

Taking Nature-Based Solutions Programs to Scale



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About this Document

This document reports on research undertaken through a partnership between Foundations of Success (FOS), the Science and Technical Advisory Panel (STAP) to the Global Environmental Facility (GEF), and the Gordon and Betty Moore Foundation (GBMF).

The genesis of this research was the realization that all three partners were simultaneously exploring similar ideas about approaches for taking projects and programs to scale. In particular, STAP was developing guidance for GEF Nature-based Solution Programs while Nick Salafsky of FOS and Richard Margoluis of GBMF were writing a book titled *Pathways to Success: Taking Conservation to Scale in Complex Systems*. This document draws on both these sources as well as additional research that was funded by the Gordon and Betty Moore Foundation.

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1. Introduction

The Challenge of Taking Nature-Based Solution Programs to Scale

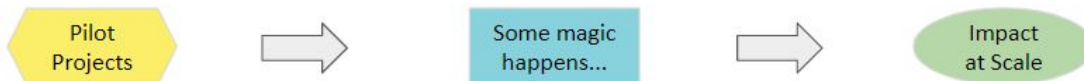
There is a great deal of interest in using nature-based solutions (NbS) to address climate change and other pressing environmental problems at scale. The IUCN defines nature-based solutions as:

“Actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits. They are underpinned by benefits that flow from healthy ecosystems and target major challenges like climate change, disaster risk reduction, food and water security, health and are critical to economic development.”

If nature-based solutions are going to meaningfully contribute to global biodiversity and development targets, then they will need to be implemented on a global scale. As a result, it is now common to see organizations and agencies offer ambitious programmatic goal statements such as:

“We are going to scale up restoration of natural ecosystems to sequester 1 gigaton of CO₂ over the next decade.”

As with any *project* or *program*, developing effective nature-based solutions that reach their target goals is greatly facilitated by modeling both the *situation* in which the solution is being implemented and the *strategy pathway* that shows the theory of change as to how the actions will lead to the desired outcomes (see Box 1 for definitions of these terms). But all too often, when organizations and agencies asked how they will achieve these ambitious NbS goals, the implicit theory of change pathway offered looks something like:



Overview of this Work

There is clearly a need to better understand how to explicitly scale NbS programs for durable impact. To this end, we asked:

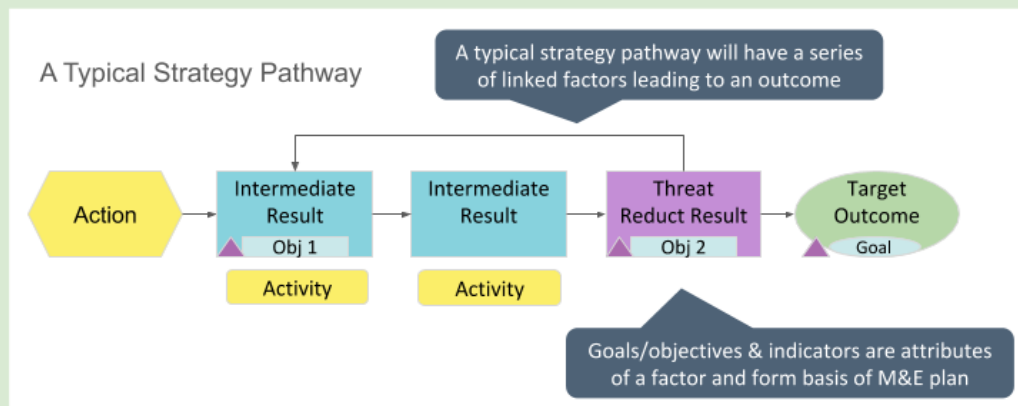
- a. How have other disciplines and thought leaders thought about scaling?
- b. Can we develop a standard framework of scaling approaches?
- c. How have GEF NbS programs approached scaling?
- d. How could NbS programs better incorporate these ideas?

To address these questions, we first conducted a brief survey of selected literature sources to see how they approached scaling. We then used the results of this survey to create a proposed standard framework of scaling approaches. We then reviewed a selected sample of GEF program documents in light of this framework. Finally, we developed some guidance as to how NbS programs could incorporate these concepts as they go to scale and discuss potential next steps.

Box 1: A Few Definitions

The following are key terms that are helpful for understanding the framework presented in this paper. This framework is based on the Conservation Measures Partnership's *Open Standards for the Practice of Conservation* (CMP 2020) as shown on the next page and implemented through *Miradi Adaptive Management Software* (available at www.miradishare.org).

- **Project** – A set of actions implemented by a defined team of people to achieve agreed upon outcomes, often at a specific site or within a thematic scope. Projects range in scale from managing a pond to an entire ocean. In GEF parlance, equivalent to the 'child projects' being implemented under Integrated Approach Pilots (IAPs) and Impact Programs (IPs).
- **Program** – A group of sibling conservation projects designed to achieve overarching goals and objectives. A program is typically both a parent administrative unit for its child projects and often also a higher-level 'project' of its own. Note that project and program are only relative terms. An entire program within the context of a municipality might be much smaller spatially and/or budget-wise than a single project that is part of a national-scale program. In GEF parlance, both Integrated Approach Pilots (IAPs) and Impact Programs (IPs) are effectively programs.
- **Situation Analysis** – A model of the system in which conservation projects and programs are taking place and trying to effect change.
- **Strategy Pathway** – A model of the theory of change as to how a project or program's actions will lead to desired outcomes. It is the basic unit of conservation work. Technically, when you are linking child projects to their parent programs, you are actually linking project-level strategic pathways to program-level strategic pathways.



As with any model, it is important to keep in mind George Box's statement: "All models are wrong but some are useful...Just as the ability to devise simple but evocative models is the signature of the great scientist so over elaboration and overparameterization is often the mark of mediocrity."

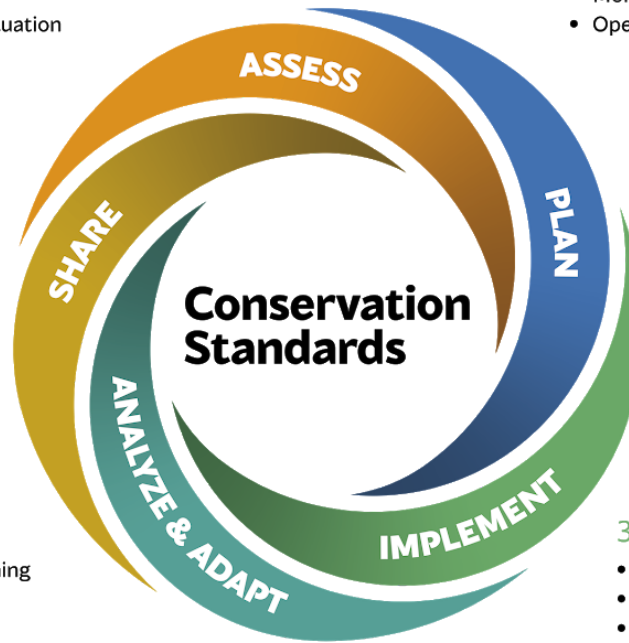
The Open Standards for the Practice of Conservation

1. ASSESS

- Purpose & team
- Scope, vision, & targets
- Critical threats
- Conservation situation

2. PLAN

- Goals, strategies, assumptions, & objectives
- Monitoring plan
- Operational plan



5. SHARE

- Document learning
- Share learning
- Foster learning

3. IMPLEMENT

- Work plan & timetable
- Budget
- Implement plan

4. ANALYZE & ADAPT

- Prepare data
- Analyze results
- Adapt plans

Source: CMP (2020)

2. A Brief Survey of the Scaling Literature

To get a broad view of what the literature is saying about scaling, we assessed a selected sample of literature across different fields of practice, from conservation to social innovation to business. Table 1 provides a high level summary of our review in the form of a “Rosetta Stone” that lines up similar concepts from each source in each row of the table. Key findings that emerge include:

- There are currently no widely-accepted standard terms or frameworks to talk about scaling. Each source seems to have its own preferred nomenclature and way of subdividing the approaches. But although the terms and subdivisions differ, it’s also clear from the alignment across rows in the table that the sources taken together are converging on similar concepts.
- There seems to be a bit of a dichotomy between the sources that address scaling from a social innovation perspective and those that think about scaling from a systems thinking perspective. The former tend to concentrate on how to replicate initial pilot efforts whereas the latter tend to think about how to use or transform the system to achieve higher-order effects.
- Finally, it was also clear from our review that while these approaches are complementary, they are not exclusive. Good scaling requires using the appropriate combination of approaches for a given situation.

Bringing these findings together, we would propose that there are five approaches to scaling that fit across three major types as shown in Table 1 below. We are proposing that these types and approaches become the basis for a more standard framework for thinking about scaling going forward.

Table 1. “Rosetta Stone” of Scaling Approaches

[Click here](#) for ‘live’ version of this table

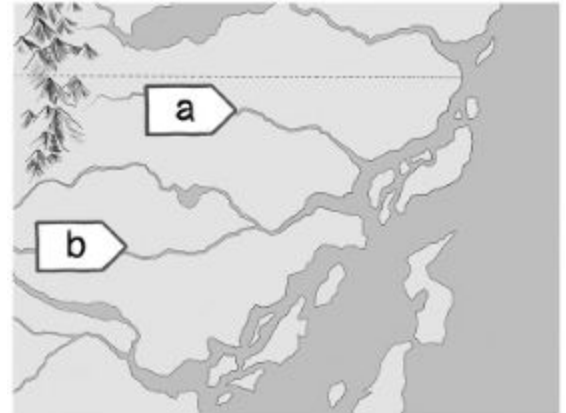
Proposed Standard Framework		Sources Reviewed									
		Conservation				Social Innovation				Systems Thinking	
Type	Approach	GEF IEO 2018	Thomas et al. 2018	GEF STAP 2020	Salafsky & Margoluis 2020	Bradach 2003	Cooley et al. 2014	Larson et al. 2017	Ruggiero et al. 2018	Meadows 2008 / Abson et al. 2017	Moore et al. 2015
1. Scaling Out	a. Expand initial pilots	Demonstration leading to mainstreaming	Innovation	Scaling Out: doing more of the same to impact greater numbers	Expand initial pilots		Setting up own branches	Branching pathways			Scale Out: ‘Impacting greater numbers’
	b. Replicate projects in programs	Replication	Replicating	- deliberate replication geographically - spread principles adapted to context	Replicate projects in programs	Franchise model	Franchising licensing	Affiliate pathways			Replication & dissemination, increasing number of people or communities impacted
	c. Promote diffusion of innovation		Spreading		Promote diffusion of innovation		Open source, sharing information	Distribution networks	Diffusion of innovation		
2. Scaling Up	Develop higher level strategies	Catalytic effects	Institutionalizing for wider impact	Scaling Up: changing rules & institutions to enable transformation - policy, legal, financing, structural changes	Develop higher level strategies					Change system ‘parameters’ & ‘design’	Scale Up: ‘Impacting laws & policy’ Changing institutions at the level of policy, rules and laws
3. Scaling Deep	Transform the system intent			Scaling Deep: changing norms, mental models and culture to support transformation - change culture & beliefs - capacity & learning		Measures other than economics				Change system ‘intent’	Scale Deep: ‘Impacting cultural roots’ Changing relationships, cultural values and beliefs, ‘hearts and minds’

3. Proposed Framework of Scaling Approaches

Based on our review of the literature, we would like to propose the following five scaling approaches across three main types. The text, graphics, and examples in this section are adapted from Salafsky & Margoluis (in press).

Approach #1. Scaling Out - Replicating an Initial Pilot Strategy

Most teams when thinking about scaling a given strategy will also instinctively propose trying out new strategies within *pilots* that they then plan to take to scale over time. These pilots can be either deliberately ‘designed’ by the program team or they can be *bright spots* developed by other actors in the system that the program team has ‘discovered’ and would like to replicate. For example, a team might restore wetlands in two small test areas (as shown in the diagram) or work with selected restaurants to promote sustainable seafood consumption in one part of a city.

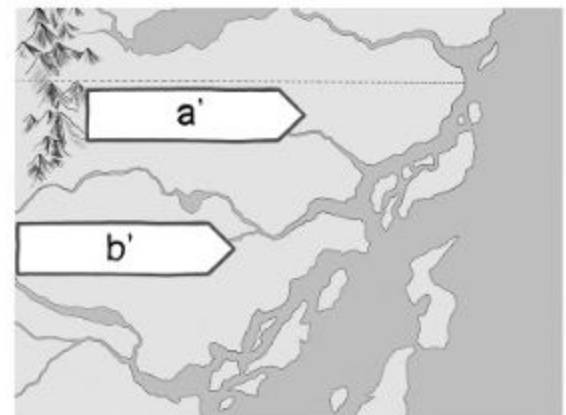


Key implementation activities involved in a pilot include deciding on the strategy, planning the pilot, getting key stakeholders on board, recruiting the pilot team, implementing the pilot, and monitoring, documenting, and sharing results.

Once pilots are completed, there are three different sub-approaches that can be used to scale out this work:

Approach #1a. Expand Scope of Pilot Strategies

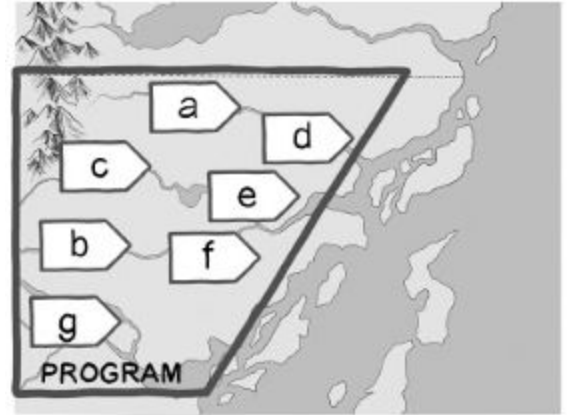
This approach involves increasing the spatial and/or conceptual scope of each individual project implementing the strategy. For example, you might expand the wetland restoration from a pilot site to the entire watershed or the sustainable seafood promotional work to all restaurants in the city. This approach is most often limited by the scope of the work that a given project team can manage.



Additional activities needed to take the pilot to scale under this approach include convincing key stakeholders to expand the work, finding the resources and additional project team members to work at scale, and adapting methods as needed to operate at larger scales.

Approach #1b. Replicate Pilot Strategies within a Program

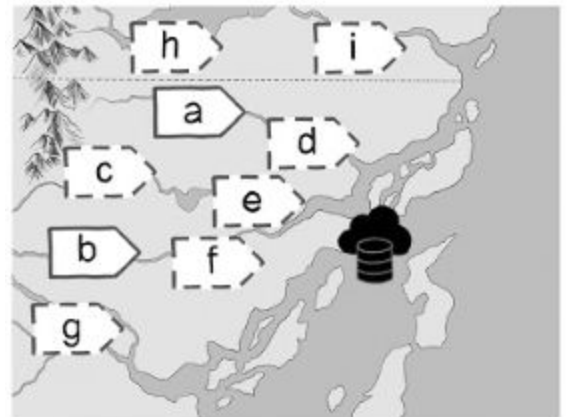
This approach involves developing and managing a suite of related projects within an overall program, each using the strategy that follows the same basic template of the original pilot. For example, you might bring on new wetland restoration project teams to new sites in the same or adjacent watersheds, or expand the sustainable seafood promotional work to other cities. This approach allows you to start new projects that build on the staff and lessons learned from your original projects. Replicated projects can be either fully owned by the implementing organization or they can be operated under a ‘franchise’ model. Either way, it is important to include resources for program-level management and maintaining quality across projects.



Activities needed to go to scale under this approach include convincing key stakeholders to expand the work, finding the resources and new project teams to implement the projects, and developing the program staff and processes needed to train and manage the new projects and ensure quality control.

Approach #1c. Promote Diffusion of Innovation

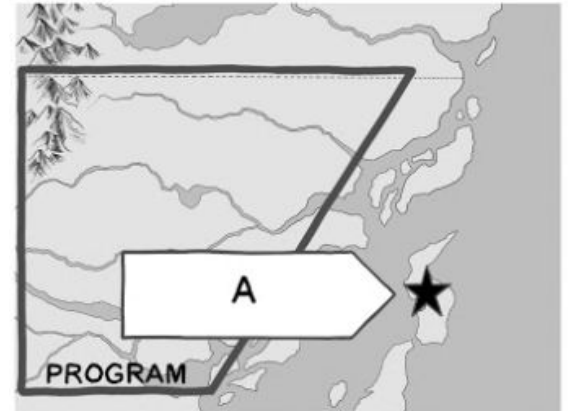
Rather than develop new projects and programs yourself, this approach involves capturing and communicating what you have learned and then getting other organizations to adopt your strategy in their work. For example, you might publish your methods in an online tools library and provide consulting services to other organizations that want to replicate your watershed management work. Or you might share your outreach materials so other organizations can use them to set up similar sustainable seafood promotion work. As shown with Strategies h and i in the diagram, this approach can even extend beyond the borders of your jurisdiction. The key is to understand how conditions vary in each site so that you can adjust the strategy as needed to succeed in these conditions. This approach benefits from understanding the extensive literature on ‘diffusion of innovation.’



Activities required to go to scale under this approach include investing more in documenting the results of the pilot work, determining the conditions under which your strategy will be effective, and figuring out the right messages and messengers to ensure diffusion of your innovations.

Approach #2. Scaling Up - Developing System Level Strategies

Instead of piloting and implementing site specific projects, this approach involves thinking about how you might work within the system to operate at a higher and more leveraged scale. For example, instead of doing wetland restoration yourself, you might work to implement a national policy that will incent key landowners to restore wetlands in watersheds that they manage. Or you might invest in developing a genetic technology that will enable better control of weeds across the region. Or you could develop a market-based strategy and partner with major seafood companies to implement sustainable seafood production.



Activities needed to go to scale under this approach include developing higher level strategies as well as raising the necessary resources and building the program team needed to implement these strategies.

Approach #3. Scaling Deep - Transforming System Intent

Finally, this approach builds on Meadow's and Abson et al.'s systems thinking in which the most powerful leverage points involve changing the underlying values, goals, and mental models of the actors in the overall system. For example, you might build a stewardship ethic among all landowners and managers to conserve and restore wetlands. Or work to make it socially unacceptable to consume non-sustainably harvested seafood.



Activities needed to go to scale under this approach might include developing and communicating the stories needed to reach and influence the hearts and minds of key influencers and stakeholders.

4. Assessment of Current GEF NbS IAP & IPs Against Scaling Framework

To see how the conservation community has approached scaling of NbS in the past and to assess how their scaling strategies fit with our five proposed approaches, we took a look at selected examples from both the Integrated Approach Pilots (IAPs) and Impact Programs (IPs) led by the Global Environment Facility. We assessed both the IAPs and IPs on three questions:

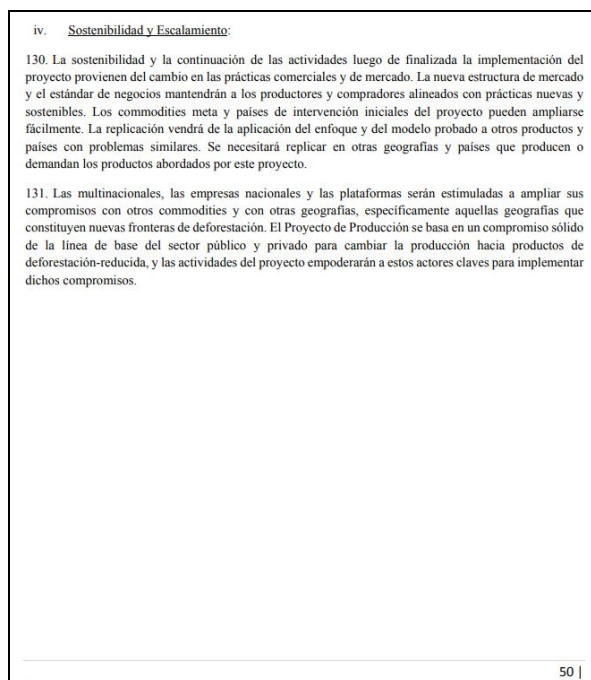
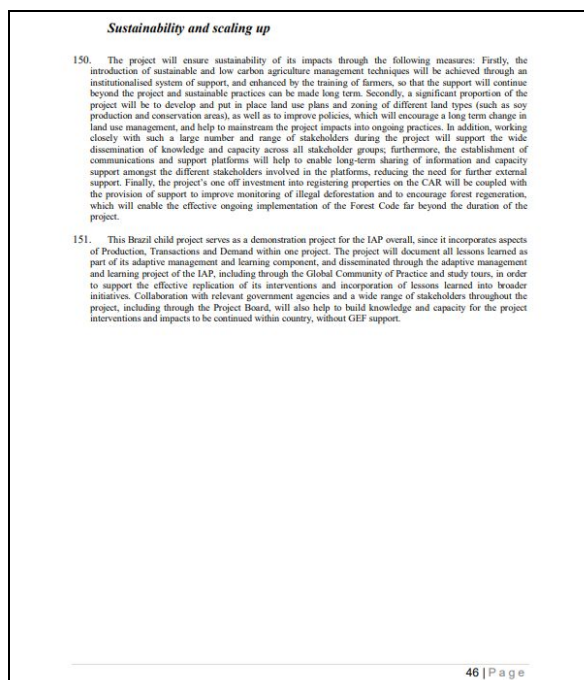
- a. What have the IAPs and IPs done to incorporate scaling strategies in their design and implementation? How are they explicitly talking about scaling?
- b. Is there evidence that the IAPs and IPs are deliberately taking pilots to scale?
- c. If so, how do the IAPs and IPs implicitly or explicitly refer to the five proposed scaling approaches?

In the remainder of this section, we provide a brief overview of our findings.

Integrated Approach Pilots (IAPs)

a. Scaling Sections Were Minimal

Although several of the documents we reviewed incorporated scaling into project components or had an explicit section in the PFD meant to describe the scaling approach, in most documents we reviewed, this section was highly abbreviated compared to the length of the overall document. For example:



b. Evidence of Deliberately Taking Pilots to Scale

Technically, IAP child projects needed to explicitly show how they fit into the overall IAP in order to qualify to be a part of it. Nonetheless (with a few exceptions), the majority of the strategy descriptions in the IAPs that we reviewed seemed to be at best piloting strategies that were then hopefully somehow going to be taken to scale, typically via diffusion of innovation. For example, each of the quotes below describes an ambition to have a pilot taken to scale, but the document does not provide any pathway for doing so.

“Testing and demonstrating sustainable agriculture production in two focal landscapes will provide the examples required for replication and scaling up of this project’s interventions, both to other regions and within other agricultural commodity supply chains. Lessons learned will be disseminated to other relevant initiatives, including the other projects within the IAP, through the Adaptive Management and Learning child project.” (Good Growth Partnership IAP, Brazil, p. 21)

“Strong emphasis will be placed on M&E frameworks to a) support WF decision making and allowing for an adaptive management approach to the targeted incentive schemes, and b) to allow for upscaling, policy integration and replication of lessons learned as quickly as feasible.” (Food Security IAP, Kenya)

“The durability of the project after it is completed depends on a change in commercial practices and the market. The new market structure and business standards will maintain producers and consumers aligned on sustainable practices. The initial intervention countries can scale easily. The replication will come from the application of the model applied to products and countries with similar problems. There is a need to replicate in geographies and countries that produce or demand the same products addressed in this project.” (translation from Good Growth Partnership, Paraguay)

c. Implicit Strategies that Fit into One of the Five Approaches

However, we did find that when these child projects contained scaling strategies, they mapped well to our proposed scaling approaches. Despite the lack of explicit scaling strategies, most if not all of the documents that we read at least implicitly used one or more of the five scaling approaches identified in our framework. For example:

Approach 1a: Expand initial pilots

“The project’s objective is ‘to increase adoption of resilient, improved production systems for sustainable food security and nutrition through integrated landscape management and sustainable food value chains.’ This will be achieved through the scaling-up of sustainable land management (SLM) technologies/integrated natural resource management (INRM) across the target landscapes, an approach which has already been proven at small-scale in Burundi. The project will work in 9 micro-catchments of three provinces in Burundi’s highlands, in order to demonstrate impact and the potential for further scaling out of SLM in different agro-ecological zones.” (Food Security IAP, Burundi)

Approach 1c: Promote diffusion of innovation

To disseminate and scale-up its results and lessons to be learned, the Project aims at establishing an information centre at the Ministry of Environment and Natural Resources, the National Museums of Kenya and at county level.” (Food Security IAP, Burundi)

Approach 2: Develop higher level strategies

“To enhance awareness and capacity amongst financial institutions, the project will support the preparation of technical briefs, the organization of targeted workshops and of training program for financial institutions and risk managers” (Good Growth Partnership, Brazil)

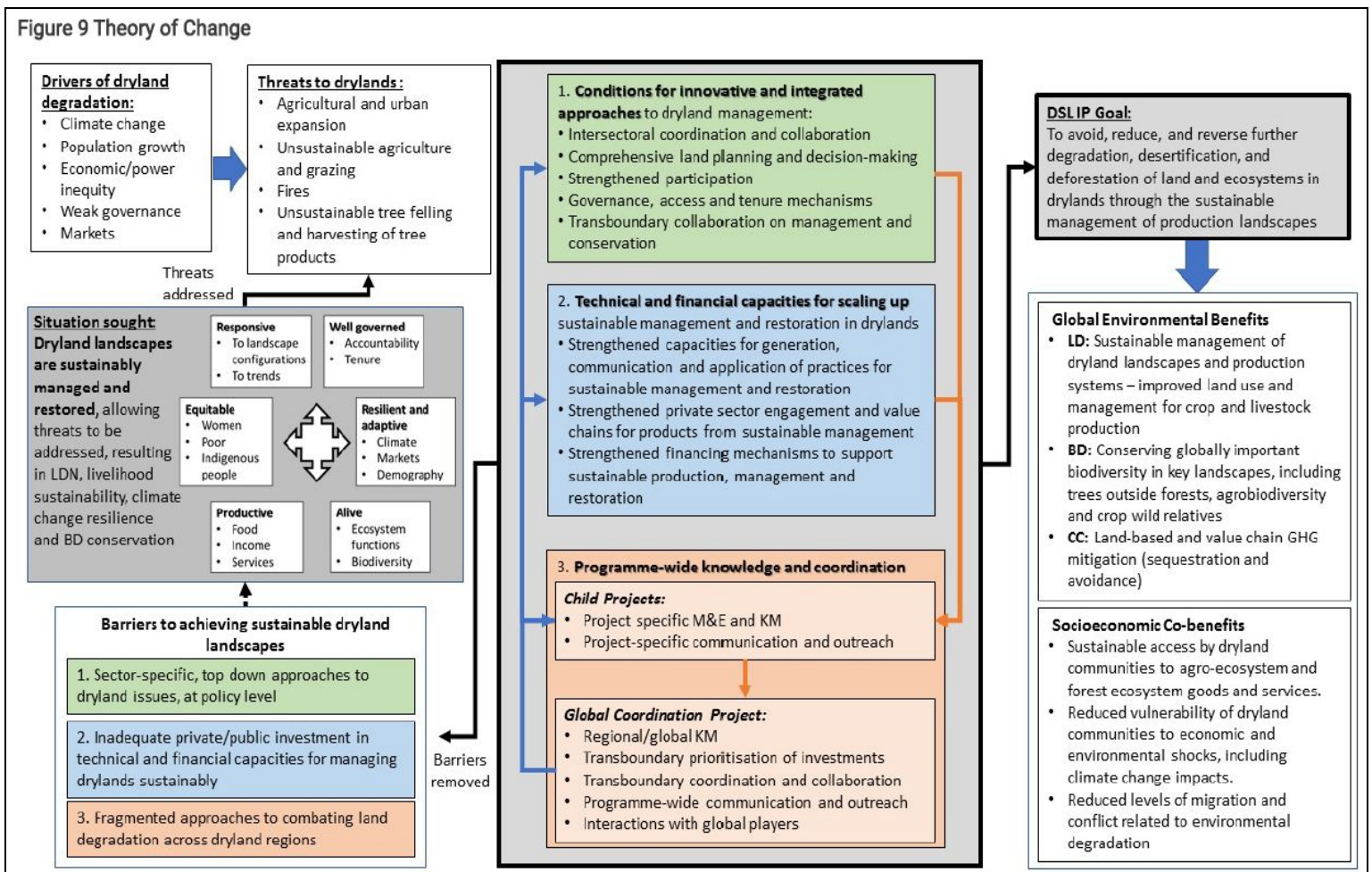
“Scaling up of SLM/INRM practices need to create a win-win-win situation whereby productivity and livelihoods are improved, while ecosystem services, such as cycling of water, biomass and nutrients, are enhanced. Scaling up of SLM/INRM should also be linked to post-harvest storage, processing, and access to markets and credit. Vulnerable groups should be targeted, especially women and youth.” (Food Security IAP, Burundi)

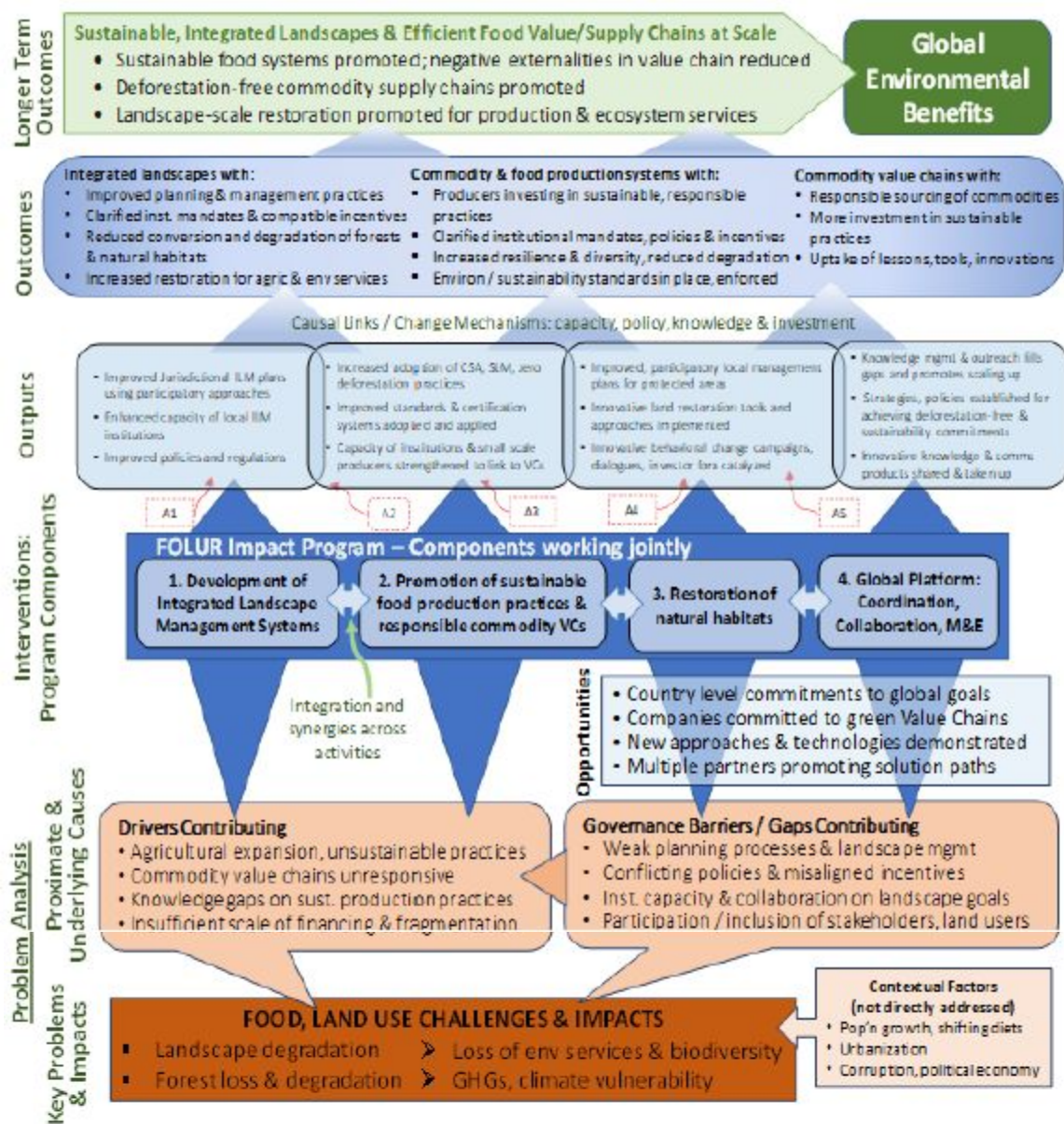
Impact Programs (IPs)

a. Inclusion of Scaling Was More Robust:

We found that these newer versions of broad GEF projects are showing improvement in explicitly addressing scaling strategies and better incorporating scaling into project design, programmatic approach, budgeting, and intended implementation. This is in part because programs that explicitly address scaling receive 25% more funding. There is also an emphasis on replicating work from one country in other countries as appropriate. Whereas the IAPs were not uniform in their incorporation of scaling concepts or strategies, the IPs have to some degree integrated scaling strategies and goals into the theories of change and project components, making scaling a benchmark for project success as shown in the two IP theories of change below:

Figure 9 Theory of Change





Critical assumptions:

- A1: Key ministries, agencies will have sufficient incentives to work together on LM at jurisdictional and higher levels
- A2: ILM plans can be implemented, leading to increased areas under improved practices and amount of land restored/conserved
- A3: ILM + improved standards lower risk; more private sector actors invest in responsible commodity VCs, & adopt sustainable (climate smart) ag practices
- A4: Improved policies & institutions incentivizing improved management of natural habitats increases area restored and protected & reduces GHG emissions
- A5: Ownership/rights for natural habitats/forests are realized by local communities

b. Evidence of Deliberately Taking Pilots to Scale

That said, scaling for impact could still be more explicitly built into strategy pathways and proposed work. While there is more consideration of how to surmount barriers and the budgetary impacts of scaling, the IPs are still exhibiting some ‘pilot and hope’ behavior and are missing some of the ‘how’ in the form of explicit strategy pathways that show how the program or various child projects will get to scale (though the IPs may be leaving this detail up to the design of the child projects). For example:

- **Scaling up and scaling deep** (paragraph 85): as shown in Figure 14, the program will further sustainability by applying the approaches of “scaling up” aimed at changing institutions at the level of policy, rules and laws (especially through the actions proposed under Component 1), and “scaling deep” aimed at changing relationships, cultural values and beliefs or “hearts and minds” through the strengthening of community-level social capital and participatory approaches to knowledge generation proposed under [Component 2](#).

Attention will be paid in particular to maximizing the prospects for sustainability of direct investments in landscape restoration, proposed under Outcome 2.4:

- Restoration/rehabilitation modalities and management regimes will be defined with the participation of local people, through inclusive and informed participatory processes: this will help to maximize their compatibility with existing resource management and livelihood support systems, and the compatibility of the products and services generated from the restored areas with the needs and cultural preferences of the population. Wherever possible restoration and rehabilitation will be integrated with existing management systems, for example through the conversion of existing agricultural systems into agroforestry systems.

- Selection of management regimes and species will also be informed by external technical expertise and research in order, for example, optimize the matching of species and management regimes to site conditions and to optimize the technical effectiveness of management regimes.

- The location and spatial configuration of rehabilitation and restoration initiatives in the landscape will be guided by the provisions of land use planning instruments, the formulation and improvement of which will be supported where necessary under Outcome 1.2.

Scaling out:

The program is designed, and will be implemented, in such a way as to result in “scaling out” of impacts at regional level, beyond the boundaries of the 11 target countries (“scaling out” is the third of the dimensions of scaling portrayed in Figure 14). Actions proposed under Component 3, in relation to transboundary knowledge management, outreach and transboundary coordination, will allow the 11 countries to function as nuclei for the catalysis of scaling out to neighbouring countries, including both other IP target countries and other, non-IP countries with similar conditions.

c. Explicit Strategies that Fit Into One of the Five Approaches

Finally, unlike the IAPs, the IPs did include explicit scaling approaches that mapped well to our proposed scaling approaches – in part because they seem to directly reference the scaling model in Moore et al (2015). Given that the child projects are still in the design and approval phase for the IPs, this could be a ripe opportunity to consider utilizing our five scaling approaches during child project implementation, as well as best practices for scaling for impact that are offered in the next section. For instance, one example that shows the scaling approaches used in the IPs is:

“The IP will promote knowledge sharing to spark improvements and leverage the financing needed to implement and scale up new approaches and move away from business as usual. Notably, there is a need to catalyze action through multi-sector coalitions to deliver transformative improvements at scale. FOLUR country projects will catalyze more resource efficient and effective production practices in more sustainable and resilient landscapes and agricultural production value chains. These results will require global engagement of the private sector, including agribusiness, food processing industry, and the financial sector, to scale up improved practices and quality standards across global value chains... The FOLUR IP design therefore aims to promote comprehensive land planning, improve governance and align incentives, scale up of practical applications in commodity value chain partnerships, leverage investments through linkage with private and public partners, and promote institutional collaboration in integrated approaches at country and landscape level.”

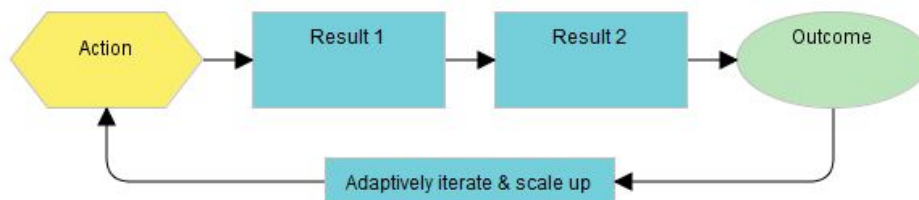
5. Guidance for Taking NbS Solutions to Scale

The key to going to scale involves not just saying you will pilot a strategy and then somehow magically take it to scale, but instead deliberately thinking about how you can take early efforts and grow them over time. Adapting material from Salafsky & Margoluis (in prep), some key guidance includes:

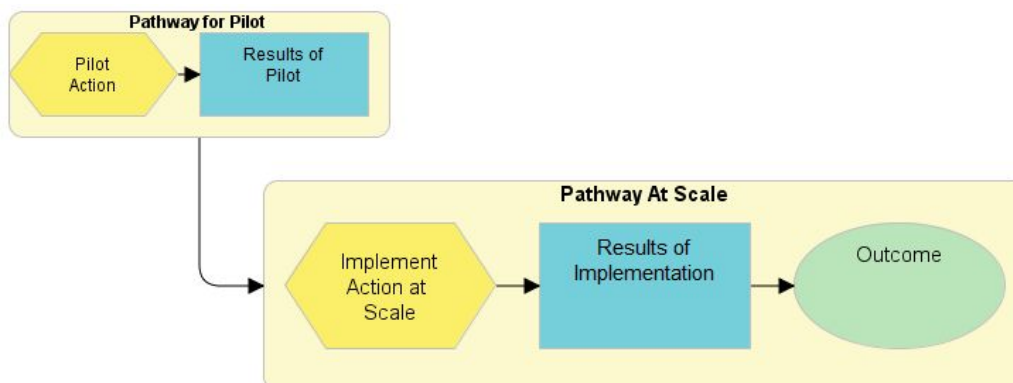
1. Be Explicit in Your Scaling Approach(es) – A key part of going to scale is thinking early on about which scaling approach, or combination of approaches, you think best fits your situation and will enable your program to get to the ultimate desired scale. This early thinking enables you to set up and use potential pilots appropriately. For example, if you are planning to either expand your projects in size or into a program, you might focus during the pilot on training staff who can go on to help implement and/or manage the future expansions. If you are planning to expand via dissemination of learning, by contrast, you may wish to invest more in monitoring and documenting your results. It also allows you to make appropriate system-level interventions.

2. Build Your Scaling Approach Into Your Strategy Pathways – Since your scaling approach is a key part of your project or program team’s work, you should explicitly build it into your strategy pathways. In complex systems, increasing scale is often a non-linear process. In addition, while there may be economies of scale, working at scale may also require substantial additional inputs and strategies.

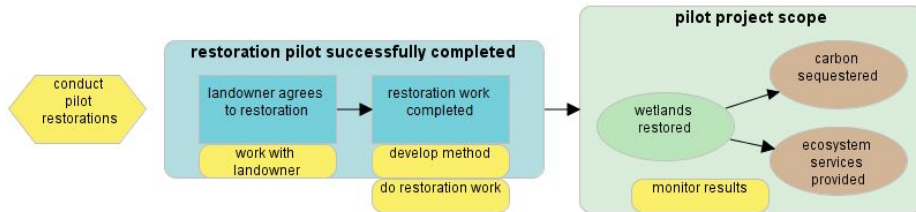
In some cases, the generic theory of change inherent in a strategy pathway might be more or less the same regardless of scale. You might then be able to represent your scaling strategy in an iterative rolling process that is similar to what the business writer Jim Collins (2005) calls “creating and turning the flywheel.” This process involves deliberately establishing a scaling cycle that starts to create its own momentum over time as shown in the flywheel pathway pattern:



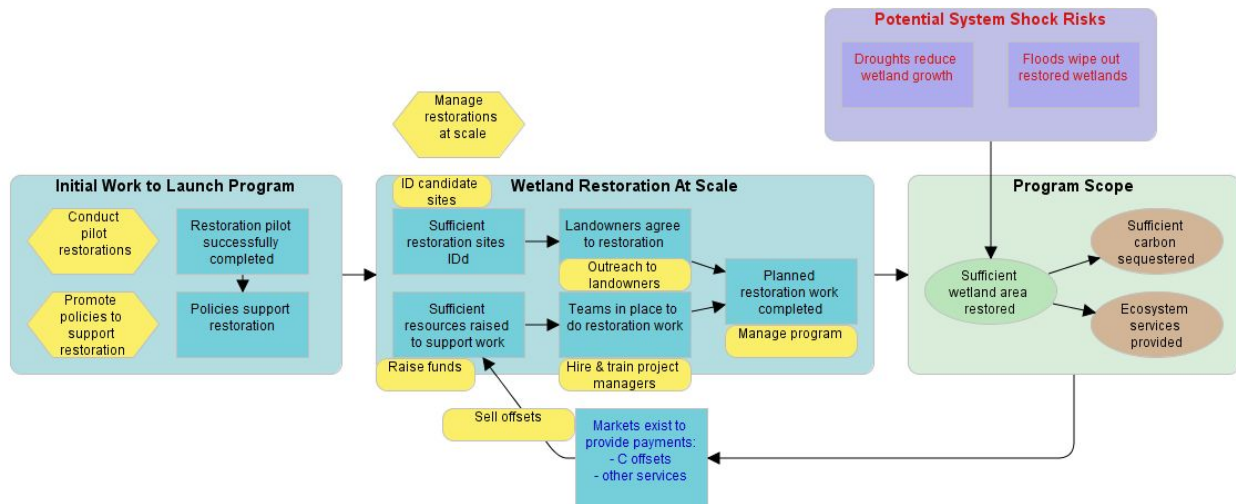
In most cases, however, when you get into the details of strategy implementation (including for example, developing specific objectives for key results or assigning the resources and time required to implement actions), your pilot and implementation pathways may be very different. So rather than create one ‘all-purpose’ pathway, you are probably better off creating specific versions of the pathway for different scales as shown in the following pattern:



As a more specific example, the strategy pathway for implementing a small wetland restoration pilot is very simple when you think about restoring a specific wetland within the confines of a nature reserve over the course of one growing season:



But this seemingly simple action becomes a much more challenging proposition when you are trying to consider restoring wetlands over a large area that includes many sites across multiple watersheds over the long-term. As shown in the diagram below, this strategy requires a compound pathway that in addition to site-level project work, requires a number of program-level actions including conducting the pilot restorations, promoting policies to support restoration, and then managing the restorations at scale.



3. Use Systems Thinking in Designing Your Pathways – As you develop your strategy pathways, it’s important to think about factors in the system that can either promote or hinder your ability to get to scale. In his classic 1990 book *The Fifth Discipline*, the business writer Peter Senge describes the utility of creating *positive reinforcing feedback loops* while also making sure to reduce the limits to growth imposed by *balancing loops* within the system. As one simple example in the wetland restoration work described above, the development of markets that provide payments for carbon offsets or other ecosystem services can increasingly help raise the resources needed to support this wetland restoration work. But conversely, your ability to get to scale may be slowed down as the obvious and cheap restoration sites get completed and you have to shift to more expensive sites – in effect the system is pushing back and imposing limits to scaling that you need to overcome.

4. Check Your Scaling Assumptions – While it can be easy to say that you plan to take a pilot strategy pathway to scale, it often can be much more challenging to do it in reality. It's thus vital to take a little bit of time upfront to check your assumptions. For example, let's assume that your organization's leadership has set an ambitious challenge goal of sequestering a half-million tons of carbon over the next decade through scaling your wetland restoration strategy following the strategy pathway shown above. The tables below show a rough estimated economic analysis of the pathway for scaling this strategy.

Table 2.1 shows some basic parameters that we are using to develop our scaling model. Note that at this point during our initial analysis, it is perfectly fine to have high-level estimates or approximations for each of these values. For example, we have used a published figure that wetlands have between 200 and 400 tons of stored carbon/ha (Row 6) to then estimate a rough time scale over which a wetland could sequester that much carbon (Rows 7-15). We have similarly made some back-of-the-envelope calculations about how much it costs to do the restoration work both in terms of carbon footprint from the restoration work itself (Rows 16-18), the financial costs (Rows 19-22), and the potential financial benefits (Rows 24-26). Finally, we include an economic discount rate that enables us to express all financial costs and benefits in Year 0 present value (PV) dollars (Row 23).

Using these project parameters, we can calculate the costs and benefits of implementing this strategy pathway at a typical project site as shown in Table 2.2.. These costs and benefits are tracked both in tons of carbon and present value dollars. This quick analysis shows us that our 10 ha project wetland restoration strategy can expect to sequester 2,000 tons of carbon over the next 25 years at a cost of \$5 per ton. Furthermore, if we can sell the carbon credits and maybe even other ecosystem services, we can turn a healthy profit!

Having made these calculations for an 'average' project, we could now try to scale up to the program level. As a starting point, if our program goal is to sequester a half-million tons of carbon, then:

$$500,000 \text{ tons of C} * 1 \text{ project}/2000 \text{ tons of C} = 250 \text{ projects required}$$

Obviously it might take a bit of work to set up 250 projects, but if we can earn over \$100,000 on each project as shown above, then this strategy should be a slam-dunk! Of course this assumes that we can find 250 suitable 10 ha wetland restoration locations within our program area. And unfortunately, this is where scaling effects come into play. As shown in Table 2.3, there are several additional parameters that we need to add to our model when we want to work at a program scale.

One key issue is that a program team can only initiate so many projects a year (Row 29). Furthermore, the program needs to ramp up its ability to initiate projects from the two initial pilots (Row 30). The program also has to pay for program management costs (Rows 35-38). Finally, the program cannot assume that all of the projects will work out as expected. To this end, we have built in parameters that assume the program will suffer periodic minor failure events (eg droughts that cause a wetland to have reduced carbon sequestration in a given year) and major failure events (eg flooding that completely destroys a restored wetland, thus both releasing saved carbon back into the system and eliminating any future gains from that site).

Table 2.1 Key Analysis Parameters for One 10 ha Wetland Restoration Project

A	B	C	D	E
1	Key Scaling Parameters		Calculation	Source
2	'AVERAGE' PROJECT PARAMETERS			
3	Type	Active wetland restoration		
4	Habitat	Degraded Ag Land --> Estuarine or Palustrine/Riverine Wetlands		
5	Average Project Size (ha)	10	Estimate	
6	Total Storage (tons C/ha)	200	200-400 tons C for avg wetland Nature Communications, Fig 2	
7	Restoration Sequestration (tons C/yr-ha)	Annual	Estimated growth curve to reach total storage	
8	0	0		
9	1-2	5		
10	3-5	10		
11	6-10	15		
12	11-15	10		
13	>15	3		
14	Cumulative Total in 25 Years	195	Sum of above * # yrs per interval	
15	Total tons CO2e in 25 Years	715	44 units CO2/12 units C US EPA	
16	Restoration Losses (tons C/yr-ha)			
17	Wetland restoration	1	100 passes * 1 gallon diesel / ac Iowa State	
18	Wetland maintenance	1.0	10 passes * US Energy Info Admin	
19	Financial Costs (Year 0 PV \$)			
20	Land acquisition (\$/ha)	0	land is not purchased (!!)	
21	Restoration costs (\$/ha-yr)	750	\$200-3300/acre, 2.47 acres/ha Amber Waves, USDA	
22	Maintenance (\$/ha-yr)	75	Estimated as 0.1 * restoration costs	
23	Discount rate (%/yr)	0.05	Conservative estimate	
24	Financial Benefits			
25	Carbon offset payments (\$/ton C)	18	\$5/ton CO2e * 44 units CO2e/12 units C	
26	Other ecosystem services (\$/ha)	10	Estimate of payments for flood control, hunting	

Table 2.2 Operating Plan for One 10 ha Wetland Restoration Project

F	G	H	I	J	K	L	M	N
41	Project Year							
42	Average 10 ha Project	0	1-2	3-5	6-10	11-15	16-25	Total
43	CARBON BUDGET (tons C)							
44	Carbon Expended	10	10	10	10	10	10	60
45	Wetland restoration	10						10
46	Wetland maintenance		10	10	10	10	10	50
47	Carbon Captured	0	100	300	750	500	300	1,950
48	Wetland sequestration	0	100	300	750	500	300	1,950
49	Net Carbon	-10	90	290	740	490	290	1,890
50	FINANCIAL BUDGET (Year PV \$)							
51	Total Expenses	7,500	1,389	1,833	2,425	1,876	2,689	17,711
52	Land acquisition	0						0
53	Wetland restoration	7,500						7,500
54	Wetland maintenance		1,389	1,833	2,425	1,876	2,689	10,211
55	Total Income	0	4,722	20,078	67,788	34,732	29,456	156,775
56	Carbon offset payments	0	3,056	12,991	43,863	22,474	19,060	101,443
57	Other ecosystem services	0	1,667	7,086	23,925	12,258	10,396	55,332
58	Net Cash Flow	-7,500	3,333	18,245	65,363	32,856	26,767	139,064
59								
60	\$ per ton C (w/out income)							5.4

Table 2.3 Additional Analysis Parameters for a Wetland Restoration Program

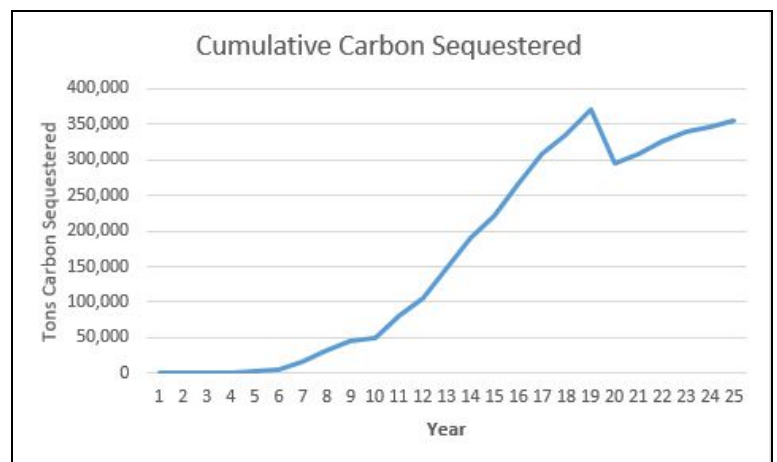
	A	B	C	D	E
27	OVERALL PROGRAM PARAMETERS				
28	Projects In Program				
29	Max # of projects initiated / year		64	Cap on the total number of project initiated	
30	Ramp-up rate from 2 pilot projects		2	2, 4, 8, 16, 32, 64	
31	Minor project failure rate (every x yrs)		3	Frequency of minor failure due to drought	
32	% of carbon lost (annual only)		30%	Loss of annual sequestration due to drought	
33	Major project failure rate (every x yrs)		10	Frequency of major failure due to flooding	
34	% of projects lost		20%	Loss of project & stored carbon due to flooding	
35	Costs (Year 0 PV \$)				
36	Startup mngmt (\$ / program-yr)		150,000	2 mid-level staff/program during initiation phase	
37	Ongoing mngmt (\$/manager-yr)		75,000	1 mid-level staff/program during ongoing mngmt phase	
38	Number of projects/manager		32	Each manager tracks 32 projects	

Table 2.4 Summary Model Outputs

	H	I	J	K	L	M
7	Summary of Program					
8	Projects initiated					446
9	Active projects at 25 years					285
10	Total tons C sequestered					355,240
11	Total costs no offsets (Year 0 PV \$)					13,559,949
12	Total costs with offsets (Year 0 PV \$)					5,415,644
13	Cost/ton C no offsets (Year 0 PV \$)					38
14	Cost/ton C with offsets (Year 0 PV \$)					15

It is not possible to capture the full version of the Program Model in this document. But Table 2.4 shows the summary ‘results’ that emerge with the parameters set as shown above. As you can see, even fairly low project failure rates (in this case 20% major failure every 10 years) dramatically reduce the number of active projects and bring down the total program carbon sequestration totals. Furthermore, this program requires a substantial cash subsidy (over \$5 million in PV \$), even if the project generates income from carbon offset payments and other ecosystem services. And these calculations assume that no payments are needed to acquire or access the land, that there is no opportunity cost of converting the land to wetlands from their current usages, and that the program can manage this work on very low overhead costs. You can, of course, change these parameters in the cash-flow model and see how the bottom line results change as a result of this *sensitivity analysis*.

Another key point that emerges from this analysis is the time frame needed to accomplish the desired outcomes. As shown in the following chart, under the current set of assumptions, after 10 years, the program is just starting to generate positive returns in terms of carbon



sequestration. And despite the typical 10-year planning horizon for most conservation programs, it's not until after well into the second decade of the program that even half the original goal of 500,000 tons of carbon sequestered is met. So even if this program goes well, it is not going to meet the ambitious timeline your boss already announced to the world.

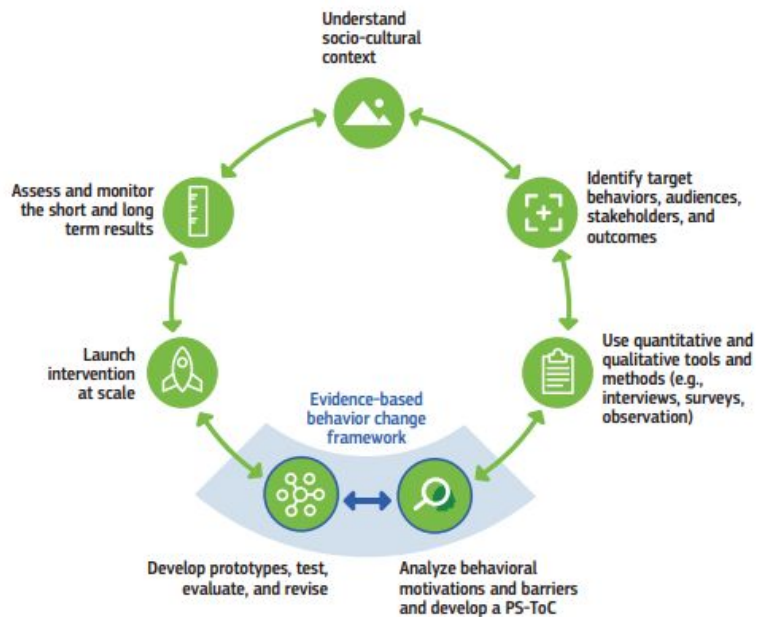
Finally, although we do not show it here, this analysis can be extended to calculate the costs and benefits that accrue to different stakeholder groups within the overall system, providing a robust model to examine potential trade-offs and inequities in the strategies costs and outcomes.

Our main take-home point in showing this analysis is to demonstrate the value of doing this level of upfront work to consider your scaling assumptions. The point of this exercise is not to create the perfect model of your scaling plan – there are undoubtedly many holes in this model including inaccuracies in the estimates used for key parameters, the omission of key factors, and the relatively non-dynamic interactions between factors in this model. Nonetheless, it is still useful to ‘stress-test’ your core assumptions and to see within orders-of-magnitude whether your scaling plan makes sense. By spending just a few hours to develop a ‘quick-and-dirty’ analysis of your scaling pathways, you may be able to find issues that if you can fix them (or alternatively decide not to undertake a program strategy that is doomed to fail!), could save your program months, years, or even decades of wasted time and treasure. Developing this explicit model also will greatly improve your ability to get input from experts and key stakeholders and to adaptively manage your program over time.

5. Integrate Behavior Change Into Your Scaling Pathways

– In a recent paper for STAP, Williamson et al. (2020) provide a review of different approaches for promoting behavior change interventions. Each of the different approaches they reviewed had both a set of principles for how to approach behavior change as well as a set of design steps for developing and implementing behavior change interventions in the context of a project or program. As can be seen in the figure on the right, the design steps recommended by all of the sources a) are consistent with the basic steps in the Open Standards for the Practice of Conservation (CMP 2020) and b) involve an explicit scaling step that goes from “develop prototypes, test, evaluate, and revise” to “launch intervention at scale.” As with any other scaling effort, this jump requires explicit scaling pathways, rather than ‘magical thinking.’

Overview of Design Steps for Behavior Change Interventions



Source: Williamson et al. (2020)

As Williamson et al. (2020) discuss, there are a number of types of different behavior change strategies and approaches. These behavior change strategies can be subdivided into those that appeal to a 'rational actor' such as sharing information, building capacity, providing material incentives, or enacting and enforcing regulations versus those that make use of modern behavioral economics and psychological insights such as the influence of social norms and choice architecture. The diagram on the right shows one such formulation of these levers (RARE cited in Metternicht et al. 2020).

6 Behavior Change Levers

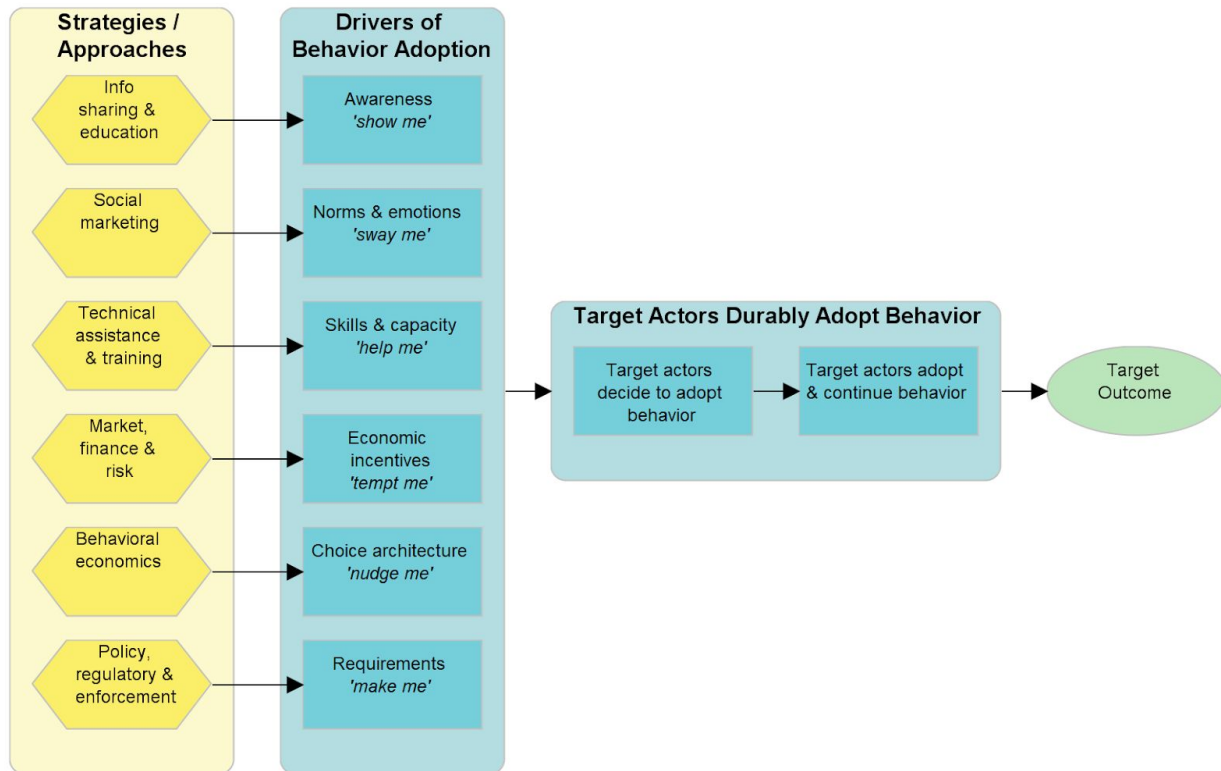


Source: RARE in Metternicht et al. 2020

Each of these strategy levers has a different theory of change pathway as shown in the following high-level theory of change diagram (note that we are using a slightly reorganized version of the six approaches; we have combined *emotional appeals* and *social influences* and then added a new category of *building skills and capacity*).

In effect, each of the sub-pathways shown in this diagram could be expanded into one or more detailed generic strategy pathway diagrams. And, of course, these pathway diagrams might be different as they increase in scale and complexity. Future work could be done to elucidate these pathways.

High-Level Theory of Change for Behavioral Change Approaches



6. Use Your Strategy Pathways to Guide Your Monitoring & Evaluation – Following the *Open Standards for the Practice of Conservation* (CMP 2020), you will want to develop your monitoring indicators to track key information needs along your theory of change in your strategy pathways. In particular, it is helpful to track the status of implementing your actions and activities and the accomplishment of key results, especially tied to your objectives and goals as shown in the generic pathway diagram in Box 1 above.

Although conceptually monitoring and evaluating large-scale NbS programs is not that different from monitoring and evaluating typical site-based projects, operationally there are some key differences when working at scale. In particular, there are some challenges when rolling-up objectives and indicators from project to program level. Here again, using your program strategy pathways can guide you in how to think about this roll-up for which there are essentially four options:

- **Option #1: Add Up Project-Level Objectives & Indicators** – This option involves summing project-level pathway objectives and indicators to their corresponding counterparts in the program-level pathway. As shown in Table 3.1 the program level objective and indicator are calculated as the sum of the project level objectives and indicators. This option requires that both the objective and indicator are expressed as quantitative variables.

Table 3.1

Program Objective 1: Within 3 years, at least 425 ha of critical wetland habitat are restored across the program scope.

Indicator: Ha of critical wetland habitat restored in each project.

Final Year 3 Measurement: The program has achieved 280 ha or 66% of its objective.

Level	Objective (ha)	Indicator (cumulative actual ha)			Total % Obj
		Year 1	Year 2	Year 3	
Project 1	120	0	42	95	79%
Project 2	165	10	80	170	103%
Project 3	140	15	15	15	11%
PROGRAM TOTAL	425	25	137	280	66%

- **Option #2: Combine Project Level Indicators to Construct Program Level Indicator** – This option involves analyzing the contribution of each project to the overall program objective by combining the data in some sort of logical manner to create a program level indicator (aka *index*). For example, as shown in Table 3.2, you might weight the contribution of each child project by the relative size of the project in terms of area, number of stakeholders, or some other appropriate parameter. Or you might look at the average contribution of each project. This option can be used with indicators that are expressed as both quantitative and qualitative variables. You just have to make sure that you are not inappropriately combining measurements with different units unless you first normalize them.

Table 3.2

Program Objective 2a: Within 3 years, > 50% of landowners support wetland restoration *across the program*.

Indicator: % of landowners in each project area that have support rated high or very high. In this example to measure both breadth and depth of support, key informants are given 10 ‘beans’ that each represent 10% of the stakeholder population of that project area. The respondents then put the beans in buckets representing Low, Medium, High, and Very High support for the wetland restoration. Although it is not shown here, this exercise could be done multiple times with multiple informants and then the average allocations could be used to calculate the program-level indicator.

Final Year 3 Measurement: The program has achieved 69% of landowners supporting wetland restoration and thus has achieved its objective.

Project Area (n = landowners)	Indicator (% of landowners at different levels of support for wetland restoration)														
	Year 1					Year 2					Year 3				
	L	M	H	VH	≥H	L	M	H	VH	≥H	L	M	H	VH	≥H
Project 1 (n = 650)	70	20	10	0	10	50	30	15	5	20	10	0	70	20	90
Project 2 (n = 320)	90	10	0	0	0	60	20	10	10	20	40	10	10	30	40
Project 3 (n = 80)	90	10	0	0	0	80	20	0	0	0	80	10	20	0	20
Program Total % (weighted by landowners)					6					18					69

Note, however, if the program objective was written as shown below for Objective 2b with an emphasis on support in each project area rather than across the program area as a whole, then it doesn’t make sense to roll up the project values themselves to the program level because it doesn’t matter that 50% of landowners on average across the program area support the wetland restoration approach. Instead, what matters is that 50% of the landowners in each project area support the approach. This case thus becomes more like Option 3 below.

Program Objective 2b: Within 3 years, > 50% of landowners support wetland restoration *in each project area*.

Indicator: % of landowners in each project area that have support rated high or very high.

Final Year 3 Measurement: In this case, only one of the projects has crossed the 50% support threshold, so the program has not met its objective.

- **Option #3: Track Projects Meeting their Objectives** – This option involves tracking the number of projects that are meeting or on track to meet their stated objectives, expressed either in terms of % of the objective or a categorical assessment (eg achieved, on-track, partially achieved, not achieved) as shown in Table 3.3. To be effective, this option assumes that project level objectives are set at a programatically meaningful level. This option can be used with all types of indicator variables as long as the indicator and the objective are both measured in comparable units.

Table 3.3

Program Objective 3: Within 3 years, at least 9 out of the 12 project areas have met at least 80% of their wetland restoration objectives.

Indicator: Number of projects that have met the 80% target.

Final Year 3 Measurement: In this case, only 5 out of 12 projects have met the desired target.

Level	% of Objective Met			> 80% in Year 3?
	Year 1	Year 2	Year 3	
Project 1	0	10	50	no
Project 2	10	50	120	yes
Project 3	15	70	105	yes
Project 4	0	0	0	no
Project 5	5	30	70	no
Project 6	10	40	90	yes
Project 7	5	45	20	no
Project 8	20	80	130	yes
Project 9	0	20	50	no
Project 10	5	25	40	no
Project 11	10	40	85	yes
Project 12	15	35	70	no
PROGRAM TOTAL				Yes = 5 No = 7

- **Option #4: Assess Higher Order Program Level Objectives and Indicators** – This option involves developing higher-level program indicators that encompass lower-level project results. In some cases where the indicator can be mapped back to specific project areas (eg the remote sensing of wetland restoration), then it can still be used to determine which projects have succeeded and which are having issues. In other cases, however, this linkage to projects is not always possible, in which case you will not be able to use the program data to help in the management of specific projects.

Program Objective 4a: Within 3 years, at least 425 ha of critical wetland habitat are restored across the program scope.

Indicator: Number of ha of critical wetland habitat restored across the program scope as measured through remote sensing.

Final Year 3 Measurement: The program has achieved 280 ha or 66% of its objective.

Program Objective 4b: Within 5 years, there are 100 pairs of wetland obligate raptors breeding in the program scope.

Indicator: Number of breeding pairs of raptors.

Final Year 3 Measurement: The program has 20 pairs, but the trend is in the right direction.

6. Next Steps

This document has provided an initial framework and some guidance for thinking about scaling Nature-based Solution projects in the context of developing project and program-level strategy pathways that articulate the theory of change for their work.

It could be interesting to pilot this framework going forward, either working to retrofit existing programs, or to work proactively with new programs as they are being developed. Practicing what we preach, we could develop our own strategy pathway for how we might then scale these pilots if successful to reach all relevant programs that could benefit from this approach. This scaling might include some elements of *scaling out* (e.g., working directly with relevant programs or creating a means of diffusing these innovations) as well as *scaling up* (e.g., creating capacity and or incentives for doing this kind of thinking in the process of program design) and perhaps even *scaling deep* (e.g., changing the culture of how program design is done).

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