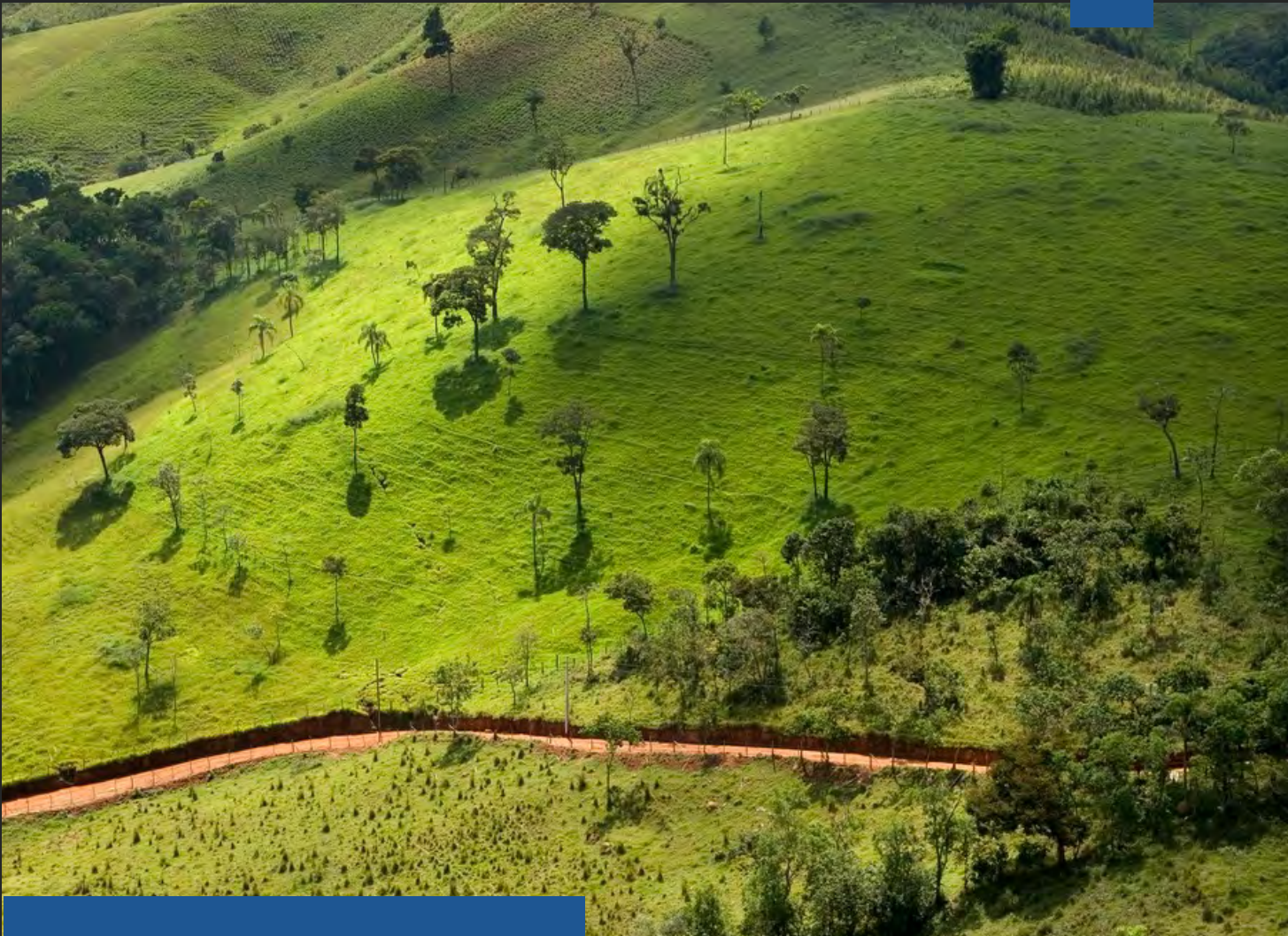




Food and Agriculture
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United Nations

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Nature-based solutions
in agriculture

Project design for securing investment

NATURE-BASED SOLUTIONS
IN AGRICULTURE
**PROJECT DESIGN FOR
SECURING INVESTMENT**

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The purpose of this finance brief is to share The Nature Conservancy's experience and the growing body of empirical evidence to assist conservation practitioners and project developers in identifying projects with high potential to benefit from securing repayable finance, and to recommend an evaluation process for choosing these projects that emphasizes deep diligence into problem definition and identification of financing as the project bottleneck.

This paper assesses the environmental and business cases for private investment in Nature-based Solutions, reviews the current state and trends of private investment in agriculture Nature-based Solutions, identifies barriers to increased product development and investment, and provides a framework and resources for project managers seeking to develop investable nature-based projects in agriculture.

CONTENTS

6 KEY MESSAGES

8 INTRODUCTION

- 10 Why Nature-based Solutions?
- 11 What are Nature-based Solutions?
- 13 Unique aspects of agriculture Nature-based Solutions

14 CURRENT STATE OF NBS INVESTING

- 15 Multiple financial instruments can support Nature-based Solutions in agriculture
- 16 Business case/investment case
- 16 Trends in investment in Nature-based Solutions: how do agriculture NbS fit in?
- 18 Barriers/challenges identified by the actors in agriculture NbS investments

22 PROJECT DESIGN IMPLICATIONS: HOW TO DESIGN FOR INVESTMENT?

- 29 Module 1: identifying project goals and technical options
- 30 Social and conservation outcomes
- 35 Identification of practices
- 41 Pathways to adoption

44 Module 2: Conducting economic analyses and identifying financing strategies

46 Cash flows and financial performance

47 Barriers to finance

50 Evaluation of concessionary capital and de-risking mechanisms

53 Module 3: Organizing the institutional arrangements and governance

54 Institutional arrangements

55 Measuring and evaluation

57 Policy alignment

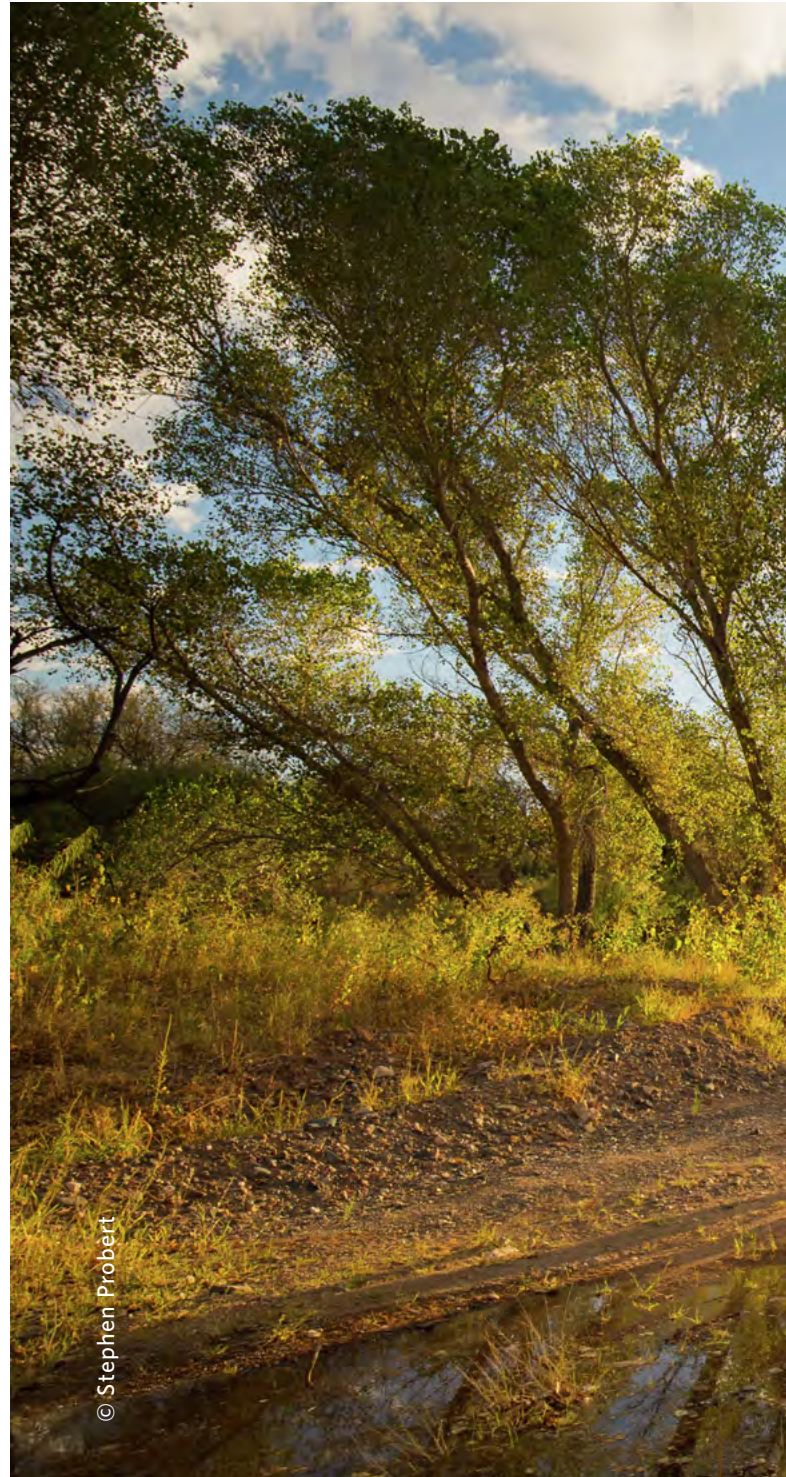
58 CONCLUSION

59 FINANCE 101

65 REFERENCES

KEY MESSAGES

- 1** Agriculture Nature-based Solutions (Ag NbS) have high potential to help mitigate the negative effects of climate change and protect biodiversity in working landscapes around the world. However, relative to its potential, Ag NbS has not scaled-up. One barrier to scaling is that Ag NbS tend to be capital intensive, requiring significant amounts of public funding or private investment, or a blend of grants and investment capital.
- 2** “Repayable finance” (defined as sources of capital that must be repaid to the capital providers - usually with a financial return in addition to principal) is an appropriate, but underutilized, source of project capital and can help bridge the funding gap between the current deployment of Nature-based Solutions and the level of deployment needed to preserve healthy ecosystems to meet global goals for climate mitigation through land-based practices.
- 3** The quality of a project and its development is one of the most critical aspects for attracting financing from public and private sources alike. On-the-ground experience and existing research commends several best practices for developing Ag NbS investments, including starting with a clear identification of project goals and how repayable finance is a key part of the solution, validating the technical performance, and rigorously substantiating the key assumptions of financial underwriting.
- 4** A range of factors influence decisions by farmers and producers about adopting new production practices. These factors vary widely by individual gender, landholdings, and business size as well as regional biophysical, economic, socio-cultural, and policy environments. Investing in Ag NbS requires a nuanced understanding of the specific constraints that different farmers face, including farmers’ access to natural resources, credit, markets, and infrastructure.





- 5** Grants or concessional loans (e.g. from international financial institutions) represent important financial and technical de-risking instruments within blended finance solutions. In such contexts and where the business and investment case for the project is relatively strong, an important consideration should be ensuring investment additionality to avoid crowding out of private investment. Also, if such grant or concessional funding is accessed, project proponents should evaluate the financial sustainability of project results once public support or concessional financing is no longer available.
- 6** The quality of the enabling environment and institutional capacities can be important determinants of success. Whilst farmer uptake of promising Ag NbS is at the core of the model, success often requires an ecosystem of actors—including non-governmental organizations (NGOs), policymakers, corporations and others—loosely coordinating their efforts and thoughtful policy and institutional engagement in order to achieve desired environmental and social impacts at scale. Engaging with the enabling environment should happen *ex ante* since assessing the context within which the project will operating can make the difference between success or failure. Costs of policy misalignment should be taken into account and internalized when assessing technical, operational and financial risks, and feasibility.

INTRODUCTION

NATURE-BASED SOLUTIONS IN AGRICULTURE: PROJECT DESIGN FOR SECURING INVESTMENT



INTRODUCTION

Today, the global food system drives a ten trillion-dollar economy that connects 7.5 billion consumers and a diverse array of more than 1 billion food producers (farmers, ranchers, pastoralists, and fish harvesters). Approximately one-half of the world's habitable lands are used for agriculture (Ritchie, 2019). Not surprisingly, the food production system has a massive impact on our planet.

As we look to the future, global food demand is set to increase 50%, including a 70% increase in protein demand by 2050 (OECD and FAO, 2018). Any solution to our challenges around climate, conservation and human well-being will need to involve a transition in the way we produce food and fiber. Agriculture can begin to use

Nature-based Solutions (NbS) to reduce environmental impacts and, in some cases, enhance agricultural productivity. But in order to realize the full potential of Ag NbS to have a positive impact on these problems, we need new ways to fund them that are commensurate with the scale of the opportunities.

Note: *this paper focuses on “repayable finance”, defined as sources of capital that must be repaid to the capital providers – usually with a financial return in addition to principal – versus all kinds of project financing. Repayable finance may come from private and public sources. The paper discusses circumstances when other kinds of finance, such as research grants, might be a critical part of ultimately attracting repayable finance.*

Agriculture and food system direct and indirect emissions account for

24%

of global greenhouse gas emissions, half of that through deforestation and land conversion (IPCC).

Agricultural expansion is the primary driver

80%

of native habitat loss globally with related extinction rates of at least 10,000 species per year (FAO / WWF).

90%

of global fisheries are fully-fished or overfished with aquaculture as the fastest-growing source of supply in animal protein (WEF).

52%

of agricultural land is **severely or moderately degraded** leading to the abandonment of 12 million hectares per year (ELD).

40%

gap in demand and supply of freshwater at the basin level with irrigated agriculture accounting for 90% of consumptive use (WEF).

WHY NATURE-BASED SOLUTIONS?

Multiple global frameworks and policy initiatives – including the UN Framework Convention on Climate Change, the Convention on Biological Diversity, and the Sustainable Development Goals – support the use of natural or ecosystem approaches to slow climate change and improve the environment. The Food and Agriculture Organization (FAO), non-governmental organizations, and multi-national corporations (ex. the [Business for Nature](#) coalition) recognize a key role in reforming food production to meet these global goals, specifically through a transition to sustainable food and agriculture systems, including crop production, livestock, forestry, and fisheries and aquaculture in the management of natural resources (FAO, 2014).

As part of this transition, agriculture can employ Nature-based Solutions (Ag NbS), which shift productive landscapes from drivers of environmental impact to environmental solution providers. NbS can provide a triple benefit when properly used—NbS can increase agricultural production and resilience, mitigate climate change, and enhance nature and biodiversity (TNC, 2020).

RESILIENT FOOD PRODUCTION

Ag NbS can help farmers adapt to and ensure food production is more resilient to future weather extremes like droughts, heavy storms, or coastal flooding by enhancing soil health and water retention, reducing soil erosion, and buffering shorelines (Global Commission on Adaptation, 2019)

MITIGATING CLIMATE CHANGE

Ag NbS can reduce carbon emissions from the food sector and store carbon by changing crop residue, cover crop, and tilling practices in ways that increase the carbon retained in plants and soils (Griscom *et al.*, 2017)

ENHANCING NATURE AND BIODIVERSITY

Ag NbS can enhance ecosystems and species by increasing habitat diversity, such as restoring wetlands and improving the quality and reliability of water (Abell *et al.*, 2017)

To incentivize the adoption of Nature-based Solutions, we must find ways to pay for them, at large scales. Currently, there is a significant gap between the amount of investment in conservation practices and the amount needed to preserve healthy ecosystems (Figure 1) and meet the goals of climate mitigation through land-based practices.

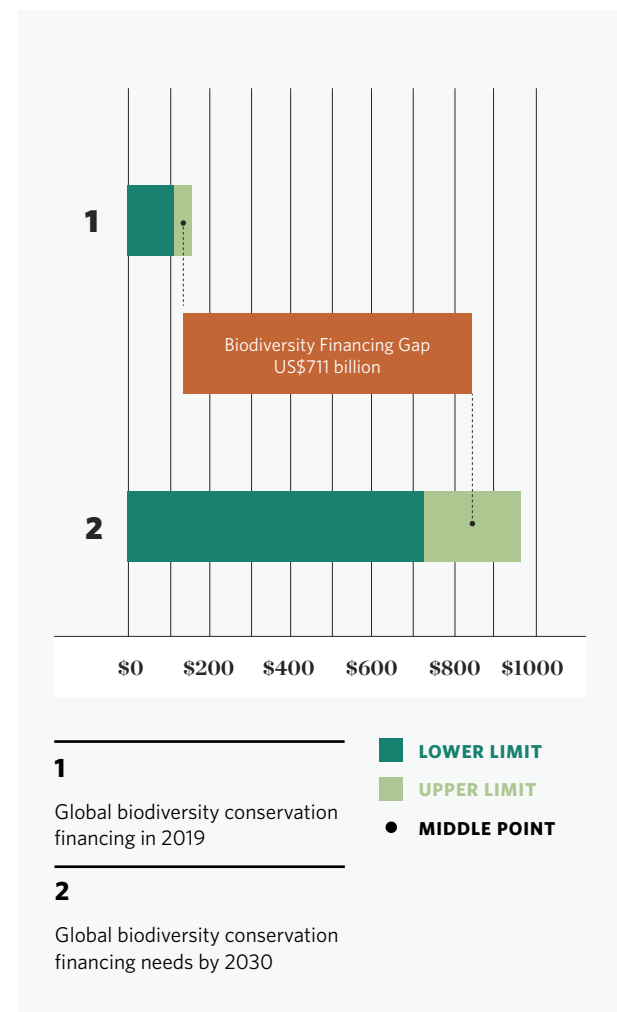


FIGURE 1. GLOBAL BIODIVERSITY FUNDING GAP (DEUTZ ET AL., 2020)

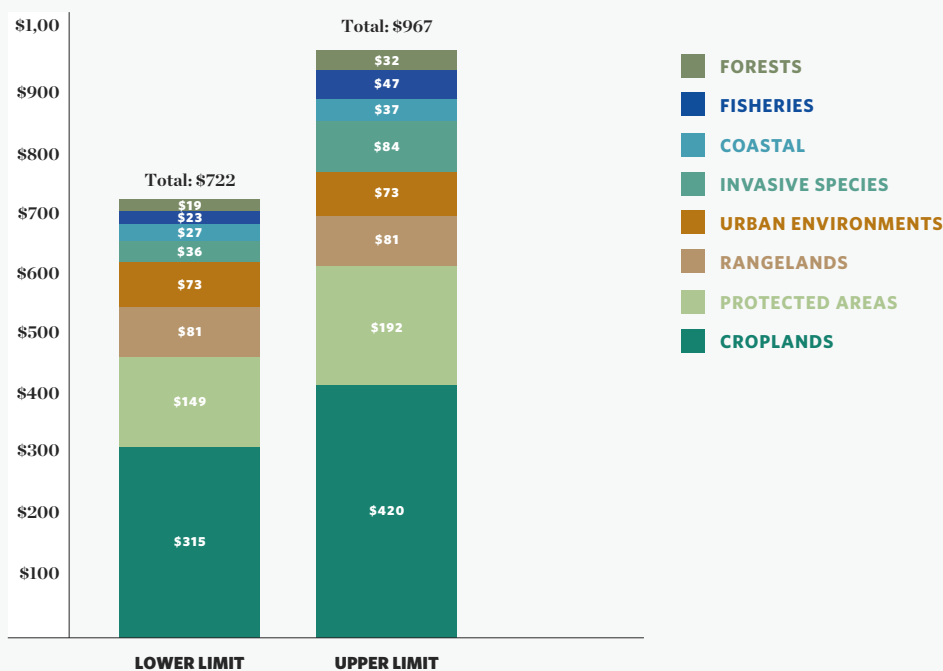


FIGURE 2. GLOBAL BIODIVERSITY CONSERVATION FUNDING NEED (DEUTZ *ET AL.*, 2020)

WHAT ARE NATURE-BASED SOLUTIONS?

A common and widely used definition of NbS comes from the International Union for Conservation of Nature (IUCN): Nature-based Solutions are defined as actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (IUCN, 2016) (Cohen-Shacham, 2016). In July 2020, the IUCN released its Global Standard for Nature-based Solutions, a framework to provide clarity and precision on what constitutes NbS and what is required to deploy NbS successfully. The framework includes financial viability and several other criteria that is helpful for practitioners evaluating projects.

NbS can range in terms of how natural or engineered a solution is, from protecting a fully intact ecosystem (e.g. an old-growth forest), restoring degraded ecosystems (e.g. re-establishing traditional agroforestry), and implementing new ecosystems (e.g. an engineered wetland) (Cohen-Shacham *et al.*, 2016). While the term “Nature-based Solutions” is relatively new, it encompasses a range of practices that in many cases have been used for decades, are based on indigenous knowledge, or were known under different names such as “conservation agriculture”. Often, the term is used as an umbrella concept to cover a range of ecosystem-related approaches including ecosystem-based adaptation, natural climate solutions, and green infrastructure.

The Nature-based Solutions in Agriculture: Sustainable Management and Conservation of Land, Water, and Biodiversity (2021) provides a broad suite of NbS that can be taken directly in the context of the production of food and fiber, either by agricultural practitioners or on lands or waters used for production. Many of these practices align with an emerging field of practice called ‘regenerative agriculture’. Nature-based Solutions can be employed in terrestrial food production, forestry and timber management, or in freshwater, coastal or marine environments, to enhance food production, store carbon, and preserve the environment and associated services.

AGRICULTURE NBS

NbS Activity	01	02	03	04	05	06	07
	GRAZING OPTIMIZATION	IMPROVED RICE CULTIVATION	BIOCHAR	CROPLAND NUTRIENT MANAGEMENT	CONSERVATION AGRICULTURE	TREES IN CROPLANDS	IMPROVED PLANTATIONS
NbS Benefits							
Functions	Improve animal grazing intensity, pasture management and feed practices to reduce GHGs.	Adopt water management techniques, improve drainage practice residue incorporation.	Increase use of biochar to increase carbon storage.	Reduce excessive fertilizer and other additives and remove perverse incentives to increase fertilizer use.	Cultivate additional cover crops in fallow period; shift to reduced or zero tillage.	Promote integration of trees into agriculture lands to increase habitat value.	Extend harvest rotation lengths on intensively managed production forests.
Quantitative example of NbS benefits	1.4B head of cattle of potential; over 90% of cattle on earth	2.9:1 benefit-cost ratio water quality improved	1,102M tons CO ₂ /yr	44M tons of nitrogen per year reduction	4.8B hectares of conservation land	1,040M tons CO ₂ /yr	257M hectares potential

FIGURE 3. AGRICULTURE NBS ACTIVITIES, BENEFIT FUNCTIONS, AND QUANTITATIVE EXAMPLES



The recognized contribution that NbS could make towards climate conservation and adaptation co-benefits (i.e. the positive benefits derived from actions to reduce greenhouse gases) has been increasingly documented in recent years. TNC has compiled a literature review, Nature-based Solutions in Agriculture: Sustainable Management and Conservation of Land, Water, and Biodiversity (2021), which documents literature sources in conservation and adaptation associated with a range of nature-based practices. For classification purposes, conservation benefits considered in this review fall into four generalized types of ecosystem services (biodiversity, water, soil, air) that may be enhanced as a result of the implementation of NbS.

UNIQUE ASPECTS OF AGRICULTURE NBS

Agriculture NbS carry elements of both private and public benefit, meaning that market forces alone are unlikely to result in sufficient adoption of even the most promising approaches. Ag NbS, such as conservation agriculture, can increase the productivity, efficiency and resilience of an individual farm, while also providing broader societal benefits for climate mitigation, biodiversity conservation, water quality and human welfare.

Understanding the private and public benefits of projects is critical in the design of finance and funding for Ag NbS, which are implemented by farmers and on agricultural lands. In the absence of smart policy and incentives, farmers may continue to implement traditional, lower cost, near-term solutions, rather than investing in unknown, seemingly more expensive, long-term Ag NbS practices.

Even for those Ag NbS with more immediate financial benefits to a farmer or producer, adoption and ultimately overall market penetration may be slow due to lack of training, awareness, certainty of the financial return on investment, culture, ease of implementation, and other non-economic factors. Other Ag NbS may not be adopted because they are not yet profitable, even on a longer time horizon, in which case policy, novel payment mechanisms and new business models are needed.

The scale of the intervention affects the complexity and pathways to successful implementation. Designing and executing an Ag NbS for a single property is different, and often simpler, than trying to apply Ag NbS at a landscape scale and with multiple public and private landowners. A challenge of Ag NbS is how to achieve landscape- or ecosystem-level impact, recognizing that it will require coordination of multiple actors, reflection of public and private benefit, and consideration for complex interactions and impacts at those larger scales.



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Understanding the **private and public benefits of interventions** is critical in the design of financing and funding for agriculture NbS ■

CURRENT STATE OF AGRICULTURE NBS INVESTING

NATURE-BASED SOLUTIONS IN AGRICULTURE: PROJECT DESIGN FOR SECURING INVESTMENT



MULTIPLE FINANCIAL INSTRUMENTS CAN

SUPPORT NATURE-BASED SOLUTIONS IN AGRICULTURE

There are several types of investment models and incentives that can increase the adoption of Agriculture NbS. Lending and investment instruments can include debt (commercial loans or bonds), equity (private equity funds or publicly traded companies), insurance risk management, payments for services, and public policies (like tax incentives, carbon pricing, or water tariffs).

In many cases, private and public finance can work together (i.e. blended finance) to enable investment. For example, there may be cases where risk is too high for private investment alone, or the public finance available is insufficient, thus creating a need to blend finance types. Financial instruments are treated in more detail in Module 2 below.

Grants				Repayable finance	
GRANTS	SUBSIDIES	PAYMENTS	RISK MANAGEMENT TOOLS	DEBT	EQUITY
<ul style="list-style-type: none"> Public funding for conservation easements Research and development grants State and federal funding for conservation acquisitions 	<ul style="list-style-type: none"> Tax incentives Public agricultural subsidies Partial cost reimbursement 	<ul style="list-style-type: none"> Payments for ecosystem services (e.g. carbon offsets and payments to farmers) 	<ul style="list-style-type: none"> Crop insurance (US Farm Policy) 	<ul style="list-style-type: none"> Commercial loans Farm lending Sustainability-linked loans Green bonds Bank ESG programs Other public credit 	<ul style="list-style-type: none"> Private equity funds Other farmland investment funds Early stage funds Publicly traded or private

FIGURE 4. FUNDING OPPORTUNITIES

Agriculture NbS can be particularly appealing because projects often provide multiple benefits. Depending on the approach, this can have advantages (e.g., multiple stakeholders can support a project; easier to gain political support due to diverse constituencies.) and disadvantages (e.g., free ridership where multiple entities must coordinate, political coordination issues, lack of clarity on governance). The structure of financing (and governance) for agriculture NbS can present opportunities and challenges. Unfortunately, structures and processes of creating shared incentives for undertaking the financial burden of natural infrastructure projects are not well understood.

BUSINESS CASE/INVESTMENT CASE

Many Ag NbS have significant societal benefits, typically broken down into a combination of private benefits that accrue directly to the asset owner or the business owner, and other benefits that are more public in nature, with the implication that those public benefits are economic externalities to the economic calculus that the individual landowner would take into account in his or her financial decisions. When evaluating the suitability of projects for repayable finance, it is important to understand the business case for that investment from the perspective of a landowner and the entity providing the capital. Investors, particularly private investors, have a widely used set of concepts and methodologies for evaluating investments (see the Finance 101 primer at the end of this paper for some of these key concepts).

This is not to say that public benefits do not matter from a financing perspective. Public funding, for example, through payments for ecosystem services such as carbon sequestration, might be an important source of revenue with which a private party could finance a project. Regardless of the source of capital, in order for a project to receive repayable finance there must be a strong business case and investment case.

The key calculus from the owner or producer perspective is how a particular investment will generate higher cash

flows and/or lead to an appreciation in the financial value of an asset. Higher cash flows can be achieved either through improving profit margins on a unit basis, which can be done either by increasing revenues for a particular area of property, or by reducing costs through efficiency measures. Asset appreciation typically occurs by improving the quality of asset itself, such as improvements in soil quality, or enhancements in the management practices on that property. The two concepts are related. Higher revenue and profitability from an asset is often the result of improving the asset.

A frequent and significant challenge of agriculture NbS is the time lag between when capital investments are made to improve cash flows or increase the value of an asset and the longer timeframe required to realize those improvements. For example, investing in the conversion of a property to organic production can take several years before a producer will see the price increases associated with the conversion to organic production. The selection of financing mechanisms for such a project would need to include a strategy for the lag between the investment and the rebound in cash flows. The time lag could make it difficult, for example, to make loan payments during the early years of such a conversion.

TRENDS IN INVESTMENT IN NATURE-BASED SOLUTIONS:

HOW DO AGRICULTURE NBS FIT IN?



Investments in Ag NbS are increasing— investors cite a variety of reasons for the increasing investment in impact sectors that create a positive return for society (Hamrick, 2016). In addition to the potential financial return, investment is often motivated by organizational mission or commitments to sustainability. However, another reason is that impact sectors contribute to a global agenda, such as the UN SDGs or the Paris Climate Accord. Given the critical opportunities for Agricultural NbS to contribute to climate, biodiversity, and human health and livelihoods (Miralles-Wilhelm, 2021), these activities are well-positioned to appeal to investor interest if the business and investment cases are compelling.

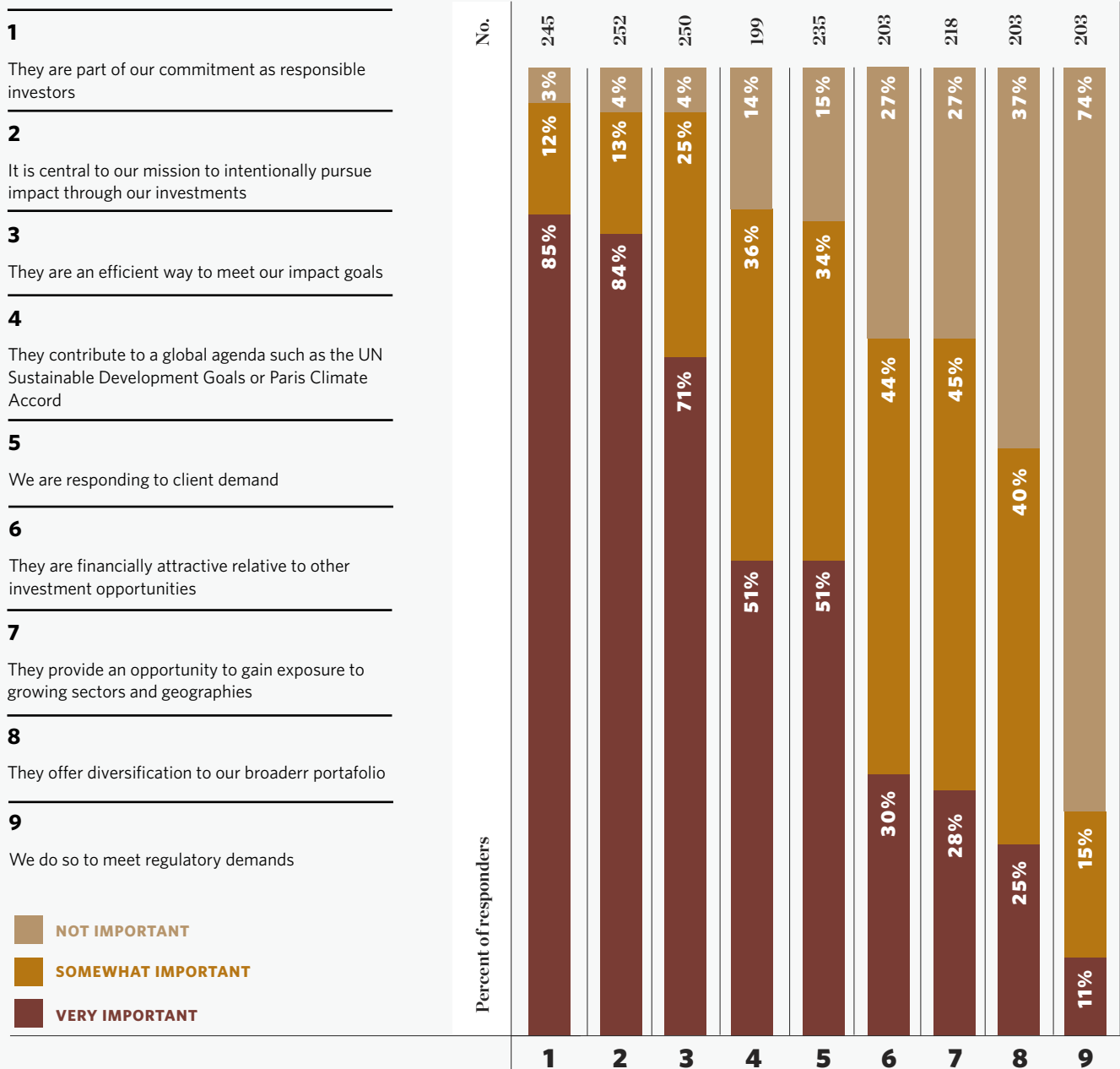


FIGURE 5. MOTIVATIONS FOR MAKING IMPACT INVESTMENTS (SOURCE: GIIN IMPACT INVESTOR SURVEY, 2019)

To date, green bonds have been among the most popular instruments for sustainable investments, with over \$750 billion raised since 2007 and an estimate \$250 billion of issuances in 2019, but few of them finance the conservation of natural capital and several have been accused of 'greenwashing' (Cooper and Tremolet, 2019).

Investors state that they see a growing opportunity for investment in NbS, particularly in the sustainable agriculture space. In a survey of 62 asset owners and managers who jointly manage more than \$3 trillion in assets, investors expressed increasing interest in sustainable agriculture investments as well as natural capital and physical assets (Figure 2, Hamrick, 2016). This paper describes a broad set of actions and specific project design recommendations to accelerate project development and investment in Agriculture NbS.

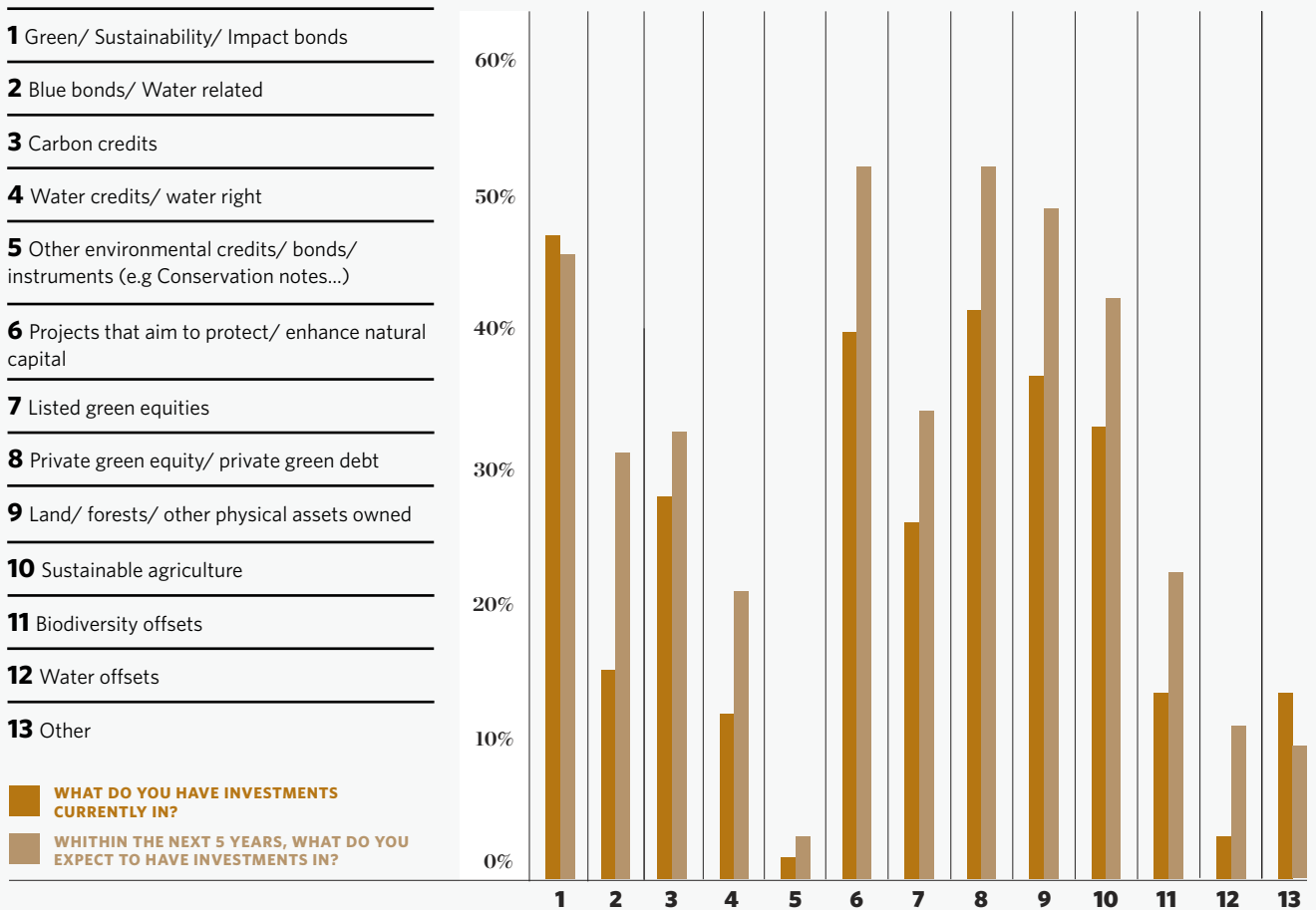


FIGURE 6. INVESTORS' CURRENT AND EXPECTED FUTURE INVESTMENT MIX

(TNC, INVESTING IN NATURE, 2019)

BARRIERS/CHALLENGES IDENTIFIED

BY THE ACTORS IN NBS INVESTMENTS

Several challenges affect the financing of Ag NbS, most of which may be categorized as either technical performance risk or financial performance risk. In addition, the deployment of agriculture NbS solutions at landscape scales can introduce additional challenges relating to coordinating actions and investments from multiple stakeholders and for multiple benefits and at landscape scales.

PRIVATE SECTOR

While investor interest appears to be high, barriers remain to the private-sector financing of Ag NbS in practice, which help to explain why the volumes of capital invested in Ag NbS remain a very small percentage

of total investable capital. Barriers to the adoption of NbS can include decentralized business operations, internal resistance to change, lack of in-house expertise to handle site-specific issues with NbS deployment, regulatory risk, company brand concerns, lack of internal resources dedicated to these technologies, and perceived uncertainty in terms of costs and performance of NbS (TNC, 2019; IUCN, 2018).

Investors, banks and other financial intermediaries cite concerns about transparency, regulatory issues, and the need for de-risking the financial and technical performance of projects before they are ready for large-scale investment.

There is strong agreement among corporations and private investors on the need for more large-scale investment opportunities. In the 2019 survey (Cooper and Tremolet, 2019), investors cited larger-scale investment opportunities as the number one factor that would lead to more investment in natural capital. Because of the transaction costs of conducting diligence, aggregating capital, and managing investments over time, many investors prefer single or fewer large investment opportunities, rather than many small, one-off conservation projects, each of which may require diligence and management and have its own unique risks. Furthermore, investors cite a range of related factors that could increase investment in NbS, including more liquid investments, higher financial returns, and better risk reduction measures.

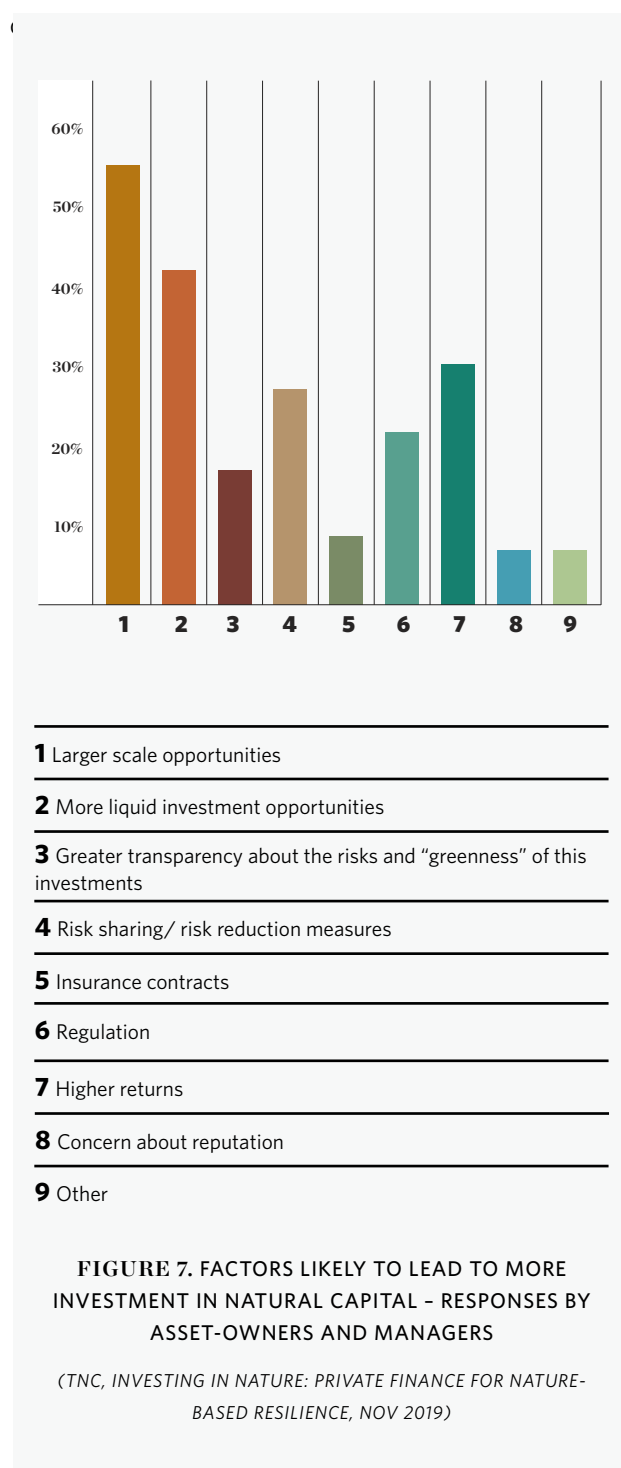
These factors point to a fundamental challenge for investing in Agriculture NbS, which is a mismatch between the timing of investments and returns: investment in NbS requires up-front spending to restore natural features or adopt new practices, but the returns on those investments in terms of increased yield, reduced costs or enhanced environmental quality often aren't realized for a decade

PUBLIC AGENCIES AND INSTITUTIONS

Despite global calls for increased investment in Agriculture NbS, public agencies have encountered barriers in providing financial support to Agriculture NbS. On one hand, public funding is a major source of capital for the adoption of Nature-based Solutions, particularly through agricultural subsidies and grants in the European Union (EU) and the US. For example, in the EU, an estimated 99 percent of the funding for NbS for the conservation of watersheds comes from public funding sources (an average of EUR 5.5 billion per year between 2014 and 2020), via CAP subsidies or dedicated grants, as well as grants from national and local governments or public agencies.

However, finding pathways for 'blended finance' - where public and private investment is combined in a single project - to serve as catalytic capital to increase private investment - has been more challenging. Public agencies may have a low-risk appetite, a lack of financial expertise, procedural hurdles, and concerns about conflicts or reputational risk in partnering in private investors.

One area that seems most promising is among the international finance institutions and development banks,



which may have sufficient finance expertise and are established for the express purpose of investment. They report according to a common methodology and have been successful in mobilizing more than \$160 billion in private investment in 2017 alone (IFC, 2017).

However, they often encounter the same challenges as private investment counterparts, for example around small or fragmented projects, limited technical expertise on NbS, or risk-return profiles.

FARMERS AND FOOD PRODUCERS

A range of factors influence decisions by farmers and producers about adopting new production practices. These factors vary depending on the local biophysical, economic, and socio-cultural context of the region in consideration. Investing in Ag NbS requires a nuanced understanding of the specific constraints that different farmers face, including farmers' access to natural resources, credit, markets, and infrastructure. These constraints affect farmers' choices, and in addition to gender can vary widely by individual landholdings, agroclimatic endowments, and policy environments.

It is also important to analyze the specific situation of men and women in different ecosystems, such as mountains and wetlands (FAO, 2018). Vulnerability assessments can greatly inform policymakers about the needs of the targeted population, and what policy interventions are likely to be more effective in helping both male and female farmers to better adapt and take up Ag NbS. There is ample evidence that broadening women's socio-economic benefits can significantly contribute to improvements in the global environment in areas such as natural resource management, reducing land degradation, renewable energy, and sustainable fisheries (FAO, World Bank Group, and IFAD, 2015; FAO and CARE, 2019). These aspects should be articulated, and the use and analysis of sex-disaggregated data and indicators is very important to uncover and articulate these dynamics and to inform specific interventions (FAO, 2019).

These aspects also differ significantly between small-holder farmers and large-scale industrial actors, who face different socio-economic, cultural, credit and reputational profiles. Additional factors affecting adoption include:



RETURNS

Any practice that reduces returns, or is perceived to reduce returns, will face high resistance to adoption. In many cases, simply the lack of concrete and specific evidence on yields and subsequent returns will prevent the adoption of new practices (e.g. IDALS 2018). The uncertainties around the balance between potential yield gains and reduced costs through fuel savings or increased labor costs are pertinent to smallholder agriculture (for instance, there is a growing body of literature concerning conservation agriculture in Africa: Giller *et al.* 2009; Andersson & D'Souza 2014; Cheesman *et al.* 2017)



RISK PROFILES

One argument for adopting NbS is that they reduce risk and make farm operations more resilient to weather and climate events. This argument may have less traction with large-scale farmers, who have access to a range of technical, investment and insurance mechanisms to reduce risk, as opposed to small holders, who are more nature-dependent, and don't possess the resources or flexibility to experiment different practices. Whether mitigated risks can be directly translated to monetary benefits to small holders is an additional consideration.



STICKY PREFERENCES

Farmers often adhere to traditional practices of prior generations or peer group practitioners and may be reluctant to adopt new practices that depart from local norms.



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TRANSACTION COSTS & CREDIT CONSTRAINTS

The adoption of new practices often requires up-front investment and may produce delayed returns. Small holder farmers, who often lack access to credit, are particularly challenged by the time and costs associated with adopting NbS. Interventions supplying credit have the potential to effectively spur agricultural technology adoption in developing countries (Magruder 2018).



ABSENTEE LANDOWNERS/NON-OPERATOR INFLUENCE

In many landscapes, farms are owned by absentee landowners, in which case farmers who are responsible for day-to-day operations of the farm or facility may not have the authority, resources or incentives to adopt new practices (Ranjan *et al.* 2019).



TIME PREFERENCE

Hypothetically, reduced soil erosion through implementing agricultural Nature-based Solutions over a longer time horizon (e.g. 20 years) could actually result in higher net yields over time. However, such long-term, indirect benefits may be relatively hard to appreciate from a farmer livelihood point of view, when reductions in yield from adopting NbS in the near term is possible. The mismatch between when farmers need money (e.g. next season) and when impacts of NbS can be realized (longer term) poses another barrier.



SUPPLY CHAIN STRUCTURES

In some geographies, like North America, companies are directly sourcing agricultural products; in other geographies, companies may not know the origin of their products or the practices being used. These differences can have an impact on the pathways to influence farmer adoption of new practices.

The modules in Section 3 of this report are designed to offer agricultural and conservation practitioners some frameworks for recognizing and addressing the barriers to investment in Ag NbS.

PROJECT DESIGN IMPLICATIONS: HOW TO DESIGN FOR INVESTMENT?

NATURE-BASED SOLUTIONS IN AGRICULTURE: PROJECT DESIGN FOR SECURING INVESTMENT



This section is designed to help agricultural and conservation practitioners evaluate opportunities for investment in agriculture NbS. Key determinations include:

- Is this project suitable for investment finance (in the sense of repayable funding or repayment of either debt or equity investment)?
- If financing appears like a viable option, what sorts of financing could be most relevant (Figure 10)
- How should the appropriate financial experts to build business models and funding and financing opportunities be engaged?
- What are the appropriate partnerships and governance mechanisms to enable and manage investment?

Not all projects are suited for private investment. Financing may not be a critical bottleneck. The development or conservation practitioner should be equipped to ask the appropriate questions, understand the practices and needs of farmers, and identify the public or conservation benefits of NbS practices to enable evaluation of project opportunities in conjunction with experts in the investment and finance communities, to determine when repayable finance may be a viable, even preferred, way to advance project goals.

At several junctures, this section points to established frameworks or blueprints for conservation impact investing, such as the [Coalition for Private Investment in](#)

The development or conservation practitioner should be equipped to ask the appropriate questions.

[Conservation \(CPIC\)](#) and the [European Investment Bank \(EIB\)](#). These can be useful resources for the conservation practitioner in understanding investment potential and design, particularly when coupled with the appropriate investment expertise, where the development or conservation practitioner may not have deep experience. Where possible, this section describes pathways for conservation practitioners to engage investment professionals in investment design and evaluation and provides tools and frameworks to identify the most promising projects from a financing standpoint as well as guidance on the information necessary for deeper project diligence.

Figure 8 breaks down the diligence process into three modules.

1. The objective of the first module is to determine project goals, the specific nature of the NbS intervention, and options for achieving those goals that may go beyond investment financing.
2. The objective of the second module is to better understand the revenue and value creation drivers that enable financing, to identify barriers to financing, and to identify promising financing mechanisms and tools.
3. The objective of the third module is to understand key enabling conditions—policies and institutional arrangements—that may make a suite of projects more likely to achieve their objectives.

Many practitioners make the mistake of starting a project at the end of Module 2— incorrectly assuming financing is the key barrier and wrongly jumping in at the point of looking at specific financing mechanisms. Such an approach is usually a mistake because often the problem or key barrier to achieving a goal is not financing.

CASE STUDY: WATER FUNDS

PRINCIPLE:

While most NbS projects will at some point struggle to fund implementation, repayable financing may not be the primary barrier because either (1) the project's design is not appropriate for a repayable scheme or (2) another barrier, e.g. farmer adoption or partner coordination, is the primary impediment to successful implementation.



GREATER CAPE TOWN WATER FUND

Cape Town's population is growing at a rate of about 2.6% per year and water demand is predicted to outstrip supply in the Greater Cape Town Region by 2021; an additional 300 - 350 million liters of water per day will be needed by 2028. Cape Town is the second largest city in South Africa and the economic hub of the Western Cape Province, accounting for 86% of the province's gross domestic product. Over two-thirds of the sub-catchments supplying the Greater Cape Town Region's water are affected by alien plant invasions, reducing the amount of water that reaches the rivers and dams by 55 billion liters per year.

NATURE-BASED SOLUTIONS

Invasive alien plants alter soil ecology, increase the frequency and severity of wildfires, and significantly impact river flow and aquifer recharge. Woody plant species such as Australian acacia, pine and eucalyptus, use up to 20% more water than the region's native vegetation, and over two-thirds of the Greater Cape Town Region's sub-catchments have some degree of invasion; 14,000 ha (9%) are heavily invaded.

While the near-term priorities of the Water Fund focus on removal of invasive plants and maintenance of restored vegetation, future interventions will include riparian restoration and agricultural land use improvements, such as buffer strips, conservation agriculture, cover crops, irrigation management, no-till or conservation tillage and nutrient management.

66.6%

of the Greater Cape Town Region's sub-catchments have some **degree of invasion**

350

job opportunities will be created in the first five years of implementation

6 yrs

timeframe for producing benefits by removing invasive plants

ENVIRONMENTAL & SOCIAL OUTCOMES

70% of plants in this province are found nowhere else on the planet. Approximately 350 job opportunities will be created in the first five years of implementation, and improved soil health and water availability will provide increased place-based economic opportunity for farmers via increased production and high-quality agricultural products.

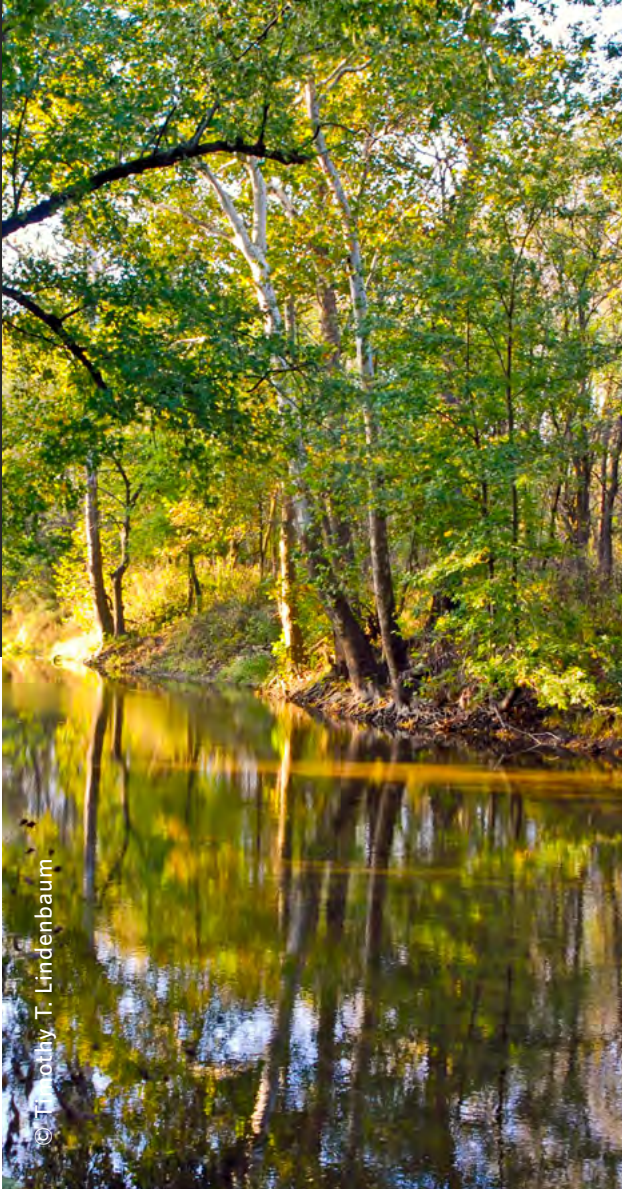
FUNDING

This concept has both technical and financial performance risk. There is a robust body of academic evidence that invasive plant removal produces significant water benefits within a short timeframe of six years, which could theoretically, be monetized. However, few large-scale projects employing this approach have been launched.

Also the program requires high, front-loaded costs that would benefit from an influx of investment at the start of the project cycle and higher on-going maintenance costs over the full project life cycle. Traditional "grey infrastructure" usually has high upfront construction costs but then requires little maintenance throughout the project life cycle. An additional and equally important barrier, however, was coordination between partners who were all working on invasive removal, including government and NGO-sponsored programs. Prioritizing sub-catchments for removal, dispersing funds and identifying the implementing party were barriers to effective implementation in the region. As a result, the team focused their efforts on conducting a collaborative, in-depth financial and prioritization model, and pursued more accessible pools of donor and private funding.



CASE STUDY: WATER FUNDS



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BLOOMINGTON WATER FUND

The Mackinaw River watershed, a tributary to the Illinois River, covers 295,000 hectares and contains some of the most productive agricultural land in the world. The land has been subjected to over 150 years of intensive row-crop production. Much of the watershed's land was historically too wet to farm, which resulted in the installation of drainage tile systems below the farmland's surface to remove water and reduce soil moisture to an optimal level for crop production. Unfortunately, the excess water that drains away washes fertilizers and chemicals into waterways.

The state of Illinois has been identified as one of the highest contributors of nitrogen and phosphorus (16.8% and 12.9%, respectively) to the Gulf of Mexico, which has been plagued for decades by hypoxic dead zones that starve marine life of oxygen and coastal fishing communities of livelihoods.

Agricultural runoff has been affecting Lake Bloomington, a reservoir supplying drinking water to the approximately 80,000 residents of Bloomington. Historically, the reservoir has experienced periods in which nitrate concentrations exceeded the US Environmental Protection Agency's 10 parts per million drinking water standards, requiring the city to divert water from a secondary reservoir to dilute the high concentrations in Lake Bloomington.

NATURE-BASED SOLUTIONS

The Bloomington Water Fund (BWF) employs agricultural best management practices and Nature-based Solutions to address nitrate and nitrogen water quality problems in the Mackinaw River watershed. The BWF focuses on constructed wetlands which can remove up to 60 percent of inflowing nitrates from subsurface tiles when they are strategically installed alongside agricultural fields. Using a combination of wetlands and saturated buffers as a natural water treatment solution has the potential to be cost-competitive with traditional ion exchange treatment systems.

60%

of inflowing nitrates from subsurface tiles removed by constructed wetlands

51%

of nitrate loads from agricultural tiles reduced annually

80,000

people benefited by the improvement in nitrate concentration

ENVIRONMENTAL & SOCIAL OUTCOMES

Preliminary results from 1-2 years of data collection from four of the seven pilot wetlands show they are reducing annual nitrate loads from agricultural tiles by up to 51%. Cumulative 10-year data from ongoing research by Dr. David Kovacic at the University of Illinois and The Nature Conservancy show that wetlands representing 3-9 percent of tile-drained areas removed 13-47 percent and 37- 94 percent of nitrate and dissolved phosphorus loadings, respectively.

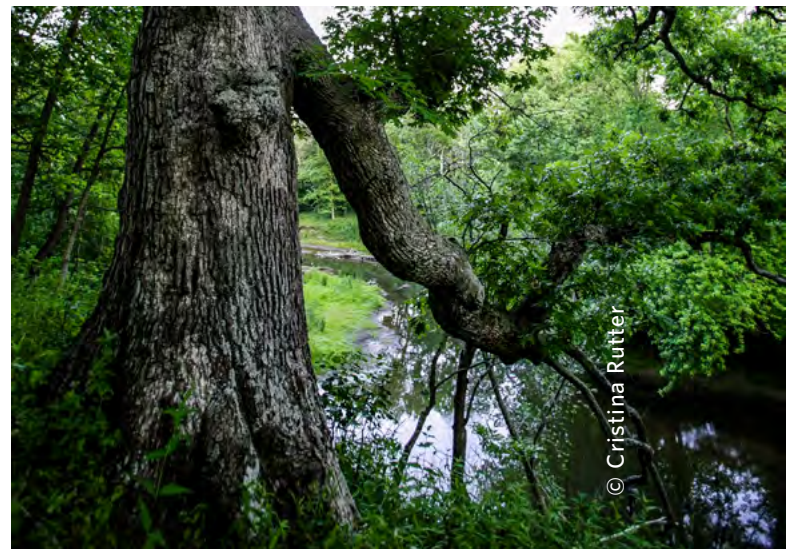
The reduction could benefit 66 native fish species and nearly 30 species of mussels in the Mackinaw River and will drastically reduce the amount of nutrients reaching the Gulf of Mexico. Further, the improvement in nitrate concentration for Lake Bloomington will benefit 80,000 people living in the city.

FUNDING

While the benefits to farmers regarding higher profit margins could be monetized into returns for investors (see case studies: Sustainable Water Investment Fund and Waikato River Limited Hybrid Bond for examples of benefits that create cashflow) repayable finance was not the only way the program could raise the needed funding.

The program had the potential to secure public and private funding that could be leveraged with U.S. Farm Bill dollars to help cover watershed conservation costs. The Natural Resources Conservation Service (NRCS) - an arm of the US Department of Agriculture - offers "financial and technical assistance through conservation practices, activities and enhancements to help agricultural producers make and maintain improvements on their land" through the Farm Bill. Potential beneficiaries can access funding through a number of avenues including through their Environmental Quality Incentives Program (EQIP) which provides financial and technical assistance to deliver environmental benefits, e.g. improved water quality, reduced soil erosion, increased wildlife habitat.

As a result, the city has developed watershed plans and established a capital fund for watershed practices that include treatment wetlands, nitrogen management and streambank erosion practices.



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FIGURE 8. PROJECT DILIGENCE MODULES



MODULE 1

IDENTIFYING PROJECT GOALS AND TECHNICAL OPTIONS

NATURE-BASED SOLUTIONS IN AGRICULTURE: PROJECT DESIGN FOR SECURING INVESTMENT



IDENTIFYING PROJECT GOALS AND TECHNICAL OPTIONS

It is the responsibility of the project sponsor to delineate the project goals, to understand how those goals may be achieved, and to identify barriers to success. Only then should a sponsor consider if financing is a key barrier and whether addressing it could help achieve the identified goals. As noted earlier, many projects skip this module and enter the diligence process assuming that financing is the solution.

It is advised that, as project development and evaluation advances, practitioners remain focused on the fundamental goals and rationale for the project: what are the socio-economic and environmental goals, will Ag NbS support the goals, and why will financing help a project make progress towards those goals?

NOTE:

Time spent on Module 1 is critical. If projects have already advanced to Module 2 without doing this foundational work, it is advised to revisit these critical first steps, or at least to be very alert to the potential need to return to module 1 during project diligence. Specific financing solutions are considered in Module 2.



SOCIAL AND CONSERVATION

OUTCOMES

DEFINE ECONOMIC AND ECOLOGICAL OUTCOMES TO BE ACHIEVED

Be as specific as possible about the outcomes and how to measure them, as that will help identify and tailor the solution. For example, 'water security' is too vague a term to serve as a useful conservation outcome in evaluating financing opportunities. Seek to be specific and quantitative where possible, for instance, 'reduce the frequency of water shortages by 30%' or 'reduce nitrogen loading by 30 tons per year in this portion of the watershed'. Outcomes can include socio-economic (e.g. farm productivity, employment, nutrition), climate (e.g. carbon sequestration or reduced emissions), and conservation (e.g. biodiversity, water, soil, air) outcomes.

Particularly with ecological objectives, it can be helpful to address spatial and temporal dimensions of the problem and solution. For example, when thinking about the potential for more efficient agricultural management of

water to be redirected to achieve instream flow benefits, it is helpful to understand exactly which stretches of a stream are underwatered and when during the calendar year that underwatering is most likely to occur. By understanding those dynamics, it may be possible to unlock financial value that would otherwise be hard to identify and monetize, or it may be possible to reduce perceived and real conflicts between agricultural interests and environmental interests. For example, it may be possible to finance an agricultural water efficiency project by selling water to farmers during the summer when water is scarce and dedicating water to instream flows during the spring and fall when farmers no longer need as much, but when that water might be critical for species of fish that need sufficient flows to migrate upstream.

CASE STUDY

MURRAY DARLING BALANCED WATER FUND

PRINCIPLE:

Clearly define environmental and social outcomes, including spatial and temporal considerations.

OVERVIEW:

The Murray-Darling Balanced Water Fund invests in permanent water rights in Australia's Southern Murray-Darling Basin to secure water for agriculture, restore threatened wetlands, and generate a financial return for investors.

AG NBS

n/a

FINANCING MECHANISM

A managed investment fund with capital from investors. The fund sells, buys and leases water entitlements on the Australian water market in the Murray Darjeeling Basin.

ENABLING CONDITIONS

- Well-established water market with sufficient transactional volume for pricing information to be robust for financial modeling.
- Water assets have a low correlation to more traditional equity and fixed income investments, which was attractive for investors looking to diversify their portfolios.
- The region's high-value agriculture may limit investor exposure to very limited commodity risk.



CASE

The Murray-Darling basin is Australia's "breadbasket" and is home to biodiverse and culturally significant wetlands. The region naturally experiences variable rainfall, and the ecosystem has evolved to withstand dry seasons and occasional periods of drought. Increased water demand, however, is extending drought periods and impacting nature and regional industries, including the agriculture sector.

To provide more water to the wetlands, especially during dry periods when the ecosystem is under the most stress, The Nature Conservancy established the Murray-Darling Balanced Water Fund. Because water may be separated from land ownership in this part of Australia, well-functioning water markets provided a critical platform through which to achieve the desired environmental and social outcomes by buying the water needed and re-allocating that water between agricultural interests and the environment.

The investment concept was to mimic the natural flows of the river system by developing a fund that would enable most of the watering of the wetlands in years of high rainfall, which, due to the laws of supply-demand, is when water has the lowest value on the market. In years of drought, the Fund would still donate water to the environment, but far less. During periods of high demand (when water was scarce), more water would be made available to agriculture through the leasing of Water Entitlements, which enabled the Fund to capture most of the financial value of the water for investors.

Returns for investors are generated through the Fund's annual lease of water entitlements, the trade of water allocations and, the long-term capital appreciation of the Fund's portfolio of water entitlements.



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CONSIDER THE INTERPLAY AMONG OUTCOMES

In some cases, a project may have only a single benefit, or even in circumstances with multiple benefits, it may be advantageous to focus on a single outcome of critical importance to simplify the economic and financial analyses, promote clarity in the project's goals, and secure investment capital that may be tailored to specific interventions. In other cases, the delivery of multiple benefits could help to broaden support and create a mix of revenue sources and hence potential investment opportunities. There is no single right answer, but it is important to understand and anticipate these dimensions of a project because they will impact the potential sources of funding for a project.

In the event of multiple benefits, project proponents should consider the interplay and feedback loops among outcomes. Are there potential synergies where certain outcomes are mutually supportive? Are there path dependencies, where providing one benefit requires achieving another benefit first? Are there trade-offs among potential outcomes that need to be weighed and eventually incorporated into the financial underwriting of a project? For example, monetizing the accumulation of biomass in an agricultural setting with carbon offsets might require committing to certain management practices over long periods that reduce the flexibility of an asset manager to adapt to changing circumstances, including changes in the pricing of the commodity being

produced. Carbon offsets could be an important source of cash flows early in a project, constraining a project through the commitment of the sales of carbon might make the project less able to attract investment capital. Or as another example, financing a project through a loan that requires annual payments might make it difficult to wait the necessary length of time for an ecosystem to fully recover and achieve what would ultimately be a higher level of productivity and profitability. Understanding these interplays can influence and help a project manager understand later in diligence what financing mechanism is best aligned with the project objectives.

In this stage of diligence, it is often valuable to distinguish between measurable, primary outcomes, and other co-benefits. In the example of carbon offsets provided earlier, the accumulation of biomass that can be monetized through carbon offsets might be the measurable, primary outcome. Important co-benefits could be the impact of higher soil quality and microbial biodiversity, and even the ability of the soil to retain moisture, but those attributes of performance might be ancillary to the primary objective and harder to measure or even not worth measuring because they are either difficult to quantify or don't offer a material improvement in the ability to finance a project.

CASE STUDY

SUSTAINABLE WATER IMPACT FUND (SWIF)

PRINCIPLE:

While a project may deliver multiple benefits, only a subset of those may be monetizable for investors, despite the broader societal value some co-benefits may provide.

OVERVIEW:

Renewable Resources Group launched SWIF in partnership with The Nature Conservancy to invest in a portfolio of companies that will improve the management of surface water, groundwater, and farms to more sustainably meet the water supply needs of people, the environment and the agricultural economy.

AG NBS

Various, depending on project.

FINANCING MECHANISM

A managed fund investing in farms and water that generate returns for investors through the sale of water and various agricultural commodities, such as grapes and almonds.

ENABLING CONDITIONS

- RRG has an excellent track record over their two decades of experience in sustainable water management and agriculture development globally
- The Nature Conservancy – technical advisor to the Fund – has over 60 years of experience assessing conservation and social outcomes of programs.



CASE

RRG and TNC collaborated to co-design a conservation framework for an institutional-scale vehicle that would invest in land and water assets to improve the management of surface water, groundwater and farms with a focus on California, Australia, and Chile. Projects will more sustainably manage water resources, the environment, and the agricultural economy, while at the same time fulfilling the Fund's fiduciary responsibilities to investors.

The SWIF purchases agricultural and/or water assets that are not being managed at the highest possible value, improves the management of those assets, and generates a return either from the sale of the assets with improved management or from the operation of the assets, or both. Operation of most assets involves agricultural production of high-value crops or groundwater banks.

While most of the projects generate environmental co-benefits, including enhanced instream flows, more habitat for local biodiversity, and more resilient systems, they are not easily monetizable and, therefore, not as relevant for investors. Instead, projects can monetize water storage and enhanced yield from agricultural production, which forms the basis of financing and funding for the SWIF.

Another reason to be granular and detailed in understanding the benefits of a project is that many funding sources are tailored to specific outcomes. Clearly understanding outcomes and the metrics for measuring them can be an important filter later on for making a realistic assessment about whether securing investment funding is possible.

UNDERSTAND LOCAL CONTEXT, STAKEHOLDERS, AND ISSUE SETTING

When considering projects, it is important to understand the local setting. Are the proposed outcomes relevant to local community members? Who will be the beneficiaries if outcomes are achieved? How do stakeholders, including farmers, view the proposed outcomes? Are there other existing partners, or proposed policies that deal with the issues to be addressed?

Understanding the local context can help in framing the outcomes, building alliances, and finding funding options as projects advance. This aspect of diligence has social justice and equity considerations, which are important in their own right and can carry over to the ability to secure financing. How a community is engaged in a project, the level of support for that project, the distribution of project benefits, and the concentration of those benefits among beneficiaries can all influence the resiliency of support and cash flows being generated by a project. In many cases, the easiest answer is to design projects that benefit the largest stakeholders in a community, whether that's the large farmers or members of the community with the most influential voices. However, in many agricultural settings, the support of smallholder farmers may be as or more important for a project's success over the long run.

As an example of community-driven development, the FAO-Dimitra program centers on a highly successful gender-transformative approach developed by the Food and Agriculture Organization of the United Nations (FAO). Dimitra Clubs are made up of groups of rural women and men equipped with solar and crank radios and mobile phones. They meet regularly to discuss the

Understanding the local context can help in framing the outcomes, building alliances, and finding funding options as projects advance.

challenges they face in their daily lives, make decisions together and take collective action to solve community problems with local resources.

A wide range of Dimitra Clubs aim to improve community resilience to climate change and increase agricultural production, strive for a better shared understanding of the food deficit they face, its underlying causes, and ways to address it. As a result, they decided on a series of adaptation strategies. These included growing off-season crops and setting up mini cereal banks, both of which can help ensure food availability during lean periods. In particular, the members of Tinkirana's Dimitra Clubs in Niger (FAO,2016). confronted the problems of declining rainfall and soil degradation. Recognizing that land rehabilitation techniques are key to fighting degradation and increasing the amount of land available for agriculture, they mobilized members of the community to work together on a 'trial' or pilot project, applying a water-harvesting technique uses semicircular earth embankments to collect and store rainwater and prevent runoff. Today, the results of the experiment are clear: agricultural production and food security has improved sustainably and women's empowerment through inter alia equal access to land has also been promoted. Since 2006, 1500 Dimitra Clubs have been set up in Burundi, the Democratic Republic of the Congo, Ghana, the Niger and Senegal.

Similarly, evidence across the Sahel region of Africa, where farmer-managed natural regeneration (FMNR) is most prevalent, shows that communities can transform their lives through the social and environmental benefits of FMNR, leading to economic sustainability. As such, FMNR is an integrated, community-driven development approach, leading to sustainable development outcomes. The main beneficiaries of this approach are those who use or depend on tree resources such as farmers, herders, community members, and particularly women and children who harvest wood and non-timber forest products. As such, FMNR projects incorporate assistance to broker agreements between the relevant stakeholders - for example, government agents, farming communities and other forms of local leadership - to ensure their equitable rights to access and control over natural resources.

FMNR's gender equality outcomes have also been documented as it improves women's lives through more efficient production and collection of firewood, which in



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turn gives women more time to spend on nutrition and caring for children and provides a platform for women to take increasingly important roles in agriculture production and community decision making.



IDENTIFICATION OF

PRACTICES

IDENTIFY THE SPECIFIC PRACTICES

Once target outcomes have been identified, a project proponent should seek to identify what practices may be most effective in achieving those outcomes. A full range of practices should be considered to determine if Ag NbS could be used and/or how they could compare to, or complement, traditional or grey infrastructure solutions to deliver comparable outcomes.

Practice identification is important because it relates directly to understanding the financing opportunity. For example, in transitioning traditional cattle ranching, which typically relies on revenue from the sale of beef or milk, to more complex, silvopastoral systems, the specific practices in those silvopastoral systems may lead to the production of more milk, more beef timber, and higher levels of biomass. Each of these practices leads to revenue streams that could ultimately help finance the overall project. Those same practices may have higher costs associated with them because managing a more complex enterprise, as is typical of silvopastoral systems, means higher capital and labor inputs. The transition to these practices may also have an important time dimension, where higher capital or labor is needed up-front, and yet the higher yields may not occur for several years. The lag between the timing of the up-front investment and the financial return would need to be addressed in the form of the financing that such a project secures.



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CASE STUDY

MAINSTREAMING SUSTAINABLE CATTLE RANCHING (SCR)

PRINCIPLE:

Identifying Nature-based Solutions that can deliver desired environmental and social outcomes while also producing a return for investors.

OVERVIEW:

To scale sustainable cattle ranching – via silvopastoral systems – in Colombia, the program is seeking support for a Sustainable Cattle Ranching Fund to provide capital and technical assistance for small and medium-sized ranchers. Ranchers will implement Ag NbS practices to produce environmental outcomes and improve local livelihoods while providing a financial return for investors.

AG NBS

Sustainable cattle ranching has four main components:

- 1. Trees:** trees scattered in pastures, living fences, and trees planted in rows for both commercial and non-commercial purposes
- 2. Pastures:** Improved grass species, legumes, fodder banks
- 3. Enhanced Technology:** Permanent and mobile electric fences, aqueduct system, mobile drinking troughs, improved cattle genetics
- 4. Conservation corridors:** set aside areas for conservation for connectivity and sediment retention, and payments for other environmental services

FINANCING MECHANISM

A managed fund investing in ranching operations that can generate returns for investors – through premium, sustainable cattle products – and environmental and social benefits.

ENABLING CONDITIONS

The Mainstreaming Sustainable Cattle Ranching project has been in place for 10 years, allowing it to

- Build relationships and trust with family farmers across Colombia
- Prove environmental and social outcomes the SCR program can drive
- Develop relationships with potential off-takers who can encourage a market for premium products

CASE

Background

Traditional cattle ranching consumes more than one-third of Colombia's territory and is the leading cause of deforestation in the region. Approximately 89 percent of Colombia's farmland is dedicated to an inefficient cattle-raising system, with very few cows occupying large amounts of land. Often, cattle ranchers cut down trees because they are thought to compete with pasture for sun and water, or because tree and limb fall are perceived as a threat to cattle.

Ag Nbs Practices

The Mainstreaming Sustainable Cattle Ranching project seeks to introduce silvopastoral practices into Colombia's ranching system to protect natural ecosystems and provide increased livelihood security for ranchers. Silvopastoral systems employ Nature-based Solutions that fall under the umbrella of agroforestry, combining fodder plants with shrubs and trees for animal nutrition and other co-benefits. They can improve yield and productivity and increase or diversify farm income, while enhancing environmental services. Silvopastoral practices include:

1. Trees: trees scattered in pastures, living fences, and trees planted in rows for both commercial and non-commercial purposes
2. Pastures: Improved grass species, legumes, fodder banks
3. Enhanced Technology: Permanent and mobile electric fences, aqueduct system, mobile drinking trough, improved cattle genetics
4. Conservation corridors: set aside areas for conservation for connectivity & sediment retention, and payments for environmental services.

Thus far, the Sustainable Cattle Ranching project has provided technical assistance to 4,100 farms, and trained an additional 24,000 farmers, building a pipeline of potential investments.

The project has been supported by the World Bank and implemented by Colombia's National Cattle Ranchers Association (FEDEGAN), in partnership with TNC, the Center for Research on Sustainable Agriculture (CIPAV), and Fondo Accion (Lerner *et al.*, 2017).

Social Benefits

While these projects enhance ecosystems and store carbon, they also provide a financial return to the farmers, in terms of cattle productivity, the quantity and quality of milk, reproduction rates, pasture condition and recovery, and resources that can be cut and saved for the dry season.

Nearly 4,100 ranchers adopting this new farming paradigm have reported more productive soils and increased cattle loads (animals per hectare) leading to a 20 percent increase in milk and/or beef production; the quality of which has also improved. Ranchers have also reported a reduction in fertilizer and pesticide use, which has lowered their operating costs and subsequently increased profit margins.

Of the nearly 4,100 ranchers trained, 1,500 farmers participated in a payment for ecosystem services (PES) program that paid out over US\$2 million to farmers.

 **20%**

increase in milk and/or beef production after adopting this new farming paradigm

 **4100**

farmers **trained**



Environmental benefits

Using a Healthy Agricultural Systems (HAS) approach that focuses on increasing production while preserving natural assets – the water, soil and rich biodiversity that make productivity possible – Colombian farmers are restoring habitat while increasing production, profits and climate resilience.

Colombian ranchers have already transformed 94,864 acres to environmentally friendly practices and protected 44,000 acres through conservation agreements with landowners. Nearly three million native trees have been planted.

To date, ranches have contributed to the capture of 1.2 million tons of CO₂ equivalent (Mt CO_{2e}) by converting degraded pastures into silvopastoral systems and secondary forests. They have further avoided emission of 0.4 Mt CO_{2e} by preserving the natural forests within the project areas.

Both contributions are highly significant to Colombia, which, under the Paris Agreement, committed to reduce GHG emissions by 67 Mt CO_{2e} (unconditional goal) by 2030. Of this total goal, silvopastoral systems alone are targeting a 10 Mt CO_{2e} reduction in GHG emissions. At the end of 2019, the SCR program contributed to 15 percent of the silvopastoral systems' target.



Sustainable Cattle Ranching Fund

To scale silvopastoral operations in Colombia, the program is seeking support for a Sustainable Cattle Ranching Fund to provide capital and technical support for small and medium ranchers to implement sustainable cattle ranching systems, recover degraded lands and develop conservation corridors.

The Fund will be managed by a fiduciary in Colombia who provides direct loans to ranchers, and ensures returns are given to investors. TNC-Colombia will be part of the fiduciary committee and guarantee proper project development that provides financial returns alongside environmental and social outcomes.

The project manager of the fund will provide technical assistance to cattle ranchers, endorse resource distribution, act as an intermediary between off-takers and cattle ranchers, and approve participants in the Fund. The Mainstreaming Sustainable Cattle Ranching project has been in place for 10 years, allowing it to build relationships and trust with family farmers across the different geographies. A separate arm will provide the majority of the technical assistance throughout the transition process.

Off-takers – ideally large private companies who have production plants across Colombia – will provide a guarantee to buy meat and milk produced under sustainable standards from ranchers in the program and encourage a market that will pay a premium price for these higher-quality goods.

The target US \$25 million fund would invest in about 4,700 ranchers (46,400 ha) over a 20-year period, with most investments frontloaded. While loans will be given to ranchers to transition their operations to silvopastoral systems, grants will be used to subsidize fund operations and technical assistance to ranchers.

\$25M

Fund would **invest in 4,700 ranchers** over a 20-year period

Water challenges	SURFACE WATER QUALITY				GROUNDWATER QUALITY		FLOODS	WATER SCARCITY		
	Nutrients	Sediments	Pesticides	Other chemicals & emerging pollutants	Nitrates	Pesticides	Upstream watershed	Lower river flows	Lower groundwater levels	Droughts
Nature-based solutions										
Reforestation/afforestation	■	■	■		■	■	■	■	■	■
Targeted land protection (including forest protection)	■	■	■		■	■	■	■	■	■
Land-use change from farmland to pasture land	■	■	■		■	■				
Riparian buffer strips/Riparian zone restoration	■	■	■				■			
Aquifer recharge	■	■						■	■	■
Reconnecting rivers to floodplains	■	■					■	■	■	■
Establishing flood bypasses							■			
Wetlands restoration/conservation	■		■				■	■	■	■
Construction of artificial wetlands	■	■		■			■			
Ponds and basins	■	■		■	■		■			
Forestry best management practices (BMP), including forest fuel reduction	■	■			■		■	■	■	
IMPROVED AGRICULTURAL PRACTICES:										
Catch crops/Cover crops	■	■	■		■					
Crop rotation	■	■	■							■
Conservation tillage	■	■			■					
Reduced fertiliser use	■				■					
Alternative plant protection			■			■				

EVALUATE THE TECHNICAL PERFORMANCE OF PRACTICES

Technical risk is one of the most important aspects of subsequent financial due diligence. Hence, once practices have been identified, they should be evaluated for technical performance in achieving outcomes. Proponents should evaluate the on-the-ground track record and any published reports of effectiveness. Local examples or pilots can be particularly useful as they may demonstrate results in the local crop and production context, and they may have the added benefit of having local validators.

For example, take a project intended to lead to the large-scale conversion of alfalfa to alternative crops that have a higher margin and improve soil quality and biodiversity. To what extent have those alternative cropping systems been tested? What is known about the differences in the ways that those production systems need to be managed?

And thinking in particular about the financial underwriting, what are the benefits on a per-unit basis, and what are the costs on a per-unit basis, both in terms of the initial



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conversion as well as the ongoing management of growing the new crops? During this technical diligence phase, it is recommendable to create common units for comparison. The graphic below compares a number of conservation practices intended to benefit both farms and the environment. The farm-level costs and benefits of the practices were evaluated using a financial model that incorporated the costs of implementation, estimated impacts on agricultural production costs, water supply for irrigation, and changes in crop yields. The analysis was used to identify the level and type of financial incentive required to promote adoption of each conservation practices. Note, these kinds of analyses do not require peer review or publication; even estimates based on expert knowledge and existing examples can provide a basis for subsequent financial analysis.

The goal is not necessarily to eliminate technical uncertainty or risk, but rather to understand and parameterize the type of uncertainty. Looking ahead to financing, there are various ways to address technical risk within financial structures. For example, performance-based purchase agreements can be a very effective way to have producers share more of the risks. First-loss guarantees, and other forms of credit enhancement are ways to change the risk profile of projects based on an evaluation of technical risk.

The goal is not necessarily to eliminate technical uncertainty or risk, but rather to understand and parameterize the types of uncertainty.



FIGURE 9. ESTIMATED COSTS AND BENEFITS OF CONSERVATION PRACTICES

(WESTWATER, 2019)



PATHWAYS TO ADOPTION

One of the key questions to address from a financing perspective is how much capital is needed, what kind of capital, and when. A key input into that decision is understanding what stage of adoption a particular practice is in. If a practice is in the early stages of development and adoption, it is important to secure financing tailored to high-risk early-stage venture, which may look more like equity and various forms of credit enhancement. Grant capital may also be needed to help defray some of the research and management expenses. By contrast, in a project where the technology has been proven and where market penetration has occurred, cash flows from the project may be sufficient to support a larger proportion of debt capital and relatively less credit enhancement.

This section outlines some key considerations in this assessment of the pathways to adoption.

This is also the moment in project diligence to challenge the assumption that financing is the missing component to scaling. Is financing the bottleneck? Are there other enabling conditions that need to precede or be put in place in parallel to financing? For example, is establishing a strong technical assistance aspect of a project critical and how will that technical assistance be delivered?

IDENTIFY BARRIERS

Consider potential barriers to broader adoption of practices. These could include capital and operating costs or credit risks – i.e. finance-related issues – or it could include issues like performance questions or uncertainty, technical support needs, policy barriers, or social inequalities, behavioral, or cultural impediments, all of which may be gender-specific barriers to uptake of ag NbS (Glenmarec, 2017).

There is broad agreement that one of the greatest challenges for land-based adaptation and sustainable land management is posed by inequalities that influence vulnerability and coping and adaptive capacity – including age, gender, wealth, knowledge, access to resources and power. For instance, secure land title and/or land access/control for women increases sustainable land management by increasing women’s conservation efforts, increasing their productive and environmentally beneficial agricultural investments, such as willingness to engage in tree planting and sustainable soil management (Hurlbert *et al.*, 2019).

Rural areas are highly dependent on natural resources, including water and firewood, for consumption and economic activities in agriculture. Women, who often bear a large share of the burden for collection of these resources and who in some contexts are able to sell a share of collected firewood for an income, therefore face substantial vulnerability (including the risk of gender-based violence), in the absence of adequate natural resource management and more efficient alternatives and technologies. The values placed on biodiversity and ecosystem services (actual or perceived benefits) also typically differ by gender, with differentiated economic participation, share of benefits and opportunities (men tend to be responsible for extractive uses, while women often for non-market purposes of these natural resources). For example, women in many agricultural contexts are involved in small-scale livestock management, relying on common property resources for their care. Increased scarcity in resources, including land, forests, and water, also have serious implications for women.

Women experienced a disproportionate loss of income due to forest closures associated with a payment for ecosystem services program (Tuijnman *et al.*, 2020), while many agroforestry practices increased women’s labor burden, often without generating commensurate or accessible benefits (Kiptot and Franzel, 2012). Women’s participation and benefits were lower than those of men in PES programs in Kenya (Kariuki and Birner, 2016), while in a global comparative study on REDD+, women in project sites reported declines in subjective well-being in comparison to male-dominated groups within the same sites and also in comparison to women in control sites (Larson *et al.*, 2018).

These gender dynamics and cultural dimensions are important considerations to be factored in adoption approaches to Ag NbS.

It is essential to understand: are farmers willing to adopt new NbS practices? (If farmers are willing to adopt new practices, Module 2 will address the question: why aren’t funds flowing?)

CONSIDER PATHWAYS TO ADOPTION

What are the best pathways or mechanisms to promote the adoption of new NbS practices? Is financing a key barrier to transitioning practices and, if so, will up-front financing help to achieve conservation goals faster and in such a way that offsets the cost and risk of financing? Are there other, more accessible financial support mechanisms like subsidies or payment for ecosystem services that are sufficient to drive implementation of NbS in an equitable and inclusive manner? Are financing mechanisms alone sufficient, or do they need to be coupled with other technical, cultural, or policy support?

A THEORY OF CHANGE

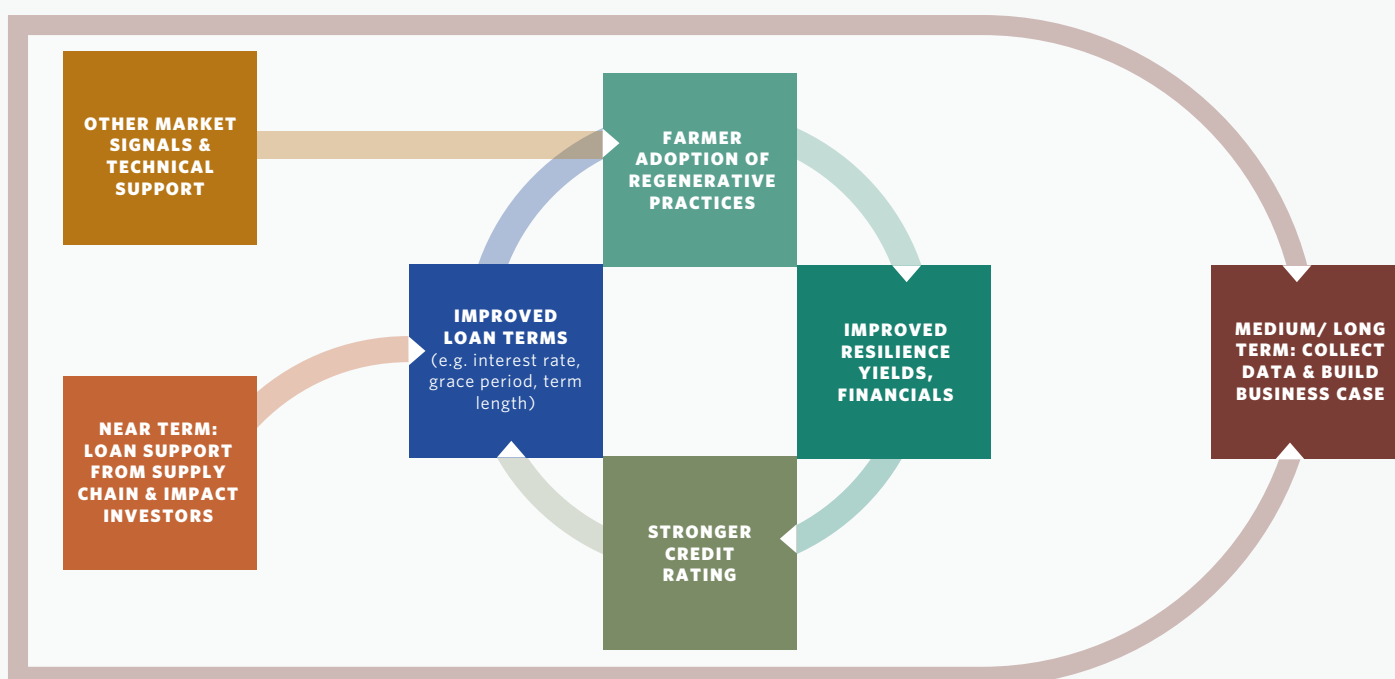


FIGURE 10. THEORY OF CHANGE

DESIGN FARMER ENGAGEMENT

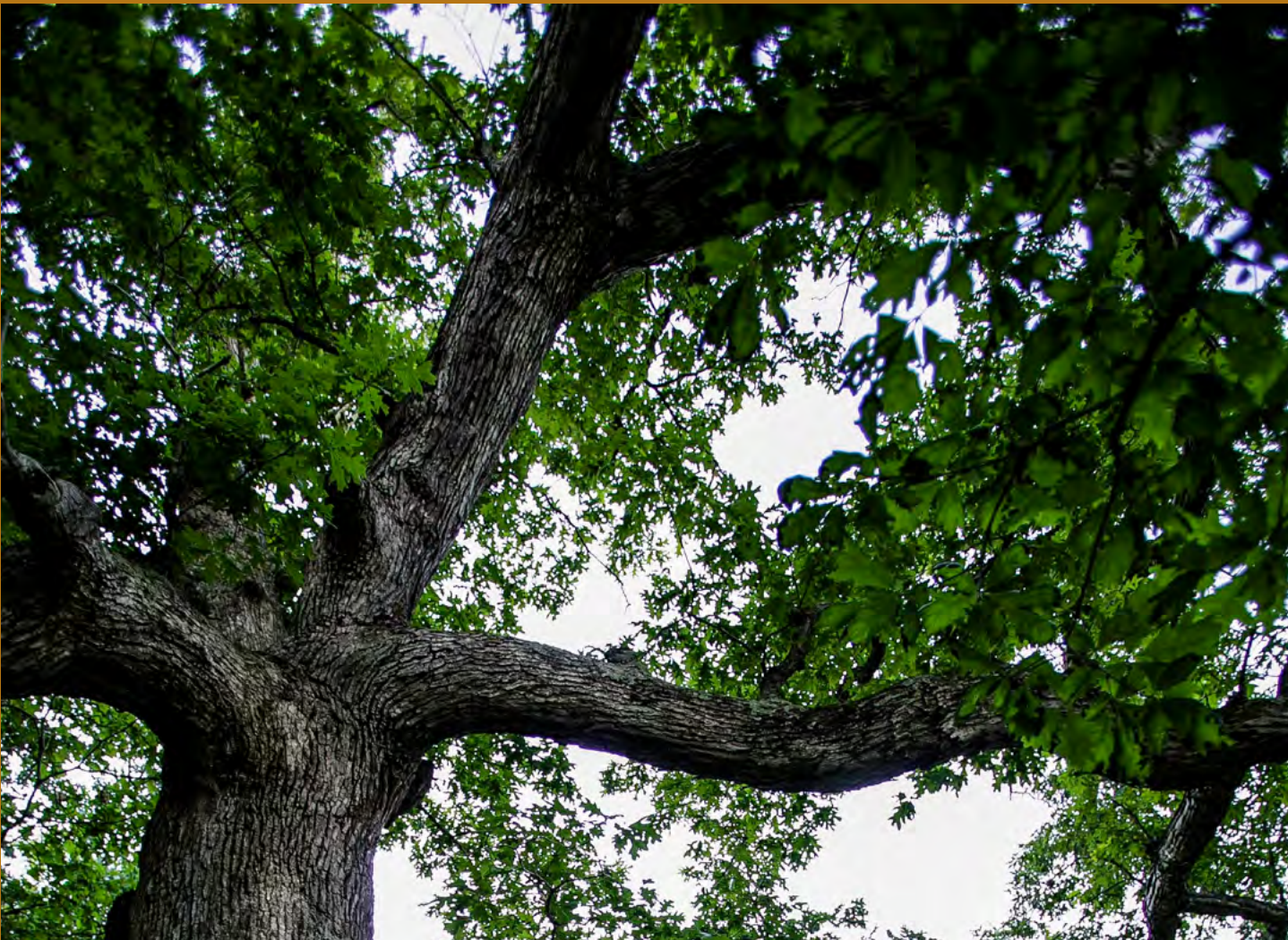
Consider how to test the willingness of farmers to participate and how to deliver services to a farming community, which often are many and fragmented. To be attractive to investors, it is important to have sufficient scale or enough volume to justify transaction costs and mitigate risk, or at least to understand them very clearly so that the sources of capital can be tailored to the particular attributes of the project being financed. When a project has high technical risks or is very early in market penetration, it may be more appropriate to consider a

relatively small scale of capital intended to reduce that risk before securing the larger amounts of capital needed for broader scale adoption. A proponent should be able to address the scale of the opportunity – for example, how much land could adopt the proposed practice, what is the projected rate and pace of adoption, and what additional measures could facilitate or enhance adoption and scale.

MODULE 2

CONDUCTING ECONOMIC ANALYSES AND IDENTIFYING FINANCING STRATEGIES

NATURE-BASED SOLUTIONS IN AGRICULTURE: PROJECT DESIGN FOR SECURING INVESTMENT



In this module, the project proponent will determine an investment thesis for the project – essentially, what cash flow and/or long-term asset appreciation can drive a return on the project and enable financing to be repaid? The investment thesis should address associated risks of the project. The purpose of this module is to take the information gathered in module 1 and to translate it into information that can be used during the financial underwriting of a transaction to understand not only whether a project can be financed, but what kinds of finance are most suitable for a project, and if necessary, what sorts of other approaches are needed to address uncertainty around the technical or financial performance of a project. Key considerations discussed in this section include the nature and timing of cash flows from a project, realistic expectations about upfront capital costs and operating costs, and any lags between those investments and changes in cash flows.

Once the investment thesis is established, a proponent can turn to the strategy to finance it – is it appropriate for private finance, or does it need public guarantees, public finance, or blended finance?

For example, if a project has revenues from the sale of a product, this could make the project a candidate for private financing. If the cash flow is based on a tax or user fee, this could look like public finance or a public-private partnership model. In this module, a project proponent can develop a high-level assessment of the possibilities for the benefits of multi-partner financing, but doing this with rigor and detail, such as incorporating such data into formal financial models, is likely out of scope, and is likely best done by an advisor or consultant with specialized expertise.

Traditional agriculture extension agents and conservation practitioners may not have deep experience in economics and project financing. This may be the proper stage in project development to invest or engage in specialized skills in the investment space. A project proponent can do significant up-front work to confirm what types of financing or funding are needed, which will inform the sorts of specialized skills that might be needed. Most projects will need to show that they have a management team skilled in investments, so sometimes these early consultants or advisers may ultimately become investment partners and managers.

Most projects will need to show that they have a management team skilled in investments.





CASH FLOWS AND FINANCIAL

PERFORMANCE

IDENTIFY CASH FLOW OR VALUE GENERATION

Project proponents should estimate the magnitude of the project: what is the scale of the problem, what is the array of potential interventions, and what is an initial range of potential costs. (Tie this to the information developed in module 1 – how you use this to identify cash flow). They should also return to the project outcomes, with a creative eye to characterizing co-benefits, partitioning them among beneficiaries, and making the case for investment when compared to a ‘business as usual’ scenario. Given the benefits produced by the adoption of NbS practices, what sources may be available to monetize them, and what are the ways to generate cash flow?



SUSTAINABLE RESOURCE MANAGEMENT

Improving yields of existing practices as a source of revenue – This involves introducing a better practice into the standard operating procedure of resource management. In these cases, there is a product, often water and/or crops, and the sale of the product provides the cash flows. The adoption of Ag NbS can be justified financially by an increase in the yield or quality of the product. In some cases, a lender may offer a more attractive interest rate (like a global agribusiness company with a mandate for sustainability) to promote improved practices in their supply chains.



POLICY FRAMEWORKS

Unlocking new sources of value as a source of revenue – Where there is an identified public interest, policy can be designed to enable the creation of cash flows via the adoption of NbS practices. For example, carbon markets or water quality trading markets enable the creation of cash flow value through the adoption of NbS that achieve policy objectives. Policies may directly create sources of funding for particular projects and therefore help contribute to financing, or they may help create new markets that allow various market participants to trade products and services produced through Nature-based Solutions.



IMPROVING THE FUNDAMENTAL VALUE OF THE UNDERLYING ASSET

Is often linked to cash flows, but could also be higher value because of more resiliency, as may be the case in soil carbon improvements.



COUNTERPARTY AGREEMENTS

Reducing financial risk through long term contracts – In these cases, there is a direct agreement between the beneficiary who provides the cash flows and the farmers who adopt the practices. The parties set a framework or standard to calculate the value generated for a certain quantity of the agricultural intervention. Water funds are an example of this arrangement, where a city utility pays farmers for practices that reduce nutrient runoff. This is a difficult arrangement to execute as there is no existing market to define cash flows.

Projects can have several ways of generating revenue or value. For Nature-based Solutions practices, there are several categories of cash flow generation that can be considered.

Project proponents should seek to characterize co-benefits and multiple outcomes and identify a full range of potential beneficiaries (including public) who may have an interest in contributing to interventions. It is worth recognizing that there is often a tradeoff between the additional complexity associated with multiple revenue streams and the potential to secure funding especially for Nature-based Solutions where the beneficiaries of

projects may be highly fragmented and diffuse, and the balance between private and public benefits from a project may offer limited ways to directly finance a project through the private benefits.

A key consideration around better practices is the timing of when investment is needed, and the better practice generating higher revenue. Another consideration is the extent to which a change in practice alters the capital or operating costs of a project on an ongoing basis.

BARRIERS TO FINANCE

SUFFICIENT CASH FLOWS OR UNCERTAIN ASSET APPRECIATION

Financing requires sufficient cash-flows to repay both the initial investment plus interest and administrative costs in the case of debt or, alternatively, asset appreciation in the case of equity. When cash flows are uneven over time, or uncertain, securing equity investment in a project may be the only way to secure financing. Determine if there is a source of positive cash-flow either from on-farm productivity improvements or long-term public investment such as payment for ecosystem services. And if cash flows insufficient, are there other strategies for repaying financing?

Nature-based Solutions are often attractive from a societal perspective because the co-benefits and externalities associated with Nature-based Solution practices can be significant. However, unless there are sources of funding from public sources explicitly tailored to provide capital to reward the delivery of public benefits, the private benefits are critical for financing and should be the focus of understanding how a project will be financed. So, in the earlier example of the sustainable water impact fund, the financing occurs through the improvements in yield and water security, not the improvements in biodiversity or soil carbon.

WHY AREN'T FUNDS FLOWING ALREADY?

If there are cash flows and return on investment, a proponent should ask: why aren't funds already available? Identify early hypotheses of prospective investors who

match the type of cash flow generated by the project, the risk profile of the project, and are interested in supporting the outcomes generated by the project. Do not make assumptions about investment types, e.g. "we're doing a green bond" or "impact investing sounds good so let's do that". In most cases, impact or private investment is not the right solution, or a project maybe may need to be fundamentally restructured in order to make it a good match for repayable sources of financing.

LACK OF PERFORMANCE DATA

Is the lack of performance data on NbS a key barrier to utility or regulator willingness to invest at sufficient scale to evaluate this concept's efficacy? The performance of NbS vary by region, crop type, and farm practice, and similarly the availability of research and performance data vary regionally and often do not include definitive measures of return on investment (see Nature-based Solutions in Agriculture: Sustainable Management and Conservation of Land, Water, and Biodiversity). Investment in local pilots may be a way to address uncertainty around performance.

TIMEFRAMES

The time value of money can be a significant barrier to investment in NbS. The recovery of ecosystem function and services can require a multi-decade or longer time horizon, which often doesn't mesh with the desires of private investment capital, which are often focused on a decade or less.

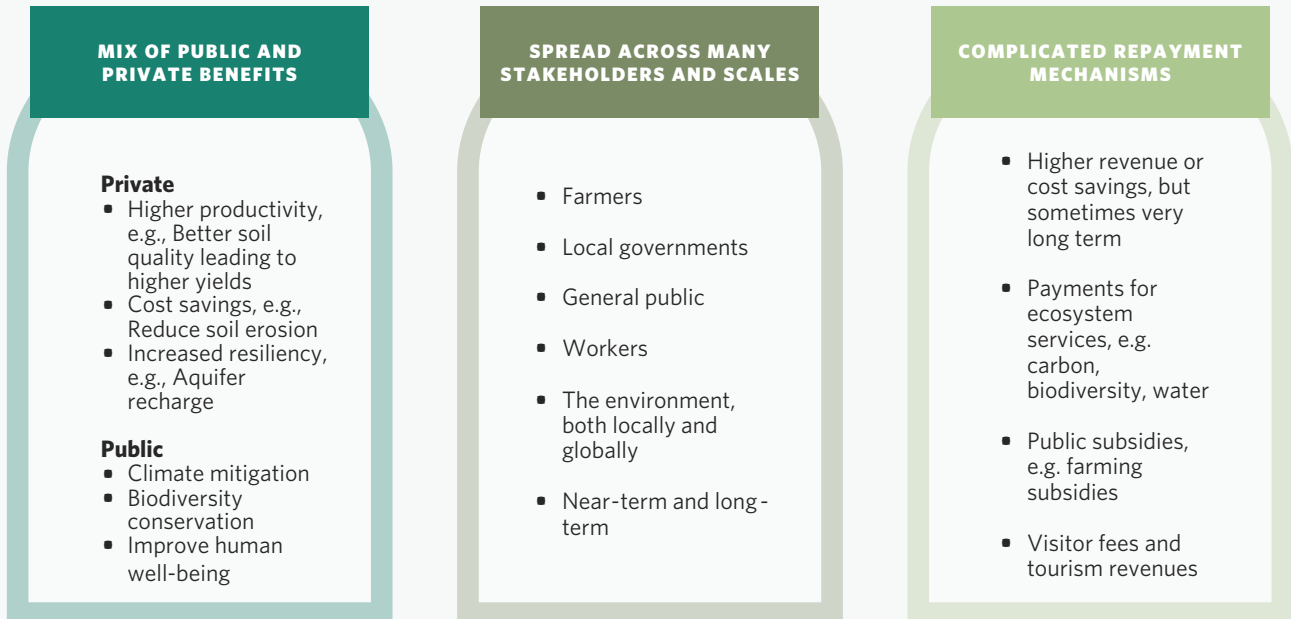


FIGURE 11. SOME BARRIERS FOR FINANCING AG NBS



CASE STUDY

WAIKATO RIVER LIMITED HYBRID BOND

PRINCIPLE:

Projects should have clear value creation (cash flow) for investors that are closely tied to the outcomes one wishes to achieve.

OVERVIEW:

Waikato River Limited has issued a NZ\$100M hybrid bond impact investment fund to improve water quality in the Waipa and Waikato Rivers by converting conventional dairy farms to organic, thereby reducing pollution from farm runoff and providing local economic growth opportunities.

AG NBS

On-farm mitigation initiatives such as riparian planting, cover crops, wetland expansion, improved fencing and afforestation.

FINANCING MECHANISM

- Bond; 10-year term with an annual coupon of 5.25% paid semi-annually.
- Possible grant funding to offset and supplement environmental mitigation costs during conversion process.

ENABLING CONDITIONS

- Demand for organic dairy products is increasing in New Zealand and overseas markets
- Organic farming practices add value to products and improve environmental outcomes fund is interested in
- Asset manager sources pipeline of farms through long-standing relationships with farmers, land agents, livestock buyers, and bankers in the Waipa catchment
- Asset manager has existing strong relationships with processors in the region who are seeking to grow their supply base of organic milk and are willing to offer competitive premiums

CASE

Funds raised from the bond issuance will be used by the fund to acquire profitable conventional farms in the target region and convert them to organic farms with additional environmental mitigation initiatives such as afforestation and riparian tree planting by waterways. During the conversion process, which will take three years on average, some farms may obtain grant funding to offset / supplement environmental mitigation costs. The farmland is expected to appreciate by 6% annually based on historical data, but organic conversion creates additional value for investors on top of the appreciation.

Organic has favorable market tailwinds with demand for organic dairy products increasing in New Zealand and overseas markets. Organic products attract premium pricing well above conventional. Organic systems will have fewer cows (19% reduction) and reduced milk solids (22% reduction), but the decrease is offset by producing a premium priced product (organic milk) from a lower operating cost base. Organic farms will import less feed and have fewer fertilizer expenditures, which lowers their operating cost by 31%.

When possible, additional revenue will be sought by pursuing public grants and creating alternative revenue streams like manuka honey, farm-stay tourism, carbon credits, and/or on-site biogas installation. Additionally, the asset manager has strong existing relationships with multiple processors in the region who would be interested in growing their supply base of organic milk and are willing to offer premiums. Establishing a relationship with a processor increases farmers direct access to the market and can magnify their earnings from the value chain.

By year four, financial models predict organic net returns exceed conventional dairy by 9% after the 3-year transition period. Financial returns could increase if grant funds are obtained to help further cover transition costs. At the notes' expiry at year 10, they are expected to be refinanced at the value of the farmland based on independent valuation. At this time, investors can opt to reinvest or receive cash based on the principal plus the share of the land appreciation.

SCALE

Will the proposed scale of the project be sufficient to achieve the economic or ecological goals identified in module 1? As mentioned above, one significant barrier to investment is a lack of scale; investors often seek larger scale, while practitioners often design smaller projects. If scale is a barrier, can this project serve as a pilot or demonstration of an innovative financing approach that could ultimately be deployed at a wider landscape to achieve wider goals?

EVALUATION OF CONCESSIONARY

CAPITAL AND DE-RISKING

MECHANISMS

In many cases it is challenging to design a new financial product that both offers attractive terms to farmers and works on a fully commercial basis for lenders and investors. New products often lack track record, involve lending terms beyond current market conditions, or involve risks and benefits that are not fully understood or accepted by the market. In such cases, it can be helpful to incorporate concessionary capital or de-risking mechanisms to share risk and/or provide capital on better than market terms for a portion of the capital structure, in order to reduce risk for commercial investors and make the mechanism financeable. De-risking capital in the ag sector is typically provided by governments seeking to encourage adoption of sustainable practices, via Development Finance Institutions and specialized funds (for example, &Green, Agri3, FMO, IDB, IFC).

...it can be helpful to incorporate **concessionary capital or de-risking mechanisms** to share risk and/or provide capital on better than market terms for a portion of the capital structure.

Often, grants or concessional loans represent important de-risking instruments within blended finance solutions for investment projects on greening agriculture, including NbS, at least in the early stages of development. In such contexts and where the business and investment case for the project is relatively strong, an important consideration should be ensuring investment additionality i.e., avoiding crowding out of private investment. Also, if such grant or concessional funding is accessed, project proponents should evaluate the financial sustainability of project results once public support or concessional financing is no longer available.

Policy programs, such as the Smart Cities initiative in India promote access to other financing instruments, for instance liquidizing the Indian bond market for green urban infrastructure (Asian Development Bank, 2017). Ratings and indices based on environmental and social concerns are increasingly penetrating the Indian equity market, energy trading schemes have been introduced, and innovative insurance schemes have addressed shortcomings in climate change affected sectors, such as agriculture.



Mechanism	Description	Illustrative examples (assumes \$50 million of capital needed)
SUBORDINATED DEBT	A loan where some combination of the principal and interest is paid only after a more “senior” (higher priority) loan is paid; the subordinated debt may also have different terms, such as a lower interest rate than a more senior loan.	Two “tranches”
		\$40 MM in senior loans (paid first)
		\$10 MM in subordinate loans (paid after the senior loans) at a lower rate, e.g. 2% annually.
		“Blended” rate reduced to farmer
		Subordinate
		Lower rate on sub. loans
SUBORDINATED EQUITY	A tranche of equity that receives its return only after other tranches of equity receive their return. This may be structured in many ways, including capping the equity returns on a particular tranche of equity.	Two “tranches” of equity
		\$40 MM in equity that receives repayment of the investment and up to a 6% (preferred) return before other equity
		\$10 MM in equity that receives its return after the preferred return threshold is met.
FULL PERFORMANCE GUARANTEE	A full performance and financial guarantee on loans and equity investments. The guarantee may be provided by a corporation, impact investor, public entity or foundation.	\$50 MM guarantee
		Loan offered by bank at lower rate than available commercially.
PARTIAL PERFORMANCE GUARANTEE	A portion of the technical and financial performance is guaranteed, usually capped at a certain percentage of potential losses of principal invested. This structure is often referred to as a “first loss guarantee” for a portion of principal and interest (i.e. the first 10% of losses).	\$10 MM first loss guarantee (20% coverage)
		Loans offered at lower rate than available commercially (and potentially with other, favourable terms).
INTEREST BUY-DOWN	Payments made to a bank to reduce the interest rate of a loan to farmers. This is most frequently used by companies to finance sales of products to farmers.	Payments to bank equivalent to 2% interest (e.g. \$1 million for one-year, \$50 MM in loans).
		Payments to bank equivalent to 2% interest (e.g. \$1 million for one-year, \$50 MM in loans).

TABLE 1. EXAMPLES OF CONCESSIONARY CAPITAL AND DE-RISKING MECHANISMS FOR AGRICULTURE NBS

OFFTAKE AGREEMENT	Buyer contract to purchase production. Can have a wide variety of terms including varying length (one-year, multi-year), price (fixed or variable depending on market conditions), and direct or through an intermediary.	Buyer enters offtake agreement with farmer.
		Term of agreement matches loan term .
PAY FOR PERFORMANCE CONTRACTS	Contracts tied to certain performance conditions, such as a reduction in pollution load, intended to reduce technical performance risk.	Bank feels more secure in offering improved lending rate to the farmer.
		Contracts pay exceeded if those performance conditions are met.

TABLE 1. EXAMPLES OF CONCESSIONARY CAPITAL AND DE-RISKING MECHANISMS FOR AGRICULTURE NBS



These structures have different characteristics and performance benefits, for example by allocating technical and financial performance risk among the different parties or enabling the creative merging of different funding streams and multi-agency participants.

They also entail different skills in order to advance the project from concept to investment. It is essential to build the right management team for the project— what kind of expertise, depending on the desired outcomes, proposed practices, and financing model? At this phase, the team should be able to develop and make the case for the investment vehicle selected, and ultimately to begin to organize the institutional arrangements and governance models to manage the investment over time.

?

THRESHOLD QUESTION: Is there a financing approach that will meet conservation and investor goals?

MODULE 3

ORGANIZING THE INSTITUTIONAL ARRANGEMENTS AND GOVERNANCE

NATURE-BASED SOLUTIONS IN AGRICULTURE: PROJECT DESIGN FOR SECURING INVESTMENT



The project sponsor will likely still have a strong role in ensuring that implementation will meet the desired goals of the project



At this juncture, the project team should consider becoming fully integrated with professionals who have the specific skills to structure the financial transaction within the appropriate legal jurisdiction. Also, the project will likely need considerable technical expertise, including scientific, implementation capabilities. The practitioner will likely still have a strong role in ensuring that implementation will meet the desired goals of the project, with appropriate safeguards and an appropriate evaluation and measures framework in place. The process of institutional arrangements and governance will involve iteration - virtually no conservation investment deal proceeds neatly on a linear process, and practitioners should be prepared to circle back on issues and be patient and creative in problem solving.



INSTITUTIONAL ARRANGEMENTS

For any investment vehicle, including investments in NbS, it is necessary to develop the legal and financial documentation and structures to support business operations, investment fundraising, and investment management. This will vary depending on the jurisdiction, relevant governing laws and oversight agencies, and the type of financing mechanism being considered. Legal expertise in the relevant jurisdiction is indispensable at this phase of a project.

In addition to legal expertise, there is an ecosystem of players needed to successfully establish and execute an investment project - to translate the available financing into on-the-ground adoption of new practices (see figure below). First, there may be a consideration for the role of the agricultural or conservation organization that has sought to design and develop this project; is there a formal role for the champion organization in the investment institutions or is it better able to advance the work by remaining independent of the legal structure. In addition to the investors and producers, other players can include technical assistance to facilitate farmer adoption and implementation; corporate support and off-take arrangements to ensure a market for products; detailed measurement and tracking of financial flows and project implementation; and verification/monitoring of impacts and regulatory compliance.

Finally, and perhaps most important, institutional arrangements and management structures must be designed with close attention to farmer engagement and adoption. Is the investment arrangement accessible to farmers, and is it working for them to address a critical need, enhance their productivity and make them more profitable? Ultimately, financing schemes can fail if the investment model creates hurdles or imposes hardships on farmers. Project proponents should seek feedback from farmers early in the design phase and should constantly seek to improve producer engagement and ease of access in the investment model.

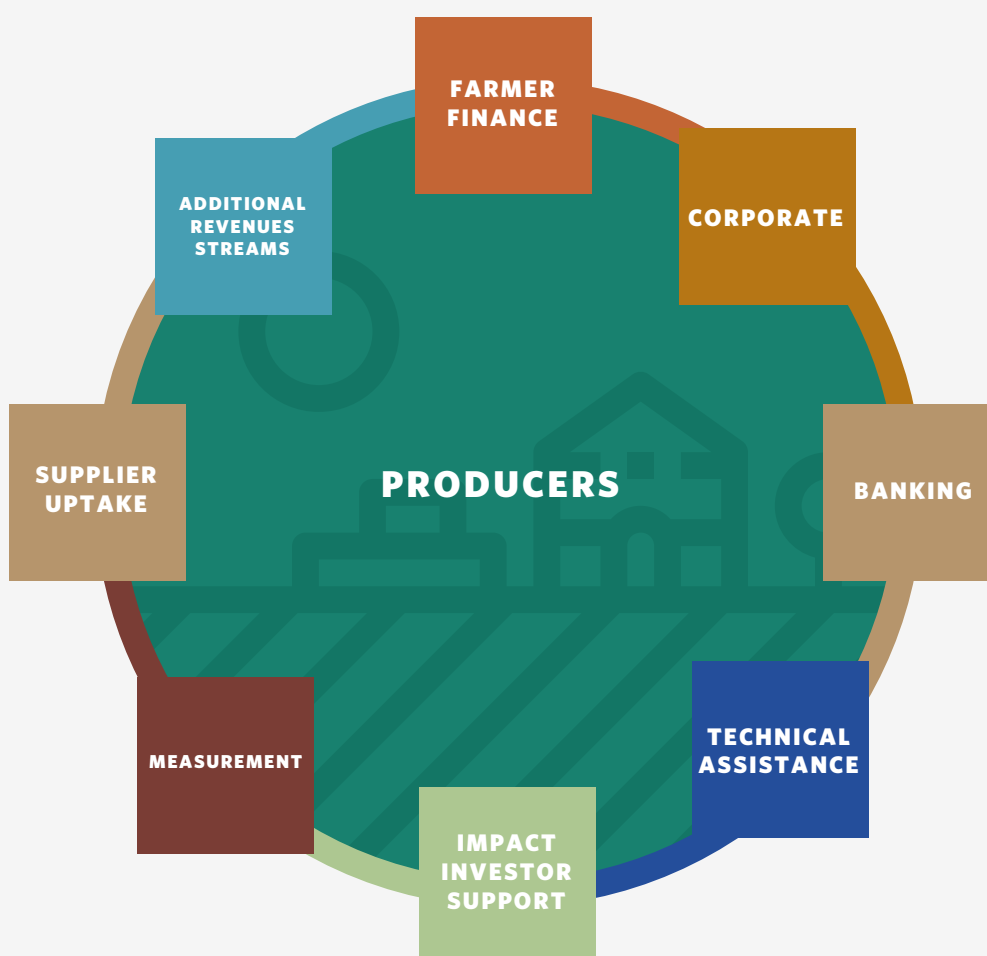


FIGURE 12. KEY ENABLING PLAYERS AND FACTORS



MEASURING AND EVALUATION

Once the legal and administrative dimensions of an investment are established, there is a need for continuous measuring and evaluation of performance. This includes data across several dimensions, including operational data on farm practices, environmental metrics to track NbS performance (e.g. GHG emissions, water quality or habitat function) and financial metrics (both for the investments as well as for the revenue and profitability of the farm operations). To the extent practicable, measuring and evaluation of NbS investment

models should recognize and account for both private benefits (like increased profitability of farms) as well as public benefits (like improved habitat condition). And investment managers should seek to design feedback loops and adaptive capacity, to adjust the investment model, farmer engagement process, and suite of practices to optimize the environmental and financial returns of the program. At a most fundamental level, the measurement and evaluation program should enable an assessment of whether the initial investment hypotheses were correct.

Robust monitoring and evaluation is essential to not just to an individual investment vehicle; it can play a critical role in advancing the adoption of NbS globally. The lack of evidence demonstrating the environmental effectiveness and return on investment of NbS practices can be a primary barrier to increased adoption by a range of actors, including investors, public agencies, and producers. To the extent innovative NbS investments can publicly share information regarding their performance across financial and environmental indicators, as well as any lessons learned or effective adjustments to improve performance, the entire sector can benefit, and future adoption and replication can be enhanced.

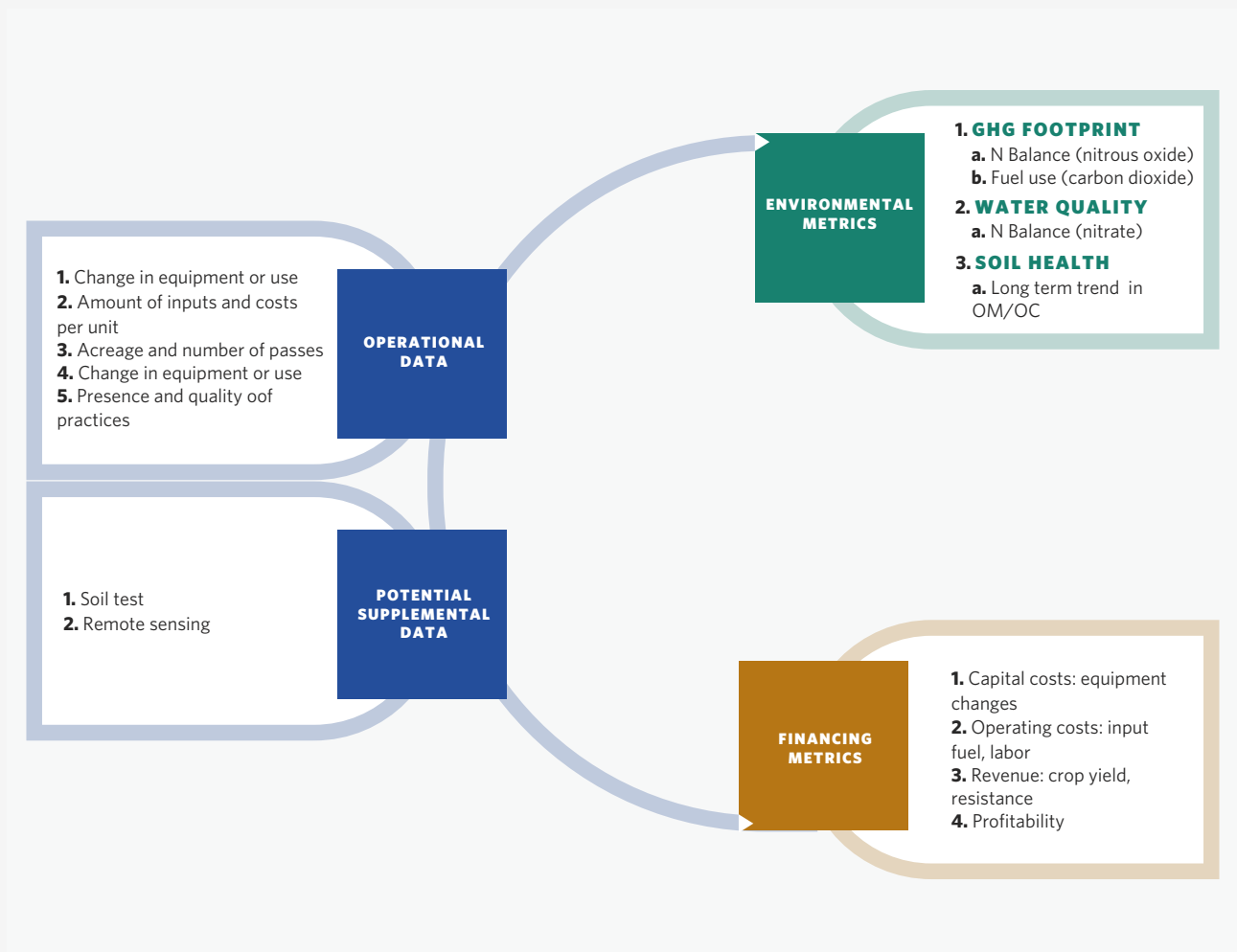


FIGURE 13. PERFORMANCE METRICS AND DATA NEEDS



POLICY ALIGNMENT

In addition to solving for the institutional structure for the investments, project sponsors should also seek to align agency administration, policy and governance opportunities for NbS at landscape scales. As described, most NbS investments have both private and public benefits, and they may require coordination among distinct jurisdictions and stakeholders at a landscape scale.

To the extent an investment is generating public benefits in environmental quality, habitat conditions, or health and well-being, there may be opportunities to engage public agency support. This could take several forms, including most immediately direct investment, technical support for adoption of practices, or monitoring and evaluation of benefits.

If practicable, practitioners should seek to engage policy makers to help facilitate the implementation of practices and to support the generation of benefits. As a starting point, project design should identify and consider policy objectives for agriculture or environmental quality and seek to align investment outcomes with existing policy frameworks. (See Module 1 on local context.) To the extent an investment aligns with public outcomes, public agency recognition of the investment vehicle and its ability to generate publicly valued benefits sends an important signal of support and can help to validate the investment premise. Beyond that, the coordination of policy goals and administrative processes can help to facilitate investment and create new value streams for the implementation of NbS.

Engaging with the enabling environment should also happen, *ex ante*, as assessing the context within which the project would be operating can make the difference between success or failure. Costs of policy misalignment are important to take into account and internalize when assessing technical, operational and financial risks and feasibility in the implementation of Module 1 and Module 2.

The recent wave of debt-for-nature swaps (UNDP, 2020) as a possible solution to align public and private interests in green investment and recovery is a helpful example. Debt-for-nature swaps are financial transactions in which

a portion of a nation's foreign debt is forgiven in exchange for local investments in environmental conservation or climate-related measures, such as environmental education and better management of protected areas. For indebted countries, debt swaps are effective in mobilizing investments towards domestic causes, as well as catalyzing additional co-financing from donors or the private sector and providing debt relief on large sums of sovereign debt.

As a financing instrument, DNS gained traction in the 1990s during early calls for debt relief, and that led to the mobilization of an estimated \$1.2 billion in domestic financing for conservation projects. While rarer, DNS schemes can also be applied to domestic debt. This is possible particularly in the case of governments managing large credit facilities for farmers. In the US, the Debt for Nature Program (USDA, 2019) can be accessed by landowners wishing to repay their debt with the Farm Service Agency (FSA) in exchange for a long-term conservation contract. The contract is a voluntary legal agreement that restricts the type and amount of development that may take place on the landowner's property. By participating in the program, the eligible borrowers reduce their debt with the FSA while contributing to conserving natural ecosystems and enhancing the environmental and scenic value of their farms, similar to other payment for ecosystem services schemes.

Implementing NbS at landscape scales will require unprecedented coordination among distinct jurisdictions and stakeholders. Such collaborative governance has, in theory, great advantages for durable decision-making and creative financing mechanisms. However, designing institutions that integrate across currently siloed interests and jurisdictions is a non-trivial problem. Constructive engagement with relevant policy frameworks and public agencies can yield a range of important benefits that enable and enhance project success.



THRESHOLD QUESTION: Are the financial institutions and policy/governance landscape aligned to support a successful outcome for investment and conservation?

CONCLUSION

NATURE-BASED SOLUTIONS IN AGRICULTURE: PROJECT DESIGN FOR SECURING INVESTMENT



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To accelerate investment in agriculture Nature-based Solutions requires engagement from multiple actors. One of the key barriers to acceleration is the availability of sufficient opportunities that can be combined or replicated predictably to achieve larger-scale opportunities for investors. The role of the project sponsor is to establish project goals and quickly assess if there are opportunities that could be packaged for investment, understanding that preparing projects for investment will require specialized skills. A successful project will additionally identify the right economic analyses and financing strategies and organize strong governance.

The agricultural sector can begin to employ Nature-based Solutions, which shift productive landscapes from drivers of impact to solution providers. Nature-based Solutions can provide multiple benefits by building agricultural production and resilience, mitigating climate change, and enhancing nature and biodiversity.

A successful project will additionally identify the right economic analyses and financing strategies and organize strong governance.

FINANCE 101

HELPFUL TERMINOLOGY AND CONCEPTS

PROJECT DESIGN FOR INVESTING IN NATURE-BASED SOLUTIONS

■ Beneficiary

The stakeholder who derives a positive impact from the Nature-based Solutions implemented in the watershed to improve water security. The 'stakeholder' may be an individual or an entity, such as a corporation.

■ Capital Structure

Refers to the way a project or program will finance its NbS through some combination of direct stakeholder investment, debt, equity, or hybrid securities.

■ Co-benefits

Additional valuable outcomes arising from the primary, focal activity or Nature-based Solutions.

■ Conservation interventions

Activities or other Nature-based Solutions that preserve or enhance the current state of the ecosystem function.

■ Cost-benefit analysis

A method for comparing the expenses (costs) and target outcomes (benefits) of a project.

■ Discount Rate

A rate used to calculate the present value of future costs or benefits. When calculating the return-on-investment (ROI), the financial modeling for a project or program should discount all costs and benefits of the program through the time horizon to their present value using an appropriate discount rate.

■ Ecosystem benefits

While ecosystem services are the outputs or aspects of nature that support human uses, such as clean water flows, the derived ecosystem benefits are the specific uses people make of ecosystem services, such as water available for municipal drinking water supply, or water available for irrigation or hydropower.

■ Ecosystem function

Processes performed by ecosystem structure, such as soil retention or aquifer recharge.

■ Ecosystem services

The outputs or aspects of nature that support human uses, such as clean freshwater flows for municipal water supply.

■ Ecosystem value

The change in human well-being that ecosystem benefits produce, such as avoided cost of municipal water treatment, of development of alternative drinking water sources or of water-related negative health effects.

■ Empirically-based benefit functions

Quantitative relationships that financially value ecosystem services in a way that is meaningful to the beneficiary's bottom line. For example, a reduction in pollutant concentration could reduce the treatment plant's application of a specific chemical, or proportionally reduce the amount of water lost in treatment sludge.

■ Implementation cost

The cost of implementing conservation interventions in the watershed.

■ Net present value (NPV)

The difference between the present value of inflows and the present value of outflows over a period of time. Often used in investment planning to analyze the profitability of a future project.

■ Opportunity cost

The difference between the profits landowners realize under business-as-usual land management and under conservation management.

■ Present value

The current worth of a future value or future stream of values. Sometimes referred to as the present discounted value

■ Restoration interventions

Activities or Nature-based Solutions that improve ecosystem function.

■ Return on Investment (ROI)

A common financial metric of profitability that measures the return – monetary value of the benefits the stakeholder receives – for the capital invested.

■ Social discount rate

The rate at which a society would be willing to trade present for future consumption (Lopez, 2008).

■ Social opportunity cost (SOC)

The value to society of the next best alternative use of the resources devoted to the project in question (Lopez, 2008).

■ Social time preference (STP)

Assigns current values to future consumption based on society's evaluation of the desirability of future consumption (Lopez, 2008).

■ Time horizon

How many years the model will project outputs into the future. Choosing an appropriate time horizon will allow a comparison of the cost-effectiveness of interventions with other solutions beneficiary(ies) may be considering.

■ Time value of money

Concept which argues that money available at the present time is worth more than the identical sum in the future, due to its potential earning capacity.

■ Transaction cost

The expenses indirectly associated with implementing Nature-based Solutions; not the cost of the intervention itself, but rather the incidental costs of coordinating among stakeholders. For example, costs associated with landowner outreach; with drawing up, monitoring and enforcing agreements with land users or owners; dispute resolution; or with establishment and operation of any compensation schemes.



NET PRESENT VALUE

In some cases, analyses can consider the **net present value** (NPV) as an alternative indicator for return-on-investment (ROI). The net present value is often used in investment planning to analyze the profitability of a future project. A positive NPV indicates that the earnings generated by a project are projected to exceed its anticipated costs. Therefore, a project with a positive NPV will be profitable and a project with a negative NPV will result in a net loss.

To understand how NPV is calculated, it's important to understand present values and discount rates. The **present value** (sometimes referred to as the present discounted value) is the current worth of a future value or future stream of values. To get this present value, future values are discounted using an appropriate **discount rate**.

It is important to understand the concept of discounting and the theory behind it. Discounting is a common valuation method used to estimate the value of a current investment based on its expected future cash flows (Chappelow, 2020). Discounting is based on the **time value of money** concept which argues that money available at the present time is worth more than the identical sum in the future, due to its potential earning capacity. If invested now, that sum of money can earn interest and increase in value. Therefore, even though the sums of money being offered now, and in the future, are of the same absolute value, the money being offered now is actually worth more because of its investment potential.

NPV is the difference between the present value of inflows and the present value of outflows over a period of time (Fern, 2020). Therefore, if a project needs a certain investment now (and in future months) and the future returns generated by the project can be predicted, then – using the discount rate – the current value of all such cash flows can be calculate (Chappelow, 2020). If the NPV is positive, the project is considered viable. If the NPV is negative, it is considered unviable.

FACTORS THAT INFLUENCE ROI

■ Time horizon

The time horizon for a ROI calculation must make sense for a project's circumstances. For an infrastructure investment like a water utility, a timeline of 25-30 years might be in line with the lifespan of the infrastructure. The time horizon, however, also indicates the time period over which a project or program should generate a positive return on investment. This can be more difficult if a program has high upfront costs and realizes its benefits slowly, as is the case for many transitions from traditional forms of agricultural production to Ag NbS.

The financial model for a restoration intervention, for example, will likely show low annual benefits initially, followed by a sharp increase over time. It takes time for restoration interventions to reach full potential, and a project will likely have high front-loaded costs due to the design, coordination and implementation costs associated with rolling out a program. Implementation costs will level out once a program is up and running, but because of the inverted time profile of costs and benefits – meaning, high costs and low benefits during the first few years – longer time horizons will, in general, increase the ROI because more years will be included during which the program is producing benefits that outweigh the costs. ²

² This would depend on your discount rate. If your team is using a high discount rate, the NPV of these benefits far into the future, decreases. This is likely a key reason why NbS are not often seen as competitive alternatives to grey infrastructure.

■ Discount rate

Discounting is the process of estimating the present value of a future value or future stream of values. When calculating the ROI, one should discount all costs and benefits of the program through the project or program time horizon (e.g. 30 years) to their present value using an appropriate discount rate. For private individuals and private companies, these rates should be based on the private rate of pure time preference (individuals) and the private cost of capital or its rate of return from competing investments (companies), respectively. Public investments in long-lived conservation projects such as watershed natural infrastructure conservation and restoration are typically discounted using a long-term **discount rate**.

Social rates, rather than market discount rates, are usually used when evaluating long-term publicly financed projects like environmental protection (Arrow *et al.*, 2013). Higher discount rates will lower the ROI while lower rates will increase the ROI. A private entity's discount rate will likely exceed the public discount rates.

■ Co-benefits

In addition to improving the targeted ecosystem service(s), the program's intervention could produce several **co-benefits** that are important to the beneficiary, other program investors or the public. While it can be difficult to quantify these co-benefits, they can often improve the program's overall ROI and substantially exceed the beneficiary's ROI.

Such divergence between the broader economic case and the specific economic case for an objective or investor highlights the importance of carefully selecting the scope of the ROI analyses and the interpretation of their results.

SCALE OF INTERVENTION

Transaction and program overhead costs often account for a high share of total program costs. However, some components of these costs are not affected by – or increase less than proportionally with the geographic scale of intervention. In other words, increasing the total intervention area to include additional high ROI sites may not incur a proportionate increase in transaction and overhead costs and thus could improve program ROI. For example, increasing conservation and restoration areas by ten percent may only increase transaction costs by six percent and likely increases overhead costs by an even smaller percentage, thus raising total program costs by much less than ten percent.

Transaction costs that are generally strongly influenced by total intervention scale include,

- Expenses related to landowner outreach and engagement;
- Landowner enrollment in intervention programs, including preparation of site-specific intervention designs and contracts, and agreement on ecosystem service payments, if any;
- Monitoring of landowner compliance with contracts, where applicable.

Program overhead costs are generally less strongly influenced by total spatial scale of interventions include,

- Program creation, engagement and coordination of key program supporters, partners and other stakeholders (e.g., industry, government);
- Program management, including strategy design, fundraising, administration, communications with the public of key stakeholders;
- Technical analyses, e.g. modeling.

BOX 7

SOCIAL DISCOUNT RATE

The social discount rate measures “the rate at which a society is willing to trade present for future consumption” (Lopez, 2008). As such, the social discount rate is especially important for projects whose benefits are only apparent after many years to decades, like green infrastructure projects.

Two types of discount rates have traditionally been advocated: social opportunity cost (SOC) of the investment and social time preference (STP). The SOC, defined as “the value to society of the next best alternative use of the resources devoted to the project in question” (Lopez, 2008), is based on the idea that the decision to invest in a project means that these resources will no longer be available to invest in the private sector. If using a SOC, then investors will choose to take on a project if their social benefit is larger than the loss that results from removing these resources from the private sector.

However, many have argued (Sen, 1961 and Feldstein, 1964) that an individual’s time preference may depend on whether he is acting alone or as part of a group. In other words, if others are willing to save, he may be willing to save as well. This is where the social time preference (STP) comes in. the STP will assign current values to future consumption based on society’s evaluation of the desirability of future consumption.

In practice, the analysis of different public interventions often requires the use of different discount rates. The European Commission recommends, for instance, using a SOC rate in cases where the financial return of a project is of concern to the public, e.g. investment by a public enterprise that will operate without subsidies. However, for standard cost benefit analyses of public projects, the European Commission recommends the use of an STP.

It will be important for a project team to work with project beneficiaries and contractor quite closely to determine the appropriate discount rate. Many stakeholders will already use discount rates to assess the viability of their future investments and will have a preference on which to use.

REFERENCES

- **Abell, R., et al.** 2017. Beyond the Source: The Environmental, Economic and Community Benefits of Source Water Protection. https://www.nature.org/content/dam/tnc/nature/en/documents/Beyond_The_Source_Full_Report_FinalV4.pdf
- **Andersson, J.A. & D'Souza, S.** 2014. From adoption claims to understanding farmers and contexts: A literature review of Conservation Agriculture (CA) adoption among smallholder farmers in southern Africa. *Agriculture, Ecosystems & Environment*, 187: 116-132. <https://doi.org/10.1016/j.agee.2013.08.008>
- **Asian Development Bank.** 2017. Catalyzing green finance: a concept for leveraging blended finance for green development. Manila, Asian Development Bank Institute. (also available at <http://public.eblib.com/choice/publicfullrecord.aspx?p=5216171>).
- **Chappelow, J.** 2020. Discount Rate. In: Investopedia [online]. <https://www.investopedia.com/terms/d/discountrate.asp>
- **Cheesman, S., Andersson, J.A. & Frossard, E.** 2017. Does closing knowledge gaps close yield gaps? On-farm conservation agriculture trials and adoption dynamics in three smallholder farming areas in Zimbabwe. *The Journal of Agricultural Science*, 155(1): 81-100. <https://doi.org/10.1017/S0021859616000095>
- **Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S.** 2016. Nature-based Solutions to address global societal challenges. <https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf>
- **Cooper, G. & Tremolet, S.** 2019. Investing in Nature: Private finance for nature-based resilience. *The Nature Conservancy and Environmental Finance*. (also available at https://www.nature.org/content/dam/tnc/nature/en/documents/TNC-INVESTING-IN-NATURE_Report_01.pdf).
- **Deutz, A., Heal, G., Niu, R., Swanson, E., Townshend, T., Li, Z., Delmar, A., Meghji, A., Sethi, S.A. & Tobin-de la Puente, J.** 2020. Financing Nature: Closing the global biodiversity financing gap. *Financing Nature: Closing the Global Biodiversity Financing Gap*. The Paulson Institute, The Nature Conservancy, and the Cornell Atkinson Center for Sustainability.
- **FAO & CARE.** 2019. Good Practices for Integrating Gender Equality and Women's Empowerment in Climate-Smart Agriculture Programmes. Atlanta. (also available at <http://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1195137/>).
- **FAO, World Bank Group, & IFAD.** 2015. Gender in Climate-Smart Agriculture. No. Module 18 for the Gender in Agriculture Sourcebook. Food and Agriculture Organization of the United Nations. (also available at <https://openknowledge.worldbank.org/bitstream/handle/10986/22983/Gender0in0clim0riculture0sourcebook.pdf?sequence=1&isAllowed=y>).
- **FAO.** 2014. Building a common vision for sustainable food and agriculture. Principles and approaches | FAO. Rome. (also available at <http://www.fao.org/3/a-i3940e.pdf>).
- **FAO.** 2016. An experiment in land rehabilitation: the catalytic effect of Dimitra Clubs in Niger [online]. <http://www.fao.org/gender/insights/detail/en/c/446421/>
- **FAO.** 2018. Guidance note on gender-sensitive vulnerability assessments in agriculture. Food and Agriculture Organization of the United Nations. (also available at <http://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1260089/>).
- **FAO.** 2019. Sex-disaggregated data in agriculture and sustainable resource management: New approaches for data collection and analysis. , p. 44. Rome. (also available at <http://www.fao.org/publications/card/en/c/18930EN/>).
- **Fern, J.** undated. Net Present Value (NPV). In: Investopedia [online]. <https://www.investopedia.com/terms/n/npv.asp>
- **Giller, K.E., Witter, E., Corbeels, M. & Tittonell, P.** 2009. Conservation agriculture and smallholder farming in Africa: The heretics' view. *Field Crops Research*, 114(1): 23-34. <https://doi.org/10.1016/j.fcr.2009.06.017>

- **Glenmarec, Y.** 2017. Addressing the gender differentiated investment risks to climate-smart agriculture. AIMS Agriculture and Food. (also available at https://www.researchgate.net/publication/312923234_Addressing_the_gender_differentiated_investment_risks_to_climate-smart_agriculture).
- **Global Commission on Adaptation.** 2019. Adapt Now: A Global Call for Leadership on Climate Resilience. (also available at https://cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf).
- **Griscom, B.W., Adams, J., Ellis, P.W., Houghton, R.A., Lomax, G., Miteva, D.A., Schlesinger, W.H., Shoch, D., Siikamäki, J.V., Smith, P., Woodbury, P., Zganjar, C., Blackman, A., Campari, J., Conant, R.T., Delgado, C., Elias, P., Gopalakrishna, T., Hamsik, M.R., Herrero, M., Kiesecker, J., Landis, E., Laestadius, L., Leavitt, S.M., Minnemeyer, S., Polasky, S., Potapov, P., Putz, F.E., Sanderman, J., Silvius, M., Wollenberg, E. & Fargione, J.** 2017. Natural climate solutions. *Proceedings of the National Academy of Sciences*, 114(44): 11645–11650. <https://doi.org/10.1073/pnas.1710465114>
- **Wollenberg, E. & Fargione, J.** 2017. Natural climate solutions. *Proceedings of the National Academy of Sciences*, 114(44): 11645–11650. <https://doi.org/10.1073/pnas.1710465114>
- **Hurlbert, M., Krishnaswamy, J., Davin, E., Johnson, F.X., Mena, C.F., Morton, J., Myeong, S., Viner, D., Warner, K., Wreford, A., Zakieldeen, S. & Zommers, Z.** 2019. Risk management and decision-making in relation to sustainable development. *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.* (also available at <https://www.ipcc.ch/srcc1/chapter/chapter-7/>).
- **International Finance Corporation (IFC) World Bank Group.** 2017. Mobilization of Private Finance by Multilateral Development Banks and. (also available at https://www.ifc.org/wps/wcm/connect/Publications_EXT_Content/IFC_External_Publication_Site/Publications_Listing_Page/2018_MDB-Mobilization-Report).
- **International Union for Conservation of Nature (IUCN).** 2018. Information Paper: Safeguarding nature through finance. (also available at https://www.iucn.org/sites/dev/files/information_paper_-_safeguarding_nature_through_finance.pdf).
- **IUCN.** 2016. Nature-based Solutions. In: IUCN [online].
- **Kariuki, J. & Birner, R.** 2016. Are Market-Based Conservation Schemes Gender-Blind? A Qualitative Study of Three Cases From Kenya. *Society & Natural Resources*, 29(4): 432–447. <https://doi.org/10.1080/08941920.2015.1086461>
- **Kiptot, E. & Franzel, S.** 2012. Gender and agroforestry in Africa: a review of women's participation. *Agroforestry Systems*, 84(1): 35–58. <https://doi.org/10.1007/s10457-011-9419-y>
- **Larson, A.M., Solis, D., Duchelle, A.E., Atmadja, S., Resosudarmo, I.A.P., Dokken, T. & Komalasari, M.** 2018. Gender lessons for climate initiatives: A comparative study of REDD+ impacts on subjective wellbeing. *World Development*, 108: 86–102. <https://doi.org/10.1016/j.worlddev.2018.02.027>
- **Lerner, A.M., Zuluaga, A.F., Chará, J., Etter, A. & Searchinger, T.** 2017. Sustainable Cattle Ranching in Practice: Moving from Theory to Planning in Colombia's Livestock Sector. *Environmental Management*, 60(2): 176–184. <https://doi.org/10.1007/s00267-017-0902-8>
- **Lopez, H.** 2008. The Social Discount Rate: Estimates for Nine Latin American Countries. Policy Research Working Paper No. 4639. Washington, DC, World Bank.
- **Magruder, J.R.** 2018. An Assessment of Experimental Evidence on Agricultural Technology Adoption in Developing Countries. *Annual Review of Resource Economics*, 10(1): 299–316. <https://doi.org/10.1146/annurev-resource-100517-023202>
- **OECD & FAO.** 2018. OECD-FAO agricultural outlook 2018–2027. Rome, Italy, FAO and OECD. (also available at https://doi.org/10.1787/agr_outlook-2018-en).
- **Ranjan, P., Wardropper, C.B., Eanes, F.R., Reddy, S.M.W., Harden, S.C., Masuda, Y.J. & Prokopy, L.S.** 2019. Understanding barriers and opportunities for adoption of conservation practices on rented farmland in the US. *Land Use Policy*, 80: 214–223. <https://doi.org/10.1016/j.landusepol.2018.09.039>
- **Resolve & Soil and Water Conservation Society.** 2018. Report: Study on the adoption of edge of field practices. Iowa Department of Agriculture and Land Stewardship. (also available at https://www.swcs.org/static/media/cms/IDALS_WQ_Report_final_2018_29770C953A917.pdf).
- **Ritchie, H.** 2019. Half of the world's habitable land is used for agriculture. In: *Our World in Data* [online]. <https://ourworldindata.org/global-land-for-agriculture>
- **The Nature Conservancy (TNC).** 2019. Strategies for

Operationalizing Nature-Based Solutions in the Private Sector. The Nature Conservancy Business Council, Natural Infrastructure Working Group. (also available at <https://www.nature.org/content/dam/tnc/nature/en/documents/NbsWhitePaper.pdf>).

- **Miralles-Wilhelm, F.** 2021. Nature-Based Solutions in Agriculture: Sustainable Management and Conservation of Land, Water, and Biodiversity. The United Nations Food and Agriculture Organization, and The Nature Conservancy.
- **Tuijnman, W., Bayrak, M.M., Hung, P.X. & Tinh, B.D.** 2020. Payments for environmental services, gendered livelihoods and forest management in Vietnam: a feminist political ecology perspective. *Journal of Political Ecology*, 27(1): 317-334. <https://doi.org/10.2458/v27i1.23643>
- **U.S. Department of Agriculture (USDA).** 2019. What is the Conservation Contract Program? In: ASK USDA [online]. <https://ask.usda.gov/s/article/What-is-the-Conservation-Contract-Program>
- **United Nations Development Programme (UNDP).** 2020. Debt for nature swaps [online]. <https://www.sdfinance.undp.org/content/sdfinance/en/home/solutions/debt-for-nature-swaps.html>
- **WestWater Research.** 2019. Conservation Practices: Costs, Benefits, and Ranking. Unpublished memo.



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