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Background Paper

Co-Benefits of Disaster Risk Management

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Abstract

Many ex ante measures taken to reduce disaster risk can deliver co-benefits that are not dependent on disasters occurring. In fact, building resilience to climate extremes and disasters can achieve multiple objectives. These are secondary to the main objective of disaster risk management of avoiding disaster losses, but identifying and measuring additional co-benefits can enhance the attractiveness of disaster risk management investments. Co-benefits are often economic, such as investment in dams or irrigation to reduce drought risk generating greater productivity; but they can also include significant environmental and social benefits. This paper identifies some of the potential categories of co-benefits associated with disaster risk management investments, expanding on typologies created by agencies seeking to promote social and environmental safeguarding in their work. The paper looks at previous

studies on disaster risk management where co-benefits are mentioned but not explored in any detail. The paper examines two new case studies where environmental and socioeconomic co-benefits were uncovered in an irrigation project to reduce drought risk, and an urban flood risk management project, in Jamaica and Mexico, respectively. This review points to several challenges in traditional cost-benefit analysis techniques and puts forward alternative approaches to identify environmental and socioeconomic co-benefits when planning disaster risk management investments. The authors argue that a comprehensive disaster risk management co-benefits framework is needed that includes and categorizes all potential positive environmental and socioeconomic impacts. Co-benefits research focused on revisiting existing cases and developing new case studies could play an important role in this regard.

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Co-Benefits of Disaster Risk Management

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1. Introduction

Disasters can be extremely costly and investing in disaster risk management (DRM) can save both money and lives. Yet policy makers tend to underinvest or not invest at all in projects to manage risk. This is, in part, because the costs of such investments are visible and immediate whereas the direct benefits of such investments, and indeed the distribution of these benefits, are unclear and distant.

One way to address this public choice dilemma is to identify, enhance, and communicate the co-benefits of DRM. Many ex-ante DRM investments will deliver co-benefits. These are the benefits that accrue in addition to the primary DRM objectives of avoiding losses and boosting development. Co-benefits can include economic, social and environmental aspects, and be non-DRM specific (GFDRR 2015). They can be seen as a secondary objective of DRM, but reinforce the fact that resilience investments can achieve multiple objectives.

If we can identify the co-benefits of DRM, decision-makers will have a greater incentive to invest in projects that reduce risk for their critical but uncertain and distant direct benefits in terms of reducing disaster losses, and also for their less visible environmental and socioeconomic co-benefits. In some cases DRM activities generate negative impacts, and these need to be addressed, but these investments often generate positive externalities too and these could be enhanced if they were better understood.

Today, investment decisions - both public and private - are increasingly expected to consider their broader contribution to sustainable development within the context of their specific investment focus. This expectation is reflected in the broadening commitment to what is often called socially responsible investment. For example, the institutional investors who have signed up to the Principles for Responsible Investment¹ hosted by the UNEP Finance Initiative and the UN Global Compact, have committed to “incorporate ESG [environmental, social, and corporate governance] issues into investment analysis and decision-making processes.”

With respect to DRM, the Rio+20 Outcome Document reaffirms worldwide political commitment to integrating DRM into public and private investments and planning for growth and development:

“We stress the importance of stronger interlinkages among disaster risk reduction, recovery and long-term development planning, and call for more coordinated and comprehensive strategies that integrate disaster risk reduction and climate change adaptation considerations into public and private investment, decision-making and the

¹ See: <http://www.unpri.org/>

planning of humanitarian and development actions, in order to reduce risk, increase resilience and provide a smoother transition between relief, recovery and development.”

This commitment is further articulated in the integration of DRM into the forthcoming Sustainable Development Goals (SDGs).² Goal 9 is to ‘build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation’ and includes facilitating ‘sustainable and resilient infrastructure development in developing countries’. This includes a commitment to “upgrade infrastructure and retrofit industries to make them sustainable.”

Similarly, proposed Goal 11 aims to “make cities and human settlements inclusive, safe, resilient and sustainable” and brings together environmental priorities such as “efforts to protect and safeguard the world’s cultural and natural heritage” and “mitigation and adaptation to climate change”, and social priorities such as “access for all to adequate, safe and affordable housing and basic services” and “inclusive and sustainable urbanization”. It also underscores the need for “resilience to disasters” and calls on governments to “develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.”

The various environmental and social frameworks under development by multilateral institutions - notably the UN and its specialized agencies and the World Bank Group - are also helping to establish a set of specific environmental, economic and social issues which can and should be addressed through public and private investments, including investments in DRM, that generate co-benefits. Given the opportunities for delivering additional visible returns, Ministries of Finance and potential public and private co-investors need to ensure that such co-benefits are identified and captured to enhance the overall package of returns - direct and indirect - from DRM investments. In so doing, DRM investments will enhance commitment by policy makers to ensuring that growth and development plans and investments are environmental and socially responsible. The successful financing and implementation of DRM programs and projects in the future is therefore likely to be judged to some extent by its ability to generate environmental and socioeconomic co-benefits.

2. Examples of local environmental and socioeconomic co-benefits

As each DRM program or project will face its own unique array of environmental and socioeconomic issues, the opportunities for enhancing co-benefits will also vary. By way of

² See: <http://sustainabledevelopment.un.org/sdgsproposal.html>.

example, one report³ lists a number of examples of co-benefits that may accrue from different types of DRM investments, divided into four types:

1. Policy and planning: e.g., institutional, policy and capacity-building measures designed to increase the abilities of countries to manage disaster risks
2. Physical (prevention): e.g., building sea-walls as part of flood defense mechanisms
3. Physical (coping / adaptive): e.g., flood shelters for use during a disaster event.
4. Capacity building (at the community level): e.g., developing a disaster preparedness committee.

Table 1 below outlines some of the potential co-benefits and the co-costs associated with particular DRM investments.

Table 1. A review of co-benefits associated with DRM measures		
DRM activity	Potential co-benefits	Potential co-costs
Flood protection structures	Provision of irrigation or potable water and hydro-electric power	Generate flooding elsewhere
Retrofitting schools	Continuation of schooling and the protection of school books	Use of schools as shelters may diminish their appropriateness as a suitable place for education
Improvements in civil society networks and linkages - to strengthen response capacity	Improved governance and more organized social structures	Reduction in state responsibility for emergency response
Proper land use and urban planning processes (to manage flood risk)	Delivery of basic necessities (e.g. potable water, drainage, sewerage, power, and community facilities)	Reduction in tax revenues from businesses that would have located in high-risk places (e.g. coastal areas)
Emergency shelters	Community facilities (e.g. clinics or schools) in non-disaster periods	Investments in purpose-built schools and hospitals foregone
Improvements in water supply systems in rural areas (particularly those prone to drought and floods)	Water supply systems improved regardless of a disaster occurring	Water taken away from other places - increasing drought risk elsewhere
Construction and use of drainage pipes to reduce flood risk	Improved irrigation practices, possibly improved agricultural practices	

³ Environmental Resources Management (2005) Natural Disaster and Disaster Risk Reduction Measures: A Desk Review of Costs and Benefits: pp 13-14.

Community-based disaster preparedness	Improved women's involvement in community level activities Enabling village men to continue to work their own land and be with their families	Reduction in state responsibility for coordinating preparedness
Installing more resilient wireless communications (particularly in hurricane-prone places)	Enhancing access to telephony and electronic data services	
Training farmers to diversify the use of crops and build resilience to drought	Reducing vulnerability to poverty	
Better monitoring of food supplies for drought early warning systems	Improving the food supply chain, possibly making it more cost-effective	
Source: Adapted from Environmental Resources Management (2005) and White and Rorick (2010). ⁴		

Some of the most commonly cited co-benefits include those associated with community-based DRM. Particularly when efforts to prepare for disasters involve high levels of community participation, these processes can have a positive impact on community cohesion⁵ and even empower vulnerable groups. Other frequently used examples of co-benefits are seen in eco-systems approaches to DRM. IUCN, for example, adopts an ecosystems approach for managing disaster risks that provides benefits to communities in post-disaster situations.⁶ Mangrove conservation programs for DRM protect poor people living on coastal land to storms and also provide wood for fuel. In addition, mangroves are important breeding places for fish, shellfish and contribute to shoreline stability.

Such co-benefits - which materialize irrespective of the advent of a disaster - are clearly important to investment decisions in DRM, although they cannot easily be incorporated in traditional CBAs. Co-benefits may therefore need to be identified and addressed in their own right, and not necessarily as inputs into an aggregate economic analysis of a disaster risk management project.

A review of the literature suggests that there may be some co-benefits that are particularly difficult to capture in traditional CBA analysis. These include the following:

⁴ White, B A, and Rorick, M M. (2010). Cost-Benefit Analysis for Community-Based Disaster Risk Reduction in Kailali. Lalitpur, Nepal: Mercy Corps Nepal.

⁵ See: http://www.disaster.co.za/pics/PrBarneyDeVilliersDMISACnf1999Disasters_Social_Imp.pdf.

⁶ See: http://www.iucn.org/about/work/programmes/ecosystem_management/disaster/about_drr/.

- Behavior change - e.g. infrastructure designed to reduce risk but with other co-benefits improvements in the design such as greening and better sanitation;
- New business opportunities - e.g., DRM investments that create new business opportunities such as a dam that offers opportunities for fishing and more robust fishing boats that permit fishing in deeper waters.

3. Challenges in identifying environmental and socioeconomic

co-benefits

A key challenge for making DRM investment decisions is incorporating environmental and socioeconomic co-benefits into traditional economic assessments. As outlined in the previous section, this is because of the shortcomings of using CBA approaches to assess these co-benefits, but it is also because of the idiosyncrasies of public decision-making with respect to public goods, such as disaster risk reduction. These challenges are described in more detail below.

3.1 Shortcomings of using standard cost-benefit analysis

Standard CBAs that aggregate costs and benefits face at least four major challenges which make it difficult to fully account for environmental and socioeconomic co-benefits associated with DRM.

First, environmental and social co-benefits most often cannot be easily monetized. How does one monetize the value of enhanced livelihoods? How does one value strengthened community empowerment, integrated environmental and social assessments with inclusive stakeholder consultation, improved environmental and social management systems, and protected ecosystems and wildlife conservation? Because most such co-benefits are not easily monetized, they are not likely to be included in a traditional CBA. This will result in the aggregate benefits of a DRM investment - including direct benefits and co-benefits - being relatively undervalued compared to aggregate costs.

Second, many co-benefits are delivered beyond the life of a project, such as social cohesion and sustainable landscape management. Thus, even if these benefits could be monetized, those occurring in the more distant future will be discounted significantly by any rate of interest chosen for an aggregate economic assessment. In present value terms, these co-benefits will then be relatively undervalued compared to costs which are more likely to occur in the near future. Once again, aggregate benefits will be undervalued compared to costs.

Third, the likelihood of a disaster occurring is, of course, uncertain, as is the timing of its occurrence. With both the likelihood and the timing of disasters being uncertain, decision-makers are unable to determine when a DRM investment should be taken. This means that any potential co-benefits arising from such an investment - irrespective of the occurrence of a disaster - are subject to deliberations over when and if such an investment decision should be made. Thus, potentially significant and more immediate co-benefits may be missed because of delays in investment decision-making.

Fourth, and perhaps most importantly, a traditional CBA does not easily account for the distributional aspects of DRM investments. CBA provides an aggregate assessment - i.e. if aggregate benefits exceed aggregate costs, then the investment should be undertaken. Co-benefits, however, may address specific environmental and socioeconomic problems, such as those outlined in previous sections and they are likely to impact various groups differently, such as workers, local communities, indigenous peoples, investors and consumers. Critically, important distributional considerations are not included in a traditional aggregate economic assessment.

When decision-makers try to be more 'business-like' and 'efficient' in their investments in DRM, there is a risk that they might actually ignore important co-benefits that are critically important for their decision-making. In particular, understanding the distributional impacts of the investments with respect to specific social and environmental issues is crucial.

3.2 Idiosyncrasies of public sector decision-making

In addition to the short-comings of CBAs, there are further idiosyncrasies of decision-making, especially with respect to investing in public goods such as DRM programs, which both mitigate the risk of disasters and potentially generate an array of environmental and socioeconomic co-benefits.

First, political time horizons tend to be short. Leaders and ruling parties generally focus on more immediate issues. Potential co-benefits of DRM, on the other hand, may be more long term and less visible to policy makers. Thus they are likely to be of less interest to those currently in power and wanting to stay in power.

Second, there may be political risks in undertaking DRM projects, especially if critical constituencies perceive that the impacts may be potentially negative. For example, risk mitigation regarding environmental sensitivities within the Arctic Circle in Alaska will be off the agenda in the US when a highly contested mid-term election is approaching. Highlighting potential environmental and social co-benefits may not always be politically popular.

Third, the direct benefits of DRM are generally seen as a public good or at least a good for a sizeable portion of the public. This means that these benefits may not be seen by citizens as a personal benefit to them and thus these citizens may not support political decision-makers who invest in them. Because of the economics of self-interest, public sector decision-makers - like their counterparts in the private sector - tend to underinvest in public goods. Thus, as we will see below, making the environmental and social co-benefits visible may be critical to actually securing an investment in a DRM project.

Fourth, and perhaps most worrisome, public decision-making may be more attracted by investments which generate quick financials return for the Treasury or quick spurts in economic growth than by a more long term and less immediate investments to managing the risks of disaster in an environmentally and socially responsible way. This preference for short term growth rather than long term sustainability and social equity may even encourage investments which increase the risk of disasters. Such investments could include promoting urban or industrial growth in sensitive areas such as flood plains, estuaries and coastal areas.

4. Opportunities to promote environmental and socioeconomic co-benefits

Although it might appear to be 'business-like' and 'efficient' to include all environmental and social impacts of their projects in a CBA, most companies and financial institutions today do not attempt to monetize all costs and benefits. Nor should governments. For some issues, such as worker safety, it is actually inappropriate to put an economic value on a company's efforts. For other issues, such as social cohesion or ecosystem integrity, an economic valuation makes little or no sense. Rather the social and environmental impacts of projects - whether private or public - should be identified, assessed, and managed. This is why expert credit agencies, commercial investment banks and others are using best-practice environmental and social standards to address the potential impacts - both negative and positive - of investment decisions.

4.1 Toward a DRM co-benefits framework

In the case of private sector investments, as can be seen in the framing of the IFC Performance Standards,⁷ the emphasis is on reducing the environmental and social risks of a commercial project. In the case of public sector investments, however, such as DRM

⁷ International Finance Corporation (IFC) Environmental and Social Performance Standards: <http://www.ifc.org/performancestandards>. Also see Annex A.

investments, the emphasis needs to be on ensuring net positive environmental and social co-benefits - both by mitigating any negative impacts and by enhancing any positive impacts.

In this respect, political decision-makers may want to refer to internationally-accepted sustainability and safeguard frameworks from the IFC, the World Bank and others to establish a *co-benefits framework for DRM investments*. For example, the approach set out in the IFC's Performance Standard 1 on the assessment and management of environmental and social risks and impacts could be adopted for a DRM Co-Benefits Framework, as follows:

- Identify and evaluate DRM environmental and social impacts;
- Mitigate potential co-risks: i.e. avoid, minimize and compensate/offset;
- Enhance potential co-benefits: i.e. require, maximize and subsidize/integrate;
- Manage DRM investments effectively to ensure net positive co-benefits;
- Communicate, listen and respond to key stakeholders; and
- Engage, disclose and disseminate to key stakeholders.

As discussed further below, further research on the co-benefits of existing DRM investments will also contribute to developing such a framework. This framework should also include a typology of co-benefits and co-costs which identifies key elements such as:

- Direct benefits vs co-benefits
- Direct costs vs co-costs
- Intended vs unintended co-benefits and co-costs
- Immediate vs long-term co-benefits and co-costs
- DRM-specific vs general public investment co-benefits and co-costs.

4.2 Qualitative Cost-Benefit Analysis

As a step toward developing a robust environmental and socioeconomic framework for DRM investments that steps away from the aggregate cost-benefit decision-making approach, a practical approach could be to simply list direct benefits, co-benefits and costs. The list could include items such as the following:

- **Direct benefits of DRM**
 - Avoided direct disaster costs
 - Avoided indirect disaster costs
 - Avoided non-economic disaster impacts
- **Co-benefits of DRM**
 - New, additional sources of income

- Improved labor and working conditions
- Efficient resource use and reduced pollution
- Enhanced community health, safety and security
- Responsible land acquisition and resettlement
- Conservation and sustainable use of biodiversity
- Respect for indigenous peoples
- Protection of cultural heritage
- **Costs of DRM**
 - Planning
 - Construction
 - Labor
 - Materials
 - Opportunity costs of the allocation of resources
- **Co-costs of DRM**
 - Increasing risk in non-target communities
 - Increasing scarcities in other public goods and services
 - Unintended changes in migration patterns
 - Negative environmental and socioeconomic externalities.

In this respect, guidance from the US Federal Emergency Management Agency (FEMA) on a *qualitative* CBA may be useful.⁸ FEMA proposes a straightforward method called ‘simple listing’, which identifies all cost and benefits of RM actions and assigns priorities.

This kind of exercise can help decision-makers to better understand the range of benefits – both direct benefits and co-benefits – of a potential investment decision. In so doing, the case for investing in DRM can be better communicated to stakeholders who are likely to be interested in the more immediate social and environmental co-benefits of a DRM program or project than in the more distant and less transparent direct benefits of the project.

By showing that the investment not only has direct benefits in terms of reducing disaster losses, but also significant, visible and accountable co-benefits for society and for the environment, it will be easier to demonstrate that the investment provides more immediate returns in support of sustainable development. In short, an articulation of the co-benefits can make the case for investing in a DRM project.

⁸ Federal Emergency Management Agency. (2007) Using Benefit-Cost Review in Mitigation Planning State and Local Mitigation Planning How-To Guide Number Five. FEMA 386-5. US Department of Homeland Security: pp 8-9.

4.3 Integrating DRM and environmental management

A number of approaches and tools have been proposed by different agencies to link DRM and environment management planning processes. The Global Development Research Center provides an overview of tools for linking DRM to environmental management in an urban context, demonstrating how DRM investments can generate environmental co-benefits through associated process of environmental management.⁹ It presents six tools for doing so, divided into three parts: planning options, assessment of options and implementing actions (see Table 2).

Parts	Tools
Planning Options	Environmental Profiling Eco and Hazard Mapping
Assessment of Options	Environmental Risk Assessment Environmental Impact Assessment Strategic Environmental Assessment
Implementing actions	Environmental Management Systems

The overview of tools proposes creating “an environmental profile (EP) of an area or community” as a first step in understanding the interactions between the local environment and disaster vulnerabilities. An EP for DRM purposes provides valuable information for other environmental management issues and thus highlights environmental co-benefits. The overview explains:

“An 'environmental profile' (EP) provides a systematic overview of the development, environment and disaster setting, and institutional arrangements of an urban area, which is designed to highlight the environment-disaster interactions, the critical issues, and the sectors and stakeholders directly concerned with them. In this tool, a brief introduction to the social, economic and physical features of the city is made.”

Regarding environmental impact assessments (EIAs), the overview proposes using these for DRM purposes to identify and generate important co-benefits:

“The EIA tool, well known for the assessment of development projects such as a dam or a complex of factory buildings, can also be used for disaster planning and management. Like the ERA [environmental risk assessment] tool, it enables informed decision making on the development of a city, but also in preparing for disasters

⁹ See: <http://www.gdrc.org/uem/disasters/disenvi/tools/>.

(whether natural or man-made), and in monitoring and evaluation of the action taken.”

Beyond planning, and in order to ensure continued implementation of measures to manage disaster risk and the environment, the overview suggests setting up an Environmental Management System (EMS) as “a systematic way to ensure environmental issues are managed consistently and systematically.” An EMS can ensure the integrated delivery of DRM and environmental and social co-benefits:

“Effectively applied, an EMS can help integrate environmental considerations within a larger disaster management plan.”

The suggestions provided above demonstrate some ways in which a DRM Co-Benefits Framework could be set up using existing tools and processes, to integrate environmental and social management practices based on international and national best practice. This will help to ensure that DRM co-benefits are identified, assessed and enhanced in DRM investment processes. In so doing, the likelihood of DRM programs and projects being approved by Ministries of Finance will also be strengthened.

5. The need for DRM co-benefits case studies

DRM case studies which highlight the benefits of investment in managing risk generally focus on the direct benefits. In some cases, they also focus on associated environmental and socioeconomic benefits which may arise in disaster response measures. Regarding co-benefits of DRM investments irrespective of whether there is a disaster, there is a need for more case studies.

One opportunity is to revisit existing DRM cases and more thoroughly explore the co-benefits aspects of these cases. Another option is to research new cases with a specific focus on co-benefits. The authors have identified two new case studies, each illustrating some of the environmental and socioeconomic co-benefits described in previous sections. These co-benefits were not fully recognized until after the DRM investments were made so did not incentivize action. However, knowing that they exist could stimulate further action to reduce disaster risk. However, the cases need to be developed further, particularly if some of these elements are to be quantified and the size of the co-benefits to be established for advocacy purposes.

Case study 1: Jamaica - the co-benefits of investing to reduce drought risk in agriculture

In Jamaica, the agricultural sector contributes about 6% of GDP and employs 17-18% of the labor force. Domestic agriculture is largely located on hillside plots with an average size of one acre with slopes above 15 degrees; while the export agriculture (including coffee, banana, cacao and coconut) contributes to 22% of total exports, raising US\$274 million in foreign exchange each year. A number of DRM programs have focused on this sector, including the Jamaica Rural Economy and Ecosystems Adapted for Climate Change (JaREEACH), which aims to strengthen local and national institutional capacity to support CCA and DRM within agriculture. The Planning Institute of Jamaica also committed US\$9.9M to the development and implementation of adaptation measures, focusing on strengthening agricultural productivity, coastal protection, and building local capacity for natural resource management.

Of these investments, those that have focused on reducing drought risk in farming seem to offer particularly high potential for co-benefits. The installation of dedicated irrigation systems to overcome the impact of drought has helped farmers to increase their productivity and output, as well as reducing soil erosion and deforestation by optimizing previously inefficient farming practices (see Box 1).

Box 1. Resilience dividends of risk management in Jamaican agriculture

Key co-benefits of integrated DRM investments include the following:

(1) Economic co-benefits

DRM irrigation projects that have reduced the impact of droughts, particularly in Southern Clarendon and St. Elizabeth. These farming communities have also benefited from increased productivity and output relative to other areas, even in the face of drought over the April-June quarter in 2014.¹⁰

(2) Social co-benefits

Training and shared learning on drip irrigation has strengthened social capital and built comradeship within the communities, especially among the farmers in the field.

(3) Environmental co-benefits

A rainwater catchment tank and drip irrigation system in Lititz, St. Elizabeth, has improved small-scale irrigation resulting in higher yields, less soil erosion and deforestation, and an increase in socioeconomic status.

¹⁰ Ministry of Agriculture and Fisheries. Statement on Drought Conditions and Impact on the Agricultural Sector. Article accessed from: http://www.moa.gov.jm/Speeches/2014/20140729_Statement-on-Drought-Conditions-and-Impact-on-the-Agricultural-Sector.php

These co-benefits have not been quantified yet - we do not know by how much productivity has increased - but identifying them provides a useful first step in building the case for scaling up investment in drought risk management in Jamaica.

Case study 2: Mexico - the co-benefits of flood protection in urban areas

The World Bank and Mexico's Ministry of Finance elaborated a joint study to determine the impact of investment in flood defense in terms of reducing flood damage in the State of Tabasco between 2007 and 2010. The study found that the cost-benefit ratio of these investments was 4:1, contributing to avoided damages and losses when floods occurred in 2010 equivalent to US \$3 billion, or 7% of the GDP of Tabasco. This figure does not however capture the full range of co-benefits associated with these investments.

The capital of Tabasco, Villahermosa, has also seen improvements in the urban environment as a result of federal government investment in flood defense. Major DRM investments have stimulated local actors to take greater care of the environment. Small scale projects with environmental benefits have been initiated, including tree planting on riverbanks to prevent landslides. People are beginning to dispose of litter more responsibly, throwing less in the streets or into drains to avoid these becoming blocked during rainy season.

A report by the Colegio de la Frontera Sur suggests, however, that there have been unintended costs or negative externalities associated with the flood defense project in Tabasco. Channeling water away from the capital Villahermosa, has led to increased flooding elsewhere in the state of Tabasco - mainly in rural areas. There have also been negative environmental impacts as a result of these large construction projects.

It seems that floods are not only caused by heavy rainfall but the way the dams operate. A Universidad Nacional Autónoma de México (UNAM) study of the floods in 2007 stated: "These results suggest that the suitable operation of the dams, based on better forecasts, would have reduced considerably the damages caused by the event". Overall, the Tabasco flood protection case study suggests that better methodologies are needed to measure the full range of costs and benefits of DRM investments, including unintentional ones.

Together these two case studies demonstrate a number of unexpected co-benefits associated with investment in DRM including direct income generating opportunities, environmental service co-benefits, increased social capital and behavioral changes.

Building on existing case studies

Regarding revisiting existing cases, this section introduces World Bank and UNDP cases which may be of interest.

Case study 3: Environmental and economic co-benefits from mangrove planting in Vietnam

A Viet Nam Red Cross 'Mangrove Plantation and Disaster Risk Reduction' project in the typhoon and flood prone coastal provinces of northern Viet Nam has proven to have significant environmental co-benefits including: carbon sequestration, nutrient retention, sediment retention, biodiversity habitat, flood attenuation, wastewater treatment and water supply and recharge. The 17 year long project cost USD 8.88 million to set up, and has involved the creation of 9,462ha of forest (8,961 ha of mangroves) in 166 communes and the 'protection of approximately 100km of dyke lines'.

In this World Bank case study, estimated benefits and costs in selected communes from 1994 - 2025 are demonstrated in Table 3.¹¹

Table 3: Estimated benefits and costs in selected communes 1994 - 2025¹²

¹¹ Taken from IFRC pg. 3 https://www.ifrc.org/Global/Publications/disasters/reducing_risks/Case-study-Vietnam.pdf

¹² Note: A: Excludes ecological benefits. B: includes ecological benefits. C: Protective benefit concern only the reduced damages to the sea-dyke. D: Protective benefits were identified but could not be validity attributed to the project. E: Protective benefits were identified but could not be quantified.
IFRC, pg. 8. https://www.ifrc.org/Global/Publications/disasters/reducing_risks/Case-study-Vietnam.pdf

Commune	Dai Hop	Thai Do	Nam Thinh	Giao An	DienBich
District	KienThuy	Thai Thuy	TienHai	GiaoThuy	DienChau
Province	HaiPhong	Thai Binh	Thai Binh	Nam Dinh	Nghe An
Population	10,955	6,087	7,240	10,496	10,521
Sea coastline (km)	3.9	5.5	5.9	3.2	3.5
Dyke line (km)	4.0	7.5	5.9	3.2	3.5
Timeframe of planting	1998-2005	1994-2005	1997-2005	1997-2005	1998-2005
Planting input (ha)	835	1,010	1,287	2,403	145
Planting output (ha)	450	900	380	678	100
Planting-related costs, USD	425,866	858,373	362,424	646,641	95,374
Protective benefits, USD	676,868 ^c	15,330,243	n.a. ^d	37,818,545	n.a. ^e
Direct economic benefits, USD	628,094	672,436	4,799,476	6,748,533	344,931
Ecological benefits, USD	10,989,000	32,730,828	12,307,055	23,308,814	3,437,879
Total identified benefits, USD	12,293,962	48,733,507	17,106,531	68,375,892	3,782,810
Benefit/cost ratio 1 ^a	3.06	18.64	13.24	68.92	3.61
Benefit/cost ratio 2 ^b	28.86	56.77	47.20	104.96	39.66

In terms of total benefits, including co-benefits, it is estimated that:¹³

- Approximately 350,000 beneficiaries have been reached directly, and two million indirectly
- There has been an 'increase in per hectare yield of aqua culture products such as shells and oysters by 209-789 percent'
- Economic benefits from aqua product collection, honeybee farming, etc., are found to be between US \$344,000 and US \$6.7 million in the selected communes.
- Environmental benefits include US \$218 million in terms of estimated minimum CO2 emissions absorbed by the planted mangroves (assuming a price of USD 20/t CO2e).

¹³ Taken from IFRC, p.7 https://www.ifrc.org/Global/Publications/disasters/reducing_risks/Case-study-Vietnam.pdf

Case study 4: Economic and livelihood co-benefits in the Lao People's Democratic Republic

The World Bank Mekong Integrated Water Resources Management Project has produced a number of economic co-benefits. Estimates of these benefits are based on the assumption that full benefits would be reached in 3 years and that the 'economic life of the investment is 15 years'.¹⁴ The project was designed with water resource management and flood plain management at its core and resulted in the rehabilitation of 10 floodgates in the Xebangfai River and about 40 village irrigation schemes were put in place in the Xebangfai and Xebanghieng Rivers of Lao PDR. The floodgate rehabilitation increased flood protection, but it also resulted in increased agricultural production (especially rice), increased fish catch in the floodplain and decreased electricity costs through increases in water use efficiency.¹⁵ A summary of the floodgate rehabilitation activities and estimated co-benefits are shown in Table 4.

Table 4: Summary of floodgate rehabilitation activities¹⁶

	Required Works	Estimated Financial Cost (USD)	Estimated Economic Cost ((USD)	Benefit Area (Ha)	Estimated Flood Protection Benefit (USD)	Estimated Fish Benefit (USD)	Total Benefit (USD)
Huay Pin	Rehabilitation of the mechanical works (gates), minor structural repairs to the headworks	72,000	68,400	120	12,375	3,600	15,975
Huay Kae	Rehabilitation of the mechanical works (gates), minor structural repairs to the headworks	52,500	49,875	100	10,313	3,600	13,913
Huay Pa Pak	Rehabilitation of the mechanical works (gates), minor structural repairs to the headworks	35,000	33,250	100	10,313	3,600	13,913
Huay Bung Or	Rehabilitation of the mechanical works (gates), resectioning of the canal (2.5 kilometer)	31,875	30,281	150	15,469	3,600	19,069
Huay Daeng	Rehabilitation of the mechanical works (gates), resectioning of the canal (3.0 kilometer)	38,250	36,338	170	17,531	3,600	21,131
Total			218,144	640	66,000	18,000	84,000

¹⁴World Bank, pg. 117 http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/02/19/000333038_20120219222343/Rendered/PDF/540090PAD0Box30official0use0only090.pdf

¹⁵ Taken from World Bank http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/02/19/000333038_20120219222343/Rendered/PDF/540090PAD0Box30official0use0only090.pdf

¹⁶ World Bank, pg. 118 http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/02/19/000333038_20120219222343/Rendered/PDF/540090PAD0Box30official0use0only090.pdf

Another component of the project included fisheries management, which aimed to support the rural infrastructure and rehabilitation/construction of the hatcheries. Although no prior economic analysis was possible, 'experience from similar projects in the region suggests that the rural infrastructure identified by the communities would have significant economic returns... reflect[ing] the priorities of the communities',¹⁷ and demonstrating co-benefits in terms of livelihood opportunities and returns.

Case study 5: Social co-benefits of women's secure housing program in the Philippines

Quantifying social co-benefits such as community empowerment and social inclusion is difficult. Engaging grassroots organizations in the design and implementation of DRM initiatives, for instance, has proven to be extremely beneficial but difficult to quantify. In the Philippines, the damayan ng maralitang Pilipinong api (DAMPA) women's group has been working on a project to help secure housing and livelihoods for the urban poor in Metro Manila, an area both earthquakes and floods. In addition to helping 3,500 poor families secure land and housing tenure, partnerships have been built with the government, civil society and private agencies that improve service delivery to poor communities, thereby making the initiatives more sustainable.

This UNDP project has provided DAMPA with improved access to 'knowledge, information, financial resources and ability to advocate for government programs that are responsive and accountable to the urban poor'.¹⁸ In addition, volunteers are now sitting on 'various local development and planning bodies organized at the local government level, where they actively participate in local governance and development planning activities in their localities'¹⁹ meaning that they can continue to advocate for the needs and voices of the poor.

Overall, despite the examples and suggested co-benefits highlighted in this paper, a comprehensive co-benefits framework is needed that includes and categorizes all potential environmental and socioeconomic impacts associated with DRM. Co-benefits research focused on revisiting existing case studies or developing new case studies could play an important role in this regard.

¹⁷ World Bank, pg. 116 http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/02/19/000333038_20120219222343/Rendered/PDF/540090PAD0Box30official0use0only090.pdf

¹⁸ http://www.undp.org/content/dam/aplaws/publication/en/publications/womens-empowerment/leading-resilient-development---grassroots-women-priorities-practices-and-innovations/f2_GROOTS_Web.pdf

¹⁹ http://www.undp.org/content/dam/aplaws/publication/en/publications/womens-empowerment/leading-resilient-development---grassroots-women-priorities-practices-and-innovations/f2_GROOTS_Web.pdf

6. Conclusions and next steps

This paper demonstrates that a business-as-usual approach to DRM is unlikely to focus sufficiently on the potential environmental and socioeconomic co-benefits of DRM. This is because these benefits are generally not seen as important to standard decision making processes for DRM; in part, because they are not included in traditional cost-benefit analyses. Nevertheless, co-benefits are already being generated by existing DRM projects and further case study research could help us to have a better understanding of these hidden benefits.

The development and testing of a *DRM Co-Benefits Framework* could help decision-makers to focus on the potential co-benefits of programs and projects aimed at building disaster resilience. Highlighting these would not only benefit the natural environment and affected communities, but also enhance the 'business case' for DRM and thus facilitate effective decision-making. In this respect, currently accepted environmental and social standards for investment and qualitative approaches to CBA may prove to be useful starting points. Also, within such a framework, as appropriate, the use of reliable, quantitative CBA information will also need to be included.

A good place to begin might be further research on current internationally-funded DRM projects which have integrated environmental and social safeguards to avoid negative impacts. As these projects are explicitly addressing environmental and social impacts, they could offer substantive insights on the potential for the DRM investments to also generate positive environmental and social co-benefits - irrespective of whether a disaster occurs.

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Annex A. Toward a set of DRM co-benefits issues

The following table outlines a selection of the environmental and socioeconomic issues set out by the International Finance Corporation (IFC), the private sector arm of the World Bank Group, in its Environment and Social Performance Standards.

Table 1. IFC Environment and social performance standards for projects	
Potential environmental co-benefits	Potential socioeconomic co-benefits
Avoided or minimized adverse impacts on human health and the environment by avoiding or minimizing pollution	Protection of workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties and workers in the project's supply chain
Sustainable use of resources, including energy and water	Safeguarding of personnel and property in accordance with relevant human rights principles and by avoided or minimized risks to the affected communities
Reduced project-related GHG emissions	Improved or restored livelihoods and standards of living, e.g. for displaced persons and for local household
Biodiversity protected and conserved	Improved living conditions for physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites
Maintained benefits from ecosystem services	Promoted sustainable development benefits and opportunities for indigenous peoples in a culturally appropriate manner
Sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities	Equitable sharing of benefits from the use of cultural heritage

The IFC Standards go further than just setting out the priority environmental and social co-benefits or co-risks of an investment. They specify topics and issues which should be addressed for each of the priority themes. As well, in associated guidance documents, they provide modalities for undertaking social and environmental assessments, for mitigating negative impacts, and some cases also for enhancing positive impacts.

For DRM investments, the specific topics and issues highlighted in the IFC Standards provide substantive coverage of the types of co-benefits which could and should be delivered with such an investment. These are outlined below and could feature in the development of a pilot DRM Co-Benefits Framework.

By focusing on such actions to ensure the management of co-benefits and to enhance the delivery of co-benefits, an investment in a DRM program or project will be much more likely to be of interest to key stakeholders, citizens, communities, and policy makers. This will improve the likelihood that the investment will be made.

However, as the IFC guidance documents focus on mitigating co-risks rather than on enhancing co-benefits, there remains a gap which will need to be filled, perhaps in part from insights emerging from DRM co-benefits case studies.

A.1 Ensuring co-benefits from DRM investments

Regarding the assessment and management of environmental and social co-risks and co-benefits, the following actions adapted from IFC PS1 are particularly relevant:

- Identify and evaluate environmental and social risks and impacts of the project
- Promote and provide means for adequate engagement with affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated
- Conduct a process of environmental and social assessment, and establish and maintain an ESMS appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts
- Establish an overarching policy defining the environmental and social objectives and principles that guide the project to achieve sound environmental and social performance
- Establish and maintain a process for identifying the environmental and social risks and impacts of the project
- Identify the range of stakeholders that may be interested in their actions and consider how external communications might facilitate a dialog with all stakeholders
- Conduct an Informed Consultation and Participation (ICP) process result in the affected communities' informed participation
- Develop and implement a Stakeholder Engagement Plan (SEP) that is scaled to the project risks and impacts and development stage, and tailored to the characteristics and interests of the affected communities
- Provide affected Communities with access to relevant information on:
 - (i) the purpose, nature, and scale of the project;
 - (ii) the duration of proposed project activities;
 - (iii) any risks to and potential impacts on such communities and relevant mitigation measures;
 - (iv) the envisaged stakeholder engagement process; and

(v) the grievance mechanism

- Provide periodic reports to the affected communities that describe progress with implementation of the project action plans on issues that involve ongoing risk to or impacts on affected communities and on issues that the consultation process or grievance mechanism have identified as a concern to those communities
- Establish and maintain an emergency preparedness and response system so that the project, in collaboration with appropriate and relevant third parties, will be prepared to respond to accidental and emergency situations in a manner appropriate to prevent and mitigate any harm to people and/or the environment

In addition to PS1, there are additional actions relevant to co-benefits management in PS5 on land acquisition and involuntary resettlement as follows:

- Consider feasible alternative project designs to avoid or minimize physical and/or economic displacement, while balancing environmental, social, and financial costs and benefits, paying particular attention to impacts on the poor and vulnerable
- When displacement cannot be avoided, offer displaced communities and persons compensation for loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living or livelihoods
- In decision-making processes related to resettlement and livelihood restoration, include options and alternatives, and, where applicable, disclosure of relevant information and participation of affected communities and persons will continue during the planning, implementation, monitoring, and evaluation of compensation payments, livelihood restoration activities, and resettlement
- Where involuntary resettlement is unavoidable, either as a result of a negotiated settlement or expropriation, a census will be carried out to collect appropriate socioeconomic baseline data to identify the persons who will be displaced by the project, determine who will be eligible for compensation and assistance, and discourage ineligible persons, such as opportunistic settlers, from claiming benefits

Relevant guidance from PS6 on community health, safety, and security includes the following action:

- Assist and collaborate with the affected communities, local government agencies, and other relevant parties, in preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations

Further relevant actions for co-benefits management from IFC PS7 on indigenous peoples include the following:

- Identify, through an environmental and social risks and impacts assessment process, all communities of indigenous peoples within the project area of influence who may be affected by the project, as well as the nature and degree of the expected direct and indirect economic, social, cultural (including cultural heritage), and environmental impacts on them
- Undertake an engagement process with the affected communities of indigenous peoples, including stakeholder analysis and engagement planning, disclosure of information, consultation, and participation, in a culturally appropriate manner
- Involve indigenous peoples' representative bodies and organizations (e.g., councils of elders or village councils), as well as members of the affected communities of indigenous peoples
- Provide sufficient time for indigenous peoples' decision-making processes

From PS8 on cultural heritage, there is the following relevant action:

- Consult with affected communities who use, or have used within living memory, the cultural heritage for long-standing cultural purposes to identify cultural heritage of importance, and to incorporate into the decision-making process the views of the affected communities on such cultural heritage
- Involve the relevant national or local regulatory agencies that are entrusted with the protection of cultural heritage

A.2 Enhancing environmental co-benefits from DRM investments

Environmental co-benefits can be generated by the following actions set out in PS3 on resource efficiency and pollution prevention:

- Apply technically and financially feasible resource efficiency and pollution prevention principles and techniques that are best suited to avoid, or where avoidance is not possible, minimize adverse impacts on human health and the environment
- Implement technically and financially feasible and cost effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with a focus on areas that are considered core project activities
- Adopt measures that avoid or reduce water usage so that the project's water consumption does not have significant adverse impacts on others

- Consider alternatives and implement technically and financially feasible and cost-effective options to reduce project-related GHG emissions during the design and operation of the project
- Avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release
- Avoid the generation of hazardous and non-hazardous waste materials
- Where appropriate, formulate and implement an integrated pest management (IPM) and/or integrated vector management (IVM) approach targeting economically significant pest infestations and disease vectors of public health significance

Regarding biodiversity conservation and sustainable management of living natural resources, PS6 sets out the following actions:

- Consider relevant threats to biodiversity and ecosystem services, especially focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution
- Sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project's lifecycle
- Avoid impacts on biodiversity and ecosystem services
- When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented
- Adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's lifecycle

A.3 Enhancing social co-benefits from DRM investments

The social co-benefits are set out in several of the IFC Performance Standards. This includes the following actions adapted from the PS2 on labor and working conditions:

- Adopt and implement human resources policies and procedures appropriate to its size and workforce that set out its approach to managing workers
- Identify migrant workers and ensure that they are engaged on substantially equivalent terms and conditions to non-migrant workers carrying out similar work
- Base the employment relationship on the principle of equal opportunity and fair treatment with no discrimination with respect to any aspects of the employment relationship, such as recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job

assignment, promotion, termination of employment or retirement, and disciplinary practices

- Take measures to prevent and address harassment, intimidation, and/or exploitation, especially in regard to women
- Do not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development
- Provide a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in the client's work areas, including physical, chemical, biological, and radiological hazards, and specific threats to women

The following social co-benefit actions are from PS6 on community health, safety, and security:

- Evaluate the risks and impacts to the health and safety of the affected communities during the project life-cycle and will establish preventive and control measures consistent with good international industry practice (GIIP)
- Design, construct, operate, and decommission the structural elements or components of the project in accordance with GIIP, taking into consideration safety risks to third parties or affected communities.
- Avoid or minimize the potential for community exposure to hazardous materials and substances that may be released by the project
- Avoid or minimize the potential for community exposure to water-borne, water based, water-related, and vector-borne diseases, and communicable diseases that could result from project activities
- Avoid or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labor.

Finally, social co-benefits actions from PS8 on cultural heritage include:

- Identify and protect cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented
- Where a project proposes to use the cultural heritage, including knowledge, innovations, or practices of local communities, inform these communities of their rights under national law and the potential consequences of such a development.