The Natural Resource Degradation and Vulnerability Nexus

An Evaluation of the World Bank's Support for Sustainable and Inclusive Natural Resource Management (2009–19)

IEG
Independent Evaluation Group

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Abbreviations

ASA	advisory services and analytics
CPF	Country Partnership Framework
IBRD	International Bank for Reconstruction and Development
IEG	Independent Evaluation Group
NRDV	natural resource degradation and vulnerability
PES	payments for environmental services
SCD	Systematic Country Diagnostic
SLM	sustainable land management
SLMP	Sustainable Land Management Project

All dollar amounts are US dollars unless otherwise indicated.

Acknowledgments

This report was prepared by an Independent Evaluation Group (IEG) team co-led by Lauren Kelly and Bekele A. Shiferaw and comprising Harsh Anuj, Joy Kaarina Butscher, Alexandra Christina Horst, Doruk Yarin Kiroglu, Chikako Miwa, and Mees Daniel van der Werf. Jozef Leonardus Vaessen and Estelle Rosine Raimondo provided valuable methodological contributions. Romayne D. Pereira and Vibhuti Narang Khanna provided excellent program assistant support, and Aarre Laakso provided structural editing. All names of team members are included in alphabetical order.

The evaluation was conducted under the guidance and supervision of Marialisa Motta, manager; José Cándido Carbajo Martinez, director; and Alison M. Evans, Director-General, Evaluation.

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Overview

Many of the world's poor people depend on natural resources for their well-being. Four-fifths of the world's poor people live in rural areas, and most rural poor people depend on natural resources for their livelihoods (World Bank 2018c).

The renewable natural resources on which poor people depend are increasingly being degraded, posing significant risks to resource-dependent communities. These essential resources are increasingly unable to sustain uses necessary for human well-being and inclusive growth. One-third of all land and one-fifth of all forest cover are severely degraded (UNCCD 2017). Groundwater, which accounts for half of drinking water and 43 percent of irrigation water, is being depleted at an alarming rate (Smith et al. 2016). The fraction of fish stocks at biologically sustainable levels fell from 90 percent in 1974 to 67 percent in 2015 (FAO 2018b). Natural resource degradation can also exacerbate social tensions that lead to conflict.

Climate change exacerbates the vulnerability risks associated with natural resource degradation. Natural resource degradation increases susceptibility and exposure to climate shocks and further strains the adaptive capacity of resource-dependent communities (Lange, Wodon, and Carey 2018).

The World Bank has committed to reducing the vulnerability of resource-dependent people. The World Bank has indicated that its twin goals should be obtained in a "sustainable and inclusive manner" and the resulting "prosperity also needs to be shared across individuals over time, requiring forms of sustainable development that fully account for environmental degradation and natural resource depletion and, crucially, their close interrelation with poverty" (World Bank 2015, 1).

Although this evaluation was conducted before the coronavirus pandemic, it offers lessons relevant to the World Bank's efforts to address the significant increase in poverty caused by the pandemic. The pandemic is compounding the negative impacts that natural resource degradation was already having on the lives of vulnerable populations. For example, many urban residents

seeking refuge in their rural homes of origin are putting pressure on already stressed resources that sustain food and water systems in rural areas.

Evaluation Aim, Methods, and Scope

This evaluation assesses how well the World Bank has addressed natural resource degradation to reduce the vulnerabilities of resource-dependent people. It answers two main questions:

1. Relevance. How well has the World Bank identified and addressed resource degradation issues threatening resource-dependent people in the places where those threats are most prominent?
2. Effectiveness. How effective has the World Bank's support for natural resource management been at promoting sustainable use of resources and reducing the associated vulnerability of resource-dependent people?

This evaluation focuses on natural resources that are critical for the livelihoods and welfare of vulnerable people who depend on them. Such resources include soil and land, local forest resources, groundwater, and small-scale fisheries. The evaluation excludes issues that pertain to the global commons (such as global deforestation, biodiversity, air pollution, and marine health) because these issues have been or are scheduled to be covered in other Independent Evaluation Group evaluations.

The evaluation uses a mixed methods approach that draws on a range of evidence to derive explanatory factors and conclusions. The methods include structured literature reviews, a global data analysis, geospatial analyses, interviews, portfolio review and analysis, and comparative case studies. To assess the relevance of the World Bank's approach, the evaluation identifies "nexus countries," which are those with high resource degradation and high resource dependence by rural poor people.

Relevance of the World Bank's Approach

The World Bank adequately diagnoses and addresses forest and soil and land degradation issues but not groundwater and small-scale fisheries issues. Most Systematic Country Diagnostics (SCDs) of forest and soil and land

nexus countries analyze resource degradation, but SCDs only diagnose these issues in half of groundwater and small-scale fisheries nexus countries. Country Partnership Frameworks (CPFs) also have significantly higher coverage of forest and soil and land degradation issues than of small-scale fisheries and groundwater issues.

The World Bank does not adequately address the vulnerability of resource-dependent people where resource degradation threats are prominent. SCDs and CPFs tend not to *jointly* analyze resource degradation and associated human vulnerability. Analysis of resource-related human vulnerability is included in, on average, half of the SCDs and CPFs, with more coverage for forest resources. Gender-related resource management and use rights are also not diagnosed in SCDs and thus not addressed in country strategies and lending programs.

SCDs, CPFs, and lending programs for sustainable land management (SLM), forest resources, and groundwater are not addressing many of the underlying factors that drive resource degradation. These factors include (i) a lack of clearly defined resource and land use rights, including inadequate awareness of customary, flexible common property arrangements; (ii) policy distortions, such as subsidized energy for irrigated agriculture; and (iii) weak regulatory and governance arrangements that undermine sustainable use and negatively affect vulnerable resource users.

Effectiveness of the Natural Resource Degradation and Vulnerability Portfolio

The identified natural resource degradation and vulnerability (NRDV) portfolio consists of 253 World Bank projects in 82 countries approved between fiscal years 2009 and 2019, with financing of almost $33 billion. This portfolio comprises 104 SLM projects mapped to the Sustainable Development Practice Group and 41 Social Protection projects with resource restoration activities mapped to the Social Protection and Jobs global practice; 55 projects with groundwater activities; and 53 projects with small-scale fisheries support.

The World Bank has been effective at improving natural resource management practices, but there is little attributable evidence of a reduction in nat-

ural resource degradation or in associated human vulnerability of resource users. Most evaluated NRDV projects were rated at least moderately satisfactory, but ratings reveal little about the effectiveness of natural resource- and vulnerability-related outcomes and their sustainability. First, only 10 percent of the closed Sustainable Development SLM projects, and none of the Social Protection SLM projects, provided attributable evidence of resource restoration. Second, although groundwater activities strengthened institutional capacity, little is known about the effects of these activities on intensity and patterns of groundwater use and impacts on resource depletion. Third, although many small-scale fisheries projects achieved their resource governance objectives, few assessed effects on fish stock health or the welfare of fishing communities.

NRDV projects do not adequately identify, address, or assess heterogeneous effects on different subgroups of vulnerable resource users. SLM projects infrequently use metrics to measure the vulnerability of resource-dependent people. Most groundwater projects reduced vulnerability by increasing water availability but did not curb overuse, nor did they indicate for whom benefits would accrue. Few small-scale fisheries projects assessed the effects of improved governance on the welfare of fishing communities.

Explanatory Factors of Effectiveness

Reducing natural resource degradation and associated human vulnerability is difficult. Interventions are situated within specific political and institutional settings and need to take account of the heterogenous factors present across different socioecological systems. Broadly speaking, three sets of factors help explain the relative effectiveness of the NRDV portfolio within specific socioecological systems: (i) natural resource management practices, (ii) resource governance arrangements, and (iii) financial incentives.

Natural Resource Management Practices

Projects that address natural resource degradation through various natural resource management practices struggle to find the right balance between achieving resource recovery and meeting the welfare needs of vulnerable resource users. Area closures enhance resource recovery but can also increase

vulnerability if livelihood risks are not mitigated, as shown in Ethiopia and Niger. Fencing in Inner China, for example, led to degradation and vulnerability; the choice not to fence in Mongolia was well aligned with herder vulnerability-reducing strategies, but land degradation continued unabated. Watershed management in India reduced farmer vulnerability, but in the absence of regulation, it could not prevent overuse and vulnerability in the long run.

Resource Governance Arrangements

Resource governance arrangements, including access and use rights and appropriate regulations and policies, are critical determinants of whether resource users will adopt and benefit from sustainable management practices.

The underdiagnosis and inadequate treatment of traditional land access and use rights in the SLM portfolio has been shown to lead to increased exclusion and vulnerability of resource users. SLM projects that aim to enhance the value of degraded land are not designed with an understanding of the coping strategies of vulnerable resource users who access these lands as a social safety net. Nor do they address overlapping land claims. Increasing the value of open- or pooled-access degraded land without clear, enforceable land use agreements has led to predation by elites and farmer encroachment. In the absence of tenure security, distributional benefits achieved through SLM may dissipate if land is divided or sold outside of the community.

In groundwater regulations and policies, balancing supply- and demand-side interventions—through regulations and incentives—can ensure groundwater security and reduce vulnerability in the long term. Policies that subsidize electricity for pumping groundwater can reduce farmer vulnerability in the short run but can also accelerate aquifer depletion, especially in stressed areas.

The devolution of resource rights to communities can contribute to the reduction of resource degradation and human vulnerability. Strengthening community groundwater rights in India helped stem illegal well drilling that was leading to groundwater depletion. The provision and enforcement of local fishing rights in East Asia reduced illegal extraction and increased incomes.

Financial Incentives

The effectiveness of financial incentives to promote improved use of natural resources and to reduce vulnerability depends on whether programs accurately target the most threatened areas and vulnerable groups with benefits that accrue in a timely manner. Payment for environmental services (also referred to as payments for ecosystem services) programs have prevented forest cover loss and have yielded some economic benefits for landowners when implemented appropriately for the context. Programs that carefully targeted threatened areas and vulnerable resource users yielded the largest environmental and social benefits. Carbon payments have been more effective at reducing degradation and vulnerability when areas targeted for restoration are well defined and monitorable and when vulnerable groups receive benefits in a timely way. Discounted loans can promote uptake of climate-friendly land practices. However, discounted loans, especially those used for climate mitigation goals, may not be the right mechanism to support reduced farmer vulnerability because transaction costs are too high to engage small farms with low risk tolerance for loans.

Overall, the analysis of these three explanatory factors reveals that the success of all types of natural resource management interventions depends on the flow of benefits to resource users over reasonable time frames. When those benefits are too small or take too long to accrue, resource users are disincentivized from maintaining sustainable resource management practices, which undermines vulnerability reduction benefits.

Conclusions and Recommendations

In sum, the World Bank could perform better in addressing resource degradation and associated vulnerability reduction issues. The evaluation shows that there are gaps in the relevance and effectiveness of the World Bank's support for reduction of natural resource degradation and the associated human vulnerability of resource users. Because of these gaps, the World Bank is not doing all it can for vulnerable natural resource users, who constitute a large fraction of the world's poor people. The report offers three recommendations to improve the World Bank's performance in this area.

Recommendation 1. **The World Bank should identify and analyze NRDV nexus issues and leverage this knowledge in SCDs and in country engagements where such issues matter for achieving sustainable poverty reduction and shared prosperity.** In a subset of countries where NRDV nexus issues matter for achieving sustainable poverty reduction, SCDs can draw on data and analytics to identify and prioritize these issues. Management can leverage this knowledge to address these issues in country engagements, including through advisory work and, where relevant, prioritize lending, including through partnerships.

Recommendation 2. **World Bank operations that address natural resource degradation should direct attention to resource governance challenges and use a mix of resource management practices and financial incentives appropriate for the relevant socioecological systems.** World Bank operations that include support for natural resource degradation can identify and address governance issues by, for example, clarifying resource rights and addressing regulatory failures and distortive policies that drive resource degradation and increase the vulnerability of resource-dependent people. These governance challenges can be addressed through concurrent operations or sequential programmatic approaches. Operations that use resource management practices (such as area closures and watershed management) should find the right balance between achieving resource recovery and meeting the welfare needs of vulnerable resource users. Such trade-offs can be managed by ensuring timely economic and social benefit flows to resource users. When using financial incentives (such as payments for environmental services), it would be important for these operations to target both threatened areas and vulnerable groups.

Recommendation 3. **World Bank Global Practices involved in addressing natural resource degradation and associated vulnerability should share knowledge, improve measurement, and enhance coordination in the design and implementation of their projects to optimize development effectiveness.** The Social Protection and Jobs Global Practice and the Sustainable Development Practice Group should measure, assess, and report the attributable resource- and vulnerability-related outcomes of their different sustainable land and resource management approaches. For enhancing coordination, the Social Protection and Jobs Global Practice could share

lessons on targeting vulnerable groups and measuring vulnerability-reducing effects. Similarly, the relevant Global Practices within the Sustainable Development Practice Group could share knowledge on the most appropriate scientific resource management practices and how to apply and measure their effects in the relevant socioecological systems. These projects should also ensure synergies when they are operating in the same geographic area. Possible ways to enhance coordination include cross-support, co-task team leadership, and joint advisory services and analytics.

Management Response

Management of the World Bank thanks the Independent Evaluation Group for the report *The Natural Resource Degradation and Vulnerability Nexus: An Evaluation of the World Bank's Support for Sustainable and Inclusive Natural Resource Management (2009–19)*. This evaluation is timely and provides useful findings that inform both the International Development Association and International Bank for Reconstruction and Development agendas, especially with respect to climate change.

World Bank Management Response

Management is pleased with the evaluation's assessment that the World Bank "adequately diagnoses and addresses forest, soil, and land degradation issues," and that "the World Bank has been effective at improving natural resource management practices." Notwithstanding this progress, management acknowledges the report's conclusion that the World Bank could perform better in addressing resource degradation and associated vulnerability reduction issues and is determined to do so. First, as noted in the report, climate change exacerbates the vulnerability risks associated with natural resource degradation. Management has raised its ambition regarding fighting climate change by aiming to ensure that 35 percent of operational financing provides climate cobenefits over FY21–25. As a plan to reach that target is developed, addressing natural resource degradation becomes a central goal, particularly given its negative consequences on the poorest segments of the population. Second, the COVID-19 pandemic is compounding the negative impacts that natural resource degradation was already having on the lives of vulnerable populations, particularly in the world's poorest countries. As the World Bank continues to help countries respond to the pandemic, a focus on long-term goals associated with climate and environmental challenges is maintained. This approach aims to help countries rebuild in a greener, more resilient, and more inclusive manner. Management will internalize the report's recommendations to seize opportunities for improvement.

Management believes that the report's account of the World Bank's work on groundwater and small-scale fisheries is less elaborate than deserved. In general, management finds discussions in the report on groundwater management useful, but groundwater issues cannot be effectively addressed or managed in isolation, and the discussion does not expand on the critical links with surface water and the need for conjunctive management, especially for improving the drought resilience of rural communities in the face of climate change. Although inclusion of groundwater in the report is helpful, its treatment is not sufficiently informed and detailed; a single case study of groundwater management, for example, does not appropriately describe the wide range of ways in which this problem may be addressed. Management does not share the report's view that inadequate attention is paid to groundwater and small-scale fisheries nexus countries because half of the corresponding Systematic Country Diagnostics (SCDs) include diagnoses of resource degradation. This observation does not sufficiently consider prioritization and selectivity in country engagements.

Management agrees with the first recommendation, to analyze natural resource degradation and vulnerability nexus issues in SCDs and in country engagements, where such issues matter for achieving sustainable poverty reduction and shared prosperity. This is consistent with management's view of the SCD as a diagnostic tool that, by its nature, is not expected to be exhaustive in its review of the development issues facing a country but rather to be selective in choosing those issues that constitute the key development bottlenecks at the time that the SCD is prepared. SCDs have the strategic objective "to identify the most critical constraints and opportunities facing countries as they work to end extreme poverty and promote shared prosperity in a sustainable manner." Given varying circumstances and conditions, not every SCD and Country Partnership Framework will present assessments of the drivers and consequences of natural resource degradation and related vulnerability. As in all cases, the World Bank will work with clients to help define and prioritize country-level objectives and will endeavor to ensure that natural resource degradation (and its effects on vulnerable populations) remains central to this dialogue in countries where these issues are prominent for poverty reduction, as suggested by the report.

Management agrees with the second recommendation—to direct attention to resource governance challenges—and will do so by combining different lending instruments. Management believes that the World Bank has made significant efforts supporting policy and regulatory reforms. The World Bank has lending instruments for addressing different development challenges, and this evaluation primarily focuses on one of those instruments—traditional investment project financing. development policy operations or loans are more suited to promoting policy, regulatory, and other governance reforms (including land tenure). Management believes that the evaluation's portfolio analysis could have been more insightful in this regard had more development policy operations been included. Similarly, the analysis could have been further enhanced by the inclusion of more Program-for-Results operations, which have been used to support natural resource degradation and vulnerability investments in some cases. Management notes that many of the natural resources discussed in the report are common-pool resources and their respective restoration efforts will be sustainable when problems are collectively addressed through various appropriate channels. It should also be noted that the specific governance challenges identified in each case may require responses that fall outside the scope of individual projects (for example, coordination across different sectors and institutions) and may require a combination of lending and nonlending instruments (for example, the provision of knowledge and capacity building) delivered through programmatic engagements.

Management agrees with the third recommendation—to work across Global Practices to share knowledge, improve measurement, and enhance coordination to optimize development effectiveness—and it is acting on it. Management is continuously striving to enhance knowledge management practices, particularly to help ensure stronger outcome orientation of country engagements. Numerous examples of coordination and knowledge sharing from global programs such as PROGREEN and PROBLUE illustrate the progress underway in this realm. The Social Protection and Jobs Global Practice is strengthening its efforts to build, reflect and disseminate insights and evidence of social protection programs and policies that are adaptive and contribute to addressing natural resource degradation. The Social Protection and Jobs Global Practice flagship report "Adaptive Social Protection:

Building Resilience to Shocks" is one such example and is complemented by multiple knowledge pieces on public works. Additionally, the Sustainable Development Practice Group has developed and shared its work and experience in areas such as integrated land use planning, benefit sharing, program design based on understanding the drivers of deforestation, ensuring the voice of marginalized and indigenous peoples in program design, diagnostics on social inclusion, and empowerment and resilience. Management will reflect on additional opportunities to continue enhancing measurement and knowledge sharing, with a view to achieving and reporting on development outcomes.

Management believes that, given the report's time horizon, evidence of the achievement of longer-term outcomes of projects targeting natural resource degradation and vulnerability is difficult to collect and so it will reflect on better ways to do so. The report notes that "the World Bank has been effective at improving natural resource management practices, but there is little attributable evidence of a reduction of natural resource degradation or associated human vulnerability of resource users." Management notes that livelihood improvements are not only difficult to measure but also to attribute to World Bank interventions, given the many forces at play and the length of time required for the effects of interventions to coalesce as tangible results. In many cases, the impact of operations on natural resources and on the well-being of the affected populations may not be fully observable until well after a project closes and an Implementation Completion and Results Report is completed. Any analysis that limits itself to Implementation Completion and Results Reports, therefore, is likely to tell only a partial story, as the impact of World Bank interventions on degradation and vulnerability extends beyond the project period, with benefits accruing after the project end-date. For this reason, it is often not possible to conduct the type of monitoring suggested in the evaluation in standard World Bank reporting. Equally, the long-term nature of impacts on resources and direct users (with focus on vulnerable populations) is challenging to assess through indicators in standard and relatively short-term project- and country-level results frameworks. Therefore, World Bank efforts include support to enhance client capacity and institutionalization of monitoring of impacts on natural resources. In practice, this is what many World Bank projects are aiming to do. In line with

the World Bank's efforts to better assess and articulate its contribution to long-term country-level outcomes, consideration is being given to extending the time frame applied to assessing the effectiveness of critical activities that follow long-term indirect pathways (such as institutional development, including capacity building, transfer of knowledge and policy dialogue) and identifying appropriate criteria against which success can be measured.

Management Action Record

IEG Findings and Conclusions. References to both natural resource degradation and associated human vulnerability occurred most frequently in forest resource nexus countries (in 64 and 55 percent of Systematic Country Diagnostics [SCDs] and Country Partnership Frameworks [CPFs], respectively) and least frequently in groundwater nexus countries (39 and 30 percent). There is a lack of analysis, across all nexus countries, about the way that resource degradation is affecting the welfare and livelihoods of poor, resource-dependent persons—in the places where these threats are most prominent. There is a tendency for SCDs and CPFs in nexus countries not to refer to both resource degradation and human vulnerability.

IEG Recommendations. **Recommendation 1: The World Bank should identify and analyze natural resource degradation and vulnerability nexus (NRDV) issues and leverage this knowledge in SCDs and in country engagements where such issues matter for achieving sustainable poverty reduction and shared prosperity.** In a subset of countries where NRDV nexus issues matter for achieving sustainable poverty reduction, SCDs can draw on data and analytics to identify and prioritize these issues. Management can leverage this knowledge to address these issues in country engagements, including through advisory work and, where relevant, prioritize lending, including through partnerships.

Acceptance by Management Agree.

Management Response Management agrees with the first recommendation, to analyze natural resource degradation and vulnerability nexus issues in SCDs and in country engagements, where such issues matter for achieving sustainable poverty reduction and shared prosperity. This is consistent with management's view of the SCD as a diagnostic tool that, by its nature, is not expected to be exhaustive in its review of the development issues facing a country but rather to be selective in choosing those issues that constitute the key development bottlenecks at the time that the SCD is prepared. SCDs have the strategic objective "to identify the most critical constraints and opportunities facing countries as they work to end extreme poverty and promote shared prosperity in a sustainable manner." Given

varying circumstances and conditions, not every SCD and Country Partnership Framework will present assessments of the drivers and consequences of natural resource degradation and related vulnerability. As in all cases, the World Bank will work with clients to help define and prioritize country-level objectives and will endeavor to ensure that natural resource degradation (and its effects on vulnerable populations) remains central to this dialogue in countries where these issues are prominent for poverty reduction, as suggested by the report.

IEG Findings and Conclusions. Three factors help explain the performance of the NRDV portfolio: (i) natural resource management practices, (ii) resource governance, and (iii) financial incentives. Projects that address natural resource degradation use many technical practices whose effectiveness depends both on their appropriateness for specific ecological systems and on their fit within particular social and economic contexts. These interventions struggle to find the right balance between achieving resource recovery and meeting the needs of vulnerable resource users. Effective resource governance, including land use rights, policies, and adequate institutional capacity, are vital to the sustainable management of and equitable access to natural resources. The effectiveness of financial incentives in promoting sustainable resource use and vulnerability reduction largely depends on whether programs target the most threatened areas and include vulnerable resource users. In most cases analyzed, financial incentives were provided through environment and climate change trust funds that did not include a vulnerability lens.

IEG Recommendations. **Recommendation 2: World Bank operations that address natural resource degradation should direct attention to resource governance challenges and use a mix of resource management practices and financial incentives appropriate for the relevant socioecological systems.** World Bank operations that include support for natural resource degradation can identify and address governance issues by, for example, clarifying resource rights and addressing regulatory failures and distortive policies that drive resource degradation and increase the vulnerability of resource-dependent people. These governance challenges can be addressed through concurrent operations or sequential programmatic approaches. Operations that use resource management practices (such as area closures and watershed management) should find the right balance between achieving resource recovery and meeting the welfare

needs of vulnerable resource users. Such trade-offs can be managed by ensuring timely economic and social benefit flows to resource users. When using financial incentives (such as payments for environmental services), it would be important for these operations to target both threatened areas and vulnerable groups.

Acceptance by Management Agree.

Management Response Management agrees with the second recommendation—to direct attention to resource governance challenges—and will do so by combining different lending instruments. Management believes that the World Bank has made significant efforts supporting policy and regulatory reforms. The World Bank has lending instruments for addressing different development challenges, and this evaluation primarily focuses on one of those instruments—traditional investment project financing. development policy operations or loans are more suited to promoting policy, regulatory, and other governance reforms (including land tenure). Management believes that the evaluation's portfolio analysis could have been more insightful in this regard had more development policy operations been included. Similarly, the analysis could have been further enhanced by the inclusion of more Program-for-Results operations, which have been used to support natural resource degradation and vulnerability investments in some cases. Management notes that many of the natural resources discussed in the report are common-pool resources and their respective restoration efforts will be sustainable when problems are collectively addressed through various appropriate channels. It should also be noted that the specific governance challenges identified in each case may require responses that fall outside the scope of individual projects (for example, coordination across different sectors and institutions) and may require a combination of lending and nonlending instruments (for example, the provision of knowledge and capacity building) delivered through programmatic engagements.

IEG Findings and Conclusions. No sustainable land management (SLM) project adequately assesses the nexus between resource-related outcomes and the vulnerability reduction of relevant resource users. Only 10 percent of the closed Sustainable Development SLM and none of the Social Protection SLM projects adequately provided attributable resource-related evidence. Only two closed Sustainable Development SLM projects attempted to measure the link between

resource restoration and reduced human vulnerability, but even in these cases the analysis was incomplete.

IEG Recommendations. **Recommendation 3: World Bank Global Practices involved in addressing natural resource degradation and associated vulnerability should share knowledge, improve measurement, and enhance coordination in the design and implementation of their projects to optimize development effectiveness.** The Social Protection and Jobs and the Sustainable Development Global Practices should measure, assess, and report the attributable resource- and vulnerability-related outcomes of their different sustainable land and resource management approaches. For enhancing coordination, the Social Protection and Jobs Global Practice could share lessons on targeting vulnerable groups and measuring vulnerability-reducing effects. Similarly, the relevant Global Practices within the Sustainable Development Practice Group could share knowledge on the most appropriate scientific resource management practices and how to apply and measure their effects in the relevant socioecological systems. These projects should also ensure synergies when they are operating in the same geographic area. Possible ways to enhance coordination include cross-support, co-task team leadership, and joint advisory services and analytics.

Acceptance by Management Agree.

Management Response Management agrees with the third recommendation—to work across Global Practices to share knowledge, improve measurement, and enhance coordination to optimize development effectiveness—and it is acting on it. Management is continuously striving to enhance knowledge management practices, particularly to help ensure stronger outcome orientation of country engagements. Numerous examples of coordination and knowledge sharing from global programs such as PROGREEN and PROBLUE illustrate the progress underway in this realm. The Social Protection and Jobs Global Practice is strengthening its efforts to build, reflect and disseminate insights and evidence of social protection programs and policies that are adaptive and contribute to addressing natural resource degradation. The Social Protection and Jobs Global Practice flagship report "Adaptive Social Protection: Building Resilience to Shocks" is one such example and is complemented by multiple knowledge pieces on public works. Additionally, the Sustainable Development Practice Group has

developed and shared its work and experience in areas such as integrated land use planning, benefit sharing, program design based on understanding the drivers of deforestation, ensuring the voice of marginalized and indigenous peoples in program design, diagnostics on social inclusion, and empowerment and resilience. Management will reflect on additional opportunities to continue enhancing measurement and knowledge sharing, with a view to achieving and reporting on development outcomes.

Report to the Board from the Committee on Development Effectiveness

The Committee on Development Effectiveness met to consider the report entitled *The Natural Resource Degradation and Vulnerability Nexus: An Evaluation of the World Bank's Support for Sustainable and Inclusive Natural Resource Management (2009–19)* and the draft World Bank management response.

The committee commended the Independent Evaluation Group for the timely and relevant evaluation, noting that its outcome focus was helpful in orienting the World Bank Group approach toward achieving greater development impact, doing no harm, and benefiting the most vulnerable populations. Members noted the evaluation's relevance to discussions on how to achieve a green, resilient, and inclusive COVID recovery and the World Bank's efforts to achieve climate adaptation goals. They also noted the relevance of the findings to inform the upcoming committee discussions on outcome orientation and highlighted the importance of having measurable results to assess the development outcomes of the World Bank's activity on nature and climate change and to maximize World Bank's outcome-oriented business model.

The committee welcomed management's response and broad agreement with the report's recommendations and was pleased to learn that the World Bank has been relevant in adequately diagnosing and addressing forest, soil, and land degradation issues and improving natural resource management practices. Members acknowledged that the coronavirus (COVID-19) was compounding the negative impacts that natural resource degradation was already having on the lives of vulnerable populations and underscored the key role that the World Bank can play in addressing the link between natural resource degradation and vulnerability to enable an inclusive COVID-19 recovery and in assisting its client countries in their efforts to reduce poverty, boost shared prosperity, and achieve the Sustainable Development Goals. Several members welcomed management's acknowledgment of the need to

assess and measure attributable outcomes even if it is not easy to do so. They encouraged management to improve knowledge sharing, develop metrics, and enhance coordination across the relevant Global Practices to optimize development effectiveness.

Members appreciated management's recognition that there was room for improvement and also its commitment to better address natural resource degradation and vulnerability issues, which are central to enabling the World Bank to meet its ambitious goal to deliver, on average, 35 percent of operations with climate cobenefits for FY21–25. They highlighted the importance of paying due attention to the natural resource degradation and vulnerability link in Systematic Country Diagnostics (SCDs) and Country Partnership Frameworks (CPFs), particularly where these issues were key for achieving poverty reduction and shared prosperity. Management explained that the World Bank helps its clients define and prioritize country-level objectives and clarified that an SCD is not exhaustive review of the development issues that a country faces at the time the SCD is being prepared but an assessment of the key development bottlenecks being faced by the country at that time. Management therefore noted that not all SCDs and CPFs present assessments of the drivers and consequences of natural resource degradation and related vulnerability. The Independent Evaluation Group clarified that the evaluation focused only on countries (and the associated SCDs and CPFs) that have relatively high resource degradation and high resource dependence among poor people. Members stressed that there was room to systematically assess the link between natural degradation and vulnerable populations in project design.

1 Background, Context, and Approach

Renewable natural resources are becoming increasingly degraded, that is, declining in their productive capacity to sustain uses necessary for human well-being and inclusive growth. One-third of all land and 20 percent of all forest cover has been severely degraded (UNCCD 2017). Groundwater, which accounts for 50 percent of drinking water and 43 percent of water used for irrigation, is being depleted at an alarming rate (Smith et al. 2016). The fraction of fish stocks at biologically sustainable levels decreased from 90 percent in 1974 to 67 percent in 2015 (FAO 2018b).

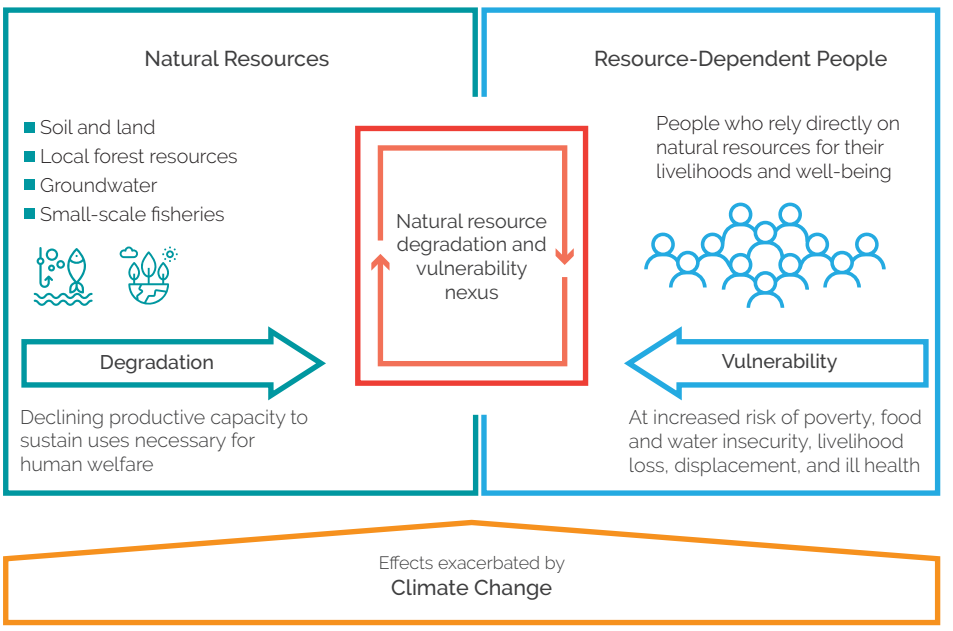
Many of the world's poor people are resource dependent, that is, directly reliant on natural resources for their well-being. Four-fifths of the world's poor live in rural areas, and most rural poor people depend on increasingly degraded natural resources for their livelihoods (IFAD 2015; World Bank 2018c). Most of the 3.1 billion people who live in rural areas depend directly on soil and land (FAO 2017). The livelihoods of 2 billion people who live in drylands and who also rear half of the world's livestock are especially threatened. About 240 million people, including those in many indigenous communities, derive approximately 20 percent of their income from forest resources, which provide 30 million jobs in the informal sector (FAO 2018a). Small-scale fisheries in developing countries employ 90 percent of the world's fishers and produce about half of global fish catches (World Bank 2012a). Nearly all fish caught are used to feed local communities.

Climate change exacerbates the vulnerability-related risks associated with natural resource degradation. Natural resource degradation increases susceptibility and exposure to climate shocks and further strains the adaptive capacity of resource-dependent communities (Lange, Wodon, and Carey 2018; World Bank 2010b). Recent studies show that the combined effects of resource degradation and climate change could force more than 100 million people into poverty by 2030, especially in Africa and South Asia (World Bank 2016c). Climate change is anticipated to contribute to the displace-

ment of 143 million people, many of whom are vulnerable and live in degraded areas (Rigaud et al. 2018). It will also severely affect food security, especially in degraded landscapes, reducing crop yields by an estimated 10 percent by 2050 (Scholes et al. 2018).

Across the world, the natural resources that are highly degraded and the people who are highly vulnerable are interconnected by a link referred to here as "the natural resource degradation and vulnerability (NRDV) nexus," which is the subject of this evaluation (figure 1.1). As shown in the left-hand side of the figure, there is a spectrum of natural resource degradation from least to most degraded. From left to right along this axis, natural resources decline in their productive capacity to sustain uses necessary for human well-being. Similarly, there is a spectrum of vulnerability among resource-dependent people from least to most vulnerable (right-hand side). Resource-related vulnerability is highly context specific. It might involve increased risk of poverty, food and water insecurity, livelihood loss, displacement, or ill health. From right to left along this axis, these risks increase for resource-dependent people. The nexus (in red in the center) is at the intersection between highly degraded resources and highly vulnerable resource-dependent people.

Figure 1.1. Natural Resource Degradation and Vulnerability Nexus



Source: Independent Evaluation Group.

The World Bank is committed to addressing resource degradation to reduce vulnerability, as articulated in its strategies and goals. Through its twin goals, the World Bank aims to end poverty and boost shared prosperity in a "sustainable and inclusive manner." The resulting prosperity "also needs to be shared across individuals over time, requiring forms of sustainable development that fully account for environmental degradation and natural resource depletion and, crucially, their close interrelation with poverty" (World Bank 2015, 1). The environment strategy working paper cites the importance of managing resources to enhance livelihoods and improve food security, pointing to vulnerable communities who bear the brunt of environmental decline and who are losing resource access (World Bank 2012b). The "Action Plan on Climate Change Adaptation and Resilience" notes that climate change impacts will "fall most heavily on vulnerable populations, including people dependent on rain-fed agricultural, pastoral, forest, and coastal resources for their livelihoods" (World Bank 2019d, 5). The theme is at the core of the 19th Replenishment of the International Development Association, which cites the need to support "vulnerable populations, indigenous peoples and local communities located in inland or coastal areas and dependent on natural resources" (World Bank 2020b, 6).

However, natural resource degradation is often overlooked because of its gradual nature and the lack of representation of resource-dependent poor people. First, natural resource degradation is a "creeping threat," not a shock. The processes that cause land and soil degradation, water depletion, and salination are gradual but have compounding effects. They are unlike disasters, whose effects are immediate and severe (Vlek 2005). Ultimately, degradation has knock-on effects on food security and resource scarcity far from its source. An example is the reduction in coastal fish stocks caused by soil erosion that negatively affects water quality. Second, the resource-dependent poor lack voice and agency. They often do not have access to information about their land and resource rights and are not represented in resource-related decision-making processes (FAO 2020). Because of underrepresentation and insecure tenure, resource-dependent communities are losing access to their land and resources, with negative effects on livelihoods, well-being, and ecosystem services (Notess et al. 2018).

Evaluation Aims and Methods

This evaluation assesses how well the World Bank has addressed natural resource degradation to reduce the vulnerabilities of resource-dependent people. It answers two main evaluation questions:

1. How well has the World Bank identified and addressed resource degradation issues threatening resource-dependent people in the places where those threats are most prominent? This question is addressed in chapter 2.

2. How effective has the World Bank's support for natural resource management been at promoting sustainable use of resources and reducing the associated vulnerability of resource-dependent people? This question is addressed by analyzing project effectiveness, including issues pertaining to measurement (chapter 3), and by analyzing a set of explanatory factors of effectiveness (chapter 4).

This evaluation covers natural resources that are critical for the livelihoods and welfare of the vulnerable people who depend on them. These resources include soil and land, local forest resources, groundwater, and small-scale fisheries. Local forest resources provide critical sources of fuelwood, fodder, protein, medicine, building materials, and income—including from nontimber forest products—for forest-dependent populations. The evaluation excludes issues pertaining to the wider global commons (for example, tropical forests, global deforestation, biodiversity, air pollution, marine health) because these either have been or will be covered in other evaluations.

The evaluation uses a mixed methods approach that draws on a range of data sources to collect evidence and derive explanatory factors. It assesses the World Bank's projects that had resource restoration activities approved and implemented during the evaluation period (2009–19). The methods include structured literature reviews, interviews, a portfolio review and analysis, and comparative case studies that include quantitative, qualitative, and geospatial analysis (see appendix A). The evaluation used an inductive approach to understand how resource-related human vulnerability is conceptualized and measured in World Bank

documentation; it further grounded this understanding in local reality through focus groups and interviews conducted with project stakeholders in the case analyses.

2 Doing the Right Things in the Right Places to Address Natural Resource Degradation and Human Vulnerability

Highlights

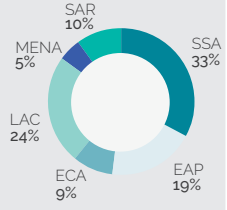
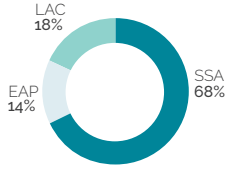
The World Bank adequately diagnoses and addresses forest and soil and land degradation issues but not groundwater and small-scale fishery issues.

However, there is a dearth of analysis in many Systematic Country Diagnostics (SCDs) about the way that resource degradation is threatening the welfare and livelihoods of poor, resource-dependent people in the places where these threats are most prominent. There is a tendency for SCDs and Country Partnership Frameworks not to refer to both resource degradation and associated vulnerability, although this occurs more frequently when forest resource issues are diagnosed.

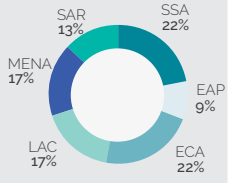
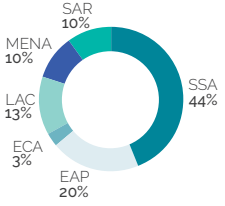
SCDs, Country Partnership Frameworks, and lending programs for sustainable land management, forest resources, and groundwater do not address many of the complex factors that drive resource degradation. SCDs and Country Partnership Frameworks for small-scale fishery nexus countries, however, directly address the underlying drivers of depletion, such as policy, regulatory, and institutional drivers.

This chapter examines the extent to which the World Bank identifies and addresses resource degradation issues threatening resource-dependent people in the places where those threats are most prominent. Specifically, it examines whether and how often the World Bank diagnoses resource degradation and associated human vulnerability issues in its Systematic Country Diagnostics (SCDs) and whether it addresses these issues in its Country Partnership Frameworks (CPFs) and country lending programs. This analysis is conducted for countries with relatively high resource degradation and high resource dependence among poor resource users. Such countries are referred to as "nexus countries" (table 2.1; see expanded methodology in appendix A). Of the 101 nexus countries, this chapter assesses the 87 with SCDs, CPFs, and active country lending portfolios (that is, countries that are not in arrears). This chapter first examines the inclusion of resource degradation and associated human vulnerability in SCDs, CPFs, and lending across all natural resources for all nexus countries. It then focuses on issues specific to each of the natural resources that are the subject of this evaluation: soil and land, local forest resources, groundwater, and small-scale fisheries. Advisory services and analytics (ASA) were not assessed because these were considered as critical inputs into—and therefore reflected in—the SCDs and CPFs where they existed.

Table 2.1. Identification of Natural Resource Degradation and Vulnerability Nexus Countries

Resource	Resource Degradation Indicators	Resource Dependence Indicators	Nexus Countries
Soil and land 	» Average soil erosion rate (Mg/ha/year, 2001–12; Borrelli et al. 2017) » Maximum erosion rate (Mg/ha/year, 2001–12; Borrelli et al. 2017)	» Employment in agriculture (percent total employment, modeled ILO estimate 2019; World Bank WDI) » Livestock per capita (number, 2017; FAOSTAT) » Rural poverty headcount ratio at national poverty lines (percent rural population, various years; WDI)	n = 58 
Local forest resources 	» Forest area (percent land area, 2000; World Bank WDI) » >75 percent tree cover loss per year 2000–12 in areas with >75 percent tree cover (percent; Hansen et al. 2013)	» Lack of access to nonsolid fuel (percent rural population without access; World Bank, SEforALL) » Number of forest-proximate people, 2012 (Newton et al. 2016; FLARE Network Secretariat 2016) » Rural poverty headcount ratio at national poverty lines (percent rural population, various years; WDI)	n = 22 

(continued)

Resource	Resource Degradation Indicators	Resource Dependence Indicators	Nexus Countries
Groundwater	» Groundwater table decline (multiplied decline by aquifer area to quantify extent of decline and aggregated at country levela	» Percent people relying on groundwater as primary source of water (southern Africa; World Bank 2014a) » Percent people relying on groundwater for livelihoods (South Asia; Hirji, Mandal, and Pangare 2017) » Percent population dependent on groundwater (Middle East and North Africa; Lezzaik, Milewski, and Mullen 2018)	n = 23 
Small-scale fisheries	» Fish stock status (0–100, various years; Yale University Center for Environmental Law and Policy)	» Pressure on artisanal fishing opportunities (score, 2015; University of California, Santa Barbara, and Conservation International) » Catch used for local human consumption (case studies; World Bank 2012a)	n = 30 

Source: Independent Evaluation Group

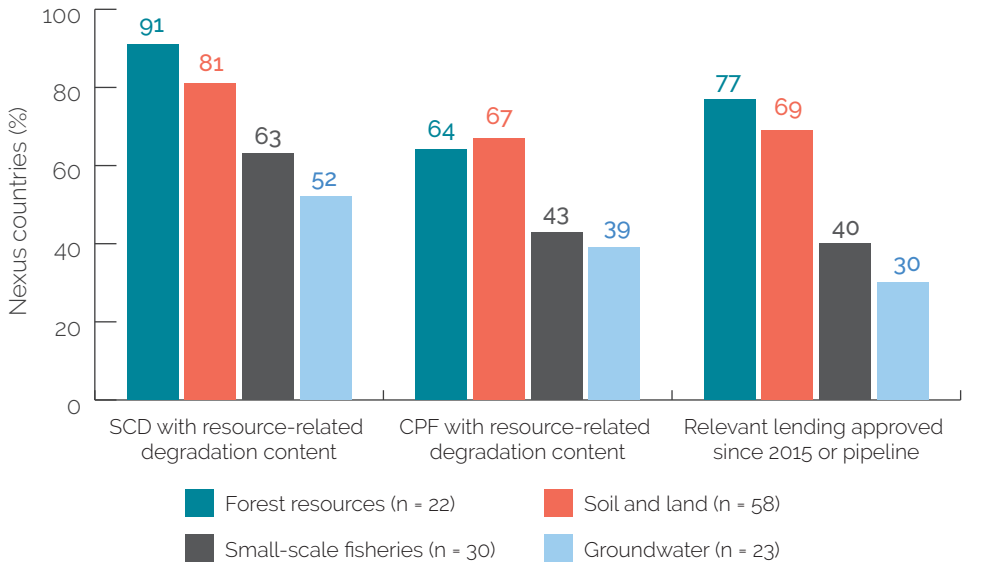
Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; FAOSTAT = Food and Agriculture Organization Statistics Division; ILO = International Labour Organization; LAC = Latin America and the Caribbean; Mg/ha/year = megagrams per hectare per year; MENA = Middle East and North Africa; SAR = South Asia; SEforALL = Sustainable Energy for All; SSA = Sub-Saharan Africa; WDI = World Development Indicators.
a. Aqueduct 3.0 (database), World Resources Institute, https://www.wri.org/aqueduct.

Overall Analysis

The SCDs of forest and soil and land nexus countries often diagnose these resource degradation issues, whereas the SCDs of groundwater and small-scale fisheries nexus countries often do not. Most SCDs of forest and soil and land nexus countries (91 and 81 percent, respectively) include a description of, and sometimes data on, forest and soil and land degradation issues (figure 2.1). However, SCDs of small-scale fisheries and groundwater nexus countries only diagnose these resource degradation issues in, respectively, 63 and 52 percent of the nexus countries.

CPFs adequately cover forest and soil and land degradation but not groundwater and small-scale fisheries issues. Across all nexus countries, there is a drop in resource-related coverage from SCDs to CPFs: 20–27 percent for small-scale fisheries and forest issues and 13–14 percent for groundwater and soil and land (figure 2.1). Although there is substantial coverage of forest and soil and land degradation issues in nexus countries—considering competing priorities—coverage is low for small-scale fisheries and groundwater issues.

Figure 2.1. Natural Resource Degradation Issues in SCDs, CPFs, and Lending in Nexus Countries



Source: Independent Evaluation Group.

Note: CPF = Country Partnership Framework; SCD = Systematic Country Diagnostic.

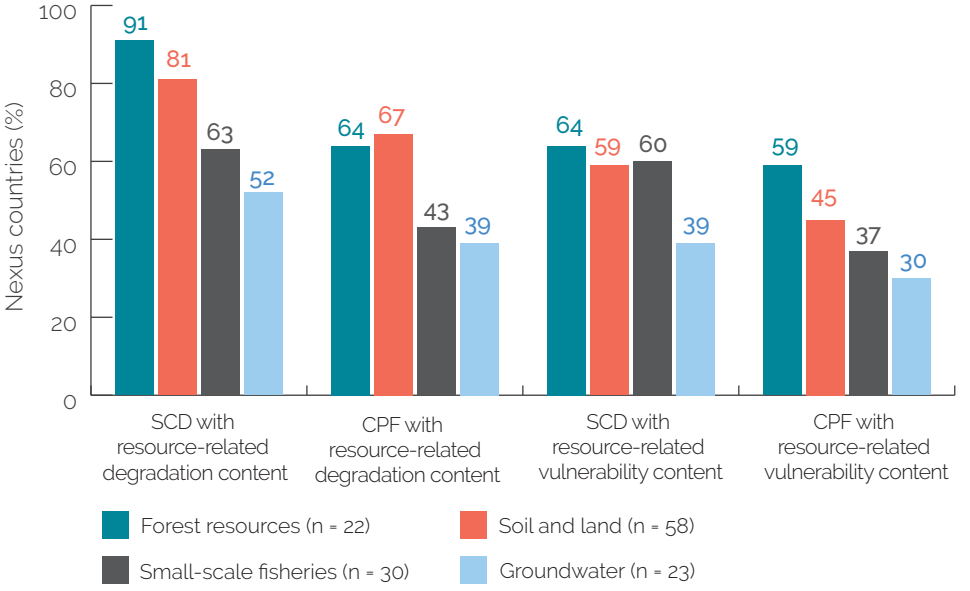
CPFs that do not carry resource degradation issues through from the SCD display one of four characteristics. Twenty-five CPFs did not refer to resource degradation even though the corresponding SCDs did. Four factors explain these gaps:

- A CPF's focus on corporate climate change mitigation goals may crowd out references to resource degradation and human vulnerability. This occurs predominantly in Latin America and the Caribbean, even in countries with relatively low greenhouse gas emission targets (for example, El Salvador and Guatemala).
- CPFs that focus on disaster risk management may drop references to resource degradation exacerbating vulnerability (as in the Comoros, Mauritius, and the Philippines). These omissions need not occur—the CPF in Honduras addresses disaster risks intensified through forest and soil degradation by applying an integrated agriculture and water management approach.
- Several International Bank for Reconstruction and Development (IBRD)/Blend small-scale fisheries nexus countries with adequate diagnostics (for example, China, the Republic of Congo, the Dominican Republic, and Nigeria) omit the issue in the CPF and have no small-scale fisheries lending.
- Some Central American IBRD nexus countries (for example, El Salvador and Guatemala) are not borrowing for natural resource management because support for other topics (for example, urban governance) is being prioritized, in a context in which projects have been limited in the analyzed years.

SCDs and CPFs refer less to resource-related human vulnerability than to resource-related degradation. Roughly 40–60 percent of SCDs and 30–60 percent of CPFs refer to resource-related vulnerability, with more complete coverage for forest-related vulnerability than for other resources (figure 2.2). Although vulnerability is highly contextual, SCDs that examine resource-related human vulnerability refer—at a minimum—to vulnerable groups (for example, poor farmers, vulnerable herders, women). Half cite the locations of vulnerable resource users but only when there is lending. Even so, this analysis is partial: migrants, the landless, historically disadvantaged peoples, unmarried women, and other marginalized resource users are not mentioned. Few SCDs and CPFs provide data on resource-related livelihoods (for example, welfare, income, or jobs). Almost none analyze the social constraints that exacerbate vulnerability (for example,

the ability to participate in resource-related decision-making, the rights to use or benefit from resources). In small-scale fisheries nexus countries, SCDs point to livelihood risks associated with depletion but not to marginalization or resource competition with large fishing vessels.

Figure 2.2. Coverage of Resource-Related Vulnerability versus Resource-Related Degradation in SCDs and CPFs in Nexus Countries



Source: Independent Evaluation Group.

Note: CPF = Country Partnership Framework; SCD = Systematic Country Diagnostic.

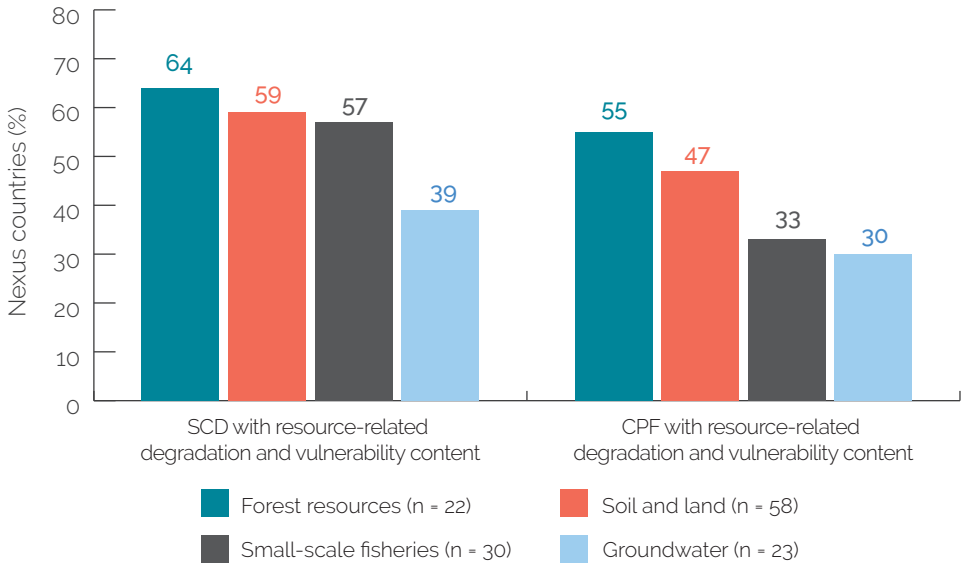
Gender-related resource management and use rights are not diagnosed in SCDs and thus not addressed in country strategies and lending programs. Nexus country SCDs make few references to gender-related natural resource access and use rights, and the corresponding CPFs make almost no commitments to address these issues. This is important because women (and many marginalized groups) tend to have low participation in traditional natural resource governance structures.[1] It is also important because resource access rights might differ from resource use rights.[2]

Degradation-induced and resource-related conflicts that increase the vulnerability of resource users are often cited in the SCDs of nexus countries but not in the associated CPFs. Half of the SCDs (45 of 89) point to either the presence or the risk of resource-related conflict. However, 70 percent of the associated CPFs do not refer to these risks. There is more depth and consistency in the treatment

of resource-related conflict risks in the SCDs for countries affected by fragility, conflict, and violence, especially in the Sahel. Sahelian SCDs refer to conflict risks associated with competition for arable and grazing land due to degradation and water scarcity, exacerbated by drought and demographic growth. They almost always point to mortal conflicts between farmers and pastoralists. However, references to these risks are frequently dropped in South Asia (except for Afghanistan) and in the Middle East and North Africa Region. Notably, references to agropastoral conflict are also dropped in the Côte d'Ivoire, Mali, Nigeria, and South Sudan CPFs. Nevertheless, there has been increased integration of resource-related conflict risk mechanisms in design (see chapter 3).

Overall, SCDs and CPFs in nexus countries tend not to jointly analyze resource degradation and human vulnerability. References to both natural resource degradation and associated human vulnerability jointly occurred most frequently in forest resource nexus countries (in 64 and 55 percent of SCDs and CPFs, respectively) and least frequently in groundwater nexus countries (39 and 30 percent; figure 2.3). But there is a dearth of analysis across many nexus countries about the way that resource degradation threatens the welfare and livelihoods of poor, resource-dependent persons in the places where these threats are most prominent.

Figure 2.3. Natural Resource Degradation and Vulnerability in SCDs and CPFs in Nexus Countries



Source: Independent Evaluation Group.

Note: CPF = Country Partnership Framework; SCD = Systematic Country Diagnostic.

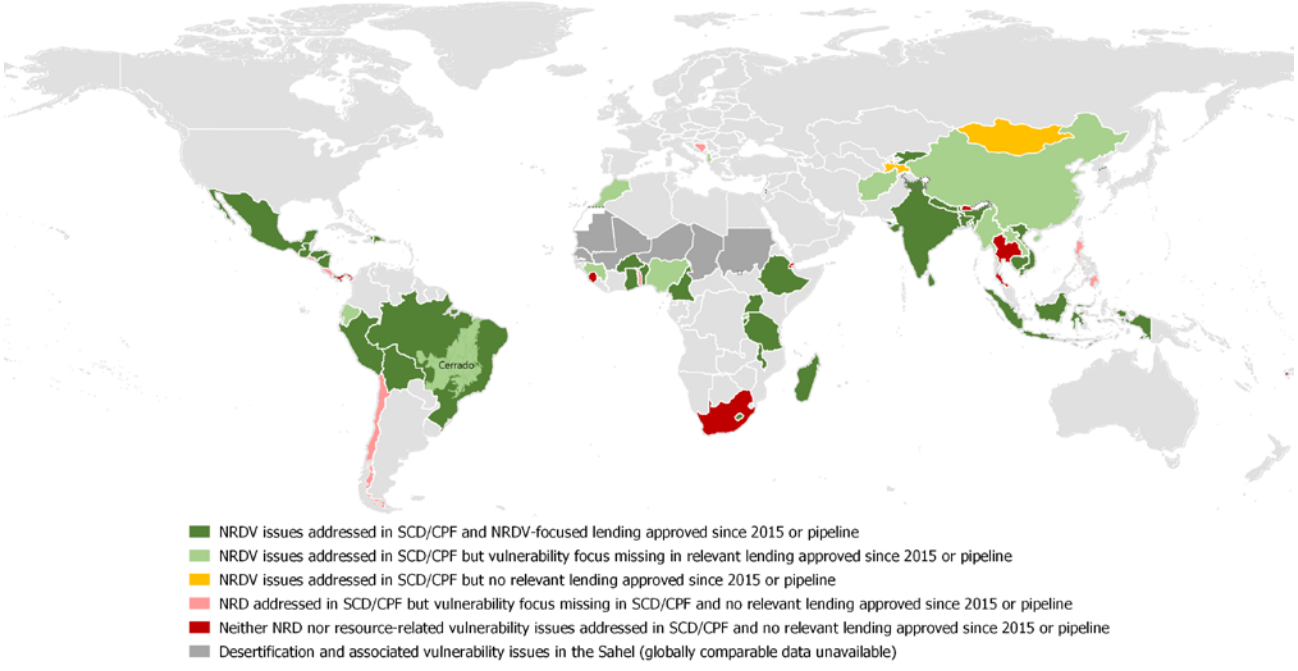
Soil and Land Resources

The World Bank diagnoses and addresses soil and land degardation issues in at least two-thirds of soil and land nexus countries. SCDs diagnose and country lending addresses soil and land degradation in 81 and 69 percent of soil and land nexus countries, respectively (figure 2.1). There are several examples where soil and land degradation and associated human vulnerability are well diagnosed and addressed in the SCD, CPF, and country lending program (identified in green in map 2.1). They include countries such as Cameroon, whose SCD analyzes the "soil fertility–poverty trap," and Honduras, whose SCD links soil degradation to deforestation and whose CPF supports resource-dependent populations in the Corredor Seco, where 92 percent of the population lives below the extreme poverty line.

Although the World Bank often diagnoses and addresses soil and land degradation issues, CPFs and lending lack a resource-related vulnerability focus. In some Central and South American countries, the lack of a vulnerability focus in the lending portfolio is due to the terms of the blended concessional finance (IBRD, carbon finance, and the Global Environment Facility), which targets large and medium-size farms (see discussion of the Cerrado in the Discounted Loans section in chapter 4). In East Asia, including in China and Mongolia, vulnerability-related aims were included in closed NRDV projects but not in similar active ones, even though the SCDs continue to cite the vulnerability of resource user groups who are physically or socially isolated, aged, or disabled. For example, in Mongolia, the first two phases of the Sustainable Livelihood Project (2002–07, 2007–13) focused on herder vulnerability, but the most recent phase dropped this support.

Although the World Bank addresses soil and land degradation frequently and in most of the right places, it inadequately addresses its drivers. SCDs acknowledge the issue of soil and land degradation, but many of them limit their diagnostics to poor farming or grazing practices, exacerbated by climatic conditions. Few SCDs point to policy distortions, including perverse incentives or lack of clearly defined property rights, or to the economic, regulatory, and resource governance factors and negative externalities that lead to market failures and drive degradation. Neither do many SCDs situate land and soil degradation within a wider context, for example, by considering the rapid growth of commodities or urbanization and migration trends.

Map 2.1. Coherence among SCDs, CPFs, and Lending for Soil and Land Degradation in Nexus Countries



Source: Independent Evaluation Group.

Note: CPF = Country Partnership Framework; NRD = natural resource degradation; NRDV = natural resource degradation and vulnerability; SCD = Systematic Country Diagnostic.

World Bank lending infrequently addresses the role of tenure insecurity and resource use rights in providing incentives for sustainable land management (SLM). Although almost 80 percent of the 58 SCDs for soil and land nexus countries cite a lack of secure land tenure or use rights as a constraint on SLM, only eight World Bank investments in seven countries address tenure insecurity. This issue is especially pertinent in Africa, where conflicting land rights undermine incentives for land-based investments and where all but one of the 24 SCDs cite land tenure insecurity as a challenge (see also Deininger, Savastano, and Xia 2017; Holden and Otsuka 2014). Good examples of relevant World Bank assistance in this area include support for local land titling, communal rights, or land certificates in Burkina Faso, Ethiopia, Ghana, Madagascar, Malawi, and Uganda.

A lack of focus on tenure insecurity and use rights undermined long-term vulnerability reduction in the Sahel. The World Bank catalyzed more than $1 billion of finance from the International Development Association and other sources (for example, the Global Environment Facility) to address land degradation and human vulnerability in the Sahel. Land degradation and associated vulnerability issues were well captured in the SCDs and CPFs and were addressed through the Sahel and West Africa Program. The projects were highly participatory and designed to (i) use various dryland technologies to help restore degraded land and (ii) reduce short-term vulnerability by delivering local investments (health, education, infrastructure) and cash-for-work arrangements in exchange for land restoration efforts. However, inadequate attention to land and resource use rights undermined the potential for longer-term vulnerability reduction (see also chapter 4).

Forest Resources

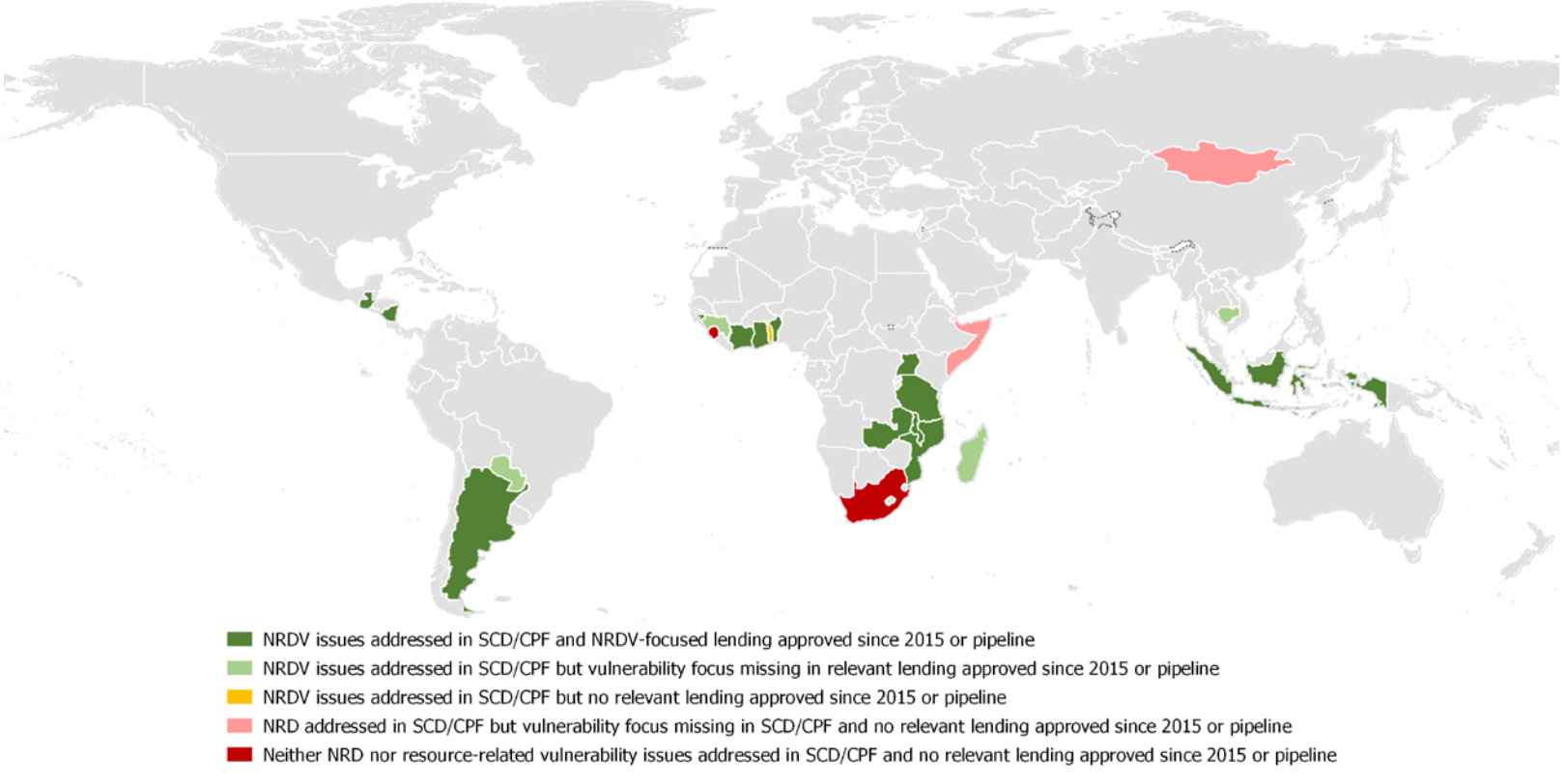
The World Bank coherently addresses forest resource loss in places where the local poor people most depend on these resources for their livelihoods and well-being. Of the SCDs in forest nexus countries, 91 percent include references to forest degradation issues, and 77 percent of these nexus countries include lending to address the issues raised in the associated SCDs (figure 2.1). This is especially the case in eastern and southern Africa (except for South Africa), where ASA, technical assistance, and investments have

been designed to address the drivers of forest resource degradation while enhancing forest resource users' well-being in areas of high poverty (map 2.2). Energy-related risks are addressed through efforts to promote fuel switching and sustainable charcoal production in Madagascar and Zambia. However, in West Africa, World Bank engagement in Guinea, Sierra Leone, and Togo does not include investments that directly address forest degradation, biomass dependence, and forest-related livelihoods, even though these SCDs cite significant forest-related vulnerability.[3]

SCDs for forest nexus countries associate vulnerability with biomass dependence, a risk that is often not addressed through lending. Vulnerability in forest nexus countries is associated with biomass dependence for cooking and heating. In most African countries, the energy sector is dominated by traditional biomass-based energy sources (for example, fuelwood). The issue of biomass dependence is also significant for vulnerable families in Latin America and the Caribbean who engage in indoor cooking. Biomass dependence is diagnosed in 80 percent of the SCDs of forest nexus countries but addressed though lending only in Benin, Madagascar, Mozambique, and Uganda.

Although SCDs include information on forest-dependent communities, they rarely analyze forest-related livelihoods, including monetary and nonmonetary benefits. Subnational livelihood data—collected from surveys and case studies—were provided in four SCDs: Argentina, Cambodia, Indonesia, and Madagascar. These data were also reflected in the targeting strategies of relevant poverty-focused forest projects.

Map 2.2. Coherence among SCDs, CPFs, and Lending for Forest Resources in Landscapes in Nexus Countries



Source: Independent Evaluation Group.

Note: CPF = Country Partnership Framework; NRD = natural resource degradation; NRDV = natural resource degradation and vulnerability; SCD = Systematic Country Diagnostic.

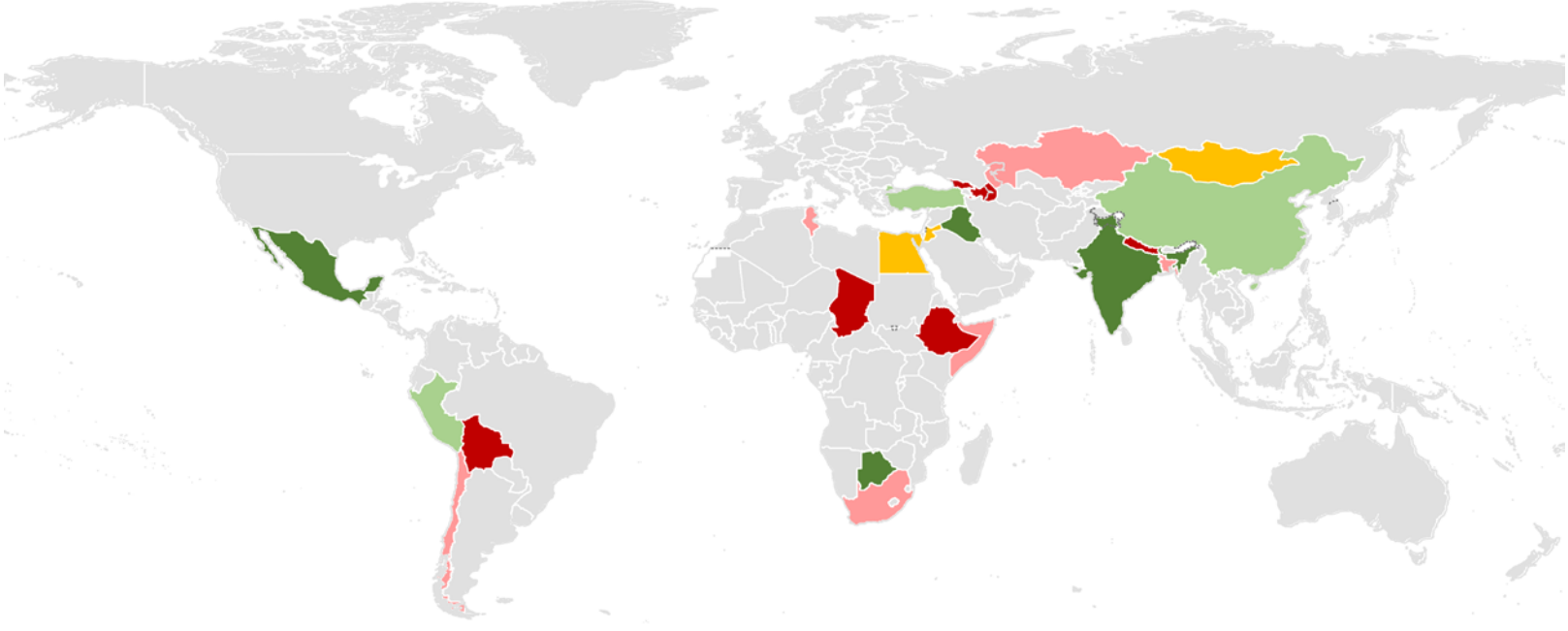
Groundwater Resources

Groundwater depletion issues are both underdiagnosed in SCDs and CPFs and insufficiently addressed through lending in nexus countries. Groundwater depletion is addressed in 52 percent of the SCDs of groundwater nexus countries and 39 percent of the associated CPFs, and much of the relevant lending in these nexus countries is closed and shrinking (figure 2.1). There is strong alignment—across diagnostics, strategy, and programming (ASA and lending)—on addressing groundwater issues in Botswana, India, Iraq, and Mexico (map 2.3).[4] But although there was strong alignment between diagnostics and lending in the Middle East and North Africa early in the evaluation period, investment support has not continued.

Country programs address the physical drivers of groundwater degradation but not the political economy drivers. Most nexus country SCDs associate groundwater depletion with inefficient or outdated irrigation, water-intensive cropping, and water-intensive industries. Half of the SCDs refer to political economy challenges (for example, water and energy price distortions, weak enforcement, lack of cost recovery) and only three (the Arab Republic of Egypt, India, and Mexico) point to distortionary effects of subsidized irrigation water use, which can lead to overexploitation, leakage, and suboptimal cropping decisions.

Wider patterns of groundwater degradation related to human vulnerability require more contextual analysis. In the context of groundwater depletion, SCDs focus on the inefficiency of irrigation systems. These SCDs often neither include groundwater data nor cite vulnerable populations. But there is a demand for more knowledge about groundwater depletion and its effects on health and welfare. For example, the Mexico SCD points to the need for more groundwater research since groundwater accounts for 65 percent of water used by Mexican cities.

Map 2.3. Coherence among SCDs, CPFs, and Lending for Groundwater Depletion in Nexus Countries



Source: Independent Evaluation Group.

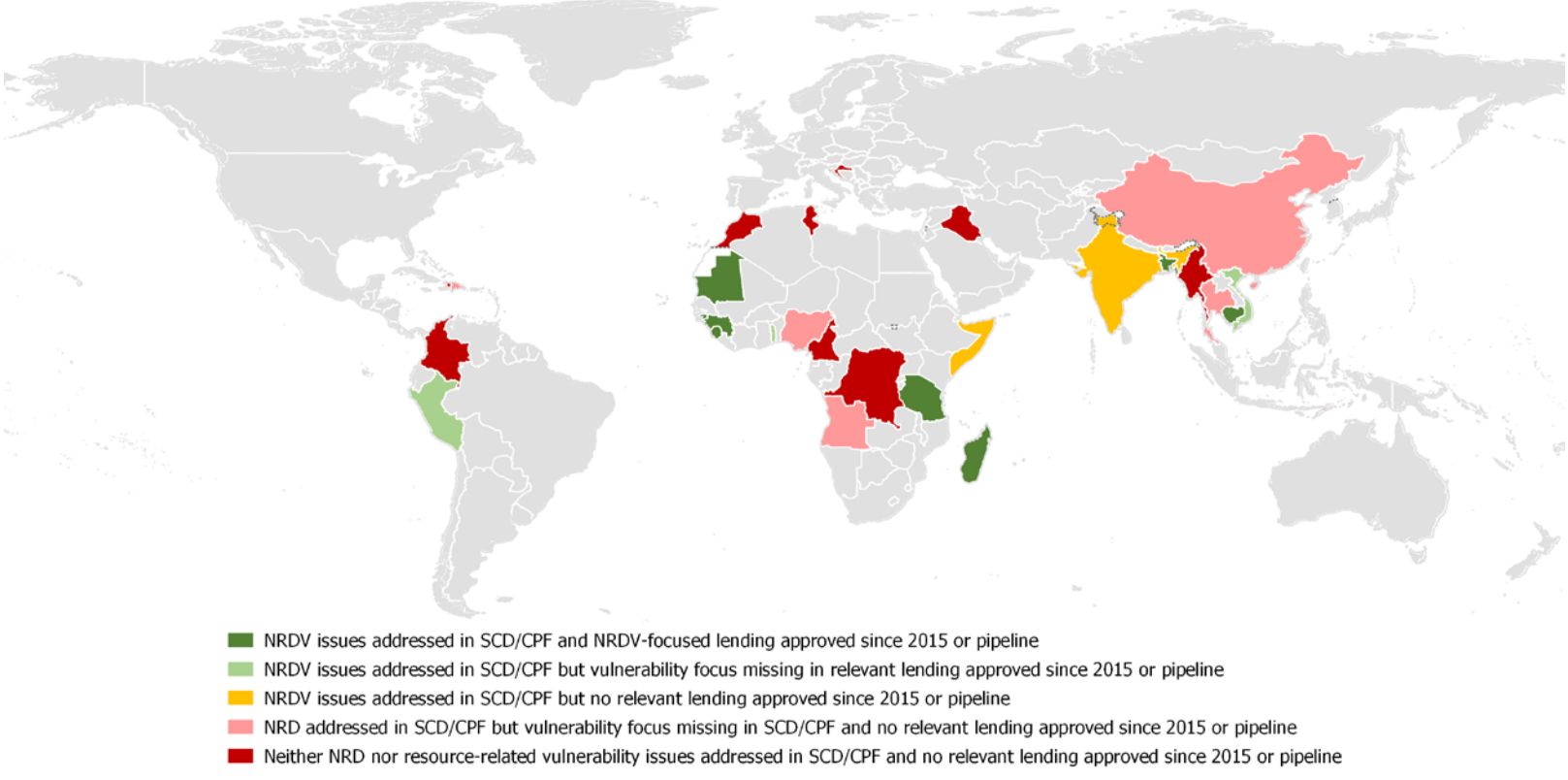
Note: CPF = Country Partnership Framework; NRD = natural resource degradation; NRDV = natural resource degradation and vulnerability; SCD = Systematic Country Diagnostic.

Small-Scale Fisheries Resources

Although many SCDs in nexus countries include analysis of small-scale fisheries depletion, these issues are often not addressed in the CPFs and lending programs. Sixty-three percent of SCDs analyze small-scale fisheries depletion, but this issue is addressed in only 43 percent of nexus CPFs and in 40 percent of lending (figure 2.1). The World Bank provided relevant support to fishing communities within nexus countries along the western African coast and in the southwest Indian Ocean. In these regions, the SCDs focused on the vulnerability-inducing effects of fish depletion (due to overfishing and unregulated fishing), and the CPFs included regional lending and technical assistance programs that address policy, regulatory, and institutional drivers of small-scale fisheries depletion (map 2.4). However, the World Bank does not adequately address these issues in coastal central Africa, where overfishing is increasing vulnerability.[5] In this region, several SCDs reference this, but CPFs do not address it.

The diagnosis of vulnerability is often incomplete in SCDs for small-scale fisheries nexus countries. Although SCDs for small-scale fisheries nexus countries point to livelihood and food insecurity risks from overexploitation, they do not analyze the increasing marginalization and competition facing fishing communities. These issues are also not reflected in lending. The focus on overexploitation in the SCDs results in projects designed to improve fisheries management and conservation. This also results in projects that are not designed with a vulnerability lens: small-scale fisheries projects often do not include mechanisms to compensate or provide safety nets to fishers. Meanwhile, these fishers face structural threats from the consolidation of the fishing industry, which affects customary resource allocation practices, and from conflict with large-scale fishing operations. Integrating vulnerability considerations into the SCDs could help inform the design of small-scale fisheries projects that address the challenges of common-pool resources.

Map 2.4. Coherence among SCDs, CPFs, and Lending for Small-Scale Fisheries in Nexus Countries



Source: Independent Evaluation Group.

Note: CPF = Country Partnership Framework; NRD = natural resource degradation; NRDV = natural resource degradation and vulnerability; SCD = Systematic Country Diagnostic.

[1] There is long-standing literature on women's comparative exclusion from traditional natural resource governance structures (UN Women 2013). Although poor rural women are often highly dependent on natural resources, they are largely excluded from traditional decision-making processes (Hyle, Devkota, and Mustalahti 2019). This is even the case when such institutions seem participatory (Agarwal 2001). Often, women have only usufruct rights to land, where their access is mediated through their male relations and their rights are an extension of their family support role rather than their individual rights (Kusakabe, Shrestha, and Veena 2015).

[2] For example, women or other marginalized groups might hold access rights to land (that is, permission to enter the land) without being allowed to withdraw resources from it (that is, withdrawal rights; RRI 2014). Alternatively, women might have access and withdrawal rights but no management rights; they cannot regulate or make decisions over the resources they use (RRI 2014).

[3] The western Guinean lowland forests provide up to 35 percent of all goods and noncash income to households (Darwall et al. 2015).

[4] In Botswana, for example, where groundwater accounts for half of all water used and where these resources are at or near their capacity for sustainable use, the World Bank is helping enhance watershed and aquifer management, including in drought-prone areas. In Iraq, the focus in the diagnostics and the lending program is on preparedness: investments in water supply and sanitation include groundwater management of the country's water security planning activities because of the lack of alternative water resources to the Tigris. The World Bank's diagnostics have emphasized the need to study groundwater and introduce water savings, water consumption reduction, and water loss reduction to ensure continued water access for 5 million Baghdad residents (over 80 percent of the Baghdad population). In Mexico, millions of citizens are facing water scarcity because the number of overexploited aquifers tripled between 1975 and 2013. Overpumping is causing land subsidence, which makes flooding worse and causes structural damage to urban infrastructure. To respond to these threats, the World Bank is implementing a large-scale effort to strengthen the management of groundwater resources in the Valley of Mexico and help improve the efficiency of the water transfer plans under the Cutzamala System—the second-largest source of water for Mexico City and the State of Mexico (World Bank 2020c).

[5] In this region, fish provide a major source of animal protein for coastal communities, which account for approximately 40 percent of the population (Polidoro et al. 2016). But many bony fish species are in danger of global extinction due to overfishing, degradation of habitats, pollution, and climate change.

3 Effectiveness of Activities Addressing Natural Resource Degradation and Vulnerability

Highlights

The World Bank has been effective at improving natural resource management practices, but there is little attributable evidence that this has led to a reduction in natural resource degradation or the associated human vulnerability of resource users.

Most evaluated natural resource degradation and vulnerability projects were rated at least moderately satisfactory, but ratings reveal little about the effectiveness or sustainability of natural resource—and vulnerability-related outcomes. Only 10 percent of the closed sustainable land management projects mapped to the Sustainable Development Practice Group—and none of the closed Social Protection projects with sustainable land management components—provided attributable evidence of resource restoration. Although groundwater activities strengthened institutional capacity, little is known about their effects on intensity and groundwater use patterns and their impacts on resource depletion. Although many small-scale fisheries projects achieved their resource governance objectives, few assessed fish stock health or the welfare of fishing communities.

Natural resource degradation and vulnerability projects do not adequately identify, assess, and address heterogeneous effects on different subgroups of vulnerable resource users. Sustainable land management projects infrequently use metrics to measure the vulnerability of resource-dependent populations. Most closed groundwater projects reduced vulnerability by increasing water

availability but did not indicate to whom benefits would accrue. These same projects did not include mechanisms to prevent overuse—and therefore reduce vulnerability—in the long run. Very few small-scale fisheries projects assessed the effects of improved resource governance on the welfare of fishing communities.

This chapter examines the effectiveness of World Bank projects that aim to address natural resource degradation, associated human vulnerability, and the nexus between them. The chapter includes a portfolio review and analysis of SLM, groundwater, and small-scale fisheries projects. The evaluable forest portfolio relevant to the evaluation scope was small (n = 8), and hence its effectiveness is not assessed as a stand-alone category in this chapter. However, projects with forest-related technical and financial instruments (for example, agroforestry, payments for environmental services) are included in the SLM portfolio and are assessed in chapter 4.[1]

The portfolio consists of 253 World Bank investment projects approved during the evaluation period (fiscal years 2009–19) with total financing of almost $33 billion. Of these projects, 117 (46 percent) were closed, and 78 (30 percent) were evaluated at the time of this evaluation. The SLM portfolio consists of 104 SLM projects mapped to the Sustainable Development Practice Group and 41 projects with SLM activities mapped to the Social Protection and Jobs Global Practice,[2] 55 projects with groundwater activities, and 53 projects with small-scale fisheries support (table 3.1). Most of the portfolio maps to four Global Practices: (i) Environment, Natural Resources, and Blue Economy; (ii) Agriculture and Food; (iii) Water; and (iv) Social Protection and Jobs. Half of it is in Sub-Saharan Africa (table 3.2).

The Independent Evaluation Group (IEG) rated most closed projects as moderately satisfactory or above, but the ratings reveal little about reduced degradation, sustainable natural resource management, or associated vulnerability outcomes. IEG rated 79 percent of closed projects moderately satisfactory or above in terms of achieving their stated objectives. However, the project development objectives that were measured reveal little about the projects' contributions to reduced natural resource degradation or associated effects on the vulnerability of resource users. There are three reasons for this. First, most projects tracked progress using corporate indicators that measure outputs, not outcomes. Most project results frameworks lacked outcome indicators. Second, causal attribution is a challenge because few projects used rigorous testing and analysis (including comparison to a counterfactual) to isolate the effect of the World Bank's technical interventions. Third, the lack of a consistently applied definition of SLM in projects complicates measurement across the portfolio. For example, SLM metrics used in Brazil refer to acts taken by landowners to register their land with

the rural cadastre, whereas in Ethiopia, SLM refers to the physical restoration of degraded lands on a wide scale. Yet these projects—like most projects in the portfolio—use the same output-level indicators (number of hectares put under SLM or SLM practices).

Table 3.1. Natural Resource Degradation and Vulnerability Portfolio, by Global Practice and Aggregate Performance Ratings

Global Practice	SLM	Groundwater	Small-Scale Fisheries	Social Protection with SLM	Total
Environment, Natural Resources, and Blue Economy (no.)	48	8	27	0	83
Agriculture and Food (no.)	38	5	14	0	57
Water (no.)	12	36	2	0	50
Social Protection and Jobs (no.)	0	0	0	41	41
Urban, Resilience, and Land (no.)	4	3	5	0	12
Other (no.)	2	3	5	0	10
Total (no.)	104	55	53	41	253
Outcome rated MS+ (percent)	78	83	68	100	79

Sources: Independent Evaluation Group, Implementation Completion and Results Report Reviews.

Note: MS+ = moderately satisfactory or above; SLM = sustainable land management.

Table 3.2. Natural Resource Degradation and Vulnerability Portfolio, by Region (Number of projects)

Portfolio Themes	EAP	ECA	LAC	MENA	SAR	SSA	Total
Sustainable land management projects	8	11	20	3	4	58	104
Projects with groundwater components	9	8	5	10	13	10	55
Projects with small-scale fishery components	16	1	2	4	5	25	53
Social Protection with SLM activities	0	0	1	6	1	33	41
Total	33	20	28	23	23	126	253

Source: Independent Evaluation Group.

Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SAR = South Asia; SSA = Sub-Saharan Africa.

Thus, this portfolio review and analysis was designed as an exploratory learning tool to distill lessons and map evidence. Because there has been no previous systematic assessment of World Bank operations exploring the link between NRDV, key functions of the portfolio review were to (i) identify the World Bank's relevant portfolio, (ii) analyze the type and consistency of metrics applied to capture natural resource- and vulnerability-related outcomes, and (iii) assess the adequacy and effectiveness of the key intervention areas.

Sustainable Land Management

The World Bank defines SLM as a knowledge-based procedure that aims to integrate the management of land, water, biodiversity, and other environmental resources to meet human needs while sustaining ecosystem services and livelihoods. SLM interventions are expected to progressively result in the sustainable management of land and associated resources in a manner that meets current and future human needs while protecting the integrity of ecosystem services (World Bank 2006).

The World Bank approved 145 operations that included support for SLM, of which 59 were evaluated. The portfolio includes 104 projects mapped to the Sustainable Development Practice Group (40 closed) that aimed to achieve SLM through a mix of physical interventions; technical and institutional support; and policy, economic, and financial tools (table 3.1). Half of these Sustainable Development SLM projects applied a participatory watershed management approach at the catchment level.[3] Other Sustainable Development SLM projects aimed to improve on-farm soil and water management for improved productivity but did not apply a watershed management approach. The SLM portfolio also includes 41 projects mapped to the Social Protection and Jobs Global Practice (15 closed) that provided cash, or in some cases food, for work to resource users to restore degraded land and resources, often as part of a social safety net program that provided financial transfers to poor households.[4]

Resource-Related Outcomes of the SLM Portfolio

Most Sustainable Development SLM projects report on the area put under SLM practices but not on the attributable, resource-related outcomes of the intervention. Only 10 percent of the closed Sustainable Development SLM

projects provided evidence of soil and resource restoration attributable to the project through measurements of vegetative cover, species richness, biomass, organic matter, waterflow, and soil stability. Good practice examples include the following: (i) the China Sustainable Management and Biodiversity Conservation of the Lake Aibi Basin Project (2011–16), which adequately measured the increase in vegetative cover and income effects for farmers; (ii) the Second Ethiopia Sustainable Land Management Project (2014–19), which demonstrated both an increase in biomass in the intervention areas and an increase in the dry season base flow of sampled microwatersheds; (iii) the Senegal Sustainable Land Management Project (2010–13), which measured the increase in organic matter in the soil in targeted areas; and (iv) the Shandong Ecological Afforestation Project (2010–17; see box 3.1). An almost equal number of closed projects attempted to measure these effects but dropped the indicators by project close.[5] The use of resource-related outcome indicators in Sustainable Development SLM projects has also declined (23 percent of closed Sustainable Development SLM projects included resource-related outcome indicators, but these were present in only 11 percent of the active results frameworks).

Box 3.1. The Shandong Ecological Afforestation Project in China (2010–17)

The Shandong Ecological Afforestation Project in China (2010–17) is a good practice example of a sustainable land management project that demonstrates how projects can test and measure their land restoration effects. The project supported the revegetation of degraded mountainous and saline coastal areas to reduce soil erosion and runoff and to improve soil quality. It did this in demonstration plots to test the effects of different afforestation and soil conservation interventions in treated and nontreated areas. By applying Earth observation technology and other measurement tools, the project demonstrated and reported on improved environmental conditions and reductions in runoff and soil erosion that were attributable to the project's interventions.

Source: Independent Evaluation Group.

Although SLM interventions are expected to progressively result in enhanced land productivity to reduce vulnerability, most Sustainable Development SLM projects do not establish attributable links between restoration activities and land productivity outcomes. The conservation and restoration of land and the pursuant efforts to manage that land sustainably can increase soil fertility, fodder, water, and ecosystem services, which in turn can increase land, resource, and livestock productivity, creating opportunities for economic diversification. Realizing improved productivity is crucial for farmers and other land users in adopting SLM practices. In the Sustainable Development SLM portfolio, 22 percent of projects have indicators that measure land-related productivity (for example, average crop yields, milk production), but only 3 percent include both attributable resource-related and productivity-related indicators.[6] Several projects reported on increased agricultural productivity in areas where SLM was adopted but did not establish links to the restoration activities. These links were not made evident even in phased SLM projects.[7]

Social Protection projects that provide cash or food for work for resource restoration are not ensuring that the physical restoration is leading to enhanced land and resource productivity, which are critical for vulnerability reduction in the long run. There were 41 Social Protection projects approved during the evaluation period that provided vulnerable resource users with cash or food for work to remediate degraded land (through a combination of irrigation and canal rehabilitation, afforestation, agroforestry, soil conservation, and land restoration). Although half of the projects included an output-based indicator (number of hectares put under improved SLM practices), none measured the quality of the restoration effects, including the longest-running and most evaluated program in the Social Protection SLM portfolio in Ethiopia. Case analysis conducted in Ethiopia suggests that more attention should be paid to the quality of land remediation in Social Protection projects with SLM components (box 3.2).

Box 3.2. The Productive Safety Nets Program in Ethiopia

The Productive Safety Nets Program (2005–20) in Ethiopia demonstrates the limited effectiveness of Social Protection projects for land restoration. It provided food and cash transfers to food-insecure households in chronically food-insecure woredas (districts). Through its four phases, the program supported watershed management through large public works activities. Evidence shows positive effects in reducing the food insecurity of vulnerable households (though it did not reduce chronic undernutrition and stunted growth of children), building community assets, and improving access to social services (Berhane, Hoddinott, and Kumar 2017; Desalegn and Ali 2018). However, the expected changes in land restoration and productivity were rarely measured and reported. The Independent Evaluation Group's case study of eight microwatersheds within the program showed that, with few exceptions, the effectiveness of public works activities in reducing land degradation to enhance livelihoods was challenged by weak implementation, technology choice, the inability to demonstrate timely benefits to land users, and labor shortages.

Source: Independent Evaluation Group.

Vulnerability-Related Outcomes of SLM Projects

In the absence of adequate targeting, it is not possible to determine the heterogeneous effects of SLM projects on different subgroups of vulnerable resource users. In the SLM portfolio, there is a tendency to identify project beneficiaries through geographic (for example, watershed) and political-administrative boundaries rather than identifying marginalized groups that are dependent on the degraded resources. Although this geographic targeting displays awareness of poverty-resource links, it does not adequately consider factors that prevent vulnerable resource-dependent subgroups—distinguished by income or wealth, risk-coping abilities, gender, race and ethnicity, and so forth—from actively participating in or benefiting from resource restoration activities. Crop farmers, including those who also rear livestock, are almost always cited as beneficiaries, but apart from indigenous groups in Latin America and the Caribbean and scheduled tribes in India, other groups such as pastoralists (in Africa), traditional communities, Afro-descendants

(Latin America and the Caribbean), and the landless are rarely integrated into project design. As expected, therefore, few projects measure the disaggregated effects of SLM activities on different subgroups. Most striking is the finding that of the 21 SLM projects that list pastoralists as beneficiaries, only two measured their benefits (for example, access to pastoral infrastructure).

SLM projects that use cash for work have achieved short-term vulnerability-reducing effects, but the distribution and magnitude of these effects is not known. Half of the 104 Sustainable Development SLM projects and all Social Protection SLM projects included a form of payment for work for the restoration of degraded land and resources. In all cases, the cash-for-work programs were implemented in degraded areas with high poverty and resource dependency. In these areas, low wages ensured that vulnerable people were targeted. What is not known, however, is how the work was distributed or the magnitude of the vulnerability-reducing effects. There are three reasons for this. First, although Social Protection SLM projects report on the number of persons who worked or the total wages paid, most Sustainable Development SLM projects do not, rendering impossible an assessment of vulnerability reduction. Second, it is not clear who participated in the cash-for-work programs. Projects rarely included gender, youth, or other social inclusion considerations. Nor is it known whether workers were local, to strengthen the synergy between restoration activities and reduced vulnerability. Third, in many cases, projects do not indicate who owns or has rights to the land being restored.[8] For example, for programs conducted on communal land, projects did not indicate how access and use rights would be preserved after project close (for example, how grazing rights would be maintained after tree planting).

Gender issues are almost always cited in SLM projects, but gender is often treated as a homogenous category, disregarding differences in voice and agency that influence access and SLM benefits. Ninety-three percent of SLM projects cite gender-related SLM issues, and 75 percent include gender-disaggregated indicators. Yet projects mainly report on the number of women reached, trained, or who have adopted practices, not on which women benefited and how. This is important because widowed and unmarried women often have less access to land and tend to benefit less from SLM activities. Unequal land and resource access were cited in one-third of the projects but rarely addressed. Good examples of gender-integrated SLM outcomes include

women's acquisition of land certificates or an increased share of commercial crop production.

Furthermore, the full social and environmental effects are unknown for several closed projects that overachieved their SLM land area targets. The introduction of new land use regimes can cause tensions among resource users with competing claims or historic grievances if these risks are not identified and mitigated. Of the 40 closed Sustainable Development SLM projects, 23 supported the adoption of SLM practices on more land than was planned. The widest outlier was a project in Burkina Faso that put 213,320 hectares of land under SLM practices against a target of just 15,000 hectares.[9] But although the SCDs or CPFs for two-thirds of the countries in which these activities took place cite potential resource-related conflict risks, none of these projects with expanded activities restructured or conducted expanded social or environmental analyses. From an environmental perspective, restructuring would also need to have considered net agroecological trade-offs (for example, the effect that tree planting upstream has on soil erosion and water availability downstream) in the targeted areas.

However, the active SLM portfolio has significantly improved in its treatment of social and conflict risks exacerbated by land and resource degradation. More than half of active SLM projects in countries with resource-related conflict risks identified by the SCD or CPF included explicit conflict management mechanisms (for example, local conflict identification and reduction capacity, trust-building arrangements, and resolution and mediation processes). These include projects in countries where conflict mechanisms were not included in a prior phase. A good example is the Ethiopia Lowlands Livelihood Resilience Project (approved in 2019) that aims to put 700,000 hectares of land under SLM and includes mechanisms for managing conflict, such as financing activities to understand the root causes of conflict and to resolve conflict.

Nexus Outcomes of the SLM Portfolio

No SLM project adequately assesses the nexus between resource-related outcomes and the vulnerability reduction of relevant resource users. Only 10 percent of the closed Sustainable Development projects and no Social Protection

project adequately provided attributable resource-related evidence. Only two closed Sustainable Development projects tried to measure the link between resource restoration and human vulnerability, but in these cases, the analysis was incomplete.[10]

Sustainable Groundwater Management

The World Bank approved 55 lending operations with groundwater components over the evaluation period, of which 28 were closed.[11] Lodged within larger water projects (for example, irrigation and water supply), the groundwater interventions include support for institutional strengthening; data gathering and monitoring; water availability and quality; and, to a lesser extent, policy, legal, and regulatory reforms. Many of these projects are in the South Asia and the Middle East and North Africa Regions, where aquifers are increasingly being depleted for agriculture and other uses (table 3.2).

Resource-Related Outcomes of the Groundwater Portfolio

Most groundwater management activities in World Bank projects have been satisfactorily implemented, but effects on groundwater use patterns and the status of groundwater depletion is not known. About 90 percent of institutional strengthening activities in groundwater projects were implemented. The World Bank helped the governments of China, Mexico, and Zambia develop groundwater and aquifer management plans and is currently helping India to build a comprehensive national water resources information system. With World Bank assistance, groundwater from key aquifers in Morocco is now being regulated to promote equitable sharing among users. In Brazil and Mongolia, new systems have been established to enable key groundwater allocation decisions. However, little is known about the effects of these activities on intensity and patterns of use or their impacts on resource depletion. This is because reliable and comparable data on groundwater stock, flow, and quality are not available. This challenge, identified in a World Bank groundwater study (Wijnen et al. 2012), continues to undermine efforts to help clients make critical groundwater use decisions.

Sustainable groundwater management has also been challenged by political economy constraints, especially in the Middle East and North Africa. More than half of the groundwater data generation and monitoring activities were not achieved, with constraints observed in the Middle East and North Africa. For example, in Tunisia, project reporting states that "vested interest provided powerful incentives not to publicly disclose the exact groundwater extraction of larger farmers . . . subverting foundations for robust groundwater management" (World Bank 2015). World Bank support for groundwater reform in Jordan, by contrast, provides a good example of how technical assistance (for example, mapping and remote-sensing technologies) can support reforms (box 3.3). These projects were implemented during the Arab Spring uprisings of 2010–12, when many reforms were affected by political and social unrest.

Box 3.3. Control of Illegal Groundwater Extraction in Jordan

In Jordan, the World Bank's Regional Coordination on Improved Water Resources Management and Capacity Building Program (2011–15) strengthened groundwater management capacity while informing policy making. The World Bank helped the government of Jordan map and identify illegal extraction sites. The exercise influenced the adoption of an amendment to the groundwater law authorizing remote sensing as an official tool for estimating water extraction and uncovering violations to regulate illegal well drilling and overextraction. A project-supported water information system also provided key inputs into the national water strategy.

Sources: World Bank 2016a, 2016b.

Vulnerability-Related Outcomes of the Groundwater Portfolio

Although most closed groundwater projects increased water availability, they did not articulate how the vulnerable would gain access. Most closed groundwater projects indicated that everyone living in the project area would benefit from the project interventions. Only one-third of the portfolio aimed to ensure that vulnerable groups (for example, poor rural households,

farmers below the poverty line) would benefit from the groundwater intervention. A good example is the India Assam Agricultural Competitiveness project, which ensured that water use benefits accrued to the landless. There is strong integration of gender-disaggregated indicators in the portfolio, but only one-fifth of closed projects had gender-sensitive designs (for example, women represented in decision-making roles in a water user association).

Very few closed groundwater projects that increased water availability include mechanisms to prevent overexploitation that threatens vulnerability in the long run. Almost two-thirds of closed projects with groundwater components improved water availability through irrigation efficiency and increased water supply. Yet only eight of these projects, or 30 percent of the closed portfolio, include regulations and measures to reduce pressure on stressed groundwater systems.

Nexus Outcomes of the Groundwater Portfolio

Although one-quarter of the closed groundwater portfolio was designed to achieve NRDV nexus outcomes, most projects struggled to find a balance between increasing groundwater availability and achieving sustainable use. Seven of the 28 closed groundwater projects included mechanisms to reduce the vulnerability of water users by improving water availability or quality, while also putting in place regulations and instruments to curb overextraction and unsustainable use.[12] Most other projects increased water availability or put in place measures to improve water quality but did not put in place regulations or mechanisms to curb depletion.[13]

Sustainable Small-Scale Fisheries Management

The World Bank approved 53 projects with small-scale fisheries activities, of which 28 were closed and evaluated. Almost 70 percent of the project development outcomes supported governance and institutional capacity building, including support for community participation and associated vulnerability reduction.

Resource-Related Outcomes of the Small-Scale Fisheries Portfolio

Two-thirds of the small-scale fisheries portfolio, which mainly focused on fisheries governance to address overexploitation and resource depletion, was rated moderately satisfactory or above. The West Africa Regional Fisheries Program supported fisheries management and governance interventions in Cabo Verde, Ghana, Guinea-Bissau, Liberia, Senegal, and Sierra Leone. The program helped many of these governments improve the monitoring and enforcement of inshore exclusion zones.[14] Satellite-based monitoring systems were established for large-scale vessels, increasing patrols and, in some cases, prosecution of infractions. The highest-funded project in the program, in Ghana, however, failed to achieve its aim of reducing external fishing pressure and overexploitation from large-scale fishers. The large-scale fleet increased, inactive vessels were not deleted from the registry, and closed seasons—seasons when fishing is prohibited—were partially implemented based on the government's fisheries management plan. Interventions to establish comanagement arrangements in the coastal fisheries sector also did not advance as envisioned.

However, few projects assessed and addressed overall fish stock health. Of the 28 closed projects, 5 were designed to address and measure the effects of project activities on fish stock health. Notably, Indonesia's Second Coral Reef Rehabilitation and Management Program (2004–12) achieved a 29 percent increase in the reef fish population. But other programs, including in Mindanao (in the Philippines), saw decreases in fish biomass (due to an unwillingness to enlarge the size of marine sanctuaries, continued poaching, and dynamite fishing), despite efforts to reverse this trend.

Vulnerability-Related Outcomes of the Small-Scale Fisheries Portfolio

Few small-scale fisheries projects focused on and measured the vulnerability-reducing effects of improved small-scale fisheries management and governance. Six closed small-scale fisheries projects addressed and measured the vulnerability-reducing effects of project-supported management and governance reforms. This mostly occurred in East Asia. For example, in

Indonesia's Second Coral Reef Rehabilitation and Management Program, mechanisms put in place to empower and incentivize fishing communities through comanagement arrangements were legally recognized and enforced. These interventions have, in turn, resulted in fewer fishing violations and increased incomes for fishing communities. The Vietnam Coastal Sustainable Resources for Development Project (2012–19) helped establish and expand comanagement partnerships with fishing communities, which contributed to a 30 percent reduction of violations within the local fishing communities and increased incomes. The project sites provided useful lessons and contributed to the amendment of the Fisheries Law (2017), which introduced comanagement and rights allocation to communities countrywide.

Nexus Outcomes of the Small-Scale Fisheries Portfolio

Small-scale fisheries nexus outcomes were achieved only in a single project. The Indonesia Second Coral Reef Rehabilitation and Management Program is the only example of a small-scale fisheries project that measurably and effectively achieved NRDV aims. It both improved fish stock health and enabled an increase in average incomes in the project area. Small-scale fisheries projects in the Philippines and Senegal were designed to achieve NRDV nexus outcomes, but both had unsatisfactory outcomes.

[1] The evaluable forest portfolio—the closed and evaluated forest projects in line with the evaluation scope (n = 8)—was too small to assess as a stand-alone category in this assessment. The Independent Evaluation Group (IEG) identified 131 forest projects approved since 2013 (since IEG's prior forest evaluation, which also included a portfolio review of poverty, economic, and social outcomes). Of these, 37 were closed. After removing categories outside the scope of this evaluation (for example, biodiversity, wildlife trafficking, forest law and environmental governance, land pollution management projects, and green growth), IEG identified 8 closed forest projects that fit the scope of this evaluation. These included 4 Forest Investment Program/Dedicated Grant Mechanism projects and 4 large-scale integrated "forests in landscape" projects. Ongoing efforts to mainstream forests into other sectors (such as mining and transport) are also recognized but were outside the scope of this evaluation. (They will be included in the forthcoming forests and biodiversity evaluation.)

[2] The World Bank approved 347 Social Protection projects during the evaluation period. Of these, 41 included public works (for example, cash or food for work) to remediate degraded land.

[3] Watershed management projects generally adopt the microwatershed as the basic management unit. This approach allows the integration of land, water, trees, and infrastructure development and the inclusion of all stakeholders through a community-based participatory process to optimize interactions and outcomes at the catchment level. The landscape approach, however, is not limited to optimizing the interactions for improved natural resource management within the targeted watersheds. It also seeks to address other external factors such as higher-level institutions, policies, political economy, and market constraints that continuously shape the resource use patterns and resource governance at a larger scale (Darghouth et al. 2008; Sayer et al. 2013; World Bank 2014). A recent review shows lack of evidence in the scientific literature concerning the effectiveness of the landscape approach, making it difficult to demonstrate where and under what conditions this approach works to achieve multiple objectives and reduce trade-offs (Reed et al. 2020).

[4] Public works within the Social Protection approach often include integrated community-based watershed management activities such as soil and water conservation measures, rangeland management (in pastoral areas), and the development of community assets such as roads, water infrastructure, schools, and clinics. These works seek to improve livelihoods (through increased availability of natural resources such as water and cultivatable land, soil fertility, increased agricultural production, and improved market access), strengthen disaster risk management and climate resilience, and enhance nutrition.

[5] Sustainable land management (SLM) projects most frequently report on results at the output level. They use corporate results indicators, such as hectares of land where SLM practices were adopted, number of farmers or land users adopting SLM practices, and hectares of forest under management plans. Other frequent indicators include number of farmers or forest users trained, technical officials trained, farmers reached with agricultural assets or services, and alternative income-generating activities financed. Projects at the watershed level often measure the corporate results indicator of hectares provided with improved irrigation and drainage services and other outputs, such as number of farmers benefiting from improved irrigation infrastructure, watersheds or basins with development or action plans, water user associations strengthened or trained, and antierosion measures implemented. Only 23 percent of closed SLM projects (9 of 40) included outcome indicators measuring restoration results. However, these indicators were dropped in almost half of these projects (4 of 9). The dropped indicators included reduction in soil loss in areas protected from erosion (percentage decrease in tons per hectare), increase in vegetation cover in targeted areas (as a percentage of baseline), and decrease in siltation and sedimentation in coastal areas as a result of better land management.

[6] SLM projects that link land restoration and land-related productivity outcomes include the Madagascar Irrigation and Watershed Management Project (2009–14), the Burundi Landscape Restoration and Resilience Project (2018–present), and the Ethiopia Lowlands Livelihood Resilience Project (fiscal year 2019–present).

[7] The evaluation recognizes that the resource-related effects of natural resource management interventions take time to materialize but notes that 25 percent of all projects in the evaluation portfolio are part of a phased approach. In those cases, the evaluation often reviewed the second or sometimes the third phase of an intervention that had been taking place for more than a decade. Examples include the Sahel and West Africa Program (Burkina Faso, Ethiopia, Niger, and so on); the Mongolia Sustainable Livelihoods Program (three phases, approved in 2002 and ongoing); regional fisheries programs; and multiple water resource investments (for example, the Arab Republic of Egypt, Morocco, Tunisia, and Uzbekistan).

[8] In the SLM portfolio, just over one-third of the projects document the ownership status of the land restored through cash-for-work mechanisms. The ownership is often communal but sometimes recorded as a mix of communal and private land.

[9] SLM projects in Chad, Malawi, Niger, Togo, and Uganda also exceeded their land area targets by 150–250 percent.

[10] For example, the China Sustainable Management and Biodiversity Conservation of the Lake Aibi Basin Project (2011–16) adequately measured the increase in vegetative cover but measured income effects only for farmers, not herders. The Tajikistan Environmental Land Management and Rural Livelihoods Project (2013–18) conducted environmental monitoring at the subproject level, but the reported well-being had only tenuous links to the SLM activities (since much of the well-being increase was achieved through infrastructure and alternative income-generating activities).

[11] Because groundwater activities are usually included as components in larger water and land management projects, it was necessary to assess the project indicators relevant to groundwater components instead of relying on project development outcome indicators. Most of the 80 groundwater indicators in project results frameworks were achieved. But these indicators reveal little about the availability or quality of the groundwater, nor do they provide information on sustainable use.

[12] See, for example, the Yemen Water Sector Support Project (2009–16), which supported increased efficiency of irrigation water (as measured by net income of participating small farmers), the establishment of ground and surface water monitoring stations, and the reduction of groundwater use for agriculture in the critically stressed basins of Amran, Dhamar, and Sanaa. See also the China Water Conservation and the Xinjiang Turpan Water Conservation Projects (2012–17; 2010–17), which reduced groundwater withdrawal and overdraft for irrigation while increasing crop yields and farmers' per capita net income from increases in irrigation efficiency and through crop switching.

[13] For example, some projects (n = 6) put in place regulations that may address groundwater overuse or quality but did not specify to whom benefits would accrue. Still other projects (n = 4) only increased water availability or measures to improve water quality but did not put in place regulations or mechanisms to curb depletion or monitor water quality, nor did they specify for whom benefits would accrue. Finally, there were also projects (n = 5) that identified vulnerable groups who would benefit from increased water availability but did not put in place critical water use regulations.

[14] An inshore exclusion zone is a 6 nautical mile area, starting from the coast, reserved exclusively for artisanal fishers. This is different from the exclusive economic zone, which stretches for about 200 nautical miles from the coast and confers full sovereignty over the waters of a given country.

4 Explanatory Factors of Effectiveness in Achieving Natural Resource Management and Vulnerability Reduction Outcomes

Highlights

This chapter explores three sets of factors that distinguish how well the World Bank's support is achieving natural resource management and vulnerability outcomes. These factors are (i) natural resource management practices, (ii) approaches to natural resource management governance, and (iii) financial incentives.

World Bank projects that apply natural resource management practices (such as area closures and watershed management) struggle to find the right balance between achieving resource recovery and meeting the welfare needs of vulnerable resource users. The effectiveness of these management practices also depends on their appropriateness for specific socioecological systems.

Natural resource governance arrangements, including access and use rights and appropriate regulations and policies, are critical determinants of whether resource users will adopt and benefit from sustainable management practices.

The effectiveness of financial incentives to promote improved use of natural resources and to reduce vulnerability depends on whether programs accurately target the most threatened areas and vulnerable groups. Inherent in targeting the right groups is identifying those for which the incentives to be provided will create enough motivation to induce the desired behavioral change.

This chapter explores three sets of factors that distinguish how well the World Bank's support is achieving NRDV outcomes. These factors are (i) natural resource management practices, (ii) approaches to natural resource management governance, and (iii) financial incentives. These factors, which emerged from the structured literature and portfolio reviews, were explored in depth as part of the case-based analyses (see appendix B for case analysis summaries).[1] Cases were chosen to ensure representativeness within different socioecological systems and within the relevant subset of the NRDV portfolio (table 4.1).[2, 3] Proportionate with the number of SLM cases in the portfolio, four of the six cases focused on typical SLM interventions in (i) tropical highlands, (ii) drylands, (iii) rangelands, and (iv) savanna. A fifth case was conducted on groundwater management in India since one-third of the groundwater portfolio approved during the evaluation period was implemented there. The sixth case draws on findings from a desk review of the World Bank's small-scale fisheries portfolio.

Table 4.1. Representativeness of Typical Cases in the Natural Resource Degradation and Vulnerability Portfolio

Socioecological System	Typical Case	Representativeness of the Typical Case within the NRDV Portfolio (FY10–20)
Tropical highlands: high-pressure and intensively cultivated tropical highland, midaltitude, and mountain regions of Africa, Asia, and Latin America	Ethiopia: Sustainable Land Management Project Phases I, II (2008–18); Resilient Landscapes and Livelihoods Project (2018–present); Productive Safety Nets Project Phases I–IV (2005–present)	This case is representative of 45 percent of the NRDV SLM portfolio in 29 countries. Similar projects target watersheds in high-pressure areas and resource users within those watersheds. They also include one or more of the following practices: integrated watershed and landscape management, soil and water conservation, afforestation or reforestation (including area closures), rehabilitation of degraded areas, protection of critical ecosystems, conservation agriculture, environmental payments, institutional strengthening, training, land use planning, and land administration.
Drylands in the Sahel: low rainfall and water-scarce ecosystems (excluding deserts) in the arid, semiarid, dry, subhumid tropics	Niger: Community Action Program Phases I, II, III (2004–present)	This case is representative of 28 percent of the NRDV SLM portfolio, including projects that are designed to operate in drylands. It is most representative of the portfolio of NRDV projects implemented across the 12 countries located in the Sahel and West Africa. Similar projects target a combination of farmers, agropastoralists, pastoralists, local government, and rural inhabitants. Often designed in a participatory manner, the projects include one or more of the following practices: land restoration, tree planting, soil and water conservation (including area closures), training, and environmental payments.
Rangelands in the steppe/Central Asian grasslands: montane subtropical and temperate grazing lands in Asia	Mongolia: Sustainable Livelihood Program Phases I, II, III (2001–present)	This case is representative of 15 percent of the NRDV SLM portfolio in 11 countries. Similar projects target herders, agropastoralists, and rural populations. They also include practices such as community-based rangeland management, institutional strengthening, training, pasture-related infrastructure, pastoral risk management, land use planning, and livelihood investments.

(continued)

Socioecological System	Typical Case	Representativeness of the Typical Case within the NRDV Portfolio (FY10–20)
Tropical savanna: extensive production systems in tropical grasslands, shrublands, and forest margins in Africa and Latin America	Brazil: Brazil Investment Program in the Cerrado (2012–present); Sustainable Production in Areas Previously Converted to Agriculture Use (2015–20); Integrated Landscape in the Cerrado Biome (2015–present)	This case is representative of 17 percent of the NRDV SLM portfolio in nine countries. Similar projects target farms and watersheds that have been degraded. They also include practices such as silvopastoral approaches, low-carbon emission agricultural practices, afforestation or reforestation, institutional strengthening, training, and environmental payments.
Hard-rock aquifers and alluvial aquifers of central and northwest India; water-scarce and groundwater-dependent systems (SAR, MENA, China, and LAC)	India: Andhra Pradesh and Telangana Community-Based Tank Management (2007–16); Tamil Nadu Irrigated Agriculture Modernization and Water Restoration Management (2007–15, 2018–present); Rajasthan Agricultural Competitiveness (2012–20)	This bundle of India groundwater cases is representative of one-third of the NRDV groundwater portfolio. Similar projects target critical watersheds with overexploited aquifers and farmers of irrigated agriculture. They also include one or more of the following practices: watershed and tank management, demand- and supply-side policies (metering, pricing, drilling restrictions, feeder segregation, subsidy reform, low-water-intensity crops, subsidized solar pumps, or participatory groundwater management), and institutional strengthening for groundwater management.
Marine fisheries in the Gulf of Guinea, southwest Indian Ocean, and East Asia and Pacific: coastal communities dependent on SSFs	» West Africa: Regional Fisheries Program (2010–present) » Indonesia: Coral Reef Rehabilitation and Management Program (2004–present) » Vietnam: Coastal Resources for Sustainable Development (2012–19)	This desk-based analysis focused on the five programs constituting 80 percent of the NRDV portfolio financing support of SSFs. Similar projects target coastal communities where livelihoods depend on local fish resources and where SSFs are overexploited. The projects often include one or more of the following activities: support for community-based organizations and comanagement plans; enforcement of fishing rights and exclusion zones; SSF monitoring and surveillance; and livelihood activities.

Source: Independent Evaluation Group.

Note: FY = fiscal year; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; NRDV = natural resource degradation and vulnerability; SAR = South Asia; SLM = sustainable land management; SSF = small-scale fishery.

Natural Resource Management Practices

World Bank projects that address natural resource degradation through various management practices struggle to find the right balance between achieving resource recovery and meeting the welfare needs of vulnerable resource users. The effectiveness of these projects also depends on their appropriateness for specific socioecological systems. This explanatory factor revealed itself across natural resource management practices and different socioecological systems:

- Area closures implemented in Ethiopia and Niger support resource recovery but also can increase the vulnerability of resource users if livelihood risks are not mitigated. Fencing in Inner China has led to increased degradation and vulnerability; in Mongolia, however, the choice not to fence was well aligned with mobile herder vulnerability-reducing strategies, but land degradation has continued unabated.
- World Bank support for recharging groundwater aquifers in India, including through watershed management, has reduced farmer vulnerability in the short term, but in the absence of regulation, it could not prevent overexploitation and vulnerability in the long run.
- Dryland soil and water conservation practices, such as rainwater harvesting techniques used in the Sahel, have reduced degradation and contributed to short-term vulnerability reduction through public works, but the sustainability of these effects is drawn into question by the misestimation of the role of rainfall and the absence of institutional mechanisms to finance maintenance, including through public works, in the long run.

The following subsections discuss these cases in turn.

Land Area Closures and Fencing

Many World Bank SLM projects use area closures—technical land management approaches that temporarily close off a designated area (for example, degraded hillsides or catchments) for productive use to allow for land and resource recovery. These ecological restoration programs often involve direct or indirect (physical or managerial) area closures of land and resources in the

short to medium term to reduce or prevent resource extraction pressures. The land is often treated with soil and water conservation practices (trenches, bunds and terraces, or integrated watershed management approaches) before closure to reduce erosion and facilitate natural regeneration. These initiatives are designed to increase the productivity of land and the flow of ecosystem services (for example, soil fertility, water availability, flood protection, fodder, fuelwood, medicinal resources) in the long term. Area closures have been mostly used in World Bank projects in Africa, and much of the research on area closures, including for World Bank projects, has been conducted in Ethiopia and Kenya.

Area closures can be effective at restoring and rehabilitating degraded land. The literature shows that, when supported by practices for controlling gullies and soil erosion, areas closures have been effective in supporting biomass production of grasses, herbs, and trees and increased plant biodiversity (Angassa 2016; Jeddi and Chaieb 2010; Yayneshet, Eik, and Moe 2009). IEG's analysis of geospatial data in more than 500 high-pressure and intensively cultivated watersheds in tropical highlands,[4] where area closures had been applied as part of watershed management programs with the support of the Ethiopia Sustainable Land Management Project (SLMP) I and II (2008–14 and 2014–19), showed statistically significant positive effects on land restoration compared with controls (table 4.2). Using three remote-sensing land restoration metrics, the statistical analysis found that SLM practices, including area closures, significantly reduced land degradation. This was further confirmed through IEG case study analysis in 22 watersheds supported by SLMP, which showed that the land and restoration efforts were achieved at a substantial level or higher (for example, in terms of restoration quality) on both communally held land and farmland (table 4.3). This expanded analysis also showed that results were notably better in low-moisture environments, which is consistent with the literature.

Table 4.2. The Relative Land Restoration Impacts of Sustainable Land Management Interventions in Ethiopia (Percent increase over controls)

Seasons	Increase in Vegetation Cover[a]	Increase in Vegetation Cover and Quality[b]	Soil and Land Capacity to Withstand Water Stress[c]
Dry season *(Bega)*	2.70	3.78	5.51
Short rainy season *(Belg)*	3.42	4.86	11.73
Main rainy season *(Kiremt)*	2.26	2.83	3.43

Source: Independent Evaluation Group difference-in-differences analysis of remote-sensed pixel-level geospatial Sustainable Land Management Project II data.
a. Measured using the Normalized Difference Vegetation Index.
b. Measured using the Enhanced Vegetation Index.
c. Measured using the Land Surface Water Index.

Area closures can exacerbate the vulnerability of resource users who are not adequately compensated for losing access to enclosed land. Ethiopia's SLMP found that, juxtaposed with their positive resource-related effects, area closures that limit grazing mobility can reduce livestock production and increase vulnerability if support for fodder production is not provided. IEG's case analysis found that communities in Ethiopia acted to mitigate these effects by rotating the areas designated for closure to allow for partial continued access. The same vulnerability-producing effects occurred in Niger through projects that used technologies and policies practiced throughout the Sahel in the SLM portfolio (box 4.1).

Table 4.3. Independent Evaluation Group Ratings of Impacts on Land Restoration in Ethiopia's Sustainable Land Management Project Microwatersheds

Agroecological Zones	Communal Land			Individual Farmland			Cases (no.)
	Rating (percent)			Rating (percent)			
	Modest	Substantial	High	Modest	Substantial	High	
Dry highlands/ midaltitude	0	57	43	14	86	0	7
Moist highlands	22	44	33	22	56	22	9
Moist midaltitude	33	50	17	17	83	0	6
Total (average)	18	50	32	18	73	9	

Source: Independent Evaluation Group analysis of 22 cases from the Sustainable Land Management Project I and II microwatersheds.

Box 4.1. Results of Area Closures in Niger

In Niger, area closures involving tree planting yielded resource- and income-related benefits for some resource users, but they also increased the vulnerability of transhumant herders and local livestock owners when grazing and other resource collection activities were prohibited.

Earth and site observations of investments supported by the Niger Community Action Program (2003–20) confirmed that vegetation was successfully established on what previously were hardpan erosion surfaces on elevated plateaus that had not supported significant vegetation for many decades. Lands were rehabilitated through large commitments of labor for soil works (for example, half-moons, zaï or tassa [soil pits], stone bunds [embankments]). The density of trees and shrubs increased dramatically. These land investments yielded many benefits, including temporary employment (digging, tree planting) and associated income, access to knowledge about tree saplings, the development of small nursery businesses, and, eventually, the production of "sweet leaves" accessed by goats and sheep after areas were opened for grazing. Observations at older sites, however, show reduced vegetation cover due to limited funds for upkeep and maintenance of these land works and the conversion of rehabilitation sites to other uses.

Photo B4.1.1. A Land Restoration Site in Sambéra Commune, Dosso, Niger

The vulnerability of transhumant herders and local livestock owners was inadequately addressed in developing area closures. There is little evidence that these groups were consulted or played a role in revegetation decisions. The fieldwork revealed cases where the rehabilitated sites increased land use pressures on existing transhumance corridors in ways that lowered livestock mobility and the associated value of livestock wealth, critical for household resilience.

Sources: Earth observation images, drone images, and Independent Evaluation Group interviews conducted in June–July 2019 with 195 individual resource users in project sites in four regions (including smallholders, landowners, landless mobile pastoralists, married and unmarried women, and youth).

For mobile pastoral societies, the choice of not fencing has reduced potential herder vulnerability, but in the absence of land regulation, it has also contributed to unsustainable use and resource degradation. For example, IEG case analysis in Mongolia showed that the World Bank recognized that area closures are not an effective tool to reduce herder vulnerability, because fencing is antithetical to herder culture and mobile coping strategies. The World Bank's Sustainable Livelihood Program was instead designed to support community-based pasture management—a system that supported land restoration through seasonal pasture rotation and mobility, agreed to by herding communities and aligned with Mongolian herding culture, which supports strong norms of reciprocity. However, although sharing pastures can reduce the vulnerability of herders during harsh conditions, it can also increase the vulnerability of hosting communities. In the case of the northern Chinese region of Inner Mongolia, the use of fencing resulted in increased land degradation and herder vulnerability (box 4.2).

Box 4.2. Results of Area Closures in Northern China

Area closures in Inner Mongolia have yielded less-than-anticipated productivity and restoration benefits while abutting traditional nomadic culture. The Chinese autonomous region of Inner Mongolia resembles Mongolia in its climate, people, and mobile pastoralist culture and economy. China, with the support of the World Bank (in Inner Mongolia and Gansu, 1999–2006 and 2004–10), applied a development strategy based on fencing and intensifying livestock. The collective grassland was divided and fenced at the household level. Although legal ownership resided at the village level, herders were assigned use rights. However, research has shown that fencing has significantly limited animal and herder mobility critical for maintaining rangeland and livestock health (Xu et al. 2015). Fencing has not achieved its goal of reducing degradation, and in some instances, there has been increased degradation where restricted herder movement has led to overgrazing (Taylor 2006). In addition to reducing the grassland's carrying capacity, fences have also restricted the movement of large wildlife, reducing wildlife biodiversity (Li and Huntsinger 2011). Area closures have also led to increased inequality among herders because some were better able to gain access to more or better land when the land was divided (Taylor 2006).

Sources: Fratkin and Mearns 2003; Li and Huntsinger 2011; Taylor 2006; Xu et al. 2015; Ying and Ruimin 2011.

Groundwater Recharge through Watershed Management

The recharging of groundwater aquifers, including through watershed management, can reduce human vulnerability in the short term, but regulation is needed to control overexploitation and to ensure that vulnerability is reduced in the long run. Two decades of watershed management experience in India shows that the approach can support aquifer recharge but could also accelerate groundwater depletion in water-stressed areas (Darghouth et al. 2008; Gray and Srinidhi 2013; World Bank 2011, 2019). World Bank support has helped the states of Andhra Pradesh, Tamil Nadu, and Telangana increase water productivity, groundwater recharge, and water availability, mainly by rehabilitating water tanks (World Bank 2019a). But the watershed and tank management projects did not include support for groundwater management, including regulations, to prevent farmers from drilling new wells. Consequently, the IEG case study and research evidence show that the gains in groundwater recharge have been lost through unsustainable use of the resource.[5]

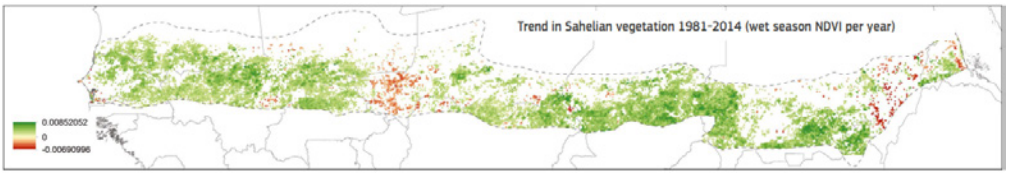
Dryland Soil and Water Conservation Practices

Rainwater harvesting microcatchment techniques—small structures designed to collect soil runoff and increase soil moisture—have contributed to both vulnerability reduction and degradation reduction in the short term. Used often in drylands, including in the Sahel, the most common techniques are *zaï* or *tassa* (soil pits), *demi-lunes* (half-moons), and *banquettes*. The World Bank financed such microcatchments in its $1 billion Sahel and West Africa Program, implemented in 12 Sahelian countries. Evidence—from both the literature and the Niger case analysis—indicates that microcatchments in the Sahel have reduced soil erosion and degradation and, in combination with manure or inorganic fertilizers, can increase millet yields (Turner et al. 2020; Vohland and Barry 2009; Warren, Batterbury, and Osbahr 2001).

However, the vulnerability and degradation reduction effects associated with the use of rainwater harvesting microcatchment techniques are questionable in the long term. First, misestimation of the role of rainfall variability as the key parameter affecting vegetative cover and agronomic productivity has a long history in the African drylands. Regional increases in vegetative

cover since the early 2000s in the Sahel—referred to as "the greening of the Sahel" (map 4.1)—are significantly shaped by changing rainfall regimes and resource use decisions made by farmers and herders. Still, unqualified statements attribute Sahelian greening entirely to the actions of farmers (GEF 2019; Great Green Wall website;[6] various World Bank SLM Implementation Completion and Results Reports), despite the fact that greening (increased ligneous [woody] cover) has occurred widely on sandy soils *whether managed or not* (Dardel et al. 2014; Herrmann, Anyamba, and Tucker 2005; Hutchinson et al. 2005; Ouedraogo et al. 2014). Second, the construction of the various dryland structures was achieved through large public works programs that were financed by World Bank projects. None of the Sahelian countries that participated in these projects institutionalized these programs, nor did the projects establish systems to support the recurrent finance needed for maintenance. There was short-term vulnerability reduction associated with the project-financed cash-for-work programs, but this effect was also temporary.

Map 4.1. The Greening of the Sahel (1981–2014)



Source: Cherlet et al. 2018.

Note: Image shows analysis of Earth observation data over the Sahel area, depicting changes in vegetation greenness and rainfall (obtained using Normalized Difference Vegetation Index time series). Cumulative changes in vegetation greenness are shown as green dots, and decreases in vegetation greenness are shown as red dots.

Resource Governance Arrangements

Natural resource governance arrangements, including access and use rights and appropriate regulations and policies, are critical determinants of whether resource users will adopt and benefit from sustainable management practices. These explanatory factors were derived from the literature, portfolio, and cases across different socioecological systems:

» Land access and use rights were identified as a critical determinant of effectiveness in the Sahel, including as demonstrated by the case of Niger.

- Extending and enforcing local fishing rights in East Asia and parts of West Africa helped reduce illegal extraction and increase incomes.
- Extending governance and management rights to communities in India helped stem illegal well drilling that was leading to groundwater depletion.
- Poor groundwater regulations and policies (for example, power subsidies) play a critical part in accelerating groundwater depletion in India (World Bank 2010a).

The following subsections discuss these cases in turn.

Land Access and Use Rights

The link between land access and resource rights and the adoption of SLM practices is well established.[7] When resource rights are uncertain, land users may not invest in SLM practices (on both communal land and private land) to reduce land degradation (Tuck and Zakout 2019). When rights are unequal or access is not ensured for some users, SLM interventions can yield uneven benefits and inadvertently cause some resource users to lose rights to lands and resources, triggering a range of negative social impacts.

Traditional land access and use rights are underdiagnosed and inadequately addressed in the SLM portfolio, which can lead to increased exclusion and vulnerability of resource users. World Bank SLM projects do not reflect an understanding of vulnerable resource users' coping strategies, which include accessing degraded lands as a social safety net (Turner et al. 2020). Lands viewed as degraded are often relied on, despite their low productivity, by local communities as common property resources. When project documents acknowledge that afforestation, reforestation, and revegetation activities could disrupt livelihood practices, attention is more likely to be directed to eviction, while the consequences of more subtle disruptions to resource access are grossly underappreciated. Project documents also do not address overlapping land and resource claims brought about by customary and modern tenure regimes associated with different seasons and land uses. Mobile pastoralists often do not reside in project areas but hold informal rights to some of the land's products. This is the case in the Sahel, where many World Bank SLM projects were implemented. In the Sahel, projects articulated tenure-associated risks but did not discuss flexible common property tenure

arrangements that play a significant role in maintaining livelihood resilience, especially among the most vulnerable, who herd, collect firewood, and gather other basic goods in degraded areas.

Increasing the value of open- or pooled-access degraded grazing land without clear land use and rights agreements among the users can lead to predation by elites and farmer encroachment. In the absence of tenure security, any distributional benefits achieved under project auspices may dissipate if open-access community land is later divided or sold outside of the community. Interviews with several affected stakeholders indicated that these infringements occurred across Niger when project-supported sites were no longer monitored by national authorities or project teams.[8] These infringements were especially egregious in sites near cities, where land values had increased significantly since the start of the land restoration activities.[9] Land, pasture, and watershed user associations supported by SLM projects can sustain land management when project-based support ends. However, such associations lack institutional and financial support, and efforts are nullified if land is sold to people outside of the community.

The creation of rules for shared common-pool land management responsibility can increase herder incomes, improve livestock health, and reduce overgrazing. Without clear access and use rights, the common-pool nature of pastureland presents complex challenges for herders to achieve sustainable natural resource management and reduce vulnerability. About 20 percent of global pasture and 73 percent of rangelands are degraded (Steinfeld et al. 2006). An important driver of rangeland degradation is the lack of enforceable rules for sustainable resource use among mobile pastoralists. This is also the case in Mongolia, where 76 percent of the land is open-access rangeland. Consequently, in a classic "tragedy of the commons" situation (where self-interested behavior reduces the common good from a shared resource), herders lack incentives not to overgraze and degrade pastures. The World Bank–supported Sustainable Livelihood Program in Mongolia tested voluntary activities for enhanced pasture and livestock management (for example, insurance, microfinance, hay stocking, early warning systems), but these activities were insufficient to address the market failure associated with the tragedy of the commons and ultimately had little impact on rangeland management. A parallel Swiss Agency for Development and Cooperation project,

referred to as Green Gold (approved in 2006), addressed tenure-related challenges by creating informal pasture-user agreements among herder groups. By creating rules for shared land management responsibility, Green Gold increased herder incomes, improved livestock health, and reduced overgrazing.

Local Fishing Rights

The clear assignment and enforcement of fishing rights to small-scale fishing communities can reduce fishing pressures and increase small-scale fishers' income. Support for small-scale fishing communities has been successful in East Asia, Indonesia, and Vietnam, where governments have supported and enforced comanagement arrangements with communities. These processes have resulted in fewer fishing violations and increased incomes in fishing communities. In African countries where interventions have built the capacity of local institutions to monitor and enforce regulations (for example, Guinea-Bissau, Libera, and Senegal through satellite-based monitoring, increased patrols, and enforcement through the prosecution of infractions by large fishing vessels), the comanagement approach has worked well. Where it has been less successful, in some West African countries, comanagement plans were issued but not enforced at a national level because of the influence of illegal fishing activities.

Community Groundwater Rights

Strengthening the role of community rights in groundwater governance can improve groundwater management. The structured literature review highlights the importance of community institutions in helping government regulators curtail illegal groundwater access and use for the sustained benefit of farming communities (Msangi 2020). For example, the IEG case study showed that in the water-stressed states of Andhra Pradesh and Telangana of India, illegal well drilling and the expansion of irrigated areas resulted in the depletion of almost all open well water. A pilot project financed by the World Bank in the Nalgonda district, Telangana, showed how participatory management with community-enforced restrictions can help state regulators reduce the drilling of illegal bore wells and improve sustainable use (box 4.3).

Box 4.3. Participatory Groundwater Management in India

The World Bank Telangana State Water Sector Improvement Project (2010–18) piloted a user-centric, aquifer-level groundwater management approach in the Nalgonda district. The approach featured a combination of supply- and demand-side activities, including (i) aquifer mapping to identify areas with high recharge potential, (ii) check dams with recharge shafts to replenish bore wells, (iii) community-regulated restrictions on the drilling of new bore wells, and (iv) support for an extension designed to incentivize farmers to adopt low-water-intensity cropping and enhanced irrigation practices. Efforts to regulate the drilling of new wells led to a significant decline in per capita well ownership and stabilization of the aquifers. There has also been a rise in groundwater levels from a critical to a semicritical category of water security in pilot areas. As a result of the pilot's success, Telangana is expanding these activities, and efforts are under way to apply them to other regions through the World Bank's new national groundwater project.

Sources: Independent Evaluation Group; World Bank 2019b, 2019c.

Groundwater Regulation and Policies

Balancing supply- and demand-side interventions—through regulations and incentives—can ensure groundwater security and reduce vulnerability in the long term. Regulations, including restrictions on well licensing and drilling, are important to reduce overexploitation in water-stressed areas (Msangi 2020). However, as the India case example shows, in the absence of such regulations, the World Bank has focused its efforts on incentivizing demand-side water-saving practices, including by helping farmers to switch to less-water-intensive crops. But as IEG case studies in Andhra Pradesh and Telangana have shown, although crop switching can reduce water use, it is not enough to combat unabated groundwater extraction. Such demand-side incentives need to be accompanied by supply-side responses to recharge groundwater and prevent illegal well drilling. Failure to regulate well drilling and the expansion of irrigated areas resulted in the depletion of almost all open well water (where the number of bore wells also increased, on average, by more than fourfold in project areas).

In the absence of appropriate regulations, providing solar pumps for groundwater extraction and subsidies for electricity can dramatically reduce the cost of irrigation for smallholder farmers in the short run, but they can also provide incentives for aquifer depletion in the long run. Solar pumps convert energy from the sun into power to help pump groundwater at low or minimal cost for use in irrigation. The World Bank supported the government of Rajasthan in supplying subsidized solar pumps for agriculture through the Rajasthan Agricultural Competitiveness Project, which seeks to test whether farmers can augment their income by selling excess power to the main grid. The IEG case study shows that these subsidies for solar pumps in Rajasthan (at a rate of 50–90 percent),[10] as in other states in India, can accelerate depletion through secondary market distortions. Interviews found that farmers who received subsidies for solar pumps were also being provided subsidized electricity for farming.[11] As a result, some farmers in Rajasthan were selling water at about half the normal price rather than selling their excess power to the main grid. Solar pumps, even without such subsidies, can contribute to overexploitation of groundwater resources and lead to farmer vulnerability over the long term. Further experimentation is needed to determine how to develop the market for solar power to disincentivize the overextraction and sale of cheap groundwater.[12]

Financial Incentives

The effectiveness of financial incentives to promote improved use of natural resources and to reduce vulnerability depends on whether programs accurately target the most threatened areas and vulnerable groups and provide timely benefits. Inherent in targeting the right groups is identifying those for which the incentives will create enough motivation to induce the desired behavioral change. The World Bank has offered various financial incentives to farmers and landowners in exchange for managing their land and providing some essential ecological functions and services. Two main financial incentives were assessed: (i) payments for environmental services (PES), including carbon payments; and (iii) discounted loans. All of these provide conditional payments to voluntary providers for improved use or conservation of resources. The literature, including a systematic review of PES and case analyses in Brazil, Ethiopia, and Niger, highlights the importance of targeting the

specific areas at highest risk of degradation to reduce the vulnerability of marginalized and vulnerable resource user groups.

Payments for Environmental Services

Governments and donors use PES programs to pay landowners for the global public goods and positive externalities associated with managing land and natural resources sustainably in ways that generate benefits for others. The World Bank has piloted and sometimes expanded different types of PES systems in 17 projects in the NRDV portfolio. Evidence is derived from a systematic review of PES conducted by the International Initiative for Impact Evaluation, which included analysis of World Bank–supported projects (Snilstveit et al. 2019). This section also presents complementary evidence derived from case analyses on the use of various forms of payments for improved resource management, including biocarbon payments in Ethiopia and Niger and conditional loans in Brazil.

PES programs, where implemented appropriately for the context, have prevented the loss of forest cover and have yielded some economic benefits for landowners. However, these outcomes can only be tentatively reported because of the lack of rigorous environmental evidence and the substantial heterogeneity of the programs that have been evaluated. Evidence on socioeconomic outcomes is even thinner. Many of the studies that find positive economic outcomes for the resource users did not identify a valid comparison group outside the program, making those findings less credible. The studies with more credible designs tended to find no effect on recipients' economic well-being.

The programs that have yielded the largest benefits—both environmentally and socially—were those where threatened areas and vulnerable resource users were carefully targeted. In terms of resource benefits, right-sizing the incentive to induce improved management (for example, conservation of forests instead of deforestation of land for other uses) and targeting meant identifying the specific areas that were at highest risk of deforestation. If this targeting was not done correctly, landowners sometimes enrolled only those portions of their land with the least valuable trees, which they would not have cut down anyway. If a program goal was primarily to help local communities economically, targeting required identifying marginalized and

vulnerable social groups who lived in areas where conservation aims were desired but who could not afford to forgo resource extraction for the public environmental good.

Carbon Payments

Carbon payments have been more effective at reducing degradation and vulnerability when areas targeted for restoration are well defined and monitorable and when vulnerable groups are provided with timely benefits.[13] As shown in Ethiopia, carbon payments are easier to administer when a targeted degraded site is monitorable, resource users are clearly identified, and their rights are defined. In Ethiopia, carbon payments supported the restoration of a degraded hillside, generating ecosystem services for resource users, who also received timely payments (box 4.4).[14] This experience contrasts with that of Niger, where remote and dispersed sites located across different types of terrain and representing different socioecological conditions, often far away from villages, were hard to monitor. In Niger, severe payment delays reduced the incentive for land users to maintain sustainable practices; they also undercut vulnerability reduction benefits.

Box 4.4. The Humbo Biocarbon Project in Ethiopia

In Ethiopia, the World Bank–supported Humbo Assisted Natural Regeneration Project (2008–18), which restored a degraded hillside, was successful in delivering carbon and economic and social cobenefits. It increased sustainable land use and productivity while yielding benefits for targeted vulnerable communities. Using farmer-managed natural regeneration, the project helped restore 2,728 hectares of natural forest, allowing for the sequestration of 338,000 tons of carbon. The BioCarbon Fund subsequently delivered $826,000 in payments to local communities. To better protect reforested hillsides, the project also distributed tree seedlings and supported diversified economic activities (for example, beekeeping, flour milling, and livestock fattening). Improved land management increased fodder for livestock. A key factor in achieving distributional benefits was the assignment of land use rights to people living around the hillside, to whom training and technical support was also provided to support diversified livelihoods.

Sources: Independent Evaluation Group; Kaboré 2013; UNEP 2016; World Bank 2013.

Discounted Loans

Discounted loans—a form of environmental payment—can promote increased uptake of climate-friendly natural resource management practices. In Brazil's Agricultura de Baixo Carbono (Low-Carbon Agriculture) Cerrado Initiative, for example, discounted loans, combined with technical assistance, promoted increased farmer uptake of climate-friendly natural resource management practices (for example, low tillage, planted pasture, agroforestry). The program helped the Brazilian government put 312,757 hectares of degraded farmland under improved management through the incentives provided by the loans and on-farm demonstrations of climate-friendly agricultural practices, which led to increased profitability.

Discounted loans that target large farms may not be the right mechanism for supporting reduced farmer vulnerability on small and family farms. The approach used in the Cerrado, targeting large farms, is applicable to other efforts aimed at achieving large-scale climate mitigation goals but not to those aimed at promoting reduced degradation and decreased farmer vulnerability on small or family farms. Family and small farms that are less than 20 hectares, constituting 80 percent of all farms in the Cerrado, for example, did not benefit from the Low-Carbon Agriculture Cerrado Initiative. The transaction costs were too high to engage small farms, whose risk tolerance for the loans was also low. Interviews indicated that this lack of an inclusive approach was associated with the terms of the concessional finance (for example, carbon payments provided by the Forest Investment Program) combined with the IBRD loans in Brazil's wealthier states. The program also carries the risk that successful farmers will expand their farms by deforesting neighboring lands. Because deforesting is more expensive than recovering degraded land, enhanced incentives could include a credit line for farmers to purchase and recover degraded land.

[1] A review of the lessons learned sections of the closed projects in the portfolio revealed that issues pertaining to technologies and practices were highlighted as factors of effectiveness in 94 percent of cases, governance was cited in 61 percent, and financial instruments were cited as a key implementation modality in 45 percent.

[2] A socioecological system is a set of resources (natural, economic, and cultural) regulated by a combination of ecological (natural) and social (human) systems. The concept captures the insight that there is no fixed distinction between human systems and natural systems. The two are usually interdependent in complex, dynamic ways.

[3] Representativeness is assessed on the basis of the following characteristics: (i) a typically occurring intervention logic based on an accepted theory of change, (ii) a representative project design—component composition and alignment with causal theory, and (iii) results indicators, including corporate indicators, that are frequently used to measure attributable outcomes of the intervention typology.

[4] The geospatial analysis was based on 504 Sustainable Land Management Project (SLMP) I and 624 SLMP II treated microwatersheds in Amhara, Oromia, and Tigray regional states. The number of treated microwatersheds in the data vary by region: 247 and 317 in Amhara, 184 and 206 in Oromia, and 73 and 101 in Tigray covered under SLMP I and SLMP II, respectively.

[5] In addition to the on-site depletion effects, the watershed projects can also trigger negative downstream effects. For example, the promotion of forestry, irrigation, and soil and water conservation measures, including water harvesting upstream, produced serious water shortages in the lower part of the catchment (Darghouth et al. 2008).

[6] https://www.greatgreenwall.org.

[7] As stated by the former vice president of Sustainable Development for the World Bank, "Research has shown that people are better stewards of the environment and their natural resource base when their property rights are secure" (Tuck and Zakout 2019).

[8] Interviews at Niger Community Action Program sites were conducted with elected commune leaders, traditional authorities, former land management committee members, project regional facilitators, and various resource users present at the site (women and men). Anonymized transcripts and photographic evidence are available by request.

[9] An IEG site visit to Commune V, just outside of Niamey, revealed the potential for elite capture of Community Action Program sites. After Community Action Program funding had ceased and the land had been restored to a relatively habitable state, interest in the land

skyrocketed, and several parcels of the former community land were sold by the local village chiefs with ownership over the land to private buyers, some of whom had political connections to the ruling political party. This purchase occurred after the project closed. Interviews revealed that interest in buying the rehabilitated lands was not unique to this project site.

[10] The subsidy depends mainly on the income or caste social category of the farmer. The average farmer pays about 10 percent of the actual cost. Small and marginal farmers and those belonging to scheduled caste or scheduled tribal communities pay 5 percent of the actual cost. For water-efficient microirrigation systems, the subsidies generally range between 50 and 90 percent depending on the social category of the farmer. Scheduled caste farmers get a 90 percent subsidy on microirrigation systems and building greenhouses. In Rajasthan, polyvinyl chloride pipes for water conveyance and drips and microsprinklers were provided by the Rajasthan Agricultural Competitiveness Project at a 75 percent subsidy, and most farmers paid 25 percent of the cost for microirrigation systems.

[11] Several states in India provide free or heavily subsidized power for agriculture (Badiani and Jessoe 2018; World Bank 2010b). Although these subsidies offer farmers in water-stressed areas greater access to water, they also create perverse incentives that lead to overexploitation and depletion of scarce groundwater resources.

[12] The free or heavily subsidized supply of electricity for farmers has significantly contributed to overexploitation of groundwater resources (for example, in Telangana), leading to farmer vulnerability over the long term. A solar subsidy is expected to transform agriculture in water-stressed areas from crop farming to "solar farming." However, the system needs to be designed carefully so that farmers will be able to sell surplus power to the main grid rather than using it to pump groundwater. If effective, the solar subsidy could provide multiple benefits, including clean green energy and poverty reduction.

[13] When land is restored and its vegetative cover increased, carbon emissions are sequestered and can be certified and sold as carbon credits. The resulting carbon payments to vulnerable resource users can supplement the ecological and economic benefits of land restoration.

[14] The IEG case study on the Humbo Assisted Natural Regeneration Project in Ethiopia showed that the project was able to deliver the full contracted amount of 165,000 tons of CO_2e certified emission reductions—during 2007–18 under the World Bank's BioCarbon purchase agreement. The carbon payments to community forest cooperatives have been invested in nine flour mills, with an average net annual income of 28,320 Ethiopian birr for each mill over six months, and nine warehouses used to store grain during harvest and for selling when

prices are high. The cooperatives also provide credit for members to buy farm inputs like improved seeds that increase farm productivity. In addition, the biodiversity of the forest recovered; streams started flowing again, increasing water supply; the landscape is fully rehabilitated, and gullies are controlled; erosion and flooding has been reduced; and livelihoods have diversified through new sources of farm and nonfarm income (farm income includes beekeeping and vegetable and fruit production; nonfarm income includes income from employment and petty trading). To secure future carbon payments, Humbo, with the assistance of World Vision Ethiopia, is in the process of transitioning to the gold standard system to access voluntary markets similar to the neighboring Soddo Reforestation Project, which has also received strong demand for carbon credits, particularly in Europe (Dean Thomson, World Vision Ethiopia, personal communication 2019).

5 Conclusions and Recommendations

Based on its experience over the last decade, the World Bank adequately identifies and addresses forest and soil and land degradation issues but not groundwater and small-scale fisheries issues in places where those resource degradation threats are most prominent. Most SCDs of forest and soil and land nexus countries analyze these degradation issues, but only about half of SCDs of groundwater and small-scale fisheries nexus countries include relevant analyses. Although the coverage for all natural resources diminishes from SCDs to CPFs, the level of coverage of forest and soil and land degradation issues is much higher—considering competing priorities—than that of groundwater and small-scale fisheries.

The World Bank does not adequately address the resource-related vulnerability of resource-dependent people. SCDs and CPFs tend not to jointly analyze and address resource degradation and associated human vulnerability issues. On average, only about half of the SCDs and 40 percent of the CPFs include analysis of resource-related human vulnerability—forest resources have more coverage—yet the analysis is incomplete. SCDs analyze the vulnerability-producing effects of resource degradation for small farmers, for fishing communities, and sometimes for herders, but not for other disadvantaged and marginalized groups (for example, the landless, mobile pastoralists, women, youth, migrants) who may be unable to participate in or benefit from land or resource restoration support. Resource-related livelihood issues are also rarely assessed (for example, welfare, income).

The World Bank is not adequately addressing many of the underlying factors that affect natural resource degradation. These factors include (i) a lack of clearly defined resource and land use rights, including inadequate awareness of customary, flexible common property arrangements; (ii) policy distortions, such as subsidized energy for irrigated agriculture; and (iii) weak regulatory and governance arrangements that undermine sustainable use and negatively affect vulnerable resource users.

The World Bank has been effective at improving natural resource management practices, but there is a lack of attributable evidence that this has led to a reduction in natural resource degradation or in vulnerability of resource users. No SLM project adequately addresses NRDV nexus issues. Only 10 percent of the closed Sustainable Development SLM projects and none of the Social Protection SLM projects provided attributable resource-related evidence. Only two closed Sustainable Development SLM projects attempted to assess resource-vulnerability links, but the analysis was incomplete. Most groundwater activities were satisfactorily achieved, but the effects on groundwater use and resource depletion are not known. Less than one-fifth of closed groundwater projects address NRDV issues (most projects neither include mechanisms to curtail unsustainable use nor identify vulnerable water user groups). Small-scale fisheries surveillance activities contributed to the recovery of fish stocks, but only one closed project measurably achieved NRDV aims.

Three factors help explain the performance of the NRDV portfolio: (i) natural resource management practices, (ii) resource governance arrangements, and (iii) financial incentives. Projects that address natural resource degradation use many technical practices whose effectiveness depends both on their appropriateness for specific ecological systems and on their fit within particular social and economic contexts. These interventions struggle to find the right balance between achieving resource recovery and meeting the needs of vulnerable resource users. Effective resource governance arrangements, including land use rights, policies, and adequate institutional capacity, are vital to the sustainable management of and equitable access to natural resources. The effectiveness of financial incentives to promote sustainable resource use and vulnerability reduction largely depends on whether programs target the most threatened areas and include vulnerable resource users. In most cases analyzed, financial incentives were provided through environment and climate change trust funds that did not include a vulnerability lens.

The success of the World Bank's natural resource management interventions depends on the flow of benefits to resource users over reasonable time frames. The evaluation found that when those benefits are too small or take too long to materialize, resource users are disincentivized from maintaining

sustainable resource management practices, which undermines vulnerability reduction benefits. The time periods for the envisioned governance, policy, and operating changes required to achieve environmental outcomes and associated welfare and income impacts for vulnerable resource users are beyond the duration of a single project. Yet life cycle considerations and programmatic implications are lacking from the World Bank's NRDV interventions (that is, theories or implementation modalities that indicate how resource and vulnerability-reducing outcomes will be sustained after the project ends).

Recommendations

Recommendation 1. **The World Bank should identify and analyze natural resource degradation and vulnerability nexus issues and leverage this knowledge in SCDs and in country engagements where such issues matter for achieving sustainable poverty reduction and shared prosperity.** In a subset of countries where NRDV nexus issues matter for achieving sustainable poverty reduction, SCDs can draw on data and analytics to identify and prioritize these issues. Management can leverage this knowledge to address these issues in country engagements, including through advisory work and, where relevant, prioritize lending, including through partnerships.

Recommendation 2. **World Bank operations that address natural resource degradation should direct attention to resource governance challenges and use a mix of resource management practices and financial incentives appropriate for the relevant socioecological systems.** World Bank operations that include support for natural resource degradation can identify and address governance issues by, for example, clarifying resource rights and addressing regulatory failures and distortive policies that drive resource degradation and increase the vulnerability of resource-dependent people. These governance challenges can be addressed through concurrent operations or sequential programmatic approaches. Operations that use resource management practices (such as area closures and watershed management) should find the right balance between achieving resource recovery and meeting the welfare needs of vulnerable resource users. Such

trade-offs can be managed by ensuring timely economic and social benefit flows to resource users. When using financial incentives (such as payments for environmental services), it would be important for these operations to target both threatened areas and vulnerable groups.

Recommendation 3. **World Bank Global Practices involved in addressing natural resource degradation and associated vulnerability should share knowledge, improve measurement, and enhance coordination in the design and implementation of their projects to optimize development effectiveness.** The Social Protection and Jobs and the Sustainable Development Global Practices should measure, assess, and report the attributable resource- and vulnerability-related outcomes of their different sustainable land and resource management approaches. For enhancing coordination, the Social Protection and Jobs Global Practice could share lessons on targeting vulnerable groups and measuring vulnerability-reducing effects. Similarly, the relevant Global Practices within the Sustainable Development Practice Group could share knowledge on the most appropriate scientific resource management practices and how to apply and measure their effects in the relevant socioecological systems. These projects should also ensure synergies when they are operating in the same geographic area. Possible ways to enhance coordination include cross-support, co-task team leadership, and joint ASA.

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APPENDIXES

Independent Evaluation Group

The Natural Resource Degradation and Vulnerability Nexus

Appendix A. Methods

This evaluation assessed how well the World Bank has addressed natural resource degradation to reduce the vulnerabilities of resource-dependent people. It answered two main evaluation questions:

1. How well has the World Bank identified and addressed resource degradation issues threatening resource-dependent people in the places where those threats are most prominent?
2. How effective has the World Bank's support for natural resource management been at promoting sustainable use of resources and reducing the associated vulnerability of resource-dependent people?

Limitations. Per the Approach Paper, this evaluation sought to assess how partnerships helped achieve the aims captured in the two questions above. However, during the conduct of the evaluation, this assessment found there were very few partnerships contributing jointly to addressing natural resource degradation and associated vulnerability reduction. Although many partnerships in which the Bank Group engages address natural resource degradation—including those that are focused on the global commons (for example, global forest cover, biodiversity)—this evaluation did not identify significant partnerships in the natural resource degradation and vulnerability (NRDV) space, with the exception of ongoing partnering on dryland issues in the Sahel. The evaluation also screened the portfolio to understand and assess the role of local partnerships. Although this screening revealed that one-half of all sustainable land management (SLM) projects, for example, partner with local organizations (such as community-based organizations) for project implementation, there is no reporting on the quality or specific contributions played by these actors in achieving NRDV outcomes, which makes evaluation of these efforts infeasible.

Methods summary. The evaluation used a mixed-methods approach that drew on a range of data sources to collect evidence and derive explanatory factors. It assessed World Bank projects that have resource restoration activities approved and implemented during the evaluation period (2009–19). The

methods include structured literature reviews, interviews, a portfolio review and analysis (PRA), and comparative case studies that include quantitative, qualitative, and geospatial analysis.

Evaluation Scope

As per the Approach Paper, this evaluation focused on natural resources that are critical for the livelihoods and welfare of the vulnerable people who depend on them. These resources include soil and land, local forest resources, groundwater, and small-scale fisheries. Local forest resources provide critical sources of fuelwood, fodder, protein, medicine, building materials, and income—including from nontimber forest products—for forest-dependent populations. The evaluation excludes issues pertaining to the wider global commons (for example, tropical forests, global deforestation, biodiversity, surface water, air pollution, marine health) because these are covered in other evaluations.

The evaluation uses an inductive approach to explore how human vulnerability is conceptualized and measured, based on review of the narrative descriptions in World Bank documentation and on focus groups and interviews with project stakeholders that helped ground this analysis within local realities. Resource-related vulnerability is highly context specific. As shown by the methods used, the evaluation indicates that such vulnerability might involve increased risk of poverty, food and water insecurity, livelihood loss, displacement, or ill health. The case analysis, which benefited from the focus groups and interviews, also explores issues of voice and agency.

Evaluation Levels

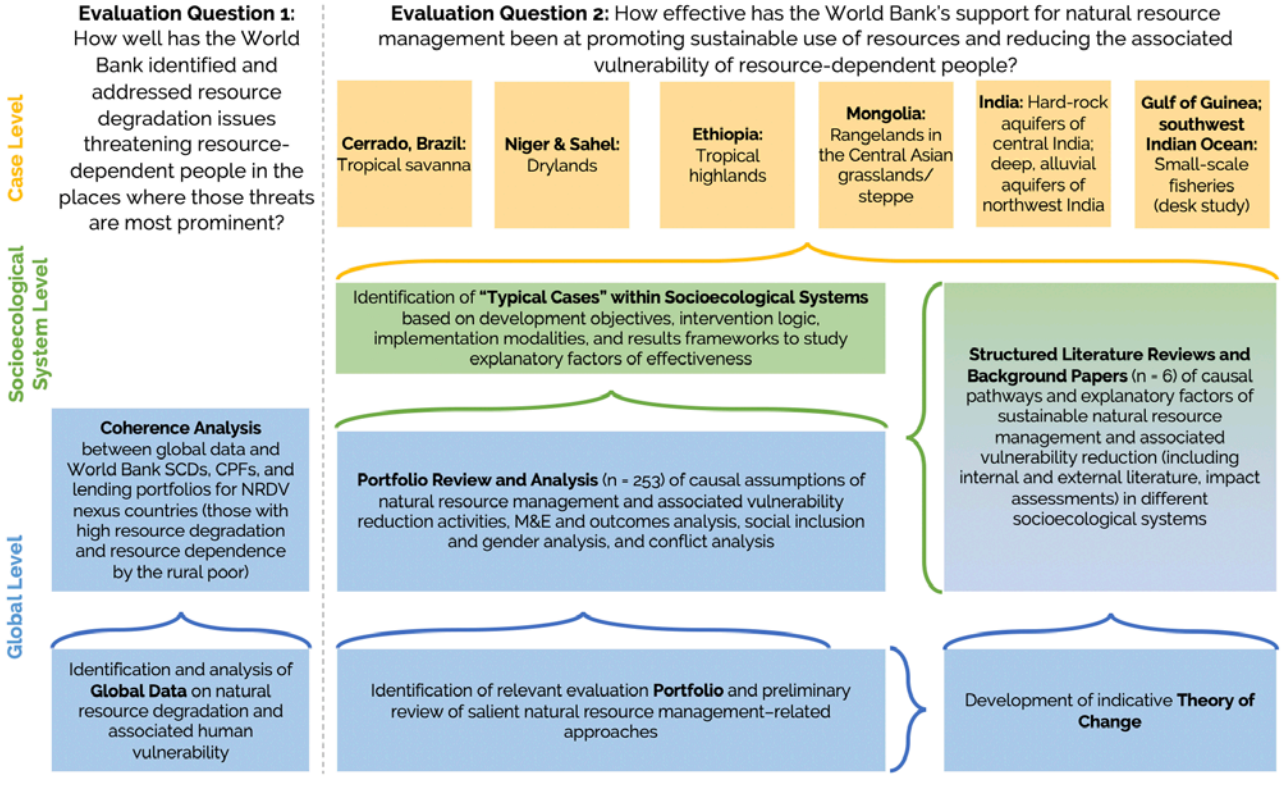
The evaluation was designed to be conducted at three levels (figure A.1):

» Global level, which included global data analysis; Systematic Country Diagnostic (SCD), Country Partnership Framework (CPF), and country lending program analysis; and a global PRA, including interviews. This level was designed to answer evaluation question 1 (global data analysis, SCD, CPF, and country program lending review) and evaluation question 2 (global PRA)

and correspond with chapters 2 and 3 of this report. Partnerships were also considered at this level.

- Socioecological system level, which included three structured literature reviews (SLRs) and three background papers focused on the resources within the evaluation scope. These were designed to provide upstream evidence on factors of effectiveness—for both addressing resource degradation and reducing associated human vulnerability—in different socioecological systems (for example, drylands in the Sahel, rangeland management in East Asia, coastal fisheries in the Gulf of Guinea and the southwest Indian Ocean). This level was designed to provide upstream evidence and insights for evaluation question 2.
- Case level, which included comparative case analysis using typical-case sampling. This level was designed to provide insights into the factors of effectiveness of representative (typical-case) World Bank operations. This level was designed to shed light on the explanatory factors linked to the effectiveness of typical World Bank operations designed to address resource degradation, from both a resource degradation and associated human vulnerability lens. This level was designed to help answer evaluation question 2.

Figure A.1. Summary Schematic of Evaluation Design



Source: Independent Evaluation Group.

Note: CPF = Country Partnership Framework; M&E = monitoring and evaluation; NRDV = natural resource degradation and vulnerability; SCD = Systematic Country Diagnostic.

Global Level

Evaluation question 1: How well has the World Bank identified and addressed resource degradation issues threatening resource-dependent people in the places where those threats are most prominent?

At the global level, the evaluation was designed to determine whether the World Bank is doing the right things in the right places. It used existing evidence, external and internal, to determine whether the World Bank is identifying and addressing the resource degradation issues that are threatening the lives and livelihoods of resource-dependent people in the places where those threats are prominent.

The Independent Evaluation Group (IEG) did this by conducting (i) a **global data analysis** to identify "nexus countries"—countries identified as having relatively high levels of resource degradation and resource dependence among poor resource users—and (ii) a **coherence analysis** across World Bank SCDs, CPFs, and country lending portfolios.

Global Data Analysis Methodology

To identify NRDV nexus countries, IEG identified sources that provided data that are comparable across countries, including data on the natural resources within the evaluation scope. For each natural resource, IEG selected the most suitable available proxy indicators for both resource degradation and resource dependence (at least one indicator for each; see table A.1). The suitability of proxy indicators was determined through a review of relevant literature and includes those data sources that are globally accepted and most cited in their respective fields. For example, to identify forest resource nexus countries, the evaluation used globally comparable data on tree cover loss, lack of access to nonsolid fuel, forest-proximate people, and rural poverty.

Table A.1. Global Data Analysis Indicators, Indicator Descriptions, and Data Sources

Natural Resource	Resource Degradation or Dependence	Indicator Name	Indicator Description	Data Source
Forest resources	Resource degradation	Forest area (percent land area, 2000)	Land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not; excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens	World Bank World Development Indicators database from Food and Agriculture Organization, electronic files and website
	Resource degradation	>75 percent tree cover loss per year, 2000–12, in areas with >75 percent tree cover (percent; Hansen et al. 2013)	Greater than 75 percent of tree cover loss between 2000 and 2012 in areas that had greater than 75 percent area under tree cover in 2000	Hansen et al. (2013)/University of Maryland, Google, US Geological Survey, National Aeronautics and Space Administration
	Resource dependence	Lack of access to nonsolid fuel (percent rural population without access, 2012)	The percentage of rural population without access to nonsolid fuel	World Bank, Sustainable Energy for All database from WHO Global Household Energy database
	Resource dependence	Number of forest-proximate people, 2012	Population living within a 5-kilometer buffer zone around forests, excluding urban areas	Newton et al. (2016); FLARE Network Secretariat (2016)
Forests, land	Resource dependence	Rural poverty headcount ratio at national poverty lines (percent rural population, various years)	The percentage of the rural population living below the national poverty lines	World Bank, Global Poverty Working Group; data are compiled from official government sources or are computed by World Bank staff using national (country-specific) poverty lines

(continued)

Natural Resource	Resource Degradation or Dependence	Indicator Name	Indicator Description	Data Source
Small-scale fisheries	Resource degradation + resource dependence	Pressure on artisanal fishing opportunities (score, 2015)	The sum of the ecological and social pressures that negatively affect opportunities for small-scale local fishing to meet the estimated need to fish; artisanal fishing refers to fisheries involving households, cooperatives, or small firms (as opposed to large, commercial companies) that use relatively small amounts of capital and energy and small fishing vessels (if any), make relatively short fishing trips, and use fish mainly for local consumption or trade	Ocean Health Index, National Center for Ecological Analysis and Synthesis at University of California, Santa Barbara, and Conservation International
	Resource degradation	Fish stock status (0–100, various years)	The percentage of a country's total catch that comes from taxa that are classified as either overexploited or collapsed	Environmental Performance Index, Yale Center for Environmental Law and Policy, Yale University
Groundwater	Resource degradation + resource dependence	Groundwater table decline	IEG calculated the country-level groundwater table decline by multiplying decline by aquifer area to quantify extent of decline, which was aggregated at country level (see expanded methodology in the following subsection)	World Resource Institute Aqueduct Framework, with data from Deltares and Utrecht University
	Resource dependence		Percentage of people relying on groundwater as primary source of water	Southern Africa: World Bank (2014) SAR: Hirji, Mandal, and Pangare (2017) MENA: Lezzaik, Milewski and Mullen (2018)

Natural Resource	Resource Degradation or Dependence	Indicator Name	Indicator Description	Data Source
Land and soil resources	Resource degradation	Average erosion rate (Mg/ha/year, 2001–12)	Total soil erosion as a proportion of total land area	IEG, from Borrelli et al. (2017)
	Resource degradation	Maximum erosion rate (Mg/ha/year, 2001–12)	Maximum rate of soil erosion for 25 square kilometer area	IEG, from Borrelli et al. (2017)
	Resource dependence	Employment in agriculture (percent of total employment; modeled ILO estimate, 2019)	Employment is defined as persons of working age who were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job or due to working-time arrangement; the agriculture sector consists of activities in agriculture, hunting, forestry, and fishing, in accordance with division 1 (ISIC 2) or categories A-B (ISIC 3) or category A (ISIC 4)	World Bank, World Development Indicators; International Labour Organization, ILOSTAT database; data retrieved in September 2019
	Resource dependence	Livestock per capita (number, 2017)	Ratio of livestock to total population	IEG, from FAOSTAT database

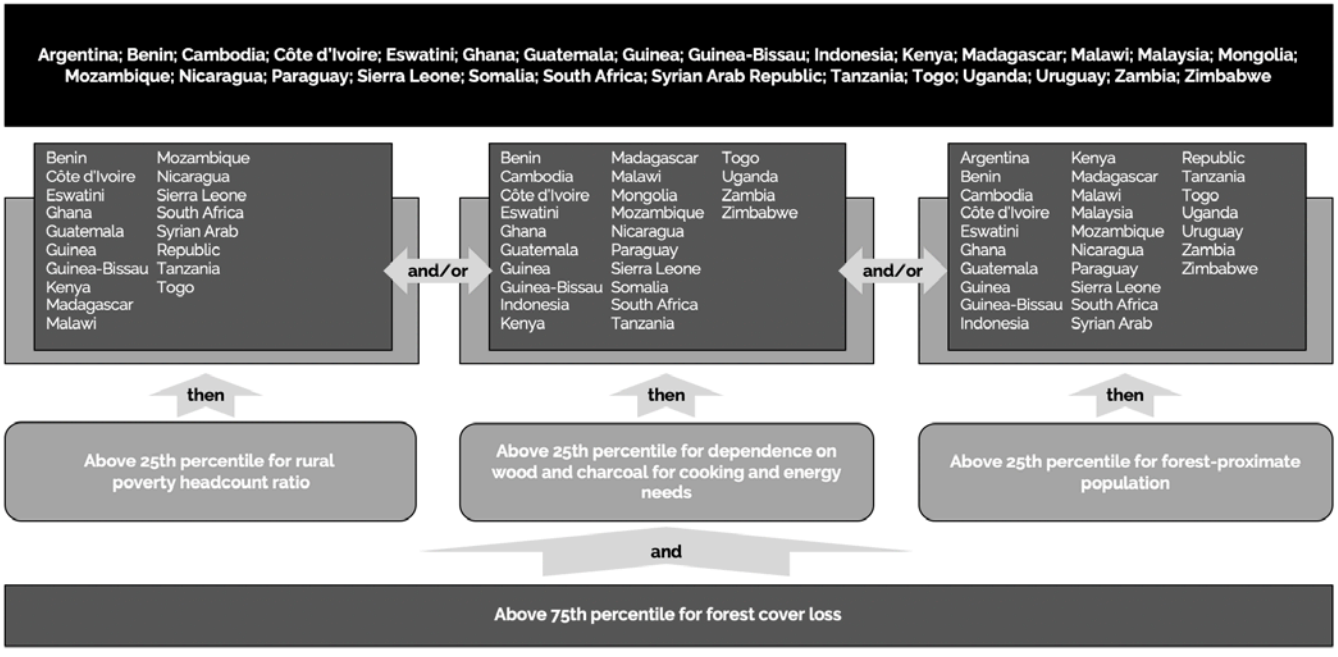
Source: Independent Evaluation Group.

Note: FAOSTAT = Food and Agriculture Organization Statistics Division; IEG = Independent Evaluation Group; ILO = International Labour Organization; ISIC = International Standard Industrial Classification; MENA = Middle East and North Africa; Mg/ha/year = megagrams per hectare per year; SAR = South Asia; WHO = World Health Organization.

To prioritize the assessment of NRDV nexus countries, IEG developed decision trees for each natural resource to identify those countries where the magnitude of resource degradation and resource dependence are comparatively high within the global sample. The methodology relied on classifying countries based on the distribution of the data of the selected indicators (that is, percentiles). Based on the varying distributions of the data sets for the different natural resources and indicators, IEG identified thresholds that would identify a sample ranging between approximately 25 and 45 nexus countries per natural resource. (The thresholds for the soil and land analysis were adjusted to widen the list of nexus countries, since this corresponds to the relative footprint of SLM interventions within the World Bank natural resource management portfolio, as demonstrated by the evaluation portfolio identification process, outlined in subsequent sections.)

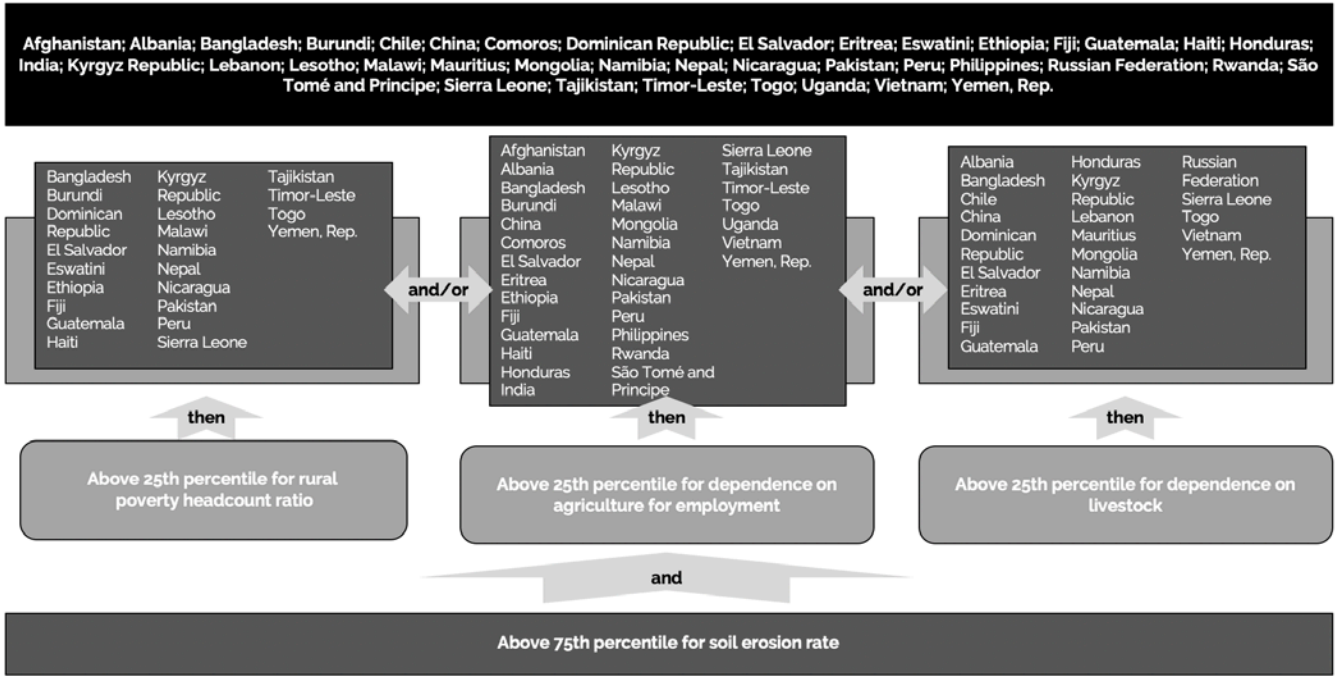
Three decision trees were used to prioritize NRDV nexus countries for forest resources, soil and land resources, and small-scale fisheries (see figures A.2, A.3, and A.4). For groundwater, due to inherent characteristics of the resource (for example, its fluid and transboundary nature and being underground and invisible from space), reliable data are difficult to collect, and thus globally comparable data are very limited. IEG used the World Resources Institute's Aqueduct 3.0 database, which includes an indicator on water table decline (see the following subsection for expanded groundwater methodology).[1]

Figure A.2. Forest Resources Decision Tree



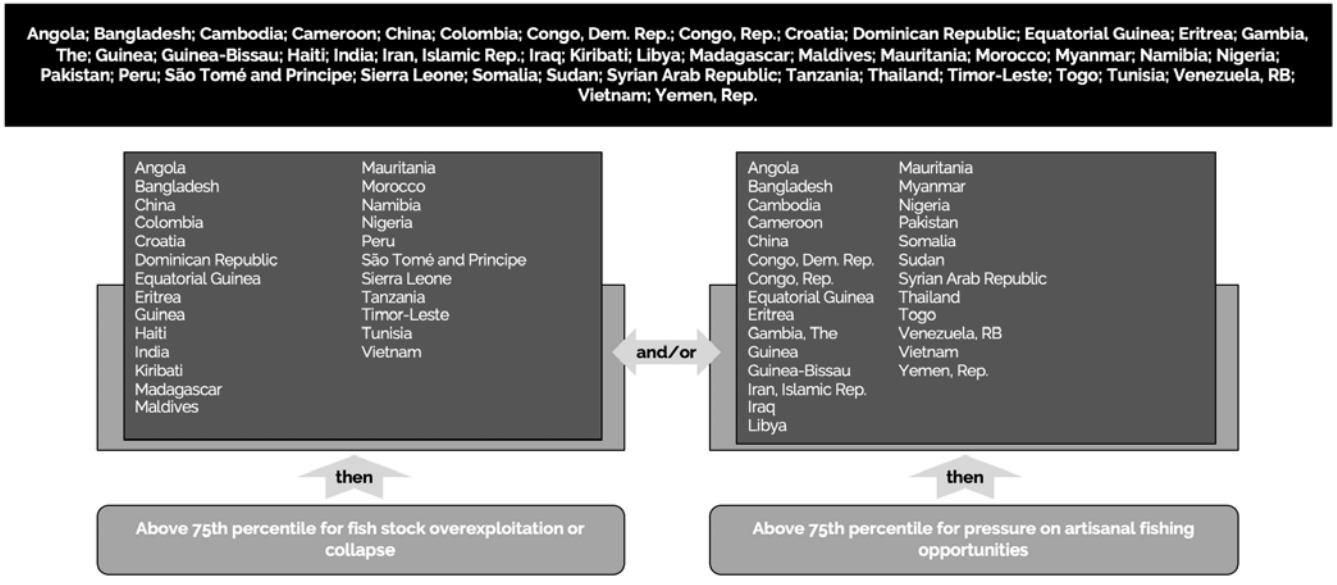
Source: Independent Evaluation Group.

Figure A.3. Soil and Land Resources Decision Tree



Source: Independent Evaluation Group.

Figure A.4. Small-Scale Fisheries Resources Decision Tree



Source: Independent Evaluation Group.

Groundwater Nexus Country Identification

Countries where the threats of groundwater decline are most prominent were identified by using the World Resources Institute Aqueduct 3.0 database (2019), which compiles advances in hydrological modeling, remotely sensed data, and published data sets into a freely accessible online platform. Since its inception in 2011, the Aqueduct information platform and underlying data have been updated regularly, making them comparable on a global scale and accessible to decision makers worldwide.

The Aqueduct water risk framework follows a composite index approach that combines 13 indicators covering various types of water-related risks (see table A.2). However, IEG used the indicator and associated data set for groundwater table decline only.

Table A.2. Overview of the Aqueduct Framework

Risk Type	Indicator	Risk
Physical risk quantity	Indicator 1	Baseline water stress
	Indicator 2	Baseline water depletion
	Indicator 3	Interannual variability
	Indicator 4	Seasonal variability
	Indicator 5	Groundwater table decline
	Indicator 6	Riverine flood risk
	Indicator 7	Coastal flood
	Indicator 8	Drought risk
Physical risk quality	Indicator 9	Untreated connected wastewater
	Indicator 10	Coastal eutrophication potential
Regulatory and reputational risk	Indicator 11	Unimproved/no drinking water
	Indicator 12	Unimproved/no sanitation
	Indicator 13	Peak RepRisk country ESG risk index

Source: Independent Evaluation Group.

Note: ESG = environmental, social, and governance; RepRisk = regulatory and reputational risk.

Groundwater table decline measures the average decline of the groundwater table as the average change for the period of study (1990–2014). The result is expressed in centimeters per year. Higher values indicate higher levels of unsustainable groundwater withdrawals. The data set (2019) is calculated using

the Deltares and Utrecht University groundwater heads time series from the PCR-GLOBWB 2, coupled with MODFLOW to account for lateral groundwater flow processes. It is based on the gridded (5 × 5 arc minute) monthly groundwater heads between January 1990 and December 2014.

The groundwater table decline data set includes multiple data observations for each country, which refer to groundwater aquifers derived from the Worldwide Hydrogeological Mapping and Assessment Programme data set (BGR and UNESCO 2018). Data are provided on the area (in square kilometers) for each aquifer.

The Aqueduct framework converts the groundwater table decline data (centimeters per year) into risk categories based on a combination of expert judgment and a literature review (Rodríguez, Sutanudjaja, and Sànchez 2017). The authors use linear interpolation to convert the raw values to a 0–5 scale (figures A.5 and A.6).

Figure A.5. Equation to Calculate Risk Score

$$score = \begin{cases} max(r+1,0), & r < 0 \\ r+1, & 0 \le r < 2 \\ \frac{1}{2}r+1, & 2 \le r < 8 \\ \min\left(5, \frac{1}{2}r+1\right), & r \ge 8 \end{cases}$$

Figure A.6. Risk Categories and Associated Score Range

RAW VALUE	RISK CATEGORY	SCORE
<0 cm/y	Low	0–1
0–2 cm/y	Low–medium	1–2
2–4 cm/y	Medium–high	2–3
4–8 cm/y	High	3–4
>8 cm/y	Extremely high	4–5

Source: World Resources Institute Aqueduct 3.0 database (https://www.wri.org/resources/data-sets/aqueduct-global-maps-30-data)

Note: r is the raw indicator value, and *score* is the indicator score (0–5); cm/y = centimeters per year.

Since the data set is provided at the aquifer level, IEG aggregated the multiple data observations for each country to calculate the total water table

decline per year at the country level. To ensure that the magnitude of decline is captured, IEG multiplied the risk score for each aquifer by the respective aquifer areas to approximate the *extent* of water being withdrawn. Countries in the top 50th percentile were included in the coherence analysis for groundwater resources (n = 30).

Limitations. IEG did not use the raw indicator value for groundwater table decline because this would have resulted in a calculation of *net* groundwater table change. This would erroneously assume that groundwater is perfectly transportable within a country and risks smoothing over subnational variations in groundwater decline that could be highly detrimental to poor people and affected populations. By using the risk category score, IEG used the most appropriate available estimation of groundwater table decline that is globally comparable.

Coherence Analysis Methodology (across SCDs, CPFs, and Lending Portfolios)

The coherence analysis was designed to assess how well the World Bank identifies and addresses resource degradation issues threatening resource-dependent people in the places where those threats are most prominent. IEG did this by examining how the World Bank is diagnosing resource degradation and associated human vulnerability issues in its SCDs and how it is addressing these issues in its CPFs and country lending programs. IEG conducted a coherence analysis for each of the four natural resources within the evaluation scope, using the identified NRDV nexus countries as the samples of the four-part analysis.

To ensure consistency in the coherence analysis, IEG limited the sample of NRDV nexus countries to those where an SCD and a CPF were available and where the World Bank had an active lending portfolio at the time of the assessment. Of the 101 nexus countries identified, the 87 with SCDs, CPFs, and active country lending portfolios are the subject of this appendix's assessment. The list of countries included in the coherence analysis is outlined in table A.3.

Table A.3. Natural Resource Degradation and Vulnerability Nexus Countries Included in the Coherence Analysis

Natural Resource	NRDV Nexus Countries	NRDV Nexus Countries with SCD, CPF, and Active Lending Portfolio	
		(no.)	Countries
Soil and land	n = 68	n = 58	Afghanistan; Albania; Bangladesh; Benin; Bhutan; Bolivia; Bosnia and Herzegovina; Brazil; Burkina Faso; Burundi; Cambodia; Cameroon; Chile; China; Comoros; Costa Rica; Djibouti; Dominican Republic; Ecuador; El Salvador; Ethiopia; Fiji; Ghana; Guatemala; Guinea; Haiti; Honduras; India; Indonesia; Kyrgyz Republic; Lao PDR; Lebanon; Lesotho; Madagascar; Malawi; Mauritius; Mexico; Mongolia; Morocco; Myanmar; Nepal; Nicaragua; Nigeria; Panama; Peru; Philippines; Russian Federation; Rwanda; Sierra Leone; South Africa; Sri Lanka; Tajikistan; Tanzania; Thailand; Timor-Leste; Togo; Uganda; Vietnam
Forest resources	n = 26	n = 22	Argentina; Benin; Cambodia; Côte d'Ivoire; Ghana; Guatemala; Guinea; Guinea-Bissau; Indonesia; Madagascar; Malawi; Mongolia; Mozambique; Nicaragua; Paraguay; Sierra Leone; Somalia; South Africa; Tanzania; Togo; Uganda; Zambia
Groundwater	n = 30	n = 23	Azerbaijan; Bangladesh; Bolivia; Botswana; Chad; Chile; China; Egypt, Arab Rep.; Ethiopia; Georgia; India; Iraq; Jordan; Kazakhstan; Mexico; Mongolia; Nepal; Peru; Russian Federation; Somalia; South Africa; Tunisia; Turkey
Small-scale fisheries	n = 43	n = 30	Angola; Bangladesh; Guinea-Bissau; Cambodia; Cameroon; China; Colombia; Congo, Dem. Rep.; Congo, Rep.; Croatia; Dominican Republic; Guinea; Haiti; India; Iraq; Madagascar; Maldives; Mauritania; Morocco; Myanmar; Nigeria; Peru; Sierra Leone; Somalia; Tanzania; Thailand; Timor-Leste; Togo; Tunisia; Vietnam

Source: Independent Evaluation Group.

Note: CPF = Country Partnership Framework; NRDV = natural resource degradation and vulnerability; SCD = Systematic Country Diagnostic.

IEG developed a coherence analysis coding template that was completed for each natural resource and for each of the respective NRDV nexus countries. Analysts screened the SCD, CPF, and lending portfolio for relevant content in line with the coding templates' main lines of enquiry (see table A.4).

A double-blind procedure was applied whereby two analysts screened the same documents independent of one another to ensure the relevant content was comprehensively captured and recorded in the coding template. The analysis of the raw data included consolidating the two data sets and tracing and assessing coherence in the content across the SCD, CPF, and relevant lending portfolio.

Table A.4. Coherence Analysis Lines of Inquiry Used for Each Natural Resource

SCD Review	CPF Review	Country Lending Review
How does the SCD reference and characterize the natural resource degradation issue(s)? What data are provided to indicate the magnitude of the natural resource degradation issue(s)?	In its pillars/focus areas/themes, how does the CPF address the natural resource degradation issue(s), including those identified by the SCD?	Does the country lending program include projects to address the natural resource degradation issue(s), including those identified by the SCD/CPF? Is the lending active or outdated?
How does the SCD reference and characterize the vulnerability associated with the resource degradation issue(s)? What data are provided to indicate the magnitude of the vulnerability associated with the resource degradation issue(s)?	In its pillars/focus areas/themes, how does the CPF address the vulnerability associated with the resource degradation issue(s), including the vulnerability identified by the SCD?	Does the country lending program include projects that address the vulnerability associated with the resource degradation issue(s), including the vulnerability identified by the SCD/CPF?
Does the SCD identify any specific groups that are particularly vulnerable to natural resource degradation?	In its pillars/focus areas/themes, how does the CPF target and address the challenges and constraints of groups that are particularly vulnerable to natural resource degradation, including those identified by the SCD?	Does the country lending program include projects that target groups that are particularly vulnerable to natural resource degradation, including those identified by the SCD/CPF?
Does the SCD point to any particularly vulnerable subnational areas experiencing higher levels of natural resource degradation and associated vulnerability?	In its pillars/focus areas/themes, how does the CPF target and address the challenges and constraints of subnational areas experiencing higher levels of natural resource degradation and associated vulnerability, including those identified by the SCD?	Does the country lending program include projects that target subnational areas experiencing higher levels of natural resource degradation and associated vulnerability, including those identified by the SCD/CPF?

Source: Independent Evaluation Group.

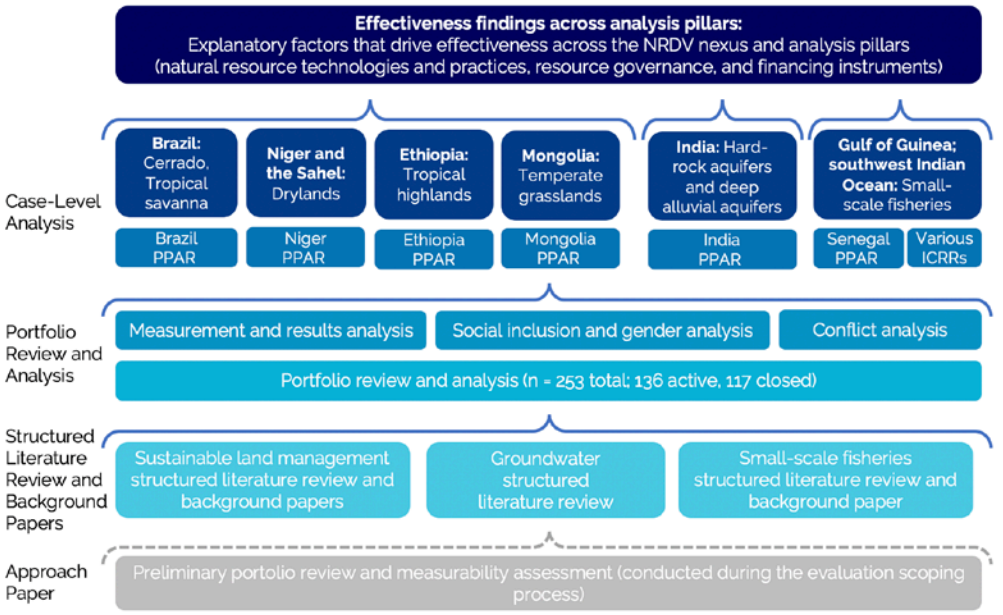
Note: CPF = Country Partnership Framework; SCD = Systematic Country Diagnostic.

Socioecological and Case Level

Evaluation question 2: How effective has the World Bank's support for natural resource management been at promoting sustainable use of resources and reducing the associated vulnerability of resource-dependent people?

To assess effectiveness, this evaluation used a layered approach that triangulated effectiveness across natural resources and socioecological systems (figure A.7). First, IEG used SLRs and background papers to identify existing evidence on the contribution of relevant approaches to achieving environmental outcomes and to reducing associated human vulnerability in different contexts. The SLRs and background papers helped inform the evaluation framework that was used during the portfolio and case-level analyses. Second, the evaluation identified a relevant World Bank portfolio and conducted a PRA to assess efficacy, social inclusion, and conflict sensitivity, among other aspects. Finally, in-depth country case studies were carried out to (i) build on the themes emerging from the SLRs, background papers, and PRA; and (ii) probe, derive, and compare explanatory factors across interventions and socioecological systems.

Figure A.7. Triangulated Effectiveness Methodology



Source: Independent Evaluation Group.

Note: ICRR = Implementation Completion and Results Report Review; NRDV = natural resource degradation and vulnerability; PPAR = Project Performance Assessment Report.

Structured Literature Reviews and Background Papers

IEG commissioned SLRs and background papers to identify and synthesize existing evidence on the contribution of different approaches to achieving environmental outcomes and to reducing associated human vulnerability, in varying contexts, at the global and socioecological system level. The evaluation commissioned SLRs on (i) SLM, (ii) groundwater, and (iii) small-scale fisheries. IEG also commissioned background papers to further explore NRDV dynamics at the socioecological system level for drylands in the Sahel, rangeland management in East Asia, and coastal fisheries in the Gulf of Guinea and the southwest Indian Ocean. The SLRs and background papers helped

- Inform the design of the evaluation framework used for the PRA;
- Derive the overarching explanatory factors that drive effectiveness across the NRDV nexus, which were used during the comparative case-level analysis (that is, natural resource technologies and practices, resource governance, and financing instruments); and
- Where evidence was available (where credible evaluations have taken place), provide insights into the relative probable effectiveness of the World Bank's interventions, since results were not made available in the project documents for most closed projects.

Portfolio Review and Analysis

The evaluation conducted a PRA of World Bank projects to assess and draw lessons from a salient portfolio of projects with activities designed to support improved and sustainable natural resource management.

Portfolio Identification

The portfolio screening process identified an NRDV portfolio consisting of 253 World Bank projects approved during the 10-year evaluation period (fiscal years 2009–19) with total financing of almost $33 billion (see appendix C for evaluation portfolio). In line with the evaluation scope, the portfolio includes projects associated with four main portfolio themes: (i) SLM projects, (ii) Social Protection projects with land and resource restoration

activities, (iii) projects with groundwater activities, and (iv) projects with small-scale fisheries support. These were identified using (i) World Bank sector and theme codes, where available and applicable, and (ii) text analytics, where World Bank sector or theme codes were not specific enough to provide a relevant portfolio.

SLM portfolio. The portfolio consists of 104 SLM projects. These were identified through text analytics using a taxonomy of keywords and phrases related to the theme, such as *SLM*. IEG identified relevant World Bank operations within the evaluation time frame that referred to the relevant taxonomy in key project descriptors such as project titles, project development objectives, component titles, and results framework indicators. The key project descriptors were sourced from multiple structured text data sources in the Operations Portal and data made available by Information Technology Services. Only projects with one or more indicators to measure land area brought under some type of SLM regime were retained, because this verified that the portfolio was designed to have a measurable impact on land management.

Social Protection projects with land and resource restoration activities. The portfolio consists of 41 Social Protection and Jobs projects with land and resource restoration activities. These were identified through text analytics using a taxonomy of keywords and phrases related to the theme, such as *soil fertility/conservation*, *water conservation*, *land restoration*, *afforestation*, *forest*, *tree planting*, and *erosion*. IEG identified relevant World Bank operations within the evaluation time frame that referred to the relevant taxonomy in key project descriptors such as project titles, project development objectives, component titles, and results framework indicators. The key project descriptors were sourced from multiple structured text data sources in the Operations Portal and data made available by Information Technology Services.

Groundwater portfolio. The portfolio consists of 55 projects with groundwater activities. These were identified through text analytics using a taxonomy of keywords and phrases related to the theme, such as *groundwater*, *aquifer*, *hydrogeology*, and *water table*. IEG identified relevant World Bank operations within the evaluation time frame that referred to the relevant taxonomy in key project descriptors such as project titles, project development objectives, component titles, and results framework indicators. The key project descrip-

tors were sourced from multiple structured text data sources in the Operations Portal and data made available by Information Technology Services.

Small-scale fisheries portfolio. The portfolio consists of 53 projects with support to small-scale fisheries. These were identified using (i) the sector codes AF—Fisheries; AK—Public Administration, Agriculture, Fishing, and Forestry; AZ—Other Agriculture, Fishing, and Forestry; and (ii) the theme code 832—Fisheries Policies and Institutions. The resulting projects were subsequently manually screened to ensure relevance to the evaluation's focus on small-scale fisheries.

NRDV portfolio characteristics. Of the 253 projects in the portfolio, 117 were closed, and IEG had validated 78 at the time of the evaluation. Most of the portfolio maps to four Global Practices: (i) Environment, Natural Resources, and Blue Economy; (ii) Agriculture and Food; (iii) Water; and (iv) Social Protection and Jobs. Half of the portfolio is located in Sub-Saharan Africa (see tables A.5 and A.6).

Table A.5. Evaluation Portfolio by Region and Project Number

Portfolio Theme	EAP	ECA	LAC	MENA	SAR	SSA	Total
Sustainable land management projects	8	11	20	3	4	58	104
Projects with groundwater components	9	8	5	10	13	10	55
Projects with small-scale fisheries components	16	1	2	4	5	25	53
Social Protection with SLM activities	0	0	1	6	1	33	41
Total	33	20	28	23	23	126	253

Source: Independent Evaluation Group.

Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SAR = South Asia; SLM = sustainable land management; SSA = Sub-Saharan Africa.

Table A.6. Evaluation Portfolio by Global Practice and Aggregate Performance Ratings

Global Practice	SLM	Groundwater	Small-Scale Fisheries	Social Protection with SLM	Total
Environment, Natural Resources, and Blue Economy	48	8	27	n.a.	83
Agriculture and Food	38	5	14	n.a.	57
Water	12	36	2	n.a.	50
Social Protection and Jobs	n.a.	n.a.	n.a.	41	41
Urban, Resilience, and Land	4	3	5	n.a.	12
Other	2	3	5	n.a.	10
Total	104	55	53	41	253
Outcome Rated MS+ (percent)	78	83	68	100	79

Sources: Independent Evaluation Group, Implementation Completion and Results Report Reviews.

Note: MS+ = moderately satisfactory or better; n.a. = not applicable; SLM = sustainable land management.

Review and Analysis

The PRA was designed as an exploratory learning tool to map evidence and distill lessons. Because there has been no previous systematic assessment of World Bank operations regarding the link between NRDV, key functions of the PRA were to (i) identify the World Bank's relevant portfolio, (ii) analyze the type and consistency of metrics applied to capture natural resource *and* vulnerability-related results, and (iii) assess the adequacy and efficacy of the key intervention areas and approaches. Different tools were used to identify and assess reported results and to elucidate different dimensions of vulnerability associated with social inclusion, gender, and conflict-related considerations.

Measurement and results analysis. For all projects in the evaluation portfolio, IEG reviewed and analyzed the indicators in the results frameworks to determine the types, frequency, and adequacy of different outcomes that are measured (for example, environmental, social, economic, institutional). For closed operations, the indicators and results reported in the Implementation

Completion and Results Reports were also examined to determine what was achieved compared with what the project had originally planned (target).

For example, in the SLM analysis, IEG conducted the following: It compared the land area (in hectares) under SLM practices that the portfolio had planned with what was actually achieved. Similarly, for active operations, it examined the indicators from Implementation Status and Results Reports to identify the land area that the projects planned to bring under SLM. This provided a quantifiable (and aggregable) measure of the World Bank's intended efforts and actual achievements in the introduction of SLM practices in client countries. IEG also screened the indicators for the presence of more advanced environmental indicators (for example, reduced soil erosion, improved soil water retention, increased vegetation cover, increased species richness), which provide additional evidence on whether adopting SLM regimes is contributing to environmental outcomes. Finally, the SLM assessment screened indicators for social, economic, and institutional measures (for example, increased yield, diversification, income, capacity) to ascertain whether projects are adequately and comprehensively reporting on the outcomes of SLM activities (that is, resource restoration) to beneficiaries (that is, vulnerability reduction), and whether institutional capacities are strengthened to sustain these results.

Social inclusion and gender analysis. The World Bank report *Inclusion Matters* defines social inclusion as the process of improving the ability, opportunity, and dignity of people disadvantaged on the basis of their identity to take part in society (World Bank 2013). Social exclusion can arise based on factors such as gender, race, caste, ethnicity, religion, and disability. In natural resource management, it is important to ensure that poor people and the most vulnerable are included in interventions and are given a role in decision-making to ensure that the unique risks faced by these groups are adequately identified and addressed. The PRA screened projects for:

- Which vulnerable groups the projects explicitly intend to support—that is, poor people, women, the landless, youth, the elderly, persons with disabilities, minorities, and displaced persons.
- How these groups will be supported through financed activities, for example skills development and training, vulnerability-sensitive design, or perception of services.

» How the projects are tracking disaggregated progress on the activities that support specific vulnerable groups—that is, indicators in the results framework. This does not include indicators for overall participation (for example, number of beneficiaries, of which 50 percent are women) as this insufficiently quantifies potential outcomes.

Conflict screening and analysis. Natural resource conflicts arise when parties disagree about the management, distribution, and protection of natural resources (UNEP 2012). These conflicts can escalate to violence when the parties are unable or unwilling to engage in a constructive process of dialogue and conflict resolution. If institutional arrangements to facilitate conflict resolution are lacking, communities can be drawn into cycles of conflict and violence, particularly if political systems are fragile and in situations where divisions between opposing parties are extreme. Conflict-sensitive natural resource management is therefore important to achieving sustainable restoration outcomes that reduce vulnerability and prevent conflict.

At the country level, the SCDs and CPFs of NRDV nexus countries were screened for references of conflict, violence, or tensions over or caused by natural resources (excluding nonrenewable resources such as fossil fuels and minerals) and their degradation. The analysis identified the nexus countries for which both, either, or none of the documents identified natural resource–related conflict. The analysis further identified various categories of resource-related conflict, such as social conflict, land conflict, and deadly conflict, and suggested interventions. For countries where neither document identified resource-related conflict, an additional literature review was conducted to ascertain the presence or absence of such conflict.

At the project level, 79 projects within the SLM portfolio were identified as taking place in a client country of which at least one of the SCD, CPF, or literature review identified resource-related conflict risks. For these World Bank interventions, the project documents (Implementation Completion and Results Reports for closed projects; Project Appraisal Documents for active projects) were analyzed for conflict sensitivity. This was done by assessing the degree to which projects aimed to tackle conflict beyond the scope of standard grievance redress mechanisms.

Case-Level Analysis

The comparative case analysis was designed to examine explanatory factors of effectiveness associated with the design and implementation of representative World Bank interventions in select socioecological systems stratified across regions. The framework for the analysis was informed by (i) SLRs and background papers and (ii) the identified and assessed evidence gaps within the PRA.

The analysis included the following socioecological systems and countries:

- Tropical savanna studied in the Cerrado, Brazil (in country)
- Drylands studied in Niger (in country) and the Sahel (on desk)
- Tropical highlands studied in Ethiopia (in country)
- Temperate grasslands studied in Mongolia (in country)
- Hard-rock aquifers and deep alluvial aquifers studied in India (in country)
- Small-scale coastal fisheries studied in the Gulf of Guinea and the southwest Indian Ocean (both on desk)

The case analysis analyzed and compared explanatory factors associated with three dimensions of effectiveness derived from the literature—including the SLRs and background papers—across all resources in the evaluation scope. These dimensions of effectiveness were (i) the appropriateness of the technology choice, (ii) the adequacy of governance arrangements and the capacity of institutions, and (iii) the role of economic and financial incentives or instruments (table A.7). For each case analysis, task teams conducted (i) desk review of relevant literature and project documents; (ii) stakeholder mapping, including localized typologies of vulnerable groups; (iii) design of field assessment, including purposive site selection and stakeholder targeting; (iv) field assessments, including key informant interviews and focus group discussions with key stakeholder groups identified; and (v) consolidation of field assessment findings in the evaluation comparative case analysis template (aligned with the explanatory factors listed above).

Table A.7. Case Analysis Recording Template

Typical Case—Describe Intervention	Describe Technology Choice(s)	NRDV Findings and Evidence (Technology Choice)	Describe Governance Arrangements	NRDV Findings and Evidence (Governance Arrangements)	Describe Financial Instruments	NRDV Findings and Evidence (Financial Arrangements)	For Whom Were NRDV Benefits Achieved (Use Stakeholder Matrix)

Source: Independent Evaluation Group.

Note: NRDV = natural resource degradation and vulnerability.

Projects selected for the comparative case analysis were based on the principle of **"typical-case" purposive sampling**—mature interventions with characteristics that are representative of larger parts of the portfolio in select socioecological systems. Such characteristics include (i) a typically occurring intervention logic based on accepted theory of change; (ii) a representative project design (component composition and alignment with causal theory); and (iii) results indicators—including corporate indicators—that are frequently used to measure attributable outcomes of the intervention typology (see table A.8).

Table A.8. Representativeness of Typical Cases in the Natural Resource Degradation and Vulnerability Portfolio

Socioecological System	Typical Case	Representativeness of the Typical Case within the NRDV Portfolio (FY10–20)
Tropical highlands: High-pressure and intensively cultivated tropical highland, midaltitude, and mountain regions of Africa, Asia, and Latin America	Ethiopia: Sustainable Land Management Project Phases I, II (2008–18); Resilient Landscapes and Livelihoods Project (2018–present); Productive Safety Nets Project Phases I–IV (2005–present)	This case is representative of 45 percent of the NRDV SLM portfolio in 29 countries. Similar projects target watersheds in high-pressure areas and resource users within those watersheds. They also include one or more of the following practices: integrated watershed and landscape management, soil and water conservation, afforestation or reforestation (including area closures), rehabilitation of degraded areas, protection of critical ecosystems, conservation agriculture, environmental payments, institutional strengthening, training, land use planning, and land administration.
Drylands in the Sahel: Low rainfall and water-scarce ecosystems (excluding deserts) in the arid, semiarid, dry, subhumid tropics	Niger: Community Action Program Phases I, II, III (2004–present)	This case is representative of 28 percent of the NRDV SLM portfolio, including projects that are designed to operate in drylands. It is most representative of the portfolio of NRDV projects implemented across the 12 countries located in the Sahel and West Africa. Similar projects target a combination of farmers, agropastoralists, pastoralists, local government, and rural inhabitants. Often designed in a participatory manner, the projects include one or more of the following practices: land restoration, tree planting, soil and water conservation (including area closures), training, and environmental payments.
Rangelands in the steppe/Central Asian grasslands: Montane subtropical and temperate grazing lands in Asia	Mongolia: Sustainable Livelihood Program Phases I, II, III (2001–present)	This case is representative of 15 percent of the NRDV SLM portfolio in 11 countries. Similar projects target herders, agropastoralists, and rural populations. They also include practices such as community-based rangeland management, institutional strengthening, training, pasture-related infrastructure, pastoral risk management, land use planning, and livelihood investments.

(continued)

Socioecological System	Typical Case	Representativeness of the Typical Case within the NRDV Portfolio (FY10–20)
Tropical savanna: Extensive production systems in tropical grasslands, shrublands, and forest margins in Africa and Latin America	Brazil: Brazil Investment Program in the Cerrado (2012–present); Sustainable Production in Areas Previously Converted to Agriculture Use (2015–20); Integrated Landscape in the Cerrado Biome (2015–present)	This case is representative of 17 percent of the NRDV SLM portfolio in nine countries. Similar projects target farms and watersheds that have been degraded. They also include practices such as silvopastoral approaches, low-carbon emission agricultural practices, afforestation or reforestation, institutional strengthening, training, and environmental payments.
Hard-rock aquifers and alluvial aquifers of central and northwest India; water-scarce and groundwater-dependent systems (SAR, MENA, China, and LAC)	India: Andhra Pradesh and Telangana Community-Based Tank Management (2007–16); Tamil Nadu Irrigated Agriculture Modernization and Water Restoration Management (2007–15, 2018–present); Rajasthan Agricultural Competitiveness (2012–20)	This bundle of India groundwater cases is representative of one-third of the NRDV groundwater portfolio. Similar projects target critical watersheds with overexploited aquifers and farmers of irrigated agriculture. They also include one or more of the following practices: watershed and tank management, demand- and supply-side policies (metering, pricing, drilling restrictions, feeder segregation, subsidy reform, low-water-intensity crops, subsidized solar pumps, or participatory groundwater management), and institutional strengthening for groundwater management.
Marine fisheries in the Gulf of Guinea, southwest Indian Ocean and East Asia and Pacific: Coastal communities dependent on SSFs	West Africa Regional Fisheries Program (2010–present) Indonesia: Coral Reef Rehabilitation and Management Program (2004–present) Vietnam: Coastal Resources for Sustainable Development (2012–19)	This desk-based analysis focused on the five programs constituting 80 percent of the NRDV portfolio financing support of SSFs. Similar projects target coastal communities where livelihoods depend on local fish resources and where SSFs are overexploited. The projects often include one or more of the following activities: support for community-based organizations and comanagement plans; enforcement of fishing rights and exclusion zones; SSF monitoring and surveillance; and livelihood activities.

Source: Independent Evaluation Group.

Note: FY = fiscal year; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; NRDV = natural resource degradation and vulnerability; SAR = South Asia; SSF = small-scale fisheries; SLM = sustainable land management.

This evaluation used several innovative methods in its case-level analyses:

- In Brazil, IEG applied grounded theory to study the contours of vulnerability caused by environmental degradation in the Cerrado biome. The study used geospatial data and concurrent purposive sampling to identify main pockets of vulnerability in the Cerrado. An initial sample of local informants (including researchers, nongovernmental organizations, project stakeholders, and public servants) was interviewed, and data from each interview were used to direct the next observation through a comparative analysis. The process served to identify clues, fill gaps, clarify uncertainties, and test interpretations as the study progressed, giving rise to three exploratory theories of vulnerability ("landlessness," "missing middle," and "traditional communities"). After the inductive process, four sites were selected to further test these theories: a landless settlement in the outskirts Brasília (Pipiribau, located in Planaltina, 45 kilometers north of Brasília); a landless settlement near the Kalunga community (Campos Belos, 410 kilometers north of Brasília); a traditional community (Kalunga Historical Site, 250 kilometers north of Brasília); and a group of seed collectors from Cavalcantes (the Seeds Network, 316 kilometers north of Brasília). In total, 32 people were interviewed between November 8 and 12, 2019. IEG analyzed all data in conjunction with coding and constant comparative analysis until theoretical saturation was reached. The plasticity of ground theory created an unfolding and iterative system that was critical to tackle Cerrado's complexity, generating new insights into how environmental degradation in the interior of Brazil is affecting people's livelihoods and well-being.
- In Ethiopia, IEG conducted a qualitative comparative analysis and a geospatial analysis. For the qualitative comparative analysis, IEG studied two major World Bank–supported programs in Ethiopia: the Sustainable Land Management Project and the Productive Safety Net Program. The analysis was conducted using 30 cases from these program clusters and looked at effectiveness in terms of three key outcome indicators: (i) reducing land degradation, (ii) increasing land productivity, and (iii) reducing vulnerability of the resource users in the target communities. The qualitative comparative analysis aimed to identify the main factors and the contextual characteristics associated with the major pathways leading to a given outcome. Using the case-based data collected systematically across the 30 case studies, the anal-

ysis attempted to explain why change happens in some cases but not others. This approach was used to identify explanatory factors of effectiveness related to appropriateness of technologies and management practices, institutional capacity, and resource governance arrangements (on farmland and communal land), among others. For the geospatial analysis, IEG collaborated with the Development Economics Vice Presidency to assesses the biophysical impacts of the World Bank–supported Sustainable Land Management Projects I and II (implemented between 2008 and 2018) using a combination of geospatial remotely sensed and project monitoring data. A counterfactual was established by matching pixels located in treated watersheds that would have similar trends in potential outcome variables with pixels in nontreated microwatersheds located within a 10-kilometer band of the respective treated watersheds. A difference-in-differences estimation strategy was then applied on the matched sample to identify the causal impact of the programs on vegetation and water indexes. Because of project monitoring data availability, the study focuses only on three regional states: Amhara, Oromia, and Tigray. The empirical results point toward positive impacts of the programs on the selected biophysical indicators: the Normalized Difference Vegetation Index, the Enhanced Vegetation Index, and the Land Surface Water Index. For more details, see the Ethiopia Sustainable Land Management Project Performance Assessment Report (World Bank 2020).

» In Niger, IEG employed a multidisciplinary approach using layered data collection methods to assess the benefits of World Bank–financed land restoration efforts in the Sahel. It mapped land use change over time with Earth observation technology and partnered with Grinnell College to acquire geographical information system expertise. The team used Stata's Reclink tool to code and process almost 5,000 project activities, which were mapped across the country using ArcGIS Pro software. This enabled the selection of field assessment sites with higher concentrations of relevant project activities (that is, a mix of environmental community-based investments). Once in the field, IEG operated drones in select sites to obtain real-time data of land use activities. The team also conducted structured individual and group interviews with federal and municipal authorities, technical agents, and project staff to gather their feedback. Deep-dive ethnographic interviews of a stratified sample of land users were also conducted to test assumptions and report

on distributional benefits between landowners and nonlandowners, men and women (married and abandoned), elders and youth, ethnic groups, and migrants. This was complemented with photography to triangulate data points, reinforce the validity of the findings, and facilitate compelling dissemination of the findings. For more details, see the Niger Community Action Program Phase I and II Project Performance Assessment Report (World Bank 2021).

» In Mongolia, IEG studied the World Bank's multipronged strategy to address the multidimensional vulnerabilities of rural Mongolians (most of whom are herders), which included pasture management, pastoral risk management, index-based livestock insurance, rural microfinance, and community-driven development. The assessment first conducted a literature and project document review; key informant interviews in Washington, DC; and a stakeholder mapping exercise. This was followed by key informant interviews with various national-level stakeholders in Ulaanbaatar in December 2019. Subsequently, field assessments were carried out to further explore emerging themes, implementation issues, and explanatory factors of vulnerability dynamics. Various sources of national data were used to purposively select the seven field assessment sites, which targeted areas based on (i) historic *dzud* (severe winter disasters) impact, (ii) duration of World Bank support (that is, pilot versus scale-up, (iii) agroecological zones, (iv) poverty rates, and (v) distance to main roads and *aimag* (province) centers. Field protocols were designed to collect triangulated perceptions from project-affected persons, including local government technical staff, rural residents (for example, female and male herders, young and elderly herders, larger and smaller herders, artisanal miners, *soum* [district] residents), and private sector actors (for example, bank managers, insurance brokers, salespersons, traders, processors). In-depth ethnographic interviews of a stratified sample of key stakeholders, complemented with photography, were also used to triangulate feedback. For more details, see the Mongolia Sustainable Livelihoods Program Phase I and II Project Performance Assessment Report (World Bank, forthcoming).

» In India, IEG partnered with national hydrology experts to study the complexity of groundwater governance and management challenges at the farmer, community, and state level to identify the different factors that contribute to the effectiveness of groundwater management in select states and projects supported by the World Bank. Field assessments were carried out

in two regions facing high threats of groundwater depletion: (i) western arid states (Rajasthan) and (ii) southern peninsular states (Andhra Pradesh and Telangana). In each study site, IEG interviewed agencies at multiple levels (line departments or state-nodal implementing agency, state project management unit, district and local implementing agencies), as well as village-level organizations and institutions, to triangulate information. At the local level, IEG implemented a detailed assessment through focus group discussions and key informant interviews using a semistructured approach, with participants selected purposively to represent different household groups in the villages.

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Appendix B. Case Analysis Summaries

Brazil Case Analysis: Addressing Unsustainable Land Use Patterns in the Cerrado

By Lauren Kelly, John Redwood III, Donald Sawyer, and Mariana Branco

The Cerrado—the second-largest biome in Brazil and South America—is a strategic biome for economic, ecological, and food security reasons, but it is under intense threat from soy and cattle expansion. The biome is composed of tropical savannas, woodlands, grasslands, and forests; it covers 24 percent of Brazil's land area and is home to 22 percent of the population (42.7 million). Although the Cerrado produces 30 percent of Brazil's gross domestic product, its Human Development Index is lower than the national average (CEPF 2017). Although it has the largest intact areas with indigenous lands, indigenous and traditional communities (including those of descendants of enslaved Africans [*quilombolas* or *maroons*]) are under intense pressure from crop and cattle expansion. The Cerrado is responsible for more than half of Brazil's soybean production and 33 percent of the national herd. According to the International Panel on Biodiversity and Ecosystem Services, 45 percent of the Cerrado has been cleared by anthropogenic means, and widescale deforestation is projected to occur by 2030 due to the expansion of agriculture into the frontier. Mechanized agribusiness in the Cerrado has created many new jobs, but research shows that the rapid mechanization of Brazilian agribusiness has resulted in higher pay but less employment. Despite these challenges, the Cerrado has been largely neglected by donors (particularly compared with the Amazon).

The Brazil Investment Plan (BIP)—financed by the government of Brazil, the World Bank, and other donors—includes a series of investments designed to promote sustainable land use and forest management in the Cerrado biome

and to contribute toward reducing pressure on the remaining forests, reducing emissions, and increasing carbon sequestration (figure B.1). The BIP was developed by Brazil to help it coordinate investments designed to help fulfill its nationally determined contributions to the United Nations Framework Convention on Climate Change. This commitment also provides the framework for the World Bank Group's approach in the Cerrado biome. More concretely, this approach is supported by World Bank–managed resources from the Forest Investment Program (FIP), one of several climate investment funds, which was approved in 2012 and involves $90 million of total funding. Independent Evaluation Group (IEG) case analysis covers those investments intended to increase the number of hectares of land put under sustainable land management (SLM), mapped to the BIP's theme 1 (figure B.1).

Figure B.1. Brazil Investment Plan

Sources: Independent Evaluation Group; World Bank 2017b.

Note: FIP = Forest Investment Program; IBRD = International Bank for Reconstruction and Development; IDB = Inter-American Development Bank; SCF = Strategic Climate Fund.

The BIP demonstrates the positive potential of using a combination of discounted loans and technical assistance to achieve climate-friendly agricultural practices on large farms, but the potential for the use of this approach on small farms is limited. The Sustainable Production in Areas Previously Converted to Agriculture Use Project, known as FIP-ABC (Agricultura de Baixo Carbono [Low-Carbon Agriculture]; 2015–20) helped the Brazilian government and farmers put 312,757 hectares of degraded farmland under

climate-friendly natural resource management practices (for example, low tillage, planted pasture, agroforestry). It did this by providing discounted loans and on-farm demonstrations of climate-friendly agricultural practices, which led to increased farm profitability. However, the impacts are dispersed from an ecological perspective: the project did not target critical watersheds, since participation was achieved through self-selection. The new Integrated Landscapes Management project (under implementation) has sought to correct for this by operating at the watershed level to enhance the potential for demonstration effects and to enlarge the environmental footprint. Although improved, the program still carries the risk that successful farmers will expand their farms by deforesting neighboring lands. Because deforesting is more expensive than recovering degraded land, enhanced incentives could include a credit line for farmers to purchase and recover degraded land.

Climate-friendly agricultural programs financed with climate investment trust funds are not designed to address resource-related vulnerability issues. The FIP-ABC and the Integrated Landscapes Management project are designed to maximize emission reductions by promoting climate-friendly agricultural practices on large and medium-size farms in the Cerrado. This approach of targeting large farms is relevant for efforts aimed at large-scale climate mitigation goals, but not for the promotion of reduced degradation and decreased farmer vulnerability on small or family farms. Family and small farms (fewer than 20 hectares) represent 80 percent of all farms in the Cerrado. These farms and the families that run them did not benefit economically from the FIP-ABC. Interviews indicated that this lack of an inclusive approach was associated with the terms of the concessional finance (for example, carbon finance provided by the FIP) combined with the International Bank for Reconstruction and Development loans in Brazil's wealthier states. However, unless local communities receive support, the tendency toward greater concentration of land in large farms is likely to remain, accelerating the rate of land use change and generating negative impacts on water and food security and on community welfare.

In Brazil, the World Bank helped evolve the design of its climate investments to include a gender lens. The Integrated Landscapes Management project, which scaled SLM efforts demonstrated under FIP-ABC, introduced a gender-sensitive approach that aims to achieve 30 percent female participation.

According to the World Bank, the fault lies with the instrument: the FIP used to finance the BIP does not include gender or other social inclusion aims. The World Bank integrated the gender lens into the wider expanded program in line with its own social inclusion standards.

There are many examples of World Bank–financed projects in Brazil that are targeting smallholders and producers and promoting environmental sustainability, but these are hard to replicate in the Cerrado because of political economy challenges. At the federal level, it is difficult to achieve lending for environmental restoration because of the availability of concessional finance. It is possible at the state level, but the states that are within the heart of the Cerrado, including those areas that now hold the remaining uncleared portions in the north, are not traditional clients of the World Bank. Although there have been moments of political opportunity, these have been short-lived, according to the World Bank. These financing challenges identified in the Cerrado are applicable to similar situations in World Bank and International Bank for Reconstruction and Development client countries (for example, wealthy states with environmental and resource-related vulnerability challenges).

Ethiopia Case Analysis: Addressing Land Degradation and Vulnerability in High-Pressure Productive Landscapes

By Bekele A. Shiferaw and Ebru Karamete

High-pressure productive landscapes include areas where land scarcity and demographic and economic pressures lead to agricultural intensification, degradation of production systems, and vulnerability of resource-dependent people. Such areas of high pressure include moist tropical highlands, mountain regions, and midaltitude areas of eastern and southern Africa, South Asia, Latin America, and China, which are often densely populated with smallholder crop and livestock farmers and poor rural households. In these areas, unsustainable agricultural practices result in soil erosion, soil fertility depletion, and loss of vegetation cover and biomass that together accelerate land degradation, reduce land productivity, and increase food security. The

Ethiopian highlands, selected for the case analysis, cover about 50 percent of the country and are home to 90 and 75 percent of the human and livestock populations, respectively; this area is extensively degraded from intensive and unsustainable agricultural production due to demographic and economic pressures. The crop and livestock farmers and rural poor people that depend on this land suffer from land scarcity, fragmentation, and extensive soil erosion, which reduces the productivity of predominantly rain-fed farming.

Sustainable Land Management

Mainstream Approach without Social Protection

The Sustainable Land Management Project (SLMP) in Ethiopia (2008–18) demonstrates how the use of participatory watershed and landscape management approaches applied in critically productive watersheds can yield positive restoration results. Implemented through a series of two operations (SLMP I and SLMP II), SLMP helped rehabilitate critically degraded watersheds within intensively cultivated landscapes. It did this by implementing several integrated activities at the watershed level that are often used in watershed and landscape management projects financed by the World Bank. These include participatory land use planning, including area closures; soil and water conservation techniques; afforestation or reforestation; agroforestry; small-scale irrigation; land registration and certification to improve security of tenure; and support for crop and livestock production and climate-smart agriculture. IEG used geospatial analysis and standardized ratings to assess the performance of the watershed management activities, including area closures.

IEG's analysis of geospatial data in over 500 high-pressure and intensively cultivated SLMP watersheds (in Amhara, Oromia, and Tigray regions) showed statistically significant positive effects on land restoration compared with controls. Using three remote-sensing land restoration metrics, the statistical analysis found that SLM practices, including watershed management and area closures, significantly reduced land degradation (table B.1). Expanded IEG analysis in 22 microwatersheds supported by SLMP also showed that the quality of the land and restoration efforts was achieved at a substantial level or higher (for example, in terms of restoration quality) on both communally

held land and farmland (table B.2). On communal land, about half of the cases achieved the substantial level and about one-third of the cases achieved the high level in reducing land degradation. On individual farmlands, about 73 percent achieved substantial reduction, but only 9 percent achieved high reduction. This expanded analysis also showed that results were notably higher in low-moisture environments, which is consistent with the literature.

Table B.1. Relative Land Restoration Impacts of Sustainable Land Management Interventions in Ethiopia (Percent increase over controls)

Seasons	Increase in Vegetation Cover[a]	Increase in Vegetation Cover and Quality[b]	Soil and Land Capacity to Withstand Water Stress[c]
Dry season (*Bega*)	2.70	3.78	5.51
Short rainy season (*Belg*)	3.42	4.86	11.73
Main rainy season (*Kiremt*)	2.26	2.83	3.43

Source: Independent Evaluation Group difference-in-differences analysis of remote-sensed pixel-level geospatial Sustainable Land Management Project II data.
a. Measured using the Normalized Difference Vegetation Index.
b. Measured using the Enhanced Vegetation Index.
c. Measured using the Land Surface Water Index.

Table B.2. Independent Evaluation Group Rating of Impacts on Land Restoration in Ethiopia's Sustainable Land Management Project Microwatersheds

Agroecological Zones	Communal Land Rating (percent)			Individual Farmland Rating (percent)			All Cases (no.)
	Modest	Substantial	High	Modest	Substantial	High	
Dry highlands/ midaltitude	0	57	43	14	86	0	7
Moist highlands	22	44	33	22	56	22	9
Moist midaltitude	33	50	17	17	83	0	6
Total (average)	18	50	32	18	73	9	22

Source: Independent Evaluation Group analysis of 22 cases under from Sustainable Land Management Project I and II microwatersheds.

The field-level case study also showed that SLMP microwatersheds displayed significant progress in improving land productivity. The IEG case analysis showed that on communal land, about 68 percent and 23 percent of the cases had substantial and high levels of reduction in land degradation, respectively. On individual farmland, 18 percent of the cases had modest performance, but 73 percent and 9 percent achieved substantial and high levels, respectively. As in reducing land degradation, the productivity improvements were higher in the drier areas (table B.3).

Table B.3. Independent Evaluation Group Rating of Impacts in Increasing Land Productivity in Ethiopia's Sustainable Land Management Project Microwatersheds

Agroecological Zones	Communal Land Rating (percent)			Individual Farmland Rating (percent)			All Cases (no.)
	Modest	Substantial	High	Modest	Substantial	High	
Dry highlands/ midaltitude	0	72	28	14	86	0	7
Moist highlands	11	67	22	22	78	0	9
Moist midaltitude	17	67	17	17	50	33	6
Total	9	68	23	18	73	9	22

Source: Independent Evaluation Group.

In SLMP-treated watersheds, resource users were more likely to report reduced vulnerability if they had received increased and improved water access as part of the land restoration effort. Although water technologies introduced by SLMP varied depending on the type of water resource in the area and the level of moisture retention, the watershed management interventions improved the availability of and access to water within treated landscapes, including in drought-prone areas. Using different collection structures, such as mechanized pumps, diversion of surface water or springs, and harvesting of runoff water, 803 small-scale irrigation plans were implemented. The increased access to agricultural inputs also enhanced crop and livestock productivity. However, from a vulnerability perspective, access to small-scale irrigation remains limited. IEG observed that, although 14 of the 22 SLMP microwatersheds visited have been engaged in developing small-

scale irrigation, fewer than 5 percent of the households benefited from the very limited infrastructure.

Further analysis using qualitative comparative analysis showed that effectiveness in reducing land degradation depends on the appropriateness of the management technology, enforcement of community bylaws for governance of area closures, and local institutional capacity at the *woreda* (district) level. The qualitative comparative analysis showed that this was the main pathway for reducing land degradation on communal lands. Adequacy of technology is a necessary factor: success cannot be assured without implementing the right resource management solutions for addressing land degradation in different agroecologies. On private farmland, two main pathways led to positive outcomes: (i) adequacy of the technology combined with high local institutional capacity, and (ii) enforcement of bylaws for governance of area closures combined with high local institutional capacity. This showed that, unlike controlling degradation on communal lands, controlling degradation on individual farmland is possible when farmers are able to use the right technologies and the woreda has the capacity to provide technical support for implementation of SLM activities.

Land productivity growth and flow of up-front economic and livelihood benefits from land restoration underpin the motivation of land users to maintain SLM practices. The qualitative comparative analysis showed two main pathways leading to increased land productivity. The first pathway includes adequacy of farmland management practices ("technology factor") combined with road accessibility of the watershed and local institutional capacity at woreda level. The second pathway includes access to small-scale irrigation combined with road accessibility and institutional capacity at the woreda level. The choice of inappropriate technologies is a key factor for failure to increase productivity in the drier areas, especially when this is associated with either low institutional capacity or lack of access to small-scale irrigation.

Area closures facilitate restoration of degraded lands but require increased investments for alternative supply of forages to convince the local communities to forgo livestock grazing and other benefits during the process of natural regeneration. As in other similar programs in Africa (Angassa 2016; Jeddi and Chaieb 2010; Yayneshet, Eik, and Moe 2009) area closures facilitate

restoration of degraded landscapes. However, area closures are difficult to implement using common-pool resources when the communities lack alternative sources of livelihoods or are not compensated for their loss. Where communal pastures and alternative sources of fodder are limited, communities faced difficulties in enforcing bylaws for area closures. The communities in Ethiopia, however, mitigated the negative effects of area closures by rotating the areas designated for closure to allow for partial continued access. Once established, regulated harvesting of biomass from area closures provided otherwise scarce fodder for livestock, strengthening incentives for land restoration and maintenance of the SLM infrastructure.

Social Protection Approach

The Productive Safety Nets Program (PSNP; 2005–20) in Ethiopia provided food and cash for work (including land remediation) to food-insecure households in chronically food-insecure woredas, but evidence that these activities support improved and sustainable natural resource use is lacking. Through its four phases, PSNP supported watershed management through large public works. Evidence shows positive effects in reducing the food insecurity of vulnerable households (though it did not reduce chronic undernutrition or stunted growth of children), building community assets, and improving access to social services (Berhane, Hoddinott, and Kumar 2017; Desalegn and Ali 2018). However, the expected changes in land restoration and productivity were rarely measured and reported.

Although PSNP did not measure resource-related outcomes, existing evidence indicates that its effectiveness in reducing degradation and improving productivity is modest. IEG's case study of eight PSNP microwatersheds using a standardized rating protocol showed that performance in reducing degradation and increasing land productivity was significantly lower than in SLMP. Only about 43 percent of the cases achieved substantial or high levels on communal land and only 25 percent on individual farmland (table B.4). With few exceptions, the effectiveness of public works in reducing land degradation to enhance livelihoods was challenged by weak implementation, technology choice, the inability to demonstrate timely benefits to land users, and labor shortages. The analysis suggests that more attention should be paid to the quality of land remediation in Social Protection projects with SLM components.

Table B.4. Independent Evaluation Group Rating of Impacts on Land Restoration and Land Productivity in Ethiopia's Productive Safety Nets Program Microwatersheds

Impact	Communal Land			Individual Farmland				All Cases (no.)
	Rating (percent)			Rating (percent)				
	Modest	Substantial	High	Negligible	Modest	Substantial	High	
Land restoration	57.1	28.6	14.3	50.0	25.0	12.5	12.5	8
Land productivity	57.1	28.6	14.3	50.0	25.0	12.5	12.5	8

Source: Independent Evaluation Group.

Carbon Payments Approach

Improvements in land restoration are often not sufficient to reduce vulnerability of resource-dependent communities in the short term, but this can be enhanced using environmental payments. The World Bank–supported Humbo Assisted Natural Regeneration Project (2007–18) in Ethiopia restored a degraded hillside and was successful in delivering carbon, economic, and social cobenefits that helped improve well-being and diversify the livelihoods of the resource-dependent communities. Using farmer-managed natural regeneration, the project helped restore 2,728 hectares of natural forest, allowing for the sequestration of some 338,000 tons of carbon credits. The BioCarbon Fund subsequently bought half the credits and delivered $826,000 in payments to participating local communities. To better protect reforested hillsides, the project also distributed tree seedlings that could be planted on community properties and supported diversified economic activities (for example, beekeeping, flour milling, livestock fattening). Improved land management also increased fodder for livestock. A key factor in achieving distributional benefits was the assignment of land use rights to participating communities that resided around the hillside, to which training and technical support was provided by the government and a nongovernmental organization (World Vision Ethiopia/Australia) to support land restoration and diversified livelihoods. After the BioCarbon project, Humbo is transitioning to the gold standard system to access voluntary carbon markets for selling carbon credits, critical for maintaining its forest cover.

For further information, see the Ethiopia SLMP I and II Project Performance Assessment Report (World Bank 2020b), which includes additional details on the Ethiopia case analysis methodology and findings.

India Case Analysis: Effectiveness of the World Bank's Support to Groundwater Management

By Bekele A. Shiferaw, Ratna Reddy, and Bharat Sharma

India faces high levels of water stress. India has 16 percent of the world's population but only 4 percent of its freshwater resources.[1] The country

ranks first in Asia and 13th in the world in terms of the imbalance between its needs for water and the available supply.[2] The extraction of groundwater accelerated significantly after an exponential increase in the number of privately owned bore wells for irrigation development. Since the 1960s, the number of bore wells has increased from 1 million to 20 million, making India the world's largest user of groundwater (Government of India 2017). Groundwater is now serving 85 percent of domestic water supply in rural areas, 45 percent in urban areas, and more than 60 percent of irrigated agriculture (Central Ground Water Board 2019). Because groundwater abstraction outpaces natural replenishment, accessible aquifers are reaching unsustainable levels of exploitation across the country. Although groundwater availability and extraction are highly uneven across India, they are highly unsustainable in several states such as Andhra Pradesh, Gujarat, Haryana, Punjab, Rajasthan, Tamil Nadu, and Telangana (World Bank 2017c). The scarcity and depletion of groundwater is exacerbated by the pollution of groundwater sources caused by poor aquifer management, which allows the infiltration of untreated wastewater from cities, pesticides and nitrates from agriculture, and effluents from industry. Furthermore, climatic change and erratic rainfall are affecting the hydrological cycle and putting additional stress on groundwater resources.

IEG's case study on groundwater management in India sought to identify the factors that contribute to the effectiveness of groundwater management in selected projects supported by the World Bank. The study strove to understand the complexity of groundwater governance and management challenges at the farmer, community, and state levels. IEG assessed World Bank–supported groundwater management activities in two regions facing the highest threats for depletion of groundwater resources: western arid states (Rajasthan) and southern peninsular states (Andhra Pradesh and Telangana). The assessed projects were the Rajasthan Agricultural Competitiveness Project (March 2012–June 2020), the Water Sector Improvement Project (June 2010–July 2018), and the Community-Based Tank Management Project (April 2007–July 2016).

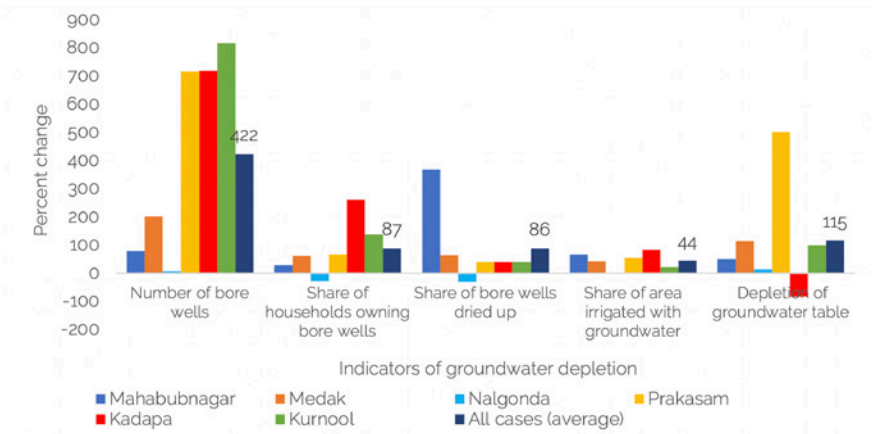
Watershed Management

The World Bank's first-generation watershed management programs emphasized supply-side measures to address groundwater depletion but did not promote integrated demand-side approaches. Although the support to watershed management was quite effective in restoring degraded landscapes and recharging aquifers, it did not lead to sustainable management of groundwater in many areas. In Andhra Pradesh and Telangana, watershed management programs and dual-purpose tank rehabilitation activities that contribute to recharging aquifers and ease irrigation water shortages were implemented, but the overall extraction of groundwater continued to expand, mainly through drilling of new and deeper bore wells to tap declining aquifers. An earlier IEG study also found that when farmers realized that surface water harvesting and recharging activities had increased the availability of groundwater, farmers drilled more bore wells to tap the unregulated open-access resource, reversing the positive impacts of watershed and tank rehabilitation activities and further depleting groundwater (World Bank 2011a).

Groundwater depletion is accelerated by unregulated drilling of bore wells or expansion in irrigated area. Despite the World Bank project interventions, the groundwater table declined (depth to the water table increased) in all cases assessed by IEG in the states of Andhra Pradesh and Telangana, with the exception of Kadapa and Nalgonda (figure B.2). This can also be seen from the increase in the percentage of bore wells that have dried up. The main drivers for this depletion include the drilling of bore wells, leading to an increase in the share of households owning bore wells (except in Nalgonda villages), and the share of the area irrigated with groundwater. The level of depletion is highest in the Prakasam villages case, where the density of bore wells has increased from 40 (before project) to over 400 (after the project); the Medak case, where the number of bore wells increased from 100 to 300; and the Kurnool case, where the well density increased from 30 in 2007 to 275. This was further exacerbated by increased dependence on groundwater due to low rainfall and poor inflows into the tanks. In Kadapa, the effect was mitigated through transfer of canal waters to fill the tanks, which contributed to recharging of the aquifers and improved the groundwater table by 83 percent. In Nalgonda, the water table has remained stable mainly because

of the participatory groundwater management (PGM) approach, which contributed to regulating demand.

Figure B.2. Groundwater Depletion in Select Villages of WSIP or CBTMP Districts in Andhra Pradesh and Telangana, 2007–19 (Percent change, before and after projects)



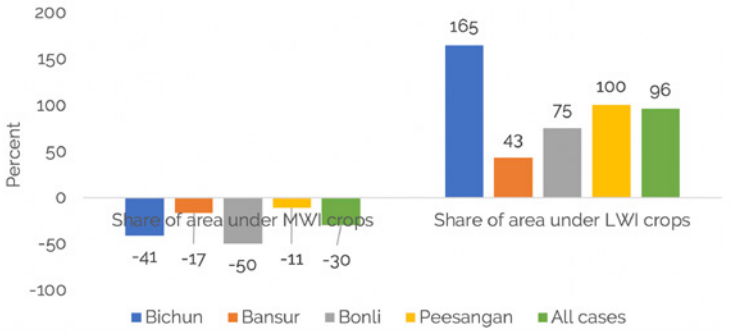
Source: Independent Evaluation Group.

Note: CBTMP = Community-Based Tank Management Project; WSIP = Water Sector Improvement Project.

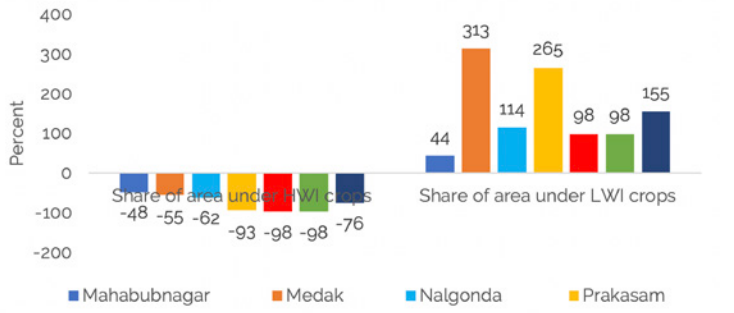
The uptake of demand-side interventions by groundwater users can ensure groundwater security and reduce vulnerability. IEG case studies also show that groundwater-scarce states are increasingly supporting demand-side water-saving practices, including growing less water-intensive crops and using microirrigation systems (small-scale drip and sprinkler irrigation systems; see figure B.3 for case study villages in Rajasthan). The area under more water-intensive crops has on average declined by 30 percent and 76 percent in the case study villages in Rajasthan and southern states, respectively. Similarly, the area under less water-intensive crops has increased in the case study villages by 96–155 percent. Although these changes alone will not guarantee groundwater sustainability, these practices—encouraged through government subsidies—have started to take off significantly. However, there has been no similar uptake of practices for replenishing declining aquifers, despite some ongoing efforts for watershed management and rehabilitation of tanks (reservoirs), which remain underfunded and lacking local ownership because the communities see the installation and maintenance of these communal assets as the responsibility of the government.

Figure B.3. Shift in Cropping Systems in Select RACP Villages, Rajasthan, and WSIP or CBTMP Districts, in Andhra and Pradesh Telangana, 2012–19
(Percent change, before and after the project)

a. Rajasthan case study villages



b. Andhra Pradesh and Telangana case study villages



Source: Independent Evaluation Group.

Note: CBTMP = Community-Based Tank Management Project; HWI = high water intensive; LWI = less water intensive; MWI = more water intensive; RACP = Rajasthan Agricultural Competitiveness Project; WSIP = Water Sector Improvement Project.

Recent interventions aim to rebalance the approach to groundwater management by integrating demand-side and supply-side measures. This is reflected in the design of the Atal Bhujal Yojana—National Groundwater Management Improvement Program, the World Bank's flagship program on groundwater governance and management in India. The program, structured as a Program-for-Results, aims to introduce bottom-up planning of groundwater interventions through community-led approaches and implement PGM, including both supply-side (for example, management practices that recharge aquifers) and demand-side measures (for example, use of surface water, to reduce pressure, and less water-intensive crops and microirriga-

tion systems that reduce water demand). It is anchored in community-led planning and groundwater management in the seven participating states to improve planning and implementation of investments and groundwater management actions aimed at arresting the decline of groundwater levels and strengthening groundwater institutions. However, the program does not address complex political economy issues or policy reforms, such as the removal of power subsidies that exacerbate depletion.

Groundwater Regulations and Policies

Strong regulatory action is key to limiting groundwater use, without which other management approaches will not be effective at reversing depletion. The effectiveness of any nonregulatory interventions can be undermined by failure to regulate the drilling of new wells and expansion of irrigated areas. When the water savings created by demand-side measures like microirrigation systems or the water increases created by supply-side measures like recharging aquifers are more than offset by expanding irrigated areas or drilling additional wells, total demand increases, leading to further depletion. Analysis of long-term monitoring data (2005–19) in the Rajasthan Agricultural Competitiveness Project villages showed that the groundwater level was declining in almost all villages. This was confirmed during IEG field visits, although the communities felt that the interventions had slowed the rate of decline.

Regulatory controls on the volume of groundwater extraction are difficult to monitor and enforce for large numbers of distributed small-scale groundwater users. The government of India restricts further development of groundwater in water-stressed states through "notification" of highly overexploited geographical blocks by the Central Ground Water Board of India. In notified blocks, regulatory restrictions are put in place so that no new groundwater structures will be constructed in the area (except those for drinking water). This also regulates access to investment financing and new electricity connections for groundwater pumps. However, only 162 blocks representing about 14 percent of the overexploited blocks in the country are currently notified, of which 22 percent are in Rajasthan and about 5 percent jointly in Andhra Pradesh and Telangana. In Rajasthan, only 36 out of 71 overexploited blocks (51 percent) are notified. In Andhra Pradesh and Telangana states,

all the overexploited blocks in the nonsafe river basins are notified (Government of Andhra Pradesh 2019; Government of Telangana and Ministry of Water Resources 2019), but areas under critical and semicritical categories remain unregulated. In addition, some states such as Haryana and Punjab restrict planting dates for rice to reduce evaporative losses from early sowing.

Power subsidies for pumping groundwater accelerate the depletion of aquifers in stressed areas. Several states affected by depletion of groundwater in India provide free or heavily subsidized power for pumping groundwater for irrigated agriculture. This creates unintended or perverse incentives that enable overexploitation and depletion of scarce groundwater resources (box B.1). The World Bank has called for deep sector reforms for sustainable groundwater management through incremental approaches (World Bank 2010, 2018c). Examples include support for feeder segregation (to separate the supply of subsidized power for agriculture from domestic and other commercial or industrial use in rural areas) and solar pumps (while buying back spare pumping capacity). Recently approved World Bank programs (for example, the Atal Bhujal Yojana—National Groundwater Management Improvement Program) also aim to install metering, register pumps, and increase data transparency on both water and energy as prerequisites for subsidy reforms (World Bank 2018c).

Box B.1. Solar Pumps in India

Solar pumps for groundwater extraction and electricity subsidies for pumping groundwater can dramatically reduce the cost of irrigation for smallholder farmers in the short run, but in the absence of appropriate regulations, they can also provide incentives for aquifer depletion in the long run. Solar pumps convert energy from the sun into power to help pump groundwater at low or minimal cost for use in irrigation. The World Bank supported the government of Rajasthan to supply subsidized solar pumps for agriculture through the Rajasthan Agricultural Competitiveness Project, which seeks to test whether farmers can augment their income by selling excess power to the main grid. These solar pump subsidies in Rajasthan (at a rate of 50–90 percent), similar to other states in India, can accelerate depletion through secondary market distortions. Independent Evaluation Group case study interviews in Rajasthan found that farmers who received subsidies for solar pumps were also receiving subsidies for electricity

(continued)

Box B.1. Solar Pumps in India

for irrigation. As a result, some farmers in Rajasthan were found to be using their solar pumps to extract and sell groundwater at about half the normal price for water. Although this is partly due to the solar power not yet being connected to the main grid, it is possible that the relative prices favor selling cheaply extracted groundwater rather than selling surplus solar power to the main grid. Solar pumps, even without such subsidies, can lower the cost of groundwater use for irrigation, contribute to overexploitation of groundwater resources, and lead to farmer vulnerability over the long term. Further experimentation is needed to identify how to develop the market for surplus solar power to disincentivize the overextraction and sale of cheap groundwater. The transition to solar pumps should also reduce the heavy financial burden on the states, which supply subsidized electricity for irrigation while generating additional income for farmers through sale of surplus solar power to the main grid.

Source: Independent Evaluation Group.

Local Institutions for Participatory Governance

Strengthening the role of community rights in groundwater governance can improve groundwater management. Several projects in peninsular India, where hard-rock aquifers with more dispersed and distinct hydrological units prevail, implemented the PGM approach, which aims to empower communities in a defined aquifer area by providing knowledge and motivation for social regulation and implementing coordinated actions. IEG case studies on groundwater management in villages supported by two World Bank projects (Community-Based Tank Management Project and Water Sector Improvement Project) in the states of Andhra Pradesh and Telangana show that the PGM approach was effective in (i) building capacity and raising community awareness to incentivize uptake of good practices; (ii) implementing participatory hydrology monitoring; (iii) applying crop-water budgeting; (iv) using tank rehabilitation and hydroengineering approaches to increase recharge; and (v) encouraging water sharing to reduce drilling of new wells. This approach did not work, however, when supply-side interventions failed to replenish groundwater or when tanks failed to store water due to recur-

rent droughts, leading to increased overexploitation. Sustaining high levels of collective action under PGM also requires strong local institutions. Other evidence shows that the approach is unlikely to work in areas with extensive alluvial aquifers (for example, northwest India) that require coordination among large numbers of users (Blakeslee, Fishman, and Srinivasan 2018; Fishman et al. 2011).

World Bank interventions support local institutional capacity for groundwater governance, but such institutions are often not viable after the end of the project. In India, water user associations and groundwater management committees are the main local institutions involved. A groundwater management committee is an informal group created through World Bank–supported projects to facilitate PGM. Water user associations are formal institutions and have a wider mandate to manage irrigation systems (surface and groundwater), with budget allocations for maintaining the systems and collecting user charges from water users. Some states, like Andhra Pradesh, support the water user associations through allocation of funds and conducting elections, but states like Telangana do not provide such support, which limits the water user associations' role in managing irrigation systems. IEG case studies found that the informal groups become dormant and dysfunctional once projects close. The key challenge for groundwater management is how the formal institutions can be revitalized and linked with the informal groups for continued engagement during the postproject phase.

Groundwater extraction, which allows rural families to reduce short-term vulnerability, may incur trade-offs and increase the risk of depletion in the long term. Increased access to groundwater resources and extraction even when the resource is being depleted allows households to increase agricultural production in the short term. Many households owning wells indicated that their vulnerability is lower after the implementation of World Bank projects, partly because of income growth and diversification and buffers provided by social safety nets. Moreover, in water-scarce areas, drilling new wells is often seen as a means of reducing poverty and vulnerability. However, without sufficient regulation or replenishment of aquifers, the increased access to and use of groundwater by smallholder farmers could lead to declining water tables and increasing water scarcity, which escalates long-term vulnerability.

In the absence of regulation, overpumping by wealthy farmers can also exacerbate poverty and increase groundwater disputes. Resource-poor and small-scale farmers often lack resources to drill new wells or to deepen existing ones when the water table declines. Wealthier farmers, however, can invest in new wells and further extend depth to reach into deeper aquifers. Although more evidence is needed, in the absence of regulation, this can accelerate depletion and increase inequalities in access to groundwater by resource-poor farmers—which could worsen poverty and increase water disputes in rural areas.

For more information, see the extended IEG case study summary (forthcoming) and Project Performance Assessment Reports (World Bank 2011a, 2019b, 2019c).

Mongolia Case Analysis: Addressing Rangeland Degradation and Herder Vulnerability

By Joy Kaarina Butscher, Mees Daniel van der Werf, Batbuyan Batjav, and Tungalag Ulambayar

Rangelands support the livelihoods, social traditions, and resilience of 500 million people, primarily in low-income countries, but are degrading rapidly (Godde et al. 2020). Rangelands are ecosystems dominated by grasses that are grazed by livestock and wildlife. The dual pressure of overexploitation and climate change have led to the degradation of 20 percent of global rangelands. Rangelands in drylands are particularly vulnerable, with 73 percent degraded (Steinfeld et al. 2006). Rangeland degradation increases the vulnerability of their users. The Eurasian steppe is home to over 60 million pastoralists (Keita et al. 2016). In Mongolia, up to half of the population's livelihoods depend directly or indirectly on livestock production, which accounts for 30 percent of gross domestic product (Johnsen et al. 2019).

Rural livelihoods in Mongolia face multiple interacting drivers within and across spatial scales and levels of social organization that affect environmental health and herder livelihoods and well-being. These drivers include

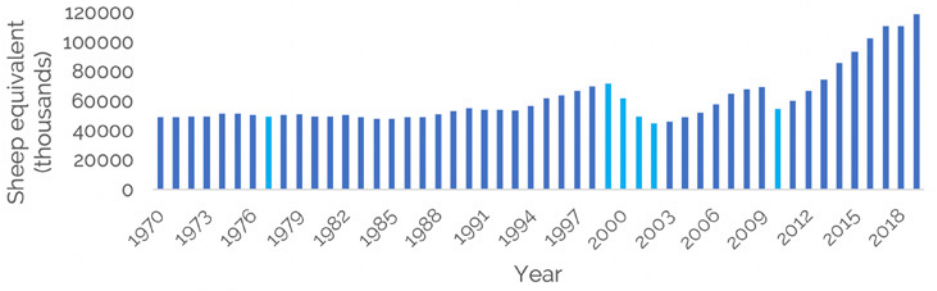
climate change, extreme weather events, drought, rangeland degradation, unpredictable forage supplies, lack of access to rural social services, national land policy, insufficient value addition, and limited markets for livestock products (Fernández-Giménez 2020). The World Bank's three-phased Sustainable Livelihoods Project (SLP; 2002–present) in Mongolia was designed to address some of these development challenges and was the focus of the Mongolia case analysis.

SLP demonstrates the challenge of addressing the degradation of common-pool resources, such as rangelands. The program used a community-based rangeland management approach to help herding communities develop mutually agreed-on rules for seasonal livestock movements to reduce pressure on pastures, while providing a layer of social and financial support. Like many projects that target herders and agropastoralists, SLP financed pasture-related infrastructure, pastoral risk management systems (for example, early warning systems, emergency planning), and subproject investment for enhanced livestock productivity and income diversification; it also supported institutional strengthening. Although programs such as SLP are effective at putting pasture management plans in place, few effectively adapt their approach to the local context of open-access rangelands, which undercuts their ability to achieve sustainable rangeland management.

SLP demonstrates the importance of addressing the institutional and market factors that drive degradation and increase herder vulnerability over time. In Mongolia, overgrazing is a leading cause of degradation, which is due in part to poor implementation and enforcement of existing regulations designed to support sound local pasture management (Fernández-Giménez and Batbuyan 2004; Upton 2012). Local governments lack the financial and technical capacity and central government support to enforce existing regulations. Thus, the burden of managing rangelands falls almost entirely on local governments and informal institutions. Although SLP supported these institutions, including by helping them to put pasture management plans in place, it did not address issues that resulted in the steady increase of livestock in Mongolia throughout the project (figure B.4). The unabated increase in the national herd has resulted in increasing pressure on pasture carrying capacity. The increase occurred because there is neither a tax on livestock nor adequate support for value addition, including through enhanced livestock

services. The unpredictable nature of markets and trade also leads herders to prioritize livestock quantity over quality, further magnifying the challenge (Brown 2020; Ichinkhorloo and Thrift 2015). These factors have all contributed to the degradation of up to 40 percent of Mongolian rangelands, and national rangeland health assessments in 2015 and 2018 show a declining trend (Densambuu et al. 2018; National Agency of Meteorology and Environment Monitoring 2015).

Figure B.4. Total Livestock Population (sheep equivalent, thousands)



Sources: Independent Evaluation Group; data from National Statistics Office of Mongolia and World Bank 2020.

Note: Light blue bars signify *dzud* years. *Dzud* is the Mongolian term for a severe winter weather disaster, during which extreme conditions inhibit foraging and lead to high livestock mortality.

In open-access rangelands, culturally sensitive, community-based land management approaches are most likely to achieve NRDV outcomes, but this requires a spatial approach and attention to social inclusion and local group governance arrangements. SLP supported pasture management practices that are congruent with the common-pool nature of pastureland in Mongolia and traditional herding cultural norms, such as negotiated pasture access, seasonal mobility, and norms of reciprocity. It also refrained from fencing, which clashes with local practices and can lead to increased vulnerability, as is the case in neighboring Inner Mongolia (box B.2). However, SLP did not apply a spatial approach in its support to organizing herders, which ultimately curtailed its ability to achieve sustainable pasture outcomes. It also did not sufficiently consider the inclusion of socially marginalized individuals and groups such as poor herders. In contrast, other donors, such as the Green Gold Ecosystem Management Program implemented by the Swiss Agency for Development and Cooperation, facilitated spatially oriented approaches and invested in the formation and governance of pasture-user groups, including by building on reciprocity norms. This helped address exclu-

sionary effects and the free-rider problem. Green Gold increased herder incomes and livestock product quality and reduced overgrazing. However, such pasture health gains are unlikely to persist without tackling the drivers of overstocking discussed earlier.

Box B.2. The Vulnerability-Inducing Effects of Fencing in Inner Mongolia

Although sharing pastures can reduce the vulnerability of herders during harsh conditions and lean times, it can also increase the vulnerability of hosting communities. Privatizing the land, or "fencing," is sometimes seen as a solution but is incongruent with local practices. In the case of the northern Chinese region of Inner Mongolia, the use of fencing resulted in increased land degradation and herder vulnerability (box 4.2). Area closures in Inner Mongolia have yielded less-than-anticipated productivity and degradation results while hindering traditional nomadic culture. Inner Mongolia resembles Mongolia in its climate, people, and mobile pastoralist culture and economy. China, with the support of the World Bank (in Inner Mongolia and Gansu 1999–2006; 2004–10), applied a development strategy based on fencing and intensifying livestock. The collective grassland was divided at the household level, fenced, and enclosed. Although legal ownership resided at the village level, herders were assigned use rights. However, research has shown that fencing has significantly limited animal and herder mobility, which is critical for maintaining rangeland and livestock health (Xu et al. 2015). Ultimately, fencing has not achieved its goal of reducing degradation, and in some instances, there has been increased degradation where restricted herder movement has led to overgrazing in overpressured pastures (Taylor 2006).

Sources: Fratkin and Mearns 2003; Li and Huntsinger 2011; Taylor 2006; Xu et al. 2015; Ying and Ruimin 2011.

SLP tested and demonstrated the important but limited vulnerability-reducing effects of livestock insurance, microfinance, and early warning. Half of the Mongolian population directly or indirectly depends on livestock for their survival; this lack of livelihood diversification puts a large share of herders at risk, particularly in the face of extreme weather, such as *dzud* (severe winter weather disaster). To mitigate risks, SLP developed an index-based livestock insurance program that helped many vulnerable herders recover from the catastrophic dzud in 2009–10. Insured households that received indemnity payments recovered

significantly faster than noninsured herders, although this difference decreased after four years, and uptake of the program is low (Bertram-Huemmer and Kraehnert 2018; box B.3). SLP also extended microfinance from urban to rural areas. Although over 70 percent of herders access loans, a number boosted by SLP, the loans have been primarily used to reinvest in livestock, thus undermining efforts to reduce vulnerability through economic diversification (National Statistics Office of Mongolia and World Bank 2020). The Livestock Early Warning System was also introduced, but it was too technically sophisticated and incompatible with national systems. Since then, an adapted warning system has been put in place, drawing on the SLP experience, and although the system is functioning, there was no evidence that IEG could draw on to assess its impacts.

Box B.3. Lessons from Mongolia's Index-Based Livestock Insurance

The Sustainable Livelihoods Program helped develop an index-based livestock insurance (IBLI) plan to reduce herder vulnerability to extreme weather events, such as dzud,[a] but its effectiveness is limited due to low uptake. IBLI uses an index of livestock mortality within a geographic unit rather than individual losses to determine payout, which reduces transaction costs and moral hazard (that is, it prevents herders from taking more risk because they are insured). IBLI helped many vulnerable herders recover from the last catastrophic dzud in 2009–10: households that received indemnity payments recovered significantly faster than noninsured herders, although this difference decreased after four years (Bertram-Huemmer and Kraehnert 2018). However, uptake of the plan—and its ability to reduce herder vulnerability—is low (7 percent of herders in 2015). This can be explained, in part, because (i) individual herder losses vary and may not be captured in the district-level mortality threshold required for payout, leading to perceptions of insufficient payout; (ii) herders are more likely to choose other traditional risk mitigation strategies, such as networks and seasonal mobility; (iii) after long periods without dzud impact and payout, interest to continue paying for insurance wanes; and (iv) aggressive marketing that was possible with project financing is too costly to continue. The system required external support to absorb the significant livestock loss of the last major dzud in 2010. Uncertainty on whether a future shock could be absorbed without renewed support undermines IBLI's sustainability.

Sources: Independent Evaluation Group; Bertram-Huemmer and Kraehnert 2018; Taylor 2016; World Bank 2016.
a. *Dzud* is the Mongolian term for a severe winter weather disaster.

For further information, see the Mongolia SLP Phase I and Phase II Project Performance Assessment Report (World Bank, forthcoming), which includes additional details on the Mongolia case analysis methodology and findings.

Niger Case Analysis: Addressing Natural Resource Degradation and Human Vulnerability in the Sahel's Drylands

By Lauren Kelly, Joy Kaarina Butscher, Leif Brottem, Christian Freymeyer, Adamou Kalilou Amadou, Manzo Rio-Rio Aminou, Omar Moumouni, and Oumou Moumouni

Dryland regions represent roughly 41 percent of the Earth's land surface and are home to more than 2 billion people. Drylands are generally defined as areas where low levels of annual precipitation and associated evapotranspiration limit plant productivity (Reid et al. 2005). Across Africa, for example, 50 percent of the continent's population lives in drylands, and 75 percent of Africa's poor (living on less than $1.25/day) live in countries where the dryland population accounts for at least 25 percent of the total population (Cervigni and Morris 2016). The Sahel dryland region, which sits just below the Sahara Desert, spans more than 5,000 kilometers and is home to 100 million inhabitants, 80 percent of whom are living below the poverty line and are dependent on natural resources.

To address land degradation across the Sahel, the World Bank supported the Sahel and West Africa Program (SAWAP) in support of the Great Green Wall from 2012 to 2019. SAWAP was a programmatic approach developed to expand sustainable land and water management in targeted landscapes and in climate-vulnerable areas in West African and Sahelian countries. It was implemented by the World Bank using $106 million of Global Environment Facility resources in addition to $1.2 billion from projects in 12 countries: Benin, Burkina Faso, Chad, Ethiopia, Ghana, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan, and Togo, and one regional project. To date, neither the SAWAP program nor the Great Green Wall have been comprehensively evaluated.[3] This evaluation uses a World Bank–commissioned review, Lessons of the SAWAP Experience, that also uses IEG's Implementation Completion

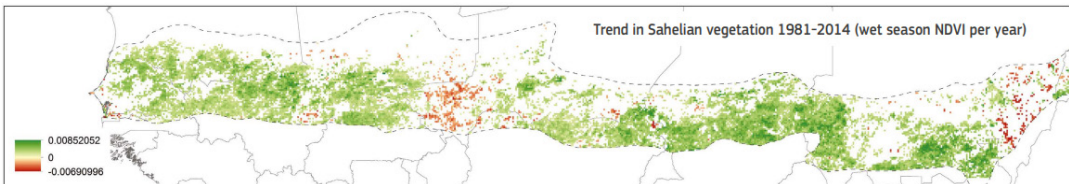
and Results Report Reviews where available (Winterbottom, Reij, and Stirrett 2020); a background paper commissioned by the evaluation on NRDV outcomes from the SAWAP program (Turner et al. 2020); and a case study and Project Performance Assessment Report in Niger, since this program has been implemented over a long enough period to permit analysis of NRDV outcomes and explanatory factors (World Bank 2021).

Although SAWAP put 1.5 million hectares of degraded land under improved management practices, little is known about the effects of the SLM technologies on vegetative cover, carbon sequestration, human vulnerability, or sustainability. A program inclusive of at least 13 projects in 12 countries, SAWAP projects included a wide range of investments that were not always directly focused on sustainable land and resource management. According to the World Bank SAWAP review (Winterbottom, Reij, and Stirrett 2020), the wide array of investment choices (including rural infrastructure, social services, and land-based interventions) diluted somewhat the focus of SAWAP on SLM, including the need to track and measure SLM interventions and to institutionalize and expand effective efforts. Moreover, SAWAP interventions were not limited to the dry areas of the targeted countries. Many projects were implemented in subhumid regions (for example, Benin, highland Ethiopia, Ghana, Nigeria, Togo), potentially shifting resources away from the most arid parts of the Sahel and limiting potential for learning about what works in hyper and semiarid dryland zones, where resource dependency and associated vulnerability are extremely high (Turner et al. 2020).

Evidence from the literature, the World Bank and IEG SAWAP reviews, and the Niger case analysis shows that the dryland technologies used by SAWAP reduce soil runoff and erosion, increase soil moisture, and contribute to food security. SAWAP implemented rainwater harvesting microcatchment techniques. Used often in drylands, including in the Sahel, the most common techniques are zaï or tassa (soil pits), demi-lunes (half-moons), and banquettes. The literature shows that the use of microcatchments in the Sahel has reduced soil erosion and degradation and, in combination with manure or inorganic fertilizers, has increased millet yields, reducing vulnerability (Turner et al. 2020; Vohland and Barry 2009; Warren, Batterbury, and Osbahr 2001). It is likely that the dryland technologies used by SAWAP contributed to these effects; however, they were not measured.

The World Bank tends to misestimate the role of rainfall affecting vegetative cover and agronomic productivity in African drylands. Misestimation of the role of rainfall variability as the key parameter affecting vegetative cover and agronomic productivity has a long history in the African drylands. First, regional increases in vegetative cover since the early 2000s in the Sahel—referred to as "the greening of the Sahel"—are largely shaped by changing rainfall regimes (map B.1). Still, promotional statements attribute Sahelian greening to the actions of farmers (GEF 2019; Great Green Wall website;[4] various World Bank SLM Implementation Completion and Results Reports) despite the fact that "greening" (increased ligneous cover) has occurred widely on sandy soils whether managed or not (Dardel et al. 2014; Herrmann, Anyamba, and Tucker 2005; Hutchinson et al. 2005; Ouedraogo et al. 2014).

Map B.1. Greening of the Sahel, 1981–2014



Source: Cherlet et al. 2018.

Note: Image shows analysis of Earth observation data over the Sahel area, depicting trends in vegetation greenness and rainfall (obtained by using NDVI time series). Increases in vegetation greenness are shown as green dots, and decreases in vegetation greenness are shown as red dots. NDVI = Normalized Difference Vegetation Index.

Many poor farmers have not used rainwater harvesting or microcatchment technologies because they perceive their net benefits as uncertain, and this is linked to the absence of evidence. The construction and maintenance costs of microcatchment rainwater harvesting techniques, used in World Bank drylands projects, can be quite high (estimated at $90 for 1 hectare). The technical assistance required, in the absence of project financing, is also often not forthcoming. Yield improvements resulting from up-front capital investments take on average two years to materialize, and this also limits uptake of microcatchments. Overall, for vulnerable food-insecure farmers, there is uncertainty about the level of benefits that can be gained over time in relation to costs. Unfortunately, the understanding of the profitability of microcatchments, mainly piloted by the World Bank, nongovernmental organizations, and other concerned entities, has been constrained by small

sample sizes, selection bias, and measurement errors (Aker 2015). Furthermore, there are few, if any, studies assessing the impact of these techniques alone on yields or profits; their impact has usually been evaluated in combination with the provision of fertilizer, an additional cost for small-scale farmers (Aker 2015).

Farmer-managed natural regeneration (FMNR), an agroforestry technique also supported by SAWAP, has helped farmers in Africa to enhance growing conditions, but a lack of experimentation undermines efforts to optimize the approach. FMNR involves the systematic regeneration and management of trees and shrubs. FMNR techniques, used in World Bank SLM projects in Africa, are appropriate for poor smallholders because of their low cost and because they are developed from indigenous practices. But evidence about transformative effects of FMNR in Africa is mainly anecdotal, with few rigorous studies available to link it to increased soil productivity and income for vulnerable resource users. There is some evidence, though not empirically derived, that suggests paying land users for FMNR, as was done in SAWAP, may negatively affect the willingness of other landowners to spontaneously take up these practices. Rather than paying, projects should support demonstration effects, since returns are enjoyed mostly on private land. Further, when the government pays for work to be done, there tends to be a perception in the Sahel that the government should also pay for maintenance (including on private lands).

The Niger Community Action Program (CAP), one of the longest-running SAWAP interventions, demonstrates not only how dryland technologies have contributed to land restoration but also the challenge of distributing and sustaining restoration-related benefits. The three-phase Niger CAP program financed many land restoration activities. The literature, satellite imagery, and IEG drone footage confirm that greening has occurred across CAP sites, although as discussed, it is not possible to draw conclusions on project attribution. Nevertheless, the project helped restore about 32,200 hectares of degraded land. But many questions remain as to the magnitude and distribution of benefits. First, there are no data available for CAP, and across the wider SAWAP program, on productivity outcomes linked to the restoration efforts. Second, the best data available come from the BioCarbon Fund—a fund used to plant acacia trees to capture carbon. These data reveal that

an adequate number of acacias survived planting but that benefits in many areas were small and hard to distribute. Third, although CAP was a phased approach, many land sites were treated only once. IEG site visits revealed that many sites treated in earlier phases needed repair but that finance was not available for maintenance. Fourth, attention was paid to setting up land tenure commissions, but experience shows that commission-backed land titles are often obtained by those outside of a community, which can create new tensions with community members who hold customary land titles. This tension was not reconciled or mitigated in the project design.

Relatedly, increasing the value of open- or pooled-access degraded grazing land without clear land use and right agreements among users can lead to predation by elites and farmer encroachment into pastoral areas. In the absence of clarity about land use rights, any distributional benefits achieved under the project may dissipate if land is later divided or sold outside of the community. Interviews with several affected stakeholders indicated that these infringements occurred across Niger, when project-supported sites that had gained value were no longer monitored by national authorities or project teams.[5] These infringements were especially egregious in sites near cities, where land values had increased significantly since the start of the land restoration activities. For example, as land prices increased over time in areas outside of Niamey, due to increased land speculation, there are examples of CAP sites being sold by traditional authorities, even though these areas were designed to benefit the communities. There was also a low level of project investment in pastoral infrastructure (just 2.5 percent of all project finance was directed toward these activities). IEG documented several instances of farmer encroachment into pastoral grazing areas that could have benefited from greater investment in demarcation and enforcement.

The Niger CAP demonstrates not only how cash for work used for the restoration of degraded land can have positive resource-related and welfare impacts in the short term but also the challenges associated with inclusion and financing maintenance in the long run. CAP's cash-for-work programs were highly sought-after by local populations because participation could increase a worker's daily wage by nearly $1.80. Male youth especially benefited from the program, backed by Nigerien policy, in part, to disincentivize external youth migration. But although the cash-for-work program had pos-

itive impacts on welfare in the short term, for male youth especially, it fell short of addressing the land scarcity issue that prevents many males from migrating in the first place. Further, there were gender-based exclusions in the program, including married Hausa women and, in some cases, widowed or abandoned women, who were not allowed to participate because of cultural norms (box B.4). Neither could transhumant communities effectively be targeted, given their tenuous connection to the local governments and land committees that put cash-for-work programs in place. Overall, there is a need to lodge these types of employment programs into the institutional framework for SLM, including by planning and budgeting for maintenance.

Box B.4. Niger's Community Action Program

The cash-for-work plan used in southern Niger to support the Community Action Program's land restoration illustrates the importance of place-based gender analytics in project design and the need for contextual analysis to ensure widescale benefits from land restoration activities. The program used a range of public work activities—including cash for work (and sometimes seeds for work)—to support land restoration and tree-planting activities. Although labor and temporary wage effects were not reported in the Implementation Completion and Results Report, the case analysis revealed that the work program was highly appreciated by multiple resource users in the project areas that participated in the programs and that it supported critical basic household needs. (For example, men reported using the cash for the purchase of seeds, and women reported buying foodstuffs and using the cash for health, nutrition, and other parenting expenses.) In some geographic areas, however, participation of married women was prohibited because of social and cultural norms and the decision-making structure in households. In the same areas, unmarried and abandoned women and Fulani female herders had higher participation rates because social norms were more permissive for them. A more differentiated and gender-sensitive design informed by place-based contextual analysis of the social conditions that affect women's participation in cash-for-work activities could have increased participation of women and reduced associated vulnerabilities.

Source: Independent Evaluation Group.

For further information, see the Niger CAP Phase I and Phase II Project Performance Assessment Report, which includes additional details on the Niger case analysis methodology and findings (World Bank 2021).

Small-Scale Fisheries Desk Study

By IEG and a team from Duke University's Nicholas Institute for Environmental Policy Solutions, which included John Virdin, director of the Ocean and Coastal Policy Program; Xavier Basurto, associate professor of sustainability science; and Colyer Woolston, research associate

Small-scale fisheries is a term that has yet to be universally defined (Smith and Basurto 2019), though it is most often defined by governments in terms of the technology used for fishing and, particularly, the size of the fishing vessel (Chuenpagdee et al. 2006). Although unable to agree on a definition, in 2003 the Food and Agriculture Organization's Working Party on Small-Scale Fisheries proposed the following general description, which remains useful:

> Small-scale fisheries can be broadly characterized as a dynamic and evolving sector employing labor intensive harvesting, processing and distribution technologies to exploit marine and inland water fishery resources. The activities of this subsector, conducted full-time or part-time, or just seasonally, are often targeted on supplying fish and fishery products to local and domestic markets, and for subsistence consumption. Export-oriented production, however, has increased in many small-scale fisheries during the last one to two decades because of greater market integration and globalization. Although typically men are engaged in fishing and women in fish processing and marketing, women are also known to engage in near shore harvesting activities and men are known to engage in fish marketing and distribution. Other ancillary activities such as net-making, boat-building, engine repair and maintenance, and so on. can provide additional fishery-related employment and income opportunities in marine and inland fishing communities. Small-scale fisheries operate at widely differing organizational levels ranging from self-employed single operators through informal microenterprises to formal sector businesses. This subsector, therefore, is not homogenous within and across

> countries and regions and attention to this fact is warranted when formulating strategies and policies for enhancing its contribution to food security and poverty alleviation. (FAO 2003)

Although the fisheries that fit this characterization are diverse, small-scale fisheries are typically considered together as one category because of these common characteristics that differentiate them from large-scale operations. Small-scale fisheries do not constitute a sector of an economy in a given context but rather are constituted by the intersection of many sectors (Basurto et al. 2017). They are most often equated with harvesting activities but are increasingly recognized to encompass pre- and postharvesting activities as well (Smith and Basurto 2019).

Using these characterizations, in 2012 the World Bank, the Food and Agriculture Organization, and WorldFish estimated that small-scale fisheries accounted for 38 percent of all fish caught in the oceans and largely existed in developing countries throughout the tropics, where they support livelihoods and food security for coastal communities (World Bank, FAO, and WorldFish 2012). Based on these estimates, small-scale fisheries would be the largest employer in the blue economy—more so than most ocean industries combined (Basurto et al. 2017; Cohen et al. 2019). However, empirical studies have suggested that these small-scale fisheries face common challenges throughout the tropics, including from the combination of impacts from climate change and overfishing and habitat loss (Barange et al. 2014; Blasiak et al. 2017), competition with large-scale fisheries, and coastal development (Basurto et al. 2017), commonly exacerbated by political marginalization (Cohen et al. 2019). In response to these challenges, countries have agreed on common principles to guide interactions with small-scale fisheries and to ensure their sustainability in the context of poverty eradication and food security (FAO 2015), as well as on a target within the 14th Sustainable Development Goal (14.b) to secure access for small-scale fisheries worldwide.

Given the link between the sustainability of marine small-scale fisheries and coastal poverty reduction, food security, and resilience, the World Bank has been one of the world's largest aid providers to small-scale fisheries (Basurto et al. 2017). To better understand how this aid has been designed and deliv-

ered and the outcomes measured, this evaluation drew on research conducted by Hamilton et al. (2020) and a desk analysis commissioned by IEG.

Most of the small-scale fisheries financing over the evaluation period (80 percent) went toward five main programs targeted to areas with high exploitation and human vulnerability. These programs were (i) Indonesia's Coral Reef Rehabilitation and Management Program (COREMAP); (ii) India's Tamil Nadu and Puducherry Coastal Disaster Risk Reduction Project (an active project approved in 2013); (iii) the Southwest Indian Ocean Fisheries Governance and Shared Growth Program (approved in 2007); (iv) Vietnam's Coastal Resources for Sustainable Development Project (2012–19); and (v) the West Africa Regional Fisheries Program (WARFP), approved in 2010. A summary of key findings from the closed programs is below.

Where there is political will, support for the implementation of comanagement plans and the clear assignment and enforcement of fishing rights to small-scale fishing communities can reduce fishing pressures and increase small-scale fishers' income. Indonesia's Second COREMAP (COREMAP 2) mostly met its aim to increase the area of coral reef ecosystems under collaborative or comanagement arrangements between stakeholders and government. Communities comanaging these areas took measures to protect coral reefs from use, with positive environmental benefits, although a lack of controls outside project areas makes attribution difficult. Additionally, average incomes rose in the project areas, with surveyed residents attributing impact to the project. Notably, the project also included microfinance (revolving funds) for communities to develop alternative activities to reef fishing, in conjunction with the establishment of fish reserves. The Vietnam Coastal Sustainable Resources for Development Project also helped establish and expand comanagement partnerships with coastal fishing communities (for over 65 percent of the provincial coastline), which contributed to a 30 percent reduction in legal violations within the local fishing communities. The project sites provided useful lessons and contributed to the amendment of the Fisheries Law (2017), which introduced fisheries comanagement and rights allocation to local communities countrywide. However, unlike COREMAP 2, natural resource outcomes related to the reduction of illegal and unsustainable harvesting practices were not measured.

Major efforts to support enhanced comanagement and governance for West African fisheries to address overexploitation and resource depletion have had mixed results. The first project in the WARFP supported fisheries management and governance interventions in Cabo Verde, Liberia, Senegal, and Sierra Leone. Outcomes to extend comanagement rights to small-scale fisheries communities were achieved in Liberia and Senegal. However, in Cabo Verde, agreements were approved by local governments but not the national government. Nor were they approved in Sierra Leone, where comanagement associations were formed but not formally authorized to manage the fisheries. A second outcome—to build government capacity to improve the monitoring and enforcement of inshore exclusion zones—was largely achieved.[6] Satellite-based monitoring systems were established for large-scale vessels, increased patrols and, in some cases, prosecution of infractions. The second project in the WARFP series supported interventions in Guinea-Bissau. It helped establish a satellite-based monitoring system and center to conduct fish stock assessments and build information systems. It also helped increase surveillance patrols, although at a frequency lower than needed. This experience demonstrated the complexities involved in institutionalizing collaborative management approaches for coastal fisheries as regional public goods.

The highest-funded project in the WARFP, in Ghana, failed to achieve its ambitious aim of reducing fishing pressure from large-scale fisheries. The large-scale fleet increased by 9 percent, inactive vessels were not deleted from the registry, and closed seasons—seasons where fishing is prohibited—were partially implemented based on the government's fisheries management plan. Although efforts to increase monitoring were successful—an observer program covering 100 percent of trawl vessels and a satellite-based monitoring system were established, along with a web-based vessel registry—low levels of prosecution and fine collection limited the vulnerability-reducing effects of these surveillance activities. Interventions to establish comanagement arrangements in the coastal fisheries also did not advance as envisaged.

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[1] The per capita water availability in 2016 was 1,437 cubic meters, which is well below the 1,700 cubic meter threshold for a country to be classified as water stressed. If current trends continue, it is estimated that per capita water availability will reach 1,139 cubic meters by 2050, close to the water scarcity threshold of 1,000 cubic meters. Some states are already facing high or very high levels of water scarcity. These include Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Rajasthan, Tamil Nadu, and Telangana, which are most affected and face water risks across sectors (World Bank 2017c).

[2] For the World Resources Institute rankings, see https://www.wri.org/applications/aqueduct/country-rankings.

[3] The World Bank commissioned a review of the Sahel and West Africa Program entitled *How to Build a Great Green Wall? Lessons from the SAWAP Experience (2012–2019)*. According to the review, it is "not a comprehensive review of the SAWAP Experience. The research for the report was conducted within a 4-week period and no travel was completed. The report is based largely on project documentation (for example, [Independent Evaluation Group] Completion Reports, [Implementation Completion and Results Report], [Implementation Status and Results Report], Aide Memoires) and limited interviews with Task Team members" (Winterbottom, Reij, and Stirrett 2020).

[4] https://www.greatgreenwall.org.

[5] Interviews at Niger Community Action Program sites were conducted with elected commune leaders, traditional authorities, former land management committee members, project regional facilitators, and various resource users present at the site (women and men). Anonymized transcripts and photographic evidence are available on request.

[6] The inshore exclusion zone is a 6 nautical mile area starting from the coast, reserved exclusively for artisanal fishers. This is different from the exclusive economic zone, which stretches for about 200 nautical miles from the coast and confers full sovereignty over the waters on a given country.

Appendix C. Evaluation Portfolio

Table C.1. Sustainable Land Management Portfolio

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P100406	Africa	AFCC2/RI-Lake Victoria Environmental Management Project Phase II	Environment, Natural Resources, and Blue Economy	2009	Closed	2018
P111330	Africa	Eastern Nile Watershed Management Project	Water	2009	Closed	2016
P118316	Africa	AFCC2/RI-Lake Victoria Environmental Management Project (Burundi and Rwanda)	Environment, Natural Resources, and Blue Economy	2011	Closed	2018
P129408	Africa	RI-Regional Pastoral Livelihoods Resilience Project	Agriculture and Food	2014	Active	2021
P152822	Africa	Development Response to Displacement Impacts Project in the HoA	Social	2016	Active	2024
P130492	Albania	Environmental Services Project	Environment, Natural Resources, and Blue Economy	2015	Active	2021
P133705	Armenia	Second Community Agriculture Resource Management and Competitiveness Project	Agriculture and Food	2014	Active	2020
P129640	Bolivia	Bolivia Climate Resilience—Integrated Basin Management	Environment, Natural Resources, and Blue Economy	2015	Active	2020

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P129961	Bosnia and Herzegovina	Sustainable Forest and Landscape Management Project	Environment, Natural Resources, and Blue Economy	2014	Closed	2019
P094233	Brazil	Espirito Santo Biodiversity and Watershed Conservation and Restoration Project	Environment, Natural Resources, and Blue Economy	2009	Closed	2015
P130682	Brazil	BR Espirito Santo Integrated Sustainable Water Management Project	Water	2014	Active	2021
P143362	Brazil	Rural Environmental Cadastre and Fire Prevention in Piauã State Project	Environment, Natural Resources, and Blue Economy	2014	Closed	2018
P143184	Brazil	Sustainable Prod. in Areas Previously Converted to Agricultural Use	Environment, Natural Resources, and Blue Economy	2015	Closed	2020
P143376	Brazil	Rural Environmental Cadastre and Fire Prevention in Bahia State Project	Environment, Natural Resources, and Blue Economy	2015	Closed	2018
P143492	Brazil	BR DGM for Indigenous People and Traditional Communities	Environment, Natural Resources, and Blue Economy	2015	Active	2021

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P150892	Brazil	ProCerrado Federal Project	Environment, Natural Resources, and Blue Economy	2015	Closed	2018
P143334	Brazil	FIP: Environmental Regularization of Rural Lands in the Cerrado of Brazil	Environment, Natural Resources, and Blue Economy	2016	Active	2022
P158000	Brazil	Amazon Sustainable Landscapes Project	Environment, Natural Resources, and Blue Economy	2018	Active	2024
P164602	Brazil	Integrated Landscape Management in the Cerrado Biome Project	Environment, Natural Resources, and Blue Economy	2019	Active	2024
P114236	Burkina Faso	Agricultural Productivity and Food Security Project	Agriculture and Food	2010	Closed	2020
P129688	Burkina Faso	Third Phase Community Based Rural Development Project	Agriculture and Food	2013	Closed	2019
P143993	Burkina Faso	FIP—Decentralized Forest and Woodland Management Project	Environment, Natural Resources, and Blue Economy	2014	Active	2021

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P127258	Burundi	Sustainable Coffee Landscape Project	Environment, Natural Resources, and Blue Economy	2013	Closed	2019
P160613	Burundi	Burundi Landscape Restoration and Resilience Project	Environment, Natural Resources, and Blue Economy	2018	Active	2023
P150631	Cambodia	KH—Land Allocation for Social and Economic Development Project II	Agriculture and Food	2016	Active	2022
P151363	Central Asia	Climate Adaptation and Mitigation Program for Aral Sea Basin CAMP4ASB	Environment, Natural Resources, and Blue Economy	2016	Active	2021
P126576	Chad	Agriculture Production Support Project	Agriculture and Food	2012	Closed	2017
P085621	Chile	Sustainable Land Management Project	Environment, Natural Resources, and Blue Economy	2013	Active	2021
P112759	China	Shandong Ecological Afforestation	Environment, Natural Resources, and Blue Economy	2010	Closed	2017
P110661	China	Sustainable Management and Biodiversity Conservation of the Lake Aibi Basin	Environment, Natural Resources, and Blue Economy	2011	Closed	2016

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P104687	Colombia	Mainstreaming Sustainable Cattle Ranching	Agriculture and Food	2010	Active	2020
P128887	Congo, Democratic Republic of	DRC Improved Forested Landscape Management Project	Environment, Natural Resources, and Blue Economy	2014	Active	2020
P163260	Dominican Republic	DR Resilient Agriculture and Integrated Water Resources Management	Agriculture and Food	2019	Active	2024
P161067	Eastern Africa	Development Response to Displacement Impacts Project (DRDIP) in the Horn of Africa	Social	2017	Active	2022
P096323	Ethiopia	Tana and Beles Integrated Water Resources Development	Water	2008	Closed	2017
P113032	Ethiopia	ET: Agricultural Growth Program	Agriculture and Food	2011	Closed	2017
P133133	Ethiopia	Sustainable Land Management Project	Environment, Natural Resources, and Blue Economy	2014	Closed	2019
P163383	Ethiopia	Ethiopia Resilient Landscapes and Livelihoods Project	Environment, Natural Resources, and Blue Economy	2019	Active	2025
P164336	Ethiopia	Lowlands Livelihood Resilience Project	Agriculture and Food	2019	Active	2026

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P170384	Ethiopia	Ethiopia Climate Action through Landscape Management Program for Results	Environment, Natural Resources, and Blue Economy	2019	Active	2025
P143914	Gabon	Gabon—Sustainable Management of Critical Wetlands Ecosystems	Environment, Natural Resources, and Blue Economy	2014	Active	2020
P098538	Ghana	Sustainable Land and Water Management	Environment, Natural Resources, and Blue Economy	2011	Active	2021
P148183	Ghana	Ghana FIP—Enhancing Natural Forest and Agroforest Landscapes Project	Environment, Natural Resources, and Blue Economy	2015	Active	2020
P162908	Haiti	Resilient Productive Landscapes in Haiti	Agriculture and Food	2018	Active	2024
P112060	India	Sustainable Rural Livelihoods and Security through Innovations in Land and Ecosystem Mgmt /Additional GEF financing to India NAIP	Agriculture and Food	2010	Closed	2014
P157836	India	Meghalaya Community-led Landscapes Management Project	Environment, Natural Resources, and Blue Economy	2018	Active	2023
P096532	Indonesia	Dam Operational Improvement and Safety	Water	2009	Active	2023

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P107798	Kenya	Kenya Agricultural Carbon Project	Agriculture and Food	2011	Closed	2018
P145559	Kenya	Coastal Region Water Security and Climate Resilience Project	Water	2015	Active	2022
P153349	Kenya	National Agricultural and Rural Inclusive Growth Project	Agriculture and Food	2017	Active	2022
P151102	Kyrgyz Republic	Integrated Forest Ecosystem Management	Environment, Natural Resources, and Blue Economy	2016	Active	2022
P165228	Lesotho	Smallholder Agriculture Development Project—II	Agriculture and Food	2019	Active	2026
P154114	Liberia	Liberia Forest Sector Project	Environment, Natural Resources, and Blue Economy	2016	Active	2020
P088887	Madagascar	Irrigation and Watershed Management Project—GEF	Agriculture and Food	2009	Closed	2014
P128831	Madagascar	Madagascar—Irrigation and Watershed Management Project—PHRD	Agriculture and Food	2014	Closed	2018
P154698	Madagascar	Sustainable Landscape Management Project	Agriculture and Food	2017	Active	2023
P105256	Malawi	Agricultural Development Programme Support Project SIL (FY08)	Agriculture and Food	2008	Closed	2017
P117617	Malawi	Malawi: Shire River Basin Management Program (Phase I) Project	Water	2012	Closed	2019
P158805	Malawi	Lower Shire Valley Landscape Project	Water	2018	Active	2024

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P129516	Mali	Natural Resources Management in a Changing Climate in Mali	Environment, Natural Resources, and Blue Economy	2014	Closed	2020
P144183	Mauritania	Mauritania Sustainable Landscape Management Project under the SAWAP	Environment, Natural Resources, and Blue Economy	2016	Active	2021
P159835	Mexico	Mexico: Sustainable Productive Landscapes Project	Agriculture and Food	2018	Active	2023
P164661	Mexico	Strengthening Entrepreneurship in Productive Forest Landscapes	Environment, Natural Resources, and Blue Economy	2018	Active	2023
P118518	Moldova	Moldova Agriculture Competitiveness Project GEF Additional Financing	Agriculture and Food	2012	Active	2021
P155968	Moldova	Climate Adaptation Project	Environment, Natural Resources, and Blue Economy	2017	Closed	2024
P125504	Mongolia	Second Sustainable Livelihoods Project Additional Financing	Urban, Resilience and Land	2011	Closed	2013
P107473	Montenegro	Montenegro Institutional Development and Agriculture Strengthening (MIDAS)	Agriculture and Food	2009	Closed	2020
P129774	Morocco	Morocco Social and Integrated Agriculture	Agriculture and Food	2013	Closed	2019

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P123201	Mozambique	Cities and Climate Change	Urban, Resilience and Land	2012	Active	2020
P149620	Mozambique	Moz Agriculture and Natural Resources Landscape Management Project	Agriculture and Food	2016	Active	2024
P160033	Mozambique	Mozambique Forest Investment Project	Environment, Natural Resources, and Blue Economy	2017	Active	2022
P147629	Myanmar	Agricultural Development Support Project	Agriculture and Food	2015	Active	2022
P158364	Nepal	NP Modernization of Rani Jamara Kulariya Irrigation Scheme—Phase 2	Water	2018	Active	2024
P102354	Niger	Community Action Program (PAC2)	Urban, Resilience and Land	2009	Closed	2013
P132306	Niger	Niger Community Action Program Phase 3	Agriculture and Food	2013	Active	2020
P145268	Niger	Niger Disaster Risk Management and Urban Development Project	Urban, Resilience and Land	2014	Active	2022
P153420	Niger	Climate Smart Agriculture Support Project	Agriculture and Food	2016	Active	2023
P109737	Nigeria	Nigeria Scaling Up Sustainable Land Management Practice, Knowledge, and Coordination	Agriculture and Food	2011	Closed	2014

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P124905	Nigeria	Nigeria Erosion and Watershed Management Project	Environment, Natural Resources, and Blue Economy	2012	Active	2021
P094335	Paraguay	Conservation of Biodiversity and Sustainable Land Management in the Atlantic Forest of Eastern Paraguay	Environment, Natural Resources, and Blue Economy	2010	Closed	2016
P163023	Peru	Integrated Forest Landscape Management Project in Atalaya, Ucayali	Environment, Natural Resources, and Blue Economy	2019	Active	2025
P096836	Philippines	Mindanao Rural Development Program (MRDP) Phase II—Natural Resource Management Component	Agriculture and Food	2010	Closed	2015
P093775	Romania	Romania Integrated Nutrient Pollution Control Project	Environment, Natural Resources, and Blue Economy	2008	Active	2022
P126440	Rwanda	Third Rural Sector Support Project	Agriculture and Food	2012	Closed	2019
P163358	Rwanda	Improving the Efficiency and Sustainability of Charcoal and Woodfuel Value Chains	Environment, Natural Resources, and Blue Economy	2018	Active	2021

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P108144	Senegal	Sustainable Land Management Project	Agriculture and Food	2010	Closed	2013
P124018	Senegal	Senegal Inclusive and Sustainable Agribusiness Development Project	Agriculture and Food	2014	Active	2021
P163742	Sri Lanka	Climate Smart Irrigated Agriculture Project	Agriculture and Food	2019	Active	2024
P129156	Sudan	Sudan Sustainable Natural Resources Management Project	Environment, Natural Resources, and Blue Economy	2014	Active	2022
P122694	Tajikistan	Environmental Land Management and Rural Livelihoods Project	Environment, Natural Resources, and Blue Economy	2013	Closed	2018
P150361	Tanzania	Second Tanzania Water Sector Support Project	Water	2017	Active	2022
P150523	Tanzania	Tanzania: Resilient Natural Resource Management for Tourism and Growth	Environment, Natural Resources, and Blue Economy	2018	Active	2024
P123922	Togo	Integrated Disaster and Land Management Project	Environment, Natural Resources, and Blue Economy	2012	Closed	2017
P086660	Tunisia	Tunisia Second Natural Resources Management Project	Agriculture and Food	2010	Closed	2018

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P151030	Tunisia	Integrated Landscapes Management in Lagging Regions Project	Environment, Natural Resources, and Blue Economy	2017	Active	2024
P109224	Uganda	Agricultural Technology and Agribusiness Advisory Services	Agriculture and Food	2010	Closed	2018
P124181	Uruguay	Sustainable Management of Natural Resources and Climate Change	Agriculture and Food	2012	Active	2022
P149610	Uzbekistan	Ferghana Valley Water Resources Management—Phase II	Water	2017	Active	2025
P153544	Vietnam	Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project	Environment, Natural Resources, and Blue Economy	2016	Active	2023
P131323	Western Africa	Senegal River Basin Climate Change Resilience Development Project	Water	2014	Active	2021
P147674	Western Africa	Regional Sahel Pastoralism Support Project	Agriculture and Food	2015	Active	2022
P153863	Western Africa	Senegal River Basin Integrated Water Resources Management Project	Water	2016	Active	2021
P144254	Zambia	Zambia COMACO Landscape Management	Agriculture and Food	2015	Closed	2020
P164764	Zambia	Transforming Landscapes for Resilience and Development in Zambia	Environment, Natural Resources, and Blue Economy	2019	Active	2026

Source: Independent Evaluation Group.

Table C.2. Social Protection with Sustainable Land Management Portfolio

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P117764	Benin	Decentralized Community Driven Services Project	Social Protection and Jobs	2012	Closed	2018
P130735	Burkina Faso	BF—Youth Employment and Skills Development	Social Protection and Jobs	2013	Closed	2020
P128534	Cameroon	Cameroon Social Safety Nets	Social Protection and Jobs	2013	Active	2023
P164830	Cameroon	Social Safety Nets for Crisis Response	Social Protection and Jobs	2018	Active	
P150754	Comoros	Comoros Social Safety Net Project	Social Protection and Jobs	2015	Active	2023
P158696	Djibouti	Djibouti Social Safety Net Second Additional Financing	Social Protection and Jobs	2016	Active	
P117440	El Salvador	Income Support and Employability Project	Social Protection and Jobs	2010	Closed	2017
P113220	Ethiopia	Productive Safety Net APL III	Social Protection and Jobs	2010	Closed	2015
P126430	Ethiopia	Productive Safety Nets Program (APL III) Additional Financing	Social Protection and Jobs	2012	Closed	
P163350	Ethiopia	Productive Safety Net 4 Project Additional Financing	Social Protection and Jobs	2017	Active	
P163438	Ethiopia	Ethiopia Rural Productive Safety Net Project	Social Protection and Jobs	2018	Active	2021
P115247	Ghana	Ghana—Social Opportunities Project	Social Protection and Jobs	2010	Closed	2018
P146923	Ghana	AF Ghana Social Opportunities Project	Social Protection and Jobs	2014	Active	
P164603	Ghana	Ghana Productive Safety Net Project	Social Protection and Jobs	2019	Active	2023
P113134	Madagascar	Madagascar—Emergency Food Security and Reconstruction Project	Social Protection and Jobs	2009	Closed	2013
P149323	Madagascar	Social Safety Net Project	Social Protection and Jobs	2016	Active	2022

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P160554	Madagascar	AF Social Safety Net Drought Response	Social Protection and Jobs	2017	Active	
P121065	Malawi	Malawi additional financing for Social Action Fund 3 APLII	Social Protection and Jobs	2010	Closed	
P131648	Malawi	Second Additional Financing for the Third Social Action Fund Project	Social Protection and Jobs	2013	Closed	
P148617	Malawi	Additional Financing Strengthening Safety Nets Systems Proj. (MASAFIV)	Social Protection and Jobs	2015	Active	
P157892	Mali	Safety Nets Project (Jigisemejiri)	Social Protection and Jobs	2017	Active	
P129524	Mozambique	MZ—Social Protection project	Social Protection and Jobs	2013	Active	2021
P113002	Nepal	Social Safety NetsProject	Social Protection and Jobs	2009	Closed	2015
P123399	Niger	Niger Safety Net Project	Social Protection and Jobs	2011	Closed	2020
P155846	Niger	Adaptive Social Safety Nets Project	Social Protection and Jobs	2016	Active	
P166602	Niger	Niger Adaptive Safety Net Project 2	Social Protection and Jobs	2019	Active	2024
P090644	Nigeria	Community and Social Development Project	Social Protection and Jobs	2009	Active	2020
P162646	Rwanda	Strengthening Social Protection Project	Social Protection and Jobs	2018	Active	2021
P143915	South Sudan	Safety Net and Skills Development	Social Protection and Jobs	2013	Closed	2019
P148349	Sudan	Sudan Social Safety Net Project	Social Protection and Jobs	2016	Active	2020
P120881	Tanzania	Second Additional Financing for TASAF II	Social Protection and Jobs	2010	Closed	
P124045	Tanzania	Tanzania Productive Social Safety Net	Social Protection and Jobs	2012	Closed	2020
P121067	Togo	Additional Financing under Community Development Project	Social Protection and Jobs	2010	Closed	
P127200	Togo	TOGO Community Development and Safety Nets Project	Social Protection and Jobs	2012	Closed	2018

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P111633	Uganda	Second Northern Uganda Social Action Fund Project (NUSAF2)	Social Protection and Jobs	2009	Closed	2016
P149965	Uganda	Third Northern Uganda Social Action Fund (NUSAF 3)	Social Protection and Jobs	2015	Active	2021
P117949	Yemen, Republic of	RY:Social Fund for Development IV	Social Protection and Jobs	2010	Closed	2017
P148474	Yemen, Republic of	Additional Financing II for SFD IV	Social Protection and Jobs	2015	Closed	
P159053	Yemen, Republic of	Yemen Emergency Crisis Response Project	Social Protection and Jobs	2017	Active	2022
P161806	Yemen, Republic of	Emergency Crisis Response Project Additional Financing	Social Protection and Jobs	2017	Active	
P163729	Yemen, Republic of	Yemen Emergency Crisis Response Project—Second Additional Financing	Social Protection and Jobs	2017	Active	

Table C.3. Groundwater Portfolio

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P127086	Africa	AFCRI—Sustainable Groundwater Management in SADC Member States	Water	2014	Active	2021
P110462	Argentina	Argentina Mining Environmental Restoration Project	Environment, Natural Resources & the Blue Economy	2009	Closed	2017
P122269	Bangladesh	BD Rural Water Supply and Sanitation Project	Water	2012	Closed	2018
P107998	Bosnia and Herzegovina	Second Solid Waste Management	Urban, Resilience and Land	2009	Closed	2018
P160911	Botswana	Emergency Water Security and Efficiency Project	Water	2017	Active	2021
P110487	Brazil	BR AF to the Ceara Integrated Water Resource Management Project	Water	2009	Closed	
P129342	Brazil	Piaui: Pillars of Growth and Social Inclusion Project	Education	2016	Active	2021
P164345	Burkina Faso	Burkina Faso Water Supply and Sanitation Program	Water	2018	Active	2024
P111163	China	Xinjiang Turfan Water Conservation Project	Water	2010	Closed	2017
P115695	China	China: Bayannaoer Water & Environment Comprehensive Management Project	Water	2011	Closed	2019
P114138	China	Water Conservation Project II	Water	2012	Closed	2017

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P126611	China	Liaoning Coastal Economic Zone Urban Infrastructure and Environmental Management Project	Urban, Resilience and Land	2013	Closed	2020
P125496	China	Integrated Modern Agriculture Development Project	Agriculture and Food	2014	Active	2021
P145533	China	China Contaminated Site Management Project	Environment, Natural Resources & the Blue Economy	2015	Active	2022
P161067	Eastern Africa	Development Response to Displacement Impacts Project (DRDIP) in the Horn of Africa	Social	2017	Active	2022
P111040	Egypt, Arab Republic of	EG—National Drainage II Add. Financing	Water	2010	Closed	
P118090	Egypt, Arab Republic of	EG—Enhanced Water Resources Management	Water	2013	Closed	2017
P130801	Egypt, Arab Republic of	Regional Coordination for Improved Water Resources Mgt. & Capacity	Water	2013	Closed	2018
P157782	Guinea	Guinea Urban Water Project	Water	2017	Active	2022
P091031	India	India—Capacity Building for Industrial Pollution Management	Environment, Natural Resources & the Blue Economy	2010	Closed	2018
P120652	India	Rajasthan Water Sector Restructuring Project—Additional Financing	Water	2010	Closed	
P105311	India	IN West Bengal Accelerated Development of Minor Irrigation	Water	2012	Closed	2020

(continued)

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P129686	India	IN—Assam Agricultural Competitiveness Project Additional Financing	Agriculture and Food	2012	Closed	
P122770	India	IN Uttar Pradesh Water Sector Restructuring Project Phase 2	Water	2014	Active	2021
P126325	India	IN Maharashtra Rural Water Supply and Sanitation Program	Water	2014	Active	2020
P132739	India	Neeranchal National Watershed Project	Agriculture and Food	2015	Closed	2020
P152698	India	National Hydrology Project	Water	2017	Active	2025
P158119	India	Atal Bhujal Yojana (Abhy)—National Groundwater Management Improvement	Water	2018	Active	2024
P160463	India	AP Integrated Irrigation & Agriculture Transformation Project	Agriculture and Food	2019	Active	2026
P162094	Iraq	Baghdad Water Supply and Sewerage Improvement Project	Water	2018	Active	2023
P086592	Kazakhstan	Second Irrigation and Drainage Improvement Project	Water	2013	Active	2022
P117635	Kenya	Kenya Water Security and Climate Resilience Project	Water	2013	Active	2023
P151660	Kenya	Addl Financing—Kenya Water Security and Climate Resilience Project	Water	2015	Active	
P112615	Kiribati	Kiribati Adaptation Program—Phase III Project (KAP III)	Urban, Resilience and Land	2012	Closed	2019
P122826	Mali	Urban Water Supply Project	Water	2014	Active	2022

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P120134	Mexico	MX DPL Adaptation to Climate Change in the Water Sector	Water	2010	Closed	2013
P117170	Middle East and North Africa	5 M—Regional Coordination on Improved Water Resources Management and Capacity Building in Cooperation with NASA	Water	2011	Closed	2015
P118109	Mongolia	MN—Mining Infrastructure Investment Supp (P118109)	Energy & Extractives	2011	Closed	2020
P122139	Montenegro	Industrial Waste Management and Cleanup Project	Environment, Natural Resources & the Blue Economy	2015	Active	2020
P127956	Morocco	MA—Inclusive Green Growth DPL	Environment, Natural Resources & the Blue Economy	2014	Closed	2015
P149747	Morocco	Morocco Inclusive Green Growth DPL2	Environment, Natural Resources & the Blue Economy	2016	Closed	2017
P154255	Pakistan	PK—Balochistan Integrated Water Resources Management & Development Project	Water	2016	Active	2023
P155226	Pakistan	Water Sector Capacity Building and Advisory Services	Water	2016	Active	
P151851	Peru	Integrated Water Resources Management in Ten Basins	Water	2017	Active	2023

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P155594	Romania	Integrated Nutrient Pollution Control Project—Additional Financing	Environment, Natural Resources & the Blue Economy	2016	Active	
P150351	Senegal	Senegal Urban Water and Sanitation Project	Water	2015	Active	2022
P095847	Tunisia	Second Water Sector Investment	Water	2009	Closed	2015
P158418	Turkey	Turkey Irrigation Modernization	Water	2019	Active	2026
P110538	Uzbekistan	Ferghana Valley Water Resources Management Phase I Project	Water	2010	Closed	2017
P127486	Uzbekistan	Sustainable Agriculture and Climate Change Mitigation Project (GEF)	Agriculture and Food	2013	Closed	2018
P149610	Uzbekistan	Ferghana Valley Water Resources Management—Phase II	Water	2017	Active	2025
P153544	Vietnam	Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project	Environment, Natural Resources & the Blue Economy	2016	Active	2023
P107037	Yemen, Republic of	Yemen—Water Sector Support	Water	2009	Closed	2017
P107636	Yemen, Republic of	RY—Groundwater & Soil Conservation Additional Financing	Water	2009	Closed	
P114949	Zambia	Zambia Water Resources Development Project	Water	2013	Closed	2019

Source: Independent Evaluation Group.

Table C.4. Small-Scale Fisheries Portfolio

Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P132123	Africa	AFR RI—South West Indian Ocean Fisheries Governance and Shared Growth Project 1	Environment, Natural Resources & the Blue Economy	2015	Active	2022
P155642	Africa	Third South West Indian Ocean Fisheries Governance and Shared Growth Project (SWIOFish3)	Environment, Natural Resources & the Blue Economy	2018	Active	2023
P111272	Bangladesh	Emergency 2007 Cyclone Recovery and Restoration Project	Urban, Resilience and Land	2009	Closed	2018
P161568	Bangladesh	Bangladesh Sustainable Coastal and Marine Fisheries	Environment, Natural Resources, and Blue Economy	2019	Active	2024
P148647	Cambodia	Mekong Integrated Water Resources Management Project—Phase III	Water	2016	Active	2021
P129791	China	Fujian Fishing Ports Project	Urban, Resilience and Land	2014	Active	2021
P125301	Comoros	Comoros: Coastal Resources Co-management for Sustainable Livelihood	Environment, Natural Resources, and Blue Economy	2011	Closed	2017
P131688	Comoros	Comoros Economic Governance Reform Grant	Macroeconomics, Trade and Investment	2014	Closed	2015
P117355	Djibouti	DJ—Rural Community Development and Water Mobilization Project (PRODERMO)	Agriculture and Food	2011	Closed	2020
P166328	Dominica	Emergency Agricultural Livelihoods and Climate Resilience Project	Agriculture and Food	2018	Active	2023

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P159382	Ethiopia	Livestock and Fisheries Sector Development Project	Agriculture and Food	2018	Active	2025
P102675	Ghana	Ghana Agriculture DPL	Agriculture and Food	2008	Closed	2009
P110147	Ghana	Ghana Second Agriculture Development Policy Operation	Agriculture and Food	2010	Closed	2011
P122796	Ghana	Ghana Third Agriculture Development Policy Operation	Agriculture and Food	2011	Closed	2012
P122808	Ghana	Ghana Fourth Agriculture Development Policy Operation	Agriculture and Food	2012	Closed	2013
P124775	Ghana	Ghana—West Africa Regional Fisheries Program	Environment, Natural Resources, and Blue Economy	2012	Closed	2019
P083453	Guinea-Bissau	Coastal and Biodiversity Management Project	Environment, Natural Resources, and Blue Economy	2005	Closed	2011
P122047	Guinea-Bissau	Guinea-Bissau Biodiversity Conservation Project	Environment, Natural Resources, and Blue Economy	2011	Closed	2016
P097985	India	Integrated Coastal Zone Management	Environment, Natural Resources, and Blue Economy	2010	Active	2020
P143382	India	Tamil Nadu and Puducherry Coastal Disaster Risk Reduction Project	Urban, Resilience and Land	2013	Active	2020
P071316	Indonesia	Coral Reef Rehabilitation and Management Program Phase II	Urban, Resilience and Land	2004	Closed	2012

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P127813	Indonesia	Coral Reel Rehabilitation and Management Program—Coral Triangle Initiative (COREMAP-CTI)	Environment, Natural Resources, and Blue Economy	2014	Active	2022
P094692	Kenya	Kenya Coastal Development Project	Environment, Natural Resources, and Blue Economy	2011	Closed	2017
P144602	Kiribati	Kiribati Economic Reform Operation	Macroeconomics, Trade and Investment	2014	Closed	2014
P149888	Kiribati	Second Economic Reform Development Policy Operation	Macroeconomics, Trade and Investment	2015	Closed	2015
P104806	Lao People's Democratic Republic	Mekong Integrated Water Resources Management	Water	2012	Active	2021
P159912	Liberia	West Africa Regional Fisheries Program in Liberia—ACGF	Environment, Natural Resources, and Blue Economy	2017	Closed	2018
P157801	Maldives	Sustainable Fisheries Resources Development Project (Fourth South West Indian Ocean Fisheries Governance and Shared Growth Project)	Environment, Natural Resources, and Blue Economy	2017	Active	2023
P151058	Mauritania	Nouadhibou Eco-Seafood Cluster Project	Finance, Competitiveness and Innovation	2016	Active	2022
P151754	Micronesia, Federated States of	Pacific Islands Regional Oceanscape Program—FSM	Environment, Natural Resources, and Blue Economy	2015	Active	2021
P164424	Montenegro	Montenegro Second Institutional Development and Agriculture Strengthening Project	Agriculture and Food	2018	Active	2023
P127822	Morocco	Second DPL in support of the Plan Maroc Vert	Agriculture and Food	2013	Closed	2014

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P149992	Mozambique	Mozambique—Artisanal Fisheries and Climate Change	Environment, Natural Resources, and Blue Economy	2015	Closed	2019
P131965	Mozambique	Mozambique Conservation Areas for Biodiversity and Development Project	Environment, Natural Resources, and Blue Economy	2015	Closed	2020
P131655	Pacific Islands	Pacific Islands Regional Oceanscape Program Forum Fisheries Agency	Environment, Natural Resources, and Blue Economy	2015	Active	2021
P155902	Peru	National Program for Innovation in Fisheries and Aquaculture	Environment, Natural Resources, and Blue Economy	2017	Active	2022
P084967	Philippines	Mindanao Rural Development Project—Phase 2	Agriculture and Food	2007	Closed	2015
P132317	Philippines	Philippine Rural Development Project	Agriculture and Food	2015	Active	2021
P145938	Samoa	Samoa Agriculture and Fisheries Cyclone Response Project	Agriculture and Food	2014	Closed	2017
P085708	Senegal	SN—Elec. Serv. for Rural Areas (FY05)	Energy and Extractives	2005	Closed	2013
P086480	Senegal	Integrated Marine and Coastal Resources Management Project	Agriculture and Food	2005	Closed	2012
P105881	Senegal	Sustainable Management of Fish Resources	Agriculture and Food	2009	Closed	2012
P153370	Southern Africa	Second South West Indian Ocean Fisheries Governance and Shared Growth Project—Madagascar	Environment, Natural Resources, and Blue Economy	2017	Active	2024
P082492	Tanzania	Marine and Coastal Environment Management	Environment, Natural Resources, and Blue Economy	2006	Closed	2013

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Project ID	Country	Project Name	Global Practice	FY Approved	Status	FY Closing
P151760	Marshall Islands	Pacific Islands Regional Oceanscape Program—Republic of the Marshall Islands	Environment, Natural Resources, and Blue Economy	2015	Active	2021
P151777	Solomon Islands	Pacific Islands Regional Oceanscape Program—The Solomon Islands	Environment, Natural Resources, and Blue Economy	2015	Active	2021
P151780	Tuvalu	Pacific Islands Regional Oceanscape Program—Tuvalu	Environment, Natural Resources, and Blue Economy	2015	Active	2021
P118979	Vietnam	Coastal Resources for Sustainable Development Project	Environment, Natural Resources, and Blue Economy	2012	Closed	2019
P106063	Western Africa	West Africa Regional Fisheries Program	Environment, Natural Resources, and Blue Economy	2010	Closed	2017
P119380	Western Africa	GEF—Africa—2nd phase fish. (GBissau)	Environment, Natural Resources, and Blue Economy	2011	Closed	2018
P126773	Western Africa	West Africa Region Fisheries Program AF Guinea, Sierra Leone and Liberia	Environment, Natural Resources, and Blue Economy	2015	Active	2021
P086886	Yemen, Republic of	Fisheries Resource Management and Conservation	Environment, Natural Resources, and Blue Economy	2006	Closed	2014
P088435	Yemen, Republic of	Second Port Cities Development Project	Urban, Resilience and Land	2010	Closed	2015

Source: Independent Evaluation Group.

Appendix D. List of Persons Consulted

Table D.1. Attendees of the PROACT Workshop

Name	Title	Organization
Steven Schonberger	Regional Director, Europe and Central Asia	World Bank
Benoit Bosquet	Regional Director, East Asia and Pacific	World Bank
Simeon Ehui	Regional Director, Africa	World Bank
Chiyo Kanda	Manager, Operations Policy and Country Services	World Bank
Robin Mearns	Practice Manager, SURR	World Bank
Anush Bezhanyan	Practice Manager, Social Protection & Labor	World Bank
Richard Damania	Senior Economic Advisor, Water GP	World Bank
Berengere Prince	Lead Natural Resources Management Specialist	World Bank
Kanta Rigaud	Lead Environment Specialist	World Bank
Glenn-Marie Lange	Senior Environmental Economist	World Bank
Eileen Burke	Senior Water Resources Management Specialist	World Bank
Arame Tall	Senior Climate Change Specialist	World Bank
Ademola Braimoh	Senior Natural Resources Management Specialist	World Bank
Stephen Pirozzi	Senior Operations Officer, Operations Policy and Country Services	World Bank
Shaza Zeinelabdin	Senior Social Development Specialist	IFC
Rosa Orellana	Chief Environmental Specialist	IFC
John Graham	Chief Environmental Specialist	IFC

Source: Independent Evaluation Group.

Note: PPAR = Project Performance Assessment Report.

Table D.2. Persons Consulted in Relation to Case Analysis and PPAR in Brazil

Name	Title	Organization
World Bank Group active and retired staff and consultants		
Garo Batmanian	Lead Environment Specialist	World Bank
Bernadete Lange	Senior Environmental Specialist	World Bank
Maria de Fatima Amazonas	Senior Rural Development Specialist	World Bank
Barbara Cristina Noronha Farinelli	Agric. Economist	World Bank
Government		
Braulio Dias	Former Secretary of Biodiversity and Forests	Ministry of Environment (MMA)
Mauro Pires	Former head of Cerrado Nucleus and Advisor to Executive Secretary	MMA
Adriana Bayma	Former coordinator of MMA sub-project	
Juliana Simões	Former team member, MMA subproject	
Paulo Costa	Former coordinator of ICMBio subproject	
Sidney Medeiros	Coordinator of ABC Cerrado Project	Ministry of Agriculture
Andrea Vulcanis	Secretary	State of Goias, Secretariat of Environment and Water Resources (SEMAD)
Janaína Rocha	Advisor to the Secretary	State of Goias, SEMAD
Suzete Araujo Pequeno	Former coordinator of Goias sub-project	State of Goias, SEMAD
Elda Maria Cunha	Former team member, Goias subproject	State of Goias, SEMAD
Graziela Carvalho Fonseca	Former team member, Goias subproject	State of Goias, SEMAD
Renato Jayme da Silva,	Secretary	State of Tocantins, Secretariat of Water Resources and Environment
Marli Terezinha dos Santos,	Former coordinator of Tocantins subproject	State of Tocantins, Secretariat of Water Resources and Environment
Cristiane Peres,	Former team member, Tocantins subproject	State of Tocantins, Secretariat of Water Resources and Environment
NGOs, civil society organizations, foundations, research institutes, academia		
Fábio Leite	GEF Liaison Officer	Brazilian Biodiversity Fund (FUNBIO)

Source: Independent Evaluation Group.

Note: PPAR = Project Performance Assessment Report.

Table D.3. Persons Consulted in Relation to Case Analysis and PPAR in Ethiopia

Name	Title	Organization
World Bank Group active and retired staff and consultants		
Iain G. Shuker	Practice Manager	World Bank
Paul Jonathan Martin	Lead Natural Resources Management Specialist	World Bank
Million Alemayehu Gizaw	Sr Natural Resources Management Specialist	World Bank
Lucian Bucur POP	Sr Social Protection Specialist	World Bank
Vikas Choudhary	Sr Agricultural Specialist	World Bank
Hisham Osman	Young Professional	World Bank
Ian Leslie Campbell	Consultant	World Bank
Hailu Tefera Ayele	Consultant	World Bank
Shimeles Sima Erketa	Consultant	World Bank
Sisay Nune Hailemariam	Consultant	World Bank
Government		
Dr Kaba Urgessa	State Minster for Natural Resources	Ministry of Agriculture
Habtamu Hailu	PIU Coordinator SLMP	Ministry of Agriculture
Feta Zeberga	M&E Coordinator SLMP	Ministry of Agriculture
Andarg Firew	M&E Officer PSNP	Ministry of Agriculture
Abiot Wondi	Agricultural Specialist PSNP	Ministry of Agriculture
Bagale Terafa	Team Leader on Land Use	Ministry of Agriculture
Abebaw Abebe	Land Law Legal Expert	Ministry of Agriculture
Abebe Seifu	Director	ECO System Rehabilitation and Combating Desertification
Mohammed Haji	SLMP Project Regional Coordinator—Oromia	Ministry of Agriculture
Enideg Diress	SLMP Project Regional Coordinator—Amhara	Ministry of Agriculture
Markos Wondie	Deputy Director	Amhara Regional Bureau of Agriculture
Getahun Alameneh	Director, Land Administration	Land Administration and Use Bureau, Amhara
Tamirat Demissie	Director, Land Use	Land Administration and Use Bureau, Amhara

(continued)

Name	Title	Organization
Derbew Ayalew	Director, Remote Sensing	Land Administration and Use Bureau, Amhara
Mohammed Ali	Senior Expert, Land Use and Focal Point for Land Certification under SLMP	Land Administration and Use Bureau, Amhara
Mehari Gebremedhin	SLMP—Regional Coordinator—Tigray	Regional Bureau of Agriculture, Tigray
Arefe Kiros	PSNP—Regional Coordinator—Tigray	Regional Bureau of Agriculture, Tigray
Yitbarek	Director, Natural Resources	Regional Bureau of Agriculture, Tigray
Muez	Deputy Director, Natural Resources	Regional Bureau of Agriculture, Tigray
Yitbarek Gebremedhin	Team Leader Resilient landscapes and Livelihoods Project	Regional Bureau of Agriculture, Tigray
Muez Hailu	Director Resilient landscapes and Livelihoods Project	Regional Bureau of Agriculture, Tigray
Girum Hagos Berhe	Procurement Specialist Resilient landscapes and Livelihoods Project	Regional Bureau of Agriculture, Tigray
Gebreyohannes Kidanu Hindeya	Financial Management Specialist Resilient landscapes and Livelihoods Project	Regional Bureau of Agriculture, Tigray
Berihu Tafere Mekonen	M&E Specialist Resilient landscapes and Livelihoods Project	Regional Bureau of Agriculture, Tigray
Gebrecherkos Teka Gebreslassie	Infrastructure Specialist Resilient landscapes and Livelihoods Project	Regional Bureau of Agriculture, Tigray
Sileshi Lemma	Deputy Director	Regional Bureau of Agriculture, Oromia
Teshde Workinch	Sebata Hawas Woreda Head	Oromia Region
Taye Garema	Woliso Woreda Head	Oromia Region
Nigusu Degefe	Gimbichu Woreda Head	Oromia Region
Mulugeta	Fagita Lekoma Woreda Watershed Focal Person	Amhara Region
Melsew	Bure Woreda Watershed Focal Person	Amhara Region
Bayh Sineshaw	Gonji Kolela Woreda Watershed Focal Person	Amhara Region
Dessie Admass	Dembecha Woreda Watershed Focal Person	Amhara Region
Worku Aschale Nigat	Mechekel Woreda Watershed Focal Person	Amhara Region
Multilateral, regional, and bilateral development partners		
Michael Glueck	Program Manager	GIZ

(continued)

Name	Title	Organization
Ato Tewodios	Program Officer	GIZ
Fikirte Regassa Beyene	Program Officer	Norwegian Embassy
Ato Tesfaye Checkol	Program Officer	German Development Bank (KfW)

Source: Independent Evaluation Group.

Note: PPAR = Project Performance Assessment Report.

Table D.4. Persons Consulted in Relation to Case Analysis in India

Name	Title	Organization
World Bank Group		
Satya Priya	Senior Water Resources Management Specialist	World Bank
Abedalrazq F. Khalil	Sector Leader	World Bank
Abel Lufafa	Senior Agricultural Specialist	World Bank
Srinivasa Rao Podipireddy	Senior Water Supply and Sanitation Specialist	World Bank
Ranjan Samantaray	Senior Agriculture Specialist	World Bank
Anju Gaur	Senior Water Resources Management Specialist	World Bank
Sumila Gulyani	Program Leader	World Bank
Tapas Paul	Lead Environmental Specialist	World Bank
Edward W. Bresnyan	Senior Agriculture Economist	World Bank
Priti Kumar	Sr. Agriculture Specialist	World Bank
Junaid Kamal Ahmad	Country Director	World Bank
Senior Officials of Government of India		
R. Buhri	Secretary of Department of Land Resources	Ministry of Rural Development, India
P. Nandkumaran	Principal Scientist, Central Groundwater Board (CGWB)	Ministry of Jal Shakti, India
Pratul Saxena	Principal Scientist, Central Groundwater Board (CGWB)	Ministry of Jal Shakti, India
Namita Priyadarshee	Joint Secretary, Department of Agriculture, Cooperation & Farmers Welfare	Ministry of Agriculture, India
Pankaj Tyagi	Director, Department of Agriculture, Cooperation & Farmers Welfare	Ministry of Agriculture, India
Persons Consulted in Rajasthan		
V. P. Singh	Director	Agriculture Department

(continued)

Name	Title	Organization
Anand Gahlot	Director	Watershed Development Department
Rajeev Kulshreshtha	Deputy Director	Watershed Development Department
Vinay Bhardwaj	Sr. Hydrologist	Groundwater Department
Jagdish Singh	PMV(JPR) expert	Agriculture Department
Rajkumar Prajapati	MIS expert	Agriculture Department
P. S. Kalra	Project Coordinator	Rajasthan Agricultural Competitiveness Project (RACP)
Himmat Singh Shekhawat	Project Coordinator	Horticulture Department
Soumik Koul	Agronomy expert	Rajasthan Agricultural Competitiveness Project (RACP)
J. D. Meena	Nodal Officer	Rajasthan Agricultural Competitiveness Project (RACP)
Devendra Gupta	PC (WS) Officer	Rajasthan Agricultural Competitiveness Project (RACP)
Kuldeep Bhardwaj	DPM Jaipur officer	Agriculture Department
Shyamender Pal	SDS PMU officer	Rajasthan Agricultural Competitiveness Project (RACP)
Naresh Nehra	Extension Officer	Rajasthan Agricultural Competitiveness Project (RACP)
Suraj Bhan Singh	Chief Engineer	Groundwater Department
S. K.Jain	Regional Director	Central Groundwater Board (CGWB)
Narendra Singh	Executive Engineer	Watershed Development Department
Bhhop Singh	Senior Engineer	Watershed Development Department
P L Meena	Dy. Director, Agri. Extension	Agriculture Department
Vinay Bhardwaj	Senior Hydrogeologist	Groundwater Department
Persons Consulted in Andhra Pradesh		
P. S. Ragahaviaiah	Project Director	APIIATP, Vijayawada, Andhra Pradesh

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Name	Title	Organization
P. Purushottam Reddy	Director	Department of Groundwater, Vijayawada
N. Srinivasu	Director	Department of Groundwater, Vijayawada
K. Padma Prasad	Director, Water Audit	Department of Groundwater, Vijayawada
D. Vijayavardhan	Director, Hydrogeology	Department of Groundwater, Vijayawada
Persons Consulted in Telangana		
Pandith Madhnure,	Director	Groundwater Department, Hyderabad
K. Shankaraiah	Assistant Director (Rtd.)	Groundwater Department, Hyderabad
Rakesh Chander	Deputy Director,	Groundwater Department, Hyderabad
S. Jitendra	Deputy Director,	Groundwater Department, Hyderabad
G. Malsur	Project Director (Krishna Basin)	Water Sector Improvement Project (PPMU), Hyderabad
M. Lakshmaiah	TRP, TCBTMP, Hyderabad	
Kasaiah	TRP, TCBTMP, Hyderabad	

Source: Independent Evaluation Group.

Table D.5. Persons Consulted in Relation to Case Analysis and PPAR in Mongolia

Name	Title	Organization
World Bank Group active and retired staff and consultants		
Andrei Mikhnev	Country Manager	World Bank, Ulaanbaatar
Badamchimeg Dondog	Public Sector Specialist	World Bank, Ulaanbaatar
Pagma Genden	Operations Officer	World Bank, Ulaanbaatar
Robin Mearns	Practice Manager	World Bank, Washington, DC
Andrew Goodland	Lead Agriculture Specialist	World Bank, Colombo

(continued)

Name	Title	Organization
Government		
B. Jamsranjav	Head of Land Management Division	Agency for Land Administration and Management, Geodesy and Cartography
G. Puntsag	Officer of State Land Management Plan, LMP	Agency for Land Administration and Management, Geodesy and Cartography
B. Sodnom	Deputy Director General (former SLP I/ SLP II staff)	General Authority for Veterinary Services
B. Temuulen	Grants Manager	Livestock and Agricultural Marketing Project (LAMP)
Z. Ganbold	Head of Division, Fiscal Policy and Planning Department, Budget Consolidation Division	Ministry of Finance
D. Davaa	Deputy Director, The Small and Medium Enterprises Development Fund	Ministry of Food, Agriculture and Light Industry (MoFALI)
Mr. Niye	Former staff of MoFALI	Ministry of Food, Agriculture and Light Industry (MoFALI)
P. Ganhuyag	Advisor to the Minister of MoFALI	Ministry of Food, Agriculture and Light Industry (MoFALI)
E. Baasandai	Head, Research Division of Agrometeorology	National Agency for Meteorology, Hydrology, and Environmental Monitoring (NAMEM)
Oyunjargal	Head, Weather Forecasting Division	National Agency for Meteorology, Hydrology, and Environmental Monitoring (NAMEM)
B. Purevnyam	Head of the Emergency Operation and Early Warning Center, Lieutenant, Colonel	National Emergency Management Agency (NEMA)
Ch. Lkhamjav	Head of the Communication and Early Warning Division, Major	National Emergency Management Agency (NEMA)
D. Sodnomragchaa	Head of Spatial Information and Technology Section, Lieutenant Colonel	National Emergency Management Agency (NEMA)

(continued)

Name	Title	Organization
U. Batmunkh	Deputy Chief, Colonel	National Emergency Management Agency (NEMA)
Z. Tuvdendorj	Specialist, Foreign Cooperation Division, Lieutenant	National Emergency Management Agency (NEMA)
M. Erdene-Ochir	Statistician, Economic Statistics Department	National Statistics Office (NSO)
O. Rentsendorj	Procurement Specialist	Office of the Deputy Prime Minister of Mongolia (former SLP I/SLP II staff)
M. Enkhbat	Senior Technical Specialist	Sustainable Livelihoods Project 3
M. Nandinchimeg	Monitoring and Evaluation Officer	Sustainable Livelihoods Project 3
Ch. Gankhuyag	Soum Governor	Khairkhandulaan Soum Administration, Uvurkhangai Aimag
A. Batsaikhan	Soum Governor Administrator	Khairkhandulaan Soum Administration, Uvurkhangai Aimag
L. Purevsuren	Land Officer	Khairkhandulaan Soum Administration, Uvurkhangai Aimag
L. Otgonjargal	Social Welfare Officer	Khairkhandulaan Soum Administration, Uvurkhangai Aimag
A. Batdolgor	Finance Officer	Khairkhandulaan Soum Administration, Uvurkhangai Aimag
A. Tsetsenbileg	Land Dep. Head	Bayankhongor Aimag Administration
J. Battur	Food and Agriculture Dep. Head	Bayankhongor Aimag Administration
D. Sosorburam	Social Welfare Officer	Bayankhongor Aimag Administration
B. Naranbaatar	Environment Officer	Bayankhongor Aimag Administration
K. Ganzorig	NSO Officer	Bayankhongor Aimag Administration
A. Altanbagana	NEMA Officer	Bayankhongor Aimag Administration
D. Ikhbayar	Development Policy Officer	Bayankhongor Aimag Administration

(continued)

Name	Title	Organization
T. Erdenebat	Secretary	Bayankhongor Aimag Citizen Khural
S. Baatar	Soum Khural Chairman	Bombogor Soum Administration, Bayankhongor Aimag
R. Amarbayar	Soum Khural Representative	Bombogor Soum Administration, Bayankhongor Aimag
O. Narantsetseg	Land Officer	Bombogor Soum Administration, Bayankhongor Aimag
L. Otgontuul	Agriculture Officer	Bombogor Soum Administration, Bayankhongor Aimag
R. Naranbat	Culture center director	Bombogor Soum Administration, Bayankhongor Aimag
D. Munkh-Ochir	Environment Inspector	Bombogor Soum Administration, Bayankhongor Aimag
B. Narangerel	Finance Div. Head	Bombogor Soum Administration, Bayankhongor Aimag
S. Amarzaya	Finance Officer	Zavkhan Aimag Administration
D. Unenkhuu	Secretary	Zavkhan Aimag Citizen Khural
J. Batstsengel	Social Welfare Officer	Zavkhan Aimag Administration
M. Tuyajargal	Small Business Investment	Zavkhan Aimag Administration
D. Batmend	Local Property Officer	Zavkhan Aimag Administration
N. Batbayar	Agriculture Officer	Zavkhan Aimag Administration
D. Javzandulam	Land Officer	Zavkhan Aimag Administration
O. Bold	NEMA Officer	Zavkhan Aimag Administration
D. Alagtuvshin	Vice Governor	Numrug Soum Administration, Zavkhan Aimag
E. Enkhtungalag	Environmental Officer	Numrug Soum Administration, Zavkhan Aimag

(continued)

Name	Title	Organization
M. Batkhuyag	Bag Governor (ii)	Numrug Soum Administration, Zavkhan Aimag
B. Nyam Ochir	Environmental Inspector	Numrug Soum Administration, Zavkhan Aimag
U. Serchmyadag	Finance Officer	Numrug Soum Administration, Zavkhan Aimag
Ts. Altantuya	Head of Administration	Numrug Soum Administration, Zavkhan Aimag
Sh. Ankhzaya	Land Officer	Numrug Soum Administration, Zavkhan Aimag
N. Damdinbazar	Bag Governor (1)	Numrug Soum Administration, Zavkhan Aimag
Bazarragchaa	Bag Governor (5)	Numrug Soum Administration, Zavkhan Aimag
G. Bavuusuren	Vice Governor	Ikh-Uul Soum Administration, Zavkhan Aimag
I. Enkhtuvshin	Chairman Ikh Khural	Ikh-Uul Soum Administration, Zavkhan Aimag
Sh. Batjargal	Chairman of Soum Administration	Ikh-Uul Soum Administration, Zavkhan Aimag
B. Purevdorj	Agriculture Officer	Ikh-Uul Soum Administration, Zavkhan Aimag
G. Batsukh	Land Officer	Ikh-Uul Soum Administration, Zavkhan Aimag
T. Sedbazar	Secretary	Ikh-Uul Soum Administration, Zavkhan Aimag
N. Baatarmaa	Finance Officer	Ikh-Uul Soum Administration, Zavkhan Aimag
N. Erdene-Ochir	Small Business Investment	Ikh-Uul Soum Administration, Zavkhan Aimag

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Name	Title	Organization
B. Bayarmandakh	Environment ranger	Ikh-Uul Soum Administration, Zavkhan Aimag
S. Oyuntogs	Environment officer	Ikh-Uul Soum Administration, Zavkhan Aimag
D. Tulga	Social Welfare Officer	Ikh-Uul Soum Administration, Zavkhan Aimag
G. Altan-Ochir	Soum Governor	Tariat Soum Administration, Arkhangai Aimag
R. Tumenbayar	Soum Governor Administrator	Tariat Soum Administration, Arkhangai Aimag
G. Enkhbayar	Land Officer	Tariat Soum Administration, Arkhangai Aimag
B. Otgonsuren	Agriculture Officer	Tariat Soum Administration, Arkhangai Aimag
R. Batkhuu	Environment Inspector	Tariat Soum Administration, Arkhangai Aimag
D. Gantamir	Former SLP1 and SLP2 Local Rep.	Tariat Soum Administration, Arkhangai Aimag
Local private sector		
O. Terbish	Chief Underwriting Officer	MongolianRe (former IBLI staff)
U. Ya	Investment Director	Net Capital Financial Group (former IBLI staff)
J. Munkhtur	Non-financial Services Officer	Micro Finance Development Fund
D. Bayarsaikhan	Senior Loan Officer	Micro Finance Development Fund
B. Bataa	Director, Agricultural Training & Information Center CEO	"Mergen Kharig" Start Up Company (former SLP I/SLP II staff)
G. Radnaa	Executive Director	CSD Consulting Co. Ltd (former SLP I/SLP II staff)
n=5 State Bank Employees		

(continued)

Name	Title	Organization
n=4 Khan Bank Employees		
n=7 salespeople, traders, processors (dairy, meat and cashmere)		
Multilateral, regional, and bilateral development partners		
Vinod Ahuja	FAO Representative in Mongolia	Food and Agriculture Organization (FAO)
Marc A. Tasse	Director of Programs	Mercy Corps
Wendy Guyot	Country Director	Mercy Corps
Ts. Enkh-Amgalan	Project Manager, Green Gold—Animal Health Project	Swiss Agency for Development and Cooperation (SDC)
Baigalmaa Gongor	National Programme Officer	Swiss Cooperation Office of the Embassy of Switzerland
Benoit Meyer-Bisch	Deputy Director of Cooperation, First Secretary	Swiss Cooperation Office of the Embassy of Switzerland
Zolzaya Lkhagvasuren	Senior National Programme Officer	Swiss Cooperation Office of the Embassy of Switzerland
Galbadrakh Davaa	Director of Conservation	The Nature Conservancy
Javkhlan Ariunbaatar	Community-based Conservation Lead	The Nature Conservancy
Beneficiaries		
n=13 male herders		
n=10 female herders		
n=40 deep-dive ethnographic interviews		

Source: Independent Evaluation Group.

Note: PPAR = Project Performance Assessment Report.

Table D.6. Persons Consulted in Relation to Case Analysis and PPAR in Niger and the Sahel

Name	Title	Organization
World Bank Group active and retired staff and consultants		
Ellysar Baroudy	Lead Natural Resources Management Specialist	World Bank
Aimee Marie Ange Mpambara	Senior Agriculture Economist	World Bank
Mahamane Maliki Amadou	Social Protection Specialist	World Bank
Hadidia Djimba	Program Assistant	World Bank
Zeinabou Bizo Hassane	Team Assistant	World Bank
Yahaya Ardé M. Achirou	E T Consultant	World Bank
Government		
Ali Moumouni Kassoum	DDE/SU/DD	
Col Hamadou Adamou	DDE/SU/DD Tibiri	
Cap Hamidou Issaka	Communal Environment Chief	
Seidou Bozari	President COFOV	
Adamou Moussa	Permanent Secretary of COFOV	
Hamidou Seyni	Environment Agent	
Boubacar Moumouni	Niger Community Action Program Phase 3 (PAC 3)	
Zakou Mounkaïla	PAC 3 Staff Member	
Ahmed Oumarou	PAC 3 Staff Member	
Sina Soumaila	PAC 3 Staff Member	
Alio Abdoulaye	PAC 3 Staff Member	
Ali Moussa	Regional Coordinator PAC3 DOSSO	
Ali Moha	National Coordinator PAC 3	
Issoufou Maazou	PAC 3 Staff Member	
Saidou Daouda	PAC 3 Staff Member	
Assane Abdouramane	PAC 3 Staff Member	
Saley Mahamadou		
Boukar Ibrah		
Hamidou Ibrahim	SSAF/PAC 3	
Djika Abdou	SPM/PAC 3	
Idé Tahirou	ATMO/KANDADJI	
Moussa Bouda	CN/PFSA	
Karimou Bassirou	RSE/PFSA	

(continued)

Name	Title	Organization
Kimba Zada Douraha-mane	RCFW/PFSA	
Moumouni Moussa	AI/D/PFSA	
Sanousi Fodé Camara	National Coordinator PRAPS	
Mohamed ELH Al-mansour	General Secretary CAPAN	
Salifou Papa Garba	DDE/SU/DD/Illéla	
Boukata Boureima	RRSE PAC 3	
Djibo Harouna	Regional coordinator PAC 3 Tahoua	
Moussa Ousman Ibrahim	ADL/PAC 3	
Kaziende Jean	Regional coordinator PAC 3 Maradi	
Adamou Amadou	Mayor	Dantchiandou Com-mune
Boubacar Djibo	General Secretary/ Town Hall	Dantchiandou Com-mune
Kaïlou Goroukoy	Councilor	Dantchiandou Com-mune
Oumoul Keirou Aldou	Councilor	Dantchiandou Com-mune
Moussa Mallam	Deputy Mayor	Loga Commune
Kadi Seybou	Deputy Mayor	Loga Commune
Amadou Hassane	General secretary/ Town Hall	Loga Commune
Hamidou Garba	Municipal Councilor	Loga Commune
Ali Soumana	Municipal Councilor	Loga Commune
Aissa Boubacar	Municipal Councilor	Loga Commune
Issa Allakaye	Vice Mayor	Guéchémé Commune
Maijima Guimba	Councilor	Guéchémé Commune
Maïzama Dadé	Councilor	Guéchémé Commune
Garba Guéro	Councilor	Guéchémé Commune
Mahamadou Adamou	Councilor	Guéchémé Commune
Assoumane Djadi	Communal Catcher	Guéchémé Commune
Abarchi Arzika	Lido chief representative	Guéchémé Commune
Ballarabé Boubacar	Takassaba chief of village	Guéchémé Commune
Boubacar Lihida	General Secretary of the Town hall	Karakara Commune
Abdou Sayo	Councilor	Karakara Commune
Kader Anaroua	Councilor	Karakara Commune
Touné Guéro	Yeldou chief of village	Karakara Commune
Moumouni Hamani	Deputy Mayor	Sambéra Commune
Amadou Mounkaïla	General Secretary	Sambéra Commune
Seyni Soumaïla	Councilor	Sambéra Commune
Amina Fodi	Councilor	Sambéra Commune

(continued)

Name	Title	Organization
Harouna Hassane	Councilor	Sambéra Commune
Bachirou Tinni	Councilor	Sambéra Commune
Sani Cheffou	Councilor	Sambéra Commune
Abdou Hamadou	Councilor	Sambéra Commune
Djibo Seyni	Chief representative of Tondi Bangou village	Sambéra Commune
Djibo Boubacar	General Secretary	Commune V
Abdourahamane Issa	Councilor	Illéla Commune
Ayouba Sidi	Councilor	Illéla Commune
Ide Beydou	Councilor	Illéla Commune
Elh Harouna Kade	Councilor	Illéla Commune
Rakia Issoufou	Councilor	Illéla Commune
Mahamadou Naroua	Councilor	Illéla Commune
Oumarou Moussa	Councilor	Illéla Commune
Habibou Ibrahima	Councilor	Illéla Commune
Issa Moussa	Councilor	Illéla Commune
Idi Nabaza	Councilor	Illéla Commune
Aichatou Assoumane	Councilor	Illéla Commune
Abase Issa	General Secretary	Illéla Commune
Abdou Amaki	Communal Catcher	Illéla Commune
Abdoul Karim Issa	Councilor	Illéla Commune
Ada Daoudé	Councilor	Illéla Commune
Oumarou Douka	Mayor	Illéla Commune
Elh Abdou Adamou	Mayor	Madarounfa Commune
Laouali Oumarou	Councilor	Madarounfa Commune
Elhadji Oumarou Adamou	Councilor	Madarounfa Commune
Adamou Oumarou	Councilor	Madarounfa Commune
Garba Souley	Councilor	Madarounfa Commune
Mahaman Lawali Abdou	Vice Mayor	Madarounfa Commune
Haoua Hassan	Councilor	Madarounfa Commune
Maman Moussa	Councilor	Madarounfa Commune
Elhadji Adamou Oumarou	Councilor	Madarounfa Commune
Lawali Mati	Councilor	Madarounfa Commune
Rabe Harouna	General Secretary	Madarounfa Commune
Adamou Abdou Fogue	Communal Catcher	Madarounfa Commune
Sani Oumarou	Councilor	Madarounfa Commune
Elhadji Oumarou Laouali	Councilor	Madarounfa Commune

(continued)

Name	Title	Organization
Maimouna Sani	Councilor	Madarounfa Commune
Hassan Ousman	Councilor	Madarounfa Commune
Laouali Sani	Councilor	Madarounfa Commune
Ibrahim Salissou	Councilor	Madarounfa Commune
Saloa Oumarou	Gamdji Chief of village	Madarounfa Commune
Garba Balla	Gamdji Chief councilor	Madarounfa Commune
Mahamadou Abdoulaye	Gamdji Chief councilor	Madarounfa Commune
NGOs, civil society organizations, foundations, research institutes, and academia		
Thaddee Mukezabatware	Humanitarian Program Manager	Save the Children International, Niger Program
Alissa Karg Girard	Chief of Party, 12/12 Alliance	Lutheran World Relief
Robert Winterbottom	Senior Fellow	EverGreening US Alliance
Multilateral, regional, and bilateral development partners		
Bernard Friedling	Chief of Section, Politics, Press, and Information	Delegation of the European Union to the Republic of Niger
Issifou Alfari	Expert of Remote Sensing and SIG, SER VIR-AO Project	AGRHYMET Regional Centre
Saratu Gadzama	Internal Auditor	Niger Basin Authority
Giovanni Tordini	Charge of Programs, Niger Bureau	Luxembourg Agency for Development Cooperation (LuxDev)
Beneficiaries		
n=11 cash-for-work beneficiaries		
n=2 cash transfer beneficiaries		
n=5 farmers and assisted natural regeneration (ANR) users		
n=3 land management committees (president and general secretary)		
n=2 biocarbon site guards		
n=20 goat/sheep fattening program beneficiaries		
n=45 deep-dive ethnographic interviews		

IEG
Independent Evaluation Group

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WHAT WORKS

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