic Information System (GIS)-based monitoring, they will need to work with local peoples and institutions. Greater gains can be secured by strengthening local institutions that blend local or traditional technical knowledge with contemporary understanding of ecology and climate to enable agile, responsive solutions. Indeed, this is perhaps the biggest prize of all, as it would shape new cultural models for managing landscapes to address the severity of the triple challenges of global inequality, climate change and biodiversity loss.

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Endnote

[1]'Recognising the Duty of the Federal Government to Create a Green New Deal' 9 February 2019 Resolution to the 1st Session of the 116th Congress (House of Representatives): https://ocasio-cortez.house.gov/sites/ocasio-cortez.house.gov/files/Resolution%20on%20a%20Green%20New%20Deal.pdf.

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