

ACHIEVING CLIMATE CHANGE ADAPTATION THROUGH INTEGRATED LANDSCAPE MANAGEMENT

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Executive Summary

Effective adaptation of land and water use to an increasingly extreme and unpredictable climate will require addressing the inextricable links between agriculture, forests, water, biodiversity and energy, as well as how these are influenced by other social, economic and political challenges. A critical mechanism for achieving integration across sectors and stakeholders is for farmers, other land managers, policy makers, civil society organizations, business leaders and investors to come together around their landscape to address common challenges at a local scale. This process is referred to as Integrated Landscape Management (ILM).

This paper argues that the rapid expansion of ILM globally can be harnessed more effectively to achieve adaptation objectives. The case of the Imarisha multi-stakeholder initiative in the Lake Naivasha Basin of Kenya illustrates how ILM can integrate adaptation across agriculture, water, biodiversity, urban settlements, and fisheries. Effective integrated landscape initiatives have five key features: institutions enabling multi-stakeholder and multi-sector coordination across the landscape; a structured process for multi-sector landscape assessment, goal-setting and planning; farm and landscape interventions that are designed for synergies; public policies and programs aligned to support integrated adaptation and development; and finance mobilized for a coordinated landscape investment portfolio.

To enable ILM to support adaptation, the Global Commission on Adaptation is advised to catalyze actions to: foster and strengthen ILM platforms for action on adaptation; improve inter-agency planning at landscape scale; build integrated landscape investment portfolios and mobilize funding for them; mobilize the private sector to incorporate ILM in adaptation strategies; and build research and knowledge systems for climate-resilient ILM. The Commission should incorporate these actions into their Action Track on “Locally-Led Action”, as well as Action Tracks on Food and Agriculture, Water, Nature-Based Solutions, Resilient Cities, Preventing Disasters and Finance and Investment.

About this paper

This paper is part of a series of background papers commissioned by the Global Commission on Adaptation to inform its 2019 flagship report. This paper reflects the views of the authors, and not necessarily those of the Global Commission on Adaptation.

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1. Introduction: the landscape challenge and opportunity for climate change adaptation

Climate change is changing the way land and water is used and managed almost everywhere. The recent report 'Adapt Now' of the Global Commission on Adaptation emphasizes that an effective climate change adaptation strategy involves reducing and preventing risks, preparing and responding to climate change, and restoring and recovering socioeconomic conditions and ecosystems.¹ Effective adaptation to an increasingly extreme and unpredictable climate will require an understanding of the inextricable links among agriculture, forests, water, biodiversity and energy, as well as how these sectors are influenced by a broad range of social, economic and political challenges. It will also require deep collaboration across a diverse set of stakeholders.

A critical mechanism for achieving integration across sectors and stakeholders is for farmers, other land managers, policy makers, civil society organizations, business leaders and investors to come together around geographical units that provide a physical and conceptual platform for addressing common challenges at a local scale—the landscape. As described below, science has shown the critical importance of promoting integrated landscape management (ILM) to address climate change adaptation, and there is considerable experience on the ground and widespread interest in forming and sustaining such landscape (territorial) partnerships. However, there is little systematic support in place for the practical implementation of ILM. The Global Commission on Adaptation can play a catalytic role in calling attention to the need for an integrated approach, disseminating information on practical implementation, and mobilizing national and international policy and financial support.

This report first summarizes the climate change adaptation challenges for land and water resources and sectors dependent on them, and introduces the concepts of landscape and integrated landscape management. Section 2 reviews the main sectoral strategies for adaptation, the limits of sectorally-siloed approaches, and the evolution of ILM. Section 3 illustrates the approach, using the case of one landscape in Kenya that is applying ILM for climate change adaptation, nested in a broader strategy

for sustainable development. Section 4 examines the key elements needed for effective ILM implementation in more detail, with illustrative examples. The final section recommends how ILM can be mobilized globally and nationally to support adaptation to climate change.

1.1. Climate change poses an immense adaptation challenge for land and water management

Climate change will impact land and water management in numerous and complicated ways. In agriculture, there will be direct impacts on yield and location due to a slew of climate-related disruptions including heat stress, more frequent extreme weather events (drought and flood), fires, shifting humidity, shifting rainfall patterns as well as more frequent outbreaks of harmful pests, weeds, and diseases.² These will have wide-ranging impact on spatial distribution, productivity and nutritional value of crops from staple foods like maize and rice to cash crops like coffee and cocoa.³ Climate impacts will affect animal health and livestock forage availability and quality, as well as forest and fisheries production in large parts of the world. It will also impact ecosystem services such as pollination which are necessary for agricultural production. To meet such challenges will require a new, climate-adapted economy.⁴

Climate change-induced natural resource disruption and scarcity will also lead to increasing competition among farmers and ranchers and between agriculture and other resource-based sectors, including water, energy, biodiversity and ecosystem conservation.⁵ Rising temperatures, shifting precipitation patterns and reduced water storage resilience are already leading to significantly stressed water supplies in the western United States, Mexico, the Middle East, the Indian sub-continent and the Mediterranean. These challenges will become deeper and wider throughout the world.⁶

Sources of land and water-based energy generation, including biofuels and hydropower, are at risk from climate change and will be less productive and predictable under unstable climatic conditions.⁷ Changing temperature and precipitation patterns will interact with existing stresses on biodiversity, particularly habitat loss, to alter species distributions and abundance. The geographic ranges of species and ecosystems functions are being altered so that locations of suitable habitats will change over time.



Notes: A landscape approach encourages resource managers to sustain a diverse mosaic of land uses, and to select land uses and management systems that explicitly contribute to many different SDGs.
 Source: . EcoAgriculture Partners/Wenceslao Almazan and Louis Wertz 2015. All rights reserved.

Consequently, the current boundaries of protected areas and other conservation efforts may shift and shrink in the future.⁸

Meanwhile, aggressive efforts to mitigate climate change in the coming decades must include actions at large scale to reduce greenhouse gas emissions from agriculture and land use sectors and take advantage of the potential for large-scale carbon sequestration in soils and vegetation. Yet large-scale land use mitigation that is designed with only mitigation objectives in mind can undermine local resilience to climate change.

1.2. Using a landscape framework to integrate adaptation across sectors

A landscape is defined broadly as a socio-ecological system that consists of a mosaic of natural and/or human-modified ecosystems, with a characteristic configuration of topography, vegetation, land use, and settlements that is influenced by the ecological, historical, economic and cultural processes and activities of the area. Landscape is the scale where different land and resource uses and users intersect and can be most workable to manage a given set of natural resource and ecosystem management challenges; a 'landscape' may range in size

from 100 to 10,000 km². That unit may be a jurisdiction, but is more commonly a watershed, biodiversity corridor or agricultural commodity sourcing area spatially defined by its priority resource management objectives or challenges.⁹

The process of multiple stakeholders, across sectors, working together to manage the natural resources sustainably at a landscape scale is referred to as Integrated Landscape Management (ILM).¹⁰ ILM provides a structured way to meet the full range of natural resource-based products and ecosystem service needs of people and nature in a particular landscape (see Figure 1). ILM can provide a platform, and framework, for pursuing ‘win-win’ outcomes, enhancing synergies, or minimizing tradeoffs through cross-sectoral negotiation and planning. From a climate change adaptation perspective, such platforms can play a critical organizing role. The challenges for landscapes from climate change go beyond the biophysical impacts such as shifts in range for agricultural crops, increased pest damage in trees, and decreased water availability. These will be nested in a broader context of demographic change, economic and social change, migration and political instability which will be intensified by an increasingly chaotic global climate. ILM based on voluntary associations can generate organizational stability—beyond political cycles—that will be needed for landscape stakeholders to respond to predicted and unforeseen disruptions.

Beyond the specific multi-sectoral interventions that arise from ILM, multi-stakeholder engagement can develop institutions and social capital that will be needed to manage broad changes within a defined physical unit. This next section will look at the evolving set of landscape-scale interventions for adaptation and resilience, the rationale for integrating sector strategies across resources and users, and emerging integrated landscape management solutions.

2. Limits of siloed sector approaches and emerging integrated landscape strategies for climate change adaptation

Serious attention to climate change adaptation in land and water resource sectors only took hold recently, in part because climate activists were concerned that attention to adaptation would undermine commitments to mitigation and because of the perception that impacts would be far into the future.¹¹ But even as terrestrial mitigation received most attention, adaptation analysis, strategies and interventions have developed rapidly for agriculture, forestry, wildlife habitat, water, and bio-energy. As our understanding of agroecosystems has advanced, however, evaluations of vulnerabilities from climate change at the larger ecosystem scale, and the socioecological unit of the landscape have become increasingly useful.

2.1. Landscape-scale interventions are important in climate change adaptation strategies

Climate change adaptation strategies have been developed for most land use sectors, as well as for integrating adaptation into terrestrial climate change mitigation efforts. Interventions most discussed focus on sector-specific farm, field, household or community interventions.¹² Table 1 summarizes some of the key interventions at those scales that have been highlighted by leading international reviews of adaptation options.

All of these may be important components in achieving climate change adaptation in different landscapes. But, in addition, these same leading reviews propose a range of landscape-scale interventions for climate change adaptation (Table 2). Coordinating the implementation of farm and community interventions across the landscape can produce impacts at scale on ecosystems, production and livelihoods. Complementary investments in sectors such as health and education will also support the achievement of land and water-based landscape objectives.

There are many encouraging examples of landscape-scale adaptation efforts that integrate multiple land use objectives, such as the example from the USA in Box 1.

TABLE 1

Farm, field, household and community adaptation actions in key land use sectors

Sector	Adaptation Action
Agriculture ¹³	<ul style="list-style-type: none"> ● Resource-improving soil, crop and livestock management practices that reduce production risks and increase efficiency of water, input and land use, such as conservation tillage, agroforestry and rotational grazing; ● Use of crop varieties and livestock breeds with multi-trait characteristics capable of withstanding multiple climatic stressors; increase agrobiodiversity; ● Diversification of farm products and income sources; ● Climate risk management through climate information systems for farmers, index-based agricultural insurance; ● Community social safety nets to protect the livelihoods of chronically vulnerable and food-insecure populations from the impacts of extreme weather events; ● On-farm and local community emergency food storage, and in-field food and grazing/forage reserves ● Prevention of food loss and waste at farm and community level.
Water ¹⁴	<ul style="list-style-type: none"> ● Water scarcity managed through rainwater harvesting at household, farm or community scales; increased drilling of wells and boreholes; farm and community water storage; ● Farm and factory water use efficiency improved through precision irrigation systems, eliminating waste in manufacturing processes, and reduced waste by fixing water leaks; ● Farm and community-level floods and flood damage controlled through engineering and nature-based flood control measures, such as building of levees and embankments, improving on-farm water drainage, creation of wetlands and wooded areas to act as sponges. ● Communities (water user associations) empowered to determine what water is needed when and where.
Biodiversity conservation ¹⁵	<ul style="list-style-type: none"> ● Adapted farm use and management practices, fencing and local infrastructure to enhance habitat value of farms, at least in the context of biological corridors; ● Protection, expansion or establishment of wildlife habitat and protection of key ecological features (eg., riparian areas, freshwater systems and keystone species habitat) on homesteads, farms and community lands; ● Farmers and communities supported in wildlife stewardship.
Climate change mitigation, with adaptation benefits ¹⁶	<ul style="list-style-type: none"> ● Agricultural practices that sequester carbon and reduce climate risks for production and livelihoods, such as mulching, composting, improved fallow, reduced tillage, cover crops and green manure, intercropping, alley cropping, relay cropping, contour strip cropping, agroforestry, improved livestock management; ● Reduced and improved input use efficiency, e.g., fertilizers, farm machinery; ● Restoration and rehabilitation of degraded farm and community lands; ● Farm and community tree-planting, forest conservation and restoration.
Energy ¹⁷	<ul style="list-style-type: none"> ● Access to off-grid renewable energy, including the production and use of bio-energy; ● Improved energy use efficiency in farm production, transport, irrigation, processing; ● Energy diversification and decentralization to eliminate reliance on a single generation source.

TABLE 2

Landscape-scale adaptation actions in key land use sectors

Sector	Adaptation Action
Agriculture ¹⁸	<ul style="list-style-type: none"> • Diversified supply chains to reduce reliance on single commodities • Production systems shifted spatially to more suitable climate conditions • Production systems shifted to ones more adapted to changing climate • Farmer seed exchanges established across the landscape • Market infrastructure hardened against climate stresses • Emergency food reserves established (in field and storage) • Emergency grazing/forage reserves established • Agribusiness landscape sourcing/supply chain strategies promoting adaptation practices and reducing climate risks
Water ¹⁹	<ul style="list-style-type: none"> • Incorporation of rainwater harvesting into landscape water supply systems (for year-round river/streamflow, aquifer recharge, groundwater levels) • Built and natural infrastructure designed to control flooding • Revegetation and protection of vegetative cover on watersheds and in riparian areas, across all land uses • Natural courses restored of rivers straightened for navigation • Wetlands, woodlands and mangroves restored for water storage and to slow flows during flooding • Water monitoring and pricing systems established
Biodiversity conservation ²⁰	<ul style="list-style-type: none"> • Reduced stressors for wildlife (e.g., exposure to disease and droughts, species, habitat loss, fires, pollution) and strengthen ecosystem processes • Conservation of key ecological features in a landscape and critical habitats keystone species • Preservation and enhancement of habitat connectivity, so species and ecological communities can shift distributions in response to climate change • Protection of climate refugia, where climate conditions are more stable • Protection of areas of important future habitat and relocation of species
Climate change mitigation, with adaptation benefits ²¹	<ul style="list-style-type: none"> • Establishment of REDD+s landscape programs for forest conservation • Conservation and establishment of forests in mosaics with agricultural production • Design of landscape revegetation strategies with co-benefits for adaptation

2.2. Siloed sectoral approaches to climate change adaptation risk conflicts, miss synergies and limit scale of impact

While sector-specific adaptation strategies can seem simpler and more efficient to implement, lack of coordina-

tion across sectors can seriously undermine their effectiveness.²² They can lead to conflicts and tradeoffs within a landscape, missed opportunities for synergy, and limited capacity for scaling impacts.

Adaptation approaches for land use have principally been organized through sectorally siloed strategies, with a focus on adaptation at field, farm, forest and community levels.²³

In the western USA, including the states of Oregon, Washington and Idaho, beaver are being protected and reintroduced in ecosystems that are being altered by climate change, on small and large scales. As climate change alters patterns of snow melt and runoff, wetlands and riparian habitat is being lost and hydrology is being broadly disturbed. Beavers build dams that collect water, slow runoff, restore riparian vegetation, protect fish and replenish groundwater. As restorers of ecosystem function, beaver are effectively increasing the resilience of the systems to climate-driven changes in hydrology.²⁴

This is mainly because most government administrations are organized by sector (e.g., agriculture, environment, rural development, water, etc.) and by jurisdiction, as illustrated in Figure 2. NGOs, donor organizations, businesses and research centers have similar silos. Indeed, the Sustainable Development Goals (SDGs) are structured by sector (food, water, biodiversity, energy, even climate change). National Adaptation Plans (NAPs) have been criticized for supporting projects that target single sectors and which fail to build upon and integrate with existing national development and poverty reduction strategies. Plans generally do not include a broad range of stakeholders in the planning process, limiting scalability.²⁵

Indeed this system of organization is less effective in the context of ecosystem functions, as water, wild species habitat, and pollinators flow across these different spaces, and management practices in one area affect outcomes in another. Managing interactions across different land uses is central. At the farm/household scale, resource-improving agricultural management practices clearly are enhanced

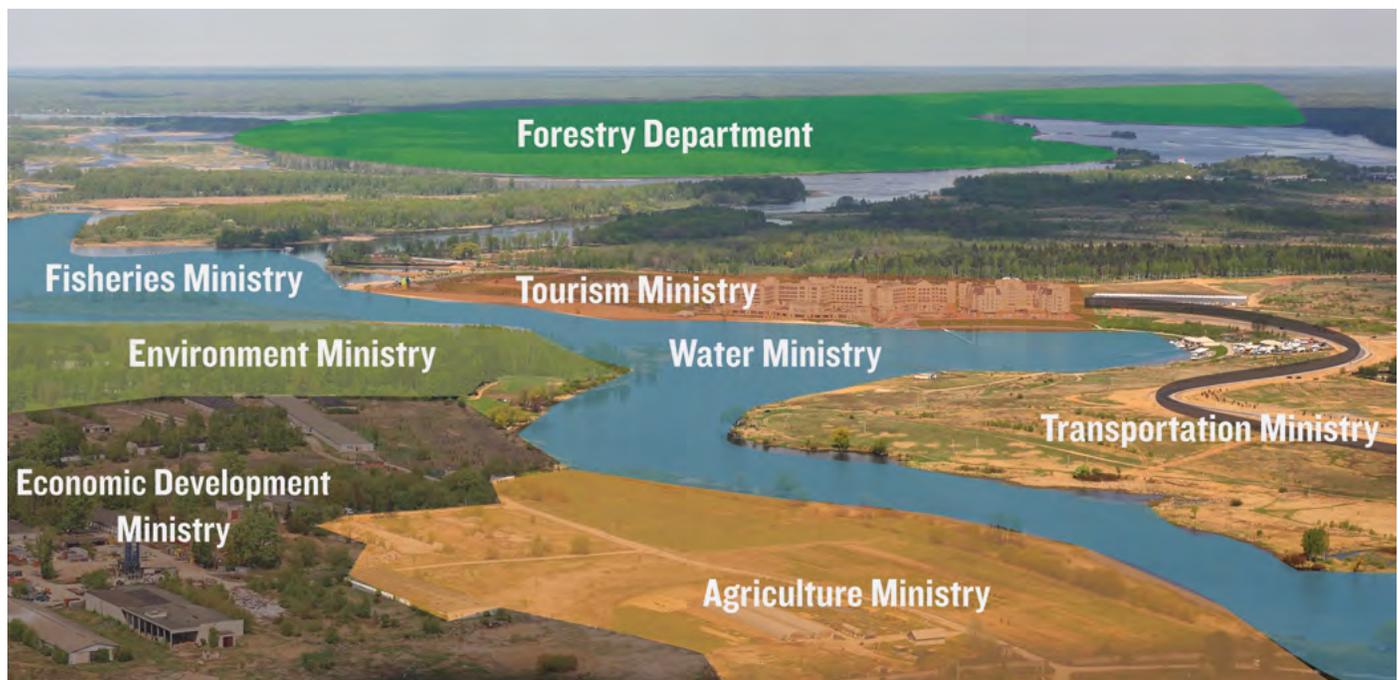
by improved water harvesting and irrigation systems. At the community level, energy efficiency and water efficiency are closely related. These connections are even clearer at the landscape-scale. Some linkages may be synergistic, such as flood management efforts that protect agricultural production, restore ecosystems and support energy production through hydropower. Other linkages may be competitive, as illustrated by the case of a bioethanol project in Mozambique in Box 2 in which resource needs for energy, water, biodiversity and livelihoods all have come into conflict.

Thus, while sectoral adaptation approaches have sometimes achieved a measure of success, they tend to not address the full suite of complex challenges that climate change poses to food, water, energy security and ecosystems. While they may simplify planning and implementation, a sectoral approach can become an impediment when institutional silos limit the ability of stakeholders to balance needs between sectors and to plan integrated activities that reinforce and complement one another. This can result

A bioethanol project in Mozambique, Procana, demonstrates the competition for natural resources that can arise when trying to balance energy, water, biodiversity and livelihood needs. For Procana 30,000 ha of land was allocated to the investor - in Massingir district, in the Southern province of Gaza - for a sugar cane plantation and a factory to produce 120 million litres of ethanol a year. The plantation was designed to take water from a dam, fed by a tributary of the Limpopo River, which also supports irrigated smallholder agriculture. Climate change has also increased the incidence of drought and water stress in the area. The Procana project was criticized by international donors and local communities, on the grounds that the land allocated to the project had already been promised to four local communities displaced from their land by the creation of the Limpopo Transfrontier Park, a joint conservation initiative among Mozambique, South Africa, and Zimbabwe. The 1,000 displaced families were promised housing, electricity, running water, and grazing at the new site. Community leaders have been told that there is sufficient land at the site for both the new villages and the biofuel plantations, but they are yet to see any construction work begin.²⁶

FIGURE 2

Sectoral division of the landscape



in overlapping, uncoordinated programs within the same area—among government agencies and between public, private and civic investments.

A siloed sector approach can also result in direct tradeoffs in allocation of natural resources. There simply may not be enough natural resources for one sector’s plans to be implemented without compromising another’s. For example, there is a large mismatch between the total biomass available in the world and what is required to achieve the SDGs if the needs for each are calculated individually. When biomass-related SDGs including food production, rural livelihoods, energy, water supplies, biodiversity conservation and climate, are analyzed in the aggregate, it is clear that the efforts to achieve all of these targets will necessarily inhibit the achievement of others unless they are integrated within frameworks that take advantage of synergies among them.²⁷

Siloed approaches can also limit the potential of sectoral climate change adaptation solutions to reach the desired scale of impact. For example, protecting agricultural pollinators threatened by climate changes will typically need not only suitable pollinator habitats on farms, but also in non-farmed lands around them.²⁸ Maintaining or expanding surface reservoirs and restoring groundwater levels to improve water security will be limited by the extent of

farmed areas using practices that slow runoff during heavy rainstorms and enable water falling on those farms to percolate into aquifers.²⁹

Thus limited financial resources for adaptation may often be better allocated to jointly-designed, integrated land use and management solutions, rather than separate sector programs. ILM pursues opportunities for greater co-financing from resource users and the private sector actors to achieve adaptation outcomes that require landscape-scale action.

The importance of such a cross-sectoral approach is being recognized in the global sustainable development agenda. A wide variety of global initiatives and targets, while taking different entry points, seek to achieve land use systems that are resilient to climate change while also providing a wide range of livelihood and ecosystem values. United Nations member states are expected to use the Sustainable Development Goals (SDGs) to frame their policy agendas to 2030 and have recognized that the SDGs are indivisible and should be implemented in an integrated manner.³⁰ This integrated agenda for natural resource management is also recognized in efforts to promote a ‘new climate economy’ and ‘inclusive green growth’.³¹ Where climate change adaptation and/or mitigation is the ‘entry point’ for intervention, these cross-sectoral, landscape planning units have been called ‘Climate-Smart Landscapes

(or Territories)'.³² Integrated Water Resources Management (IWRM) uses a methodology based on landscape principles to balance the water requirements of people, economic activity and ecosystem. 'Ecosystem-Based Adaptation' uses biodiversity and ecosystem services to confront climate change.³³

2.3. Integrated landscape management to sustain adaptation to climate change

Integrated landscape management (ILM) has evolved from and been built on these integrated approaches to emerge as a robust organizing framework for action and policy across multiple dimensions of land and resource use (see Figure 3).

Evidence from across diverse communities of practice shows five common elements for effective integrated landscape initiatives over time, in the context of dynamic climatic, ecological, social, economic, and political conditions:

- Institutions in the landscape enabling sustained multi-stakeholder negotiation, cooperation, coordination and learning;
- Cross-sector, spatially-explicit landscape analysis, negotiation, goal-setting and strategic planning;
- Farm and landscape interventions designed to generate sector synergies;
- Public policies and programs that support integrated development, environment and social strategies; and
- Financing for a coordinated landscape investment portfolio for resilient, climate-smart economic and social development.³⁴

Within the context of climate change, ILM is especially important in building organizational resilience. Strong landscape-based governance structures will be critical in adapting to a world confronting climate change as well as other related ecological and socioeconomic disruptions including habitat loss, water shortages, migration and political instability. The processes of stakeholder facilitation in ILM, and specific tools that surface and address key points of existing or potential conflict, build greater trust among stakeholders, spur cooperative behaviors, deepen appreciation of others' realities, and reduce perceptions of risks. While actors continue to defend their interests, they become more open to and creative in devising alternative solutions.³⁵

2.4. ILM is expanding globally and could be more widely used to organize and implement climate change adaptation

Integrated landscape management is expanding rapidly worldwide, as a way to address the multitude of serious land and resource management challenges, including climate change adaptation. Integrated landscape initiatives take different institutional forms and go by myriad names, including landscape restoration, territorial development, ecosystem approach, model forests, and agricultural green growth (see Scherr, Shames and Friedman 2013 for a list of 80 terms used by different communities of practice).³⁶

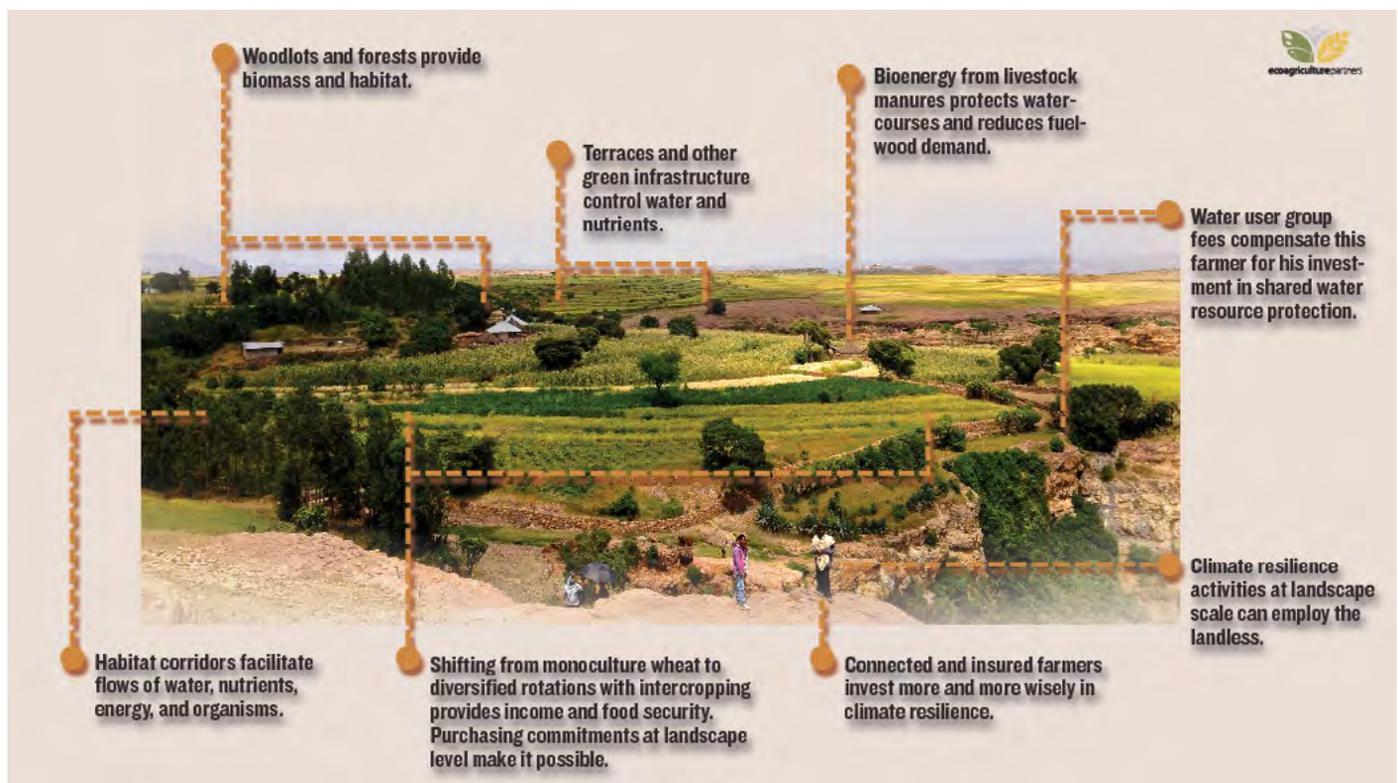
A set of continental surveys of integrated landscape initiatives was undertaken 2013-2015 in sub-Saharan Africa, Latin America and the Caribbean, South and Southeast Asia, and Europe, sponsored by the Landscapes for People, Food and Nature initiative.³⁷ These surveys identified 428 landscape partnerships that met criteria of having multi-sector, long-term objectives; a multi-stakeholder platform, and at least a few years of operation. They ranged in size from a few thousand square kilometers to several million square kilometers, and from human populations of a few thousand to several million. Numerous 'entry points' had stimulated their formation, responding to food security, water, biodiversity, and numerous other challenges that affected many stakeholders in the landscape and could only be addressed through collective or coordinated action.

Climate change adaptation was reported to be an important issue for two thirds of the initiatives documented in Africa, Latin America and Asia, as shown in Table 3. Climate change mitigation and adaptation was an important motivation in 64.7% of the initiatives, and reducing vulnerability to extreme climate events was an important motivation for 67.5% of the initiatives.³⁸

It is notable that other land and resource-related issues—around agricultural performance, ecosystem health and human well-being—were more often the priority 'entry point' for collective action. But not only were climate change adaptation issues being addressed by landscape platforms, but intervention strategies to address many of the other issues were—or could be—designed to have climate change adaptation benefits. Indeed, climate change adaptation is increasingly being incorporated into integrated

FIGURE 3

Relationships between land use interventions for climate change adaptation at a landscape scale



landscape initiative planning.³⁹

The spread of ILM has been accelerated by recent national policy developments that made it easier to work through local leadership and partnerships at landscape scale. These include increased recognition of the importance of multi-stakeholder participation in natural resource management (NRM); decentralization of NRM; and strengthened local tenure and resource rights.⁴⁰ The integrated landscape approach has been endorsed by the UNCCD in its scientific framework for achieving ‘Land Degradation Neutrality’,⁴¹ by the Convention on Biological Diversity,⁴² by the UN Framework Convention on Climate Change,⁴³ and in 2018 by the High-Level Political Forum for the SDGs.⁴⁴

While local, bottom-up mobilization of cross-sector landscape partnerships, in response to local crises of broad concern, is probably still the main way landscape partnerships are formed, major international NGOs have begun to establish landscape programs, primarily environmental NGOs (e.g., African Wildlife Foundation, WWF, Conservation International, Flora and Fauna International, IUCN) but increasingly also NGOs promoting sustainable agriculture (e.g., Solidaridad Network and Heifer International), poverty

reduction and empowerment of marginalized people (e.g., CARE and OXFAM). Landscape initiatives with a strong climate change adaptation focus include climate-smart territories in Latin America (e.g., supported by the higher education and research center CATIE). Local governments and municipalities are advancing ILM, often with a food or water security perspective.⁴⁵

National governments are widely establishing landscape programs concerned with climate change adaptation (e.g., the ECADERT multi-country program in the Central American drylands and the west African Great Green Wall; countries like El Salvador and Ethiopia). Landscape programs initially set up with other sectoral entry points (e.g., AFR100 in Africa and 20X20 in Latin America on forest landscape restoration; TerrAfrica on sustainable land management; or FAO’s sustainable rice landscape program in Asia) have incorporated climate change adaptation as central objectives. The World Bank and the Global Environment Facility have large portfolios of sustainable landscape projects with partner countries, many with multiple sector objectives and processes for stakeholder collaboration, and many which focus on climate change adaptation. While all these initiatives represent enormous progress, much more needs to be done.

TABLE 3

Climate change adaptation and other objectives in 357 integrated landscape initiatives

Motivations	% of ILIs that listed the motivation as important (no limit)
Enhance food security	77.0
Improve crop productivity	73.1
Diversify food production	66.7
Improve livestock productivity	72.5
Reduce the environmental impacts of agriculture	78.4
Conserve biodiversity	92.2
Conserve soil/Increase soil fertility	82.9
Conserve/increase water quality/water flow	74.5
Stop/reverse natural resource degradation	86.3
Enhance sustainable land management	69.5
Increase farmer incomes	81.0
Improve health/nutrition	73.1
Climate change mitigation and adaptation, obtain carbon credits	64.7
Reduce vulnerability to extreme weather events	67.5

Sources: Synthesized in Denier, et al 2015, pp 50-53, based on survey data from Estrada-Carmona, N., Hart, A. K., DeClerck, F. A., Harvey, C. A., & Milder, J. C. (2014). *Integrated Landscape Management for Agriculture, Rural Livelihoods, and Ecosystem Conservation: An Assessment of Experience from Latin America and the Caribbean*. *Landscape and Urban Planning*, 129, 1-11.; and Milder, J. C., Hart, A. K., Dobie, P., Minai, J., & Zaleski, C. (2014, February). *Integrated Landscape Initiatives for African Agriculture, Development, and Conservation: A Region-Wide Assessment*. *World Development*, 54, 68-80; and Zanzanaini, C., Tràn, B. T., Singh, C., Hart, A., Milder, J., and DeClerck, F. (2017). *Integrated Landscape Initiatives for Agriculture, Livelihoods and Ecosystem Conservation: An Assessment of Experiences from South and Southeast Asia*. *Landscape and Urban Planning*, 165, 11-21.

3. An example of integrated climate change adaptation at landscape scale: Lake Naivasha Basin, Kenya⁴⁶

3.1. Climate crises challenge a multifunctional landscape

The Lake Naivasha landscape in Kenya demonstrates how multi-sector collaboration can focus and accelerate adaptation to climate change at scale using principles of ILM. This landscape is located in the eastern Rift Valley and encompasses 3,400 km² of the Lake Naivasha watershed, northwest of Nairobi, Kenya. The basin is an important hub of economic activity, as well as a critical, diverse ecosystem. Its land use mosaic supports subsistence farmers,

commercial farming operations - particularly cut flowers, fishing, livestock ranching, and thriving geothermal energy and tourism industries. The Lake Naivasha landscape also includes three national parks, and eight wildlife reserves. Irrigation for agriculture is important in the basin, particularly for the horticulture industry, which employs over 50,000 people in the lake area. Population has soared from under 50,000 to over 750,000 in the past 40 years, driven by the booming economy.⁴⁷

Resulting deforestation, overgrazing, and poor land use have reduced rainfall infiltration and increased siltation in rivers flowing into the lake. Agricultural chemicals and nutrients have seeped into rivers and then the lake. The flower industry and municipal uses have increased water extraction. Symptoms of climate change are evident throughout the basin, and have exacerbated other stresses. Precipitation patterns are more erratic. Highland tempera-

tures are increasingly mild, which has changed growing zones for some crops and increased agricultural pests.

When a major drought hit in 2008—likely exacerbated by climate change—the level of the lake decreased precipitously. Fish stocks and tourism declined and horticulture companies were seriously considering moving elsewhere, which would have been a huge blow to the local economy.⁴⁸

3.2. Diverse actors formed a multi-stakeholder platform for action

The drought crisis motivated the creation of the Imarisha Naivasha initiative – a public, private, and civic multi-stakeholder partnership organized to improve management and coordination of water and land use in the landscape by all key actors. In 2011, this initiative was formally established by the Kenyan Government as the Imarisha Naivasha Management Board, chaired by the Office of the Prime Minister. The Board members include civil society organizations, community-based forest and water user groups, herdsman, fishers, horticulture producers, the Tourism Board, as well as retailers. A secretariat was created to coordinate the activities of the various stakeholders; monitor compliance with laws and regulations; develop and enforce local codes of conduct; and develop and execute a Trust to receive and manage financial resources for the conservation of the Basin.⁴⁹ Imarisha Naivasha mobilized financial resources from the national government, businesses operating in the landscape, and international donors.⁵⁰

3.3. Actors collaborated in an integrated landscape assessment and produced spatially explicit goals, strategy and action plan

The initiative first inventoried relevant on-going projects in the basin to develop a shared understanding of the state of action in the landscape. They then worked together to develop a common vision for the future. Based on this vision, and the perceived gaps identified from the inventory, they developed an action plan.⁵¹ While the stakeholders originally convened to confront the water crises, they quickly recognized that the water issues could not be addressed in isolation. A strategy and plan with coordinated, spatially-targeted efforts across the water, agriculture, wildlife conservation, urban and energy sectors, was required to adapt to the landscape's changing and increasingly erratic climate.

3.4. Farm and landscape interventions were designed for sector synergies

The first pillar of the plan was to identify and promote sustainable water management practices. Investments were designed to stimulate improvements in ecosystem health and resilience to climate change. Interventions included such as riparian buffer zone protection, water harvesting, drip irrigation, and gully restoration. The second pillar of action related to on-farm climate smart agriculture practices including crop diversification, intercropping, and rotational grazing.

The third pillar focused on supporting community associations of water users and forest users through co-financing of projects, land use planning and training on sustainable forest and water management practices. Finally, the Plan included actions to sustain the multi-stakeholder collaborative platform and develop a sustainable financing mechanism for the initiative to function. Compliance with the plan by stakeholders is voluntary, but actions are encouraged by local laws and institutions on land and water management.⁵²

3.5. Public policies were aligned to support integrated strategies

The Imarisha Naivasha initiative has facilitated coordination between public agencies. It provides a platform for the coordination of various actors related to landscape governance, including government and civil society entities such as Community Forest Associations (CFAs) and Water Resources User Associations (WRUAs). These actors undertake their own programs of work, but they are doing it in a coordinated way guided by input from other stakeholders and a common action plan. For example, CFAs have become more active in forest management. To support biodiversity, access to wildlife resources is being managed through community partnerships with the Kenya Wildlife Service. For access to public land near roadways, the county government has ordered the reclamation of land near roads mitigate encroachment. Access to the lake itself is being managed through a public-private partnership. Meanwhile the export flower producers have partnered with their European buyers to support the Imarisha platform and encourage sustainable floriculture practices.⁵³

3.6. Finance and investment were coordinated to support adaptation and other landscape goals

Imarisha Naivasha acts as a hub to coordinate and orchestrate financing through the development of proposals with cross-cutting objectives, helping to align sectoral activities into the integrated plan and finance framework, and engaging public and private partners to seek financing. Each project or program may be funded through a multi-sectoral financial pool raised through the leadership of Imarisha Naivasha or separately through sector funding mechanisms.

Examples of supportive investments going into the Naivasha landscape include payments for ecosystem services to smallholder farmers in the upper catchment; loans from Equity Bank to farmers for small-scale dams to assist with water management during dry periods; program support from Government of Kenya for the work of the line ministries; and grants from European retailers that source products from the landscape. Imarisha Naivasha is working to attract and coordinate investments through the development of a Sustainable Development Fund and ensure the achievement of the partnership's goals.⁵⁴

3.7. Concrete progress has been made for adaptation to climate change

Over the past 10 years, the Imarisha Naivasha collaboration catalyzed improved watershed health, increased water use efficiency, resolved water conflicts, and enriched habitat for biodiversity. Specific results include:

- Clarification of riparian zoning issues, many of which were politically sensitive and required urgent action;
- Protection of 70 kilometers of riparian zone to build the resilience of the watershed to drought;
- Lake Naivasha sewage treatment plant rehabilitated and a wetland created nearby, improving the resilience of the local hydrological system;
- More than 150,000 trees planted by community organizations to protect the watershed;
- Development and implementation of a lake water-level monitoring system to provide an early warning for drought or flooding become more serious;
- A rebound in tourism income after 2009 which provides an alternative source of income if climate change forces some people from farming, forestry or fishing;

- Payments for ecosystem services piloted to fund watershed conservation and development upstream, to benefit land and water users downstream; and
- Training of community-based water management associations in sustainable land and water management practices so that they are more adaptable to extreme weather.⁵⁵

Multi-stakeholder action can take time, but the actors in the Lake Naivasha landscape were able to work relatively quickly to establish their initiative and generate some 'quick wins'. By acknowledging the inter-related issues they were addressing, the actors were able to communicate across their sectoral divides and find areas of action on which to jointly work. To fully rehabilitate the landscape and adapt the economy and ecosystems to the impacts of climate change, this collaboration will need to continue and strengthen.

But its early successes provide an example for other landscapes facing similar challenges. This case also emphasizes that in the face of climate-induced disruption ILM does not focus only on discreet climate change adaptation interventions. By focusing on issues across sectors landscape stakeholders can build a deeper capacity for resilience to a wide range of ecological, economic, social and political disruptions that will be intensified by climate change. In establishing an effective platform for continued dialogue and planning, they are positioned to address continuing climate change adaptation challenges.

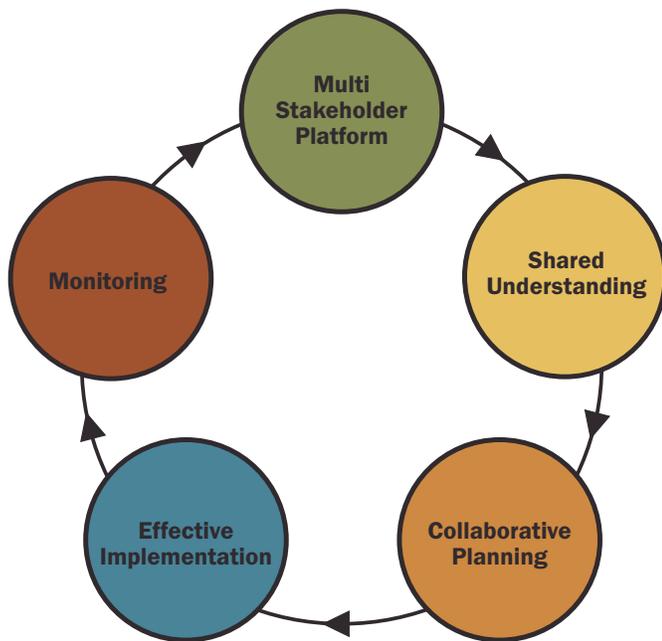
4. Implementing integrated landscape management: Key elements

Research and experience around the world with integrated landscape management to achieve climate change adaptation, in the context of other socioeconomic and ecological challenges, has generated insights and guidance for action. This section organizes these insights around the five key elements of ILM introduced at the end of section 2.

4.1. Institutions enabling multi-stakeholder and multi-sector coordination across the landscape are built or strengthened

Developing a climate-resilient local economy can involve

FIGURE 4 The ILM Cycle



Source: Adapted from Denier, et al. (2015). *The Little Sustainable Landscapes Book*. Oxford, UK: Global Canopy Programme.

fundamental shifts in paradigms and in institutions governing landscape use and management. It is thus essential to build social capital and organizational resilience to enable collective action for adaptation as climate continues to change amid other types of change.⁵⁶ It is not enough for public planners or investors to take a landscape perspective; that perspective needs to be shared—and to a significant extent generated by—local people whose everyday decisions affect resources in the landscape.

This requires a platform where all relevant stakeholders—legitimate local, regional, national, and business interests—are involved in processes to negotiate priority goals, activities and investments. In an ILM process, stakeholders from multiple sectors need to have a role in landscape analysis, visioning and planning, such as decisions about agriculture, water, energy, conservation, health, infrastructure, human settlements, culture and education. Systematic processes are needed to ensure voices of socially marginal and vulnerable groups contribute fully in goal-setting, design and implementation.

Such platforms can facilitate a shared assessment of landscape conditions and challenges, set long-term landscape objectives, plan strategies and coordinated actions to meet those objectives, finance them, and monitor progress. A

strong multi-stakeholder platform (MSP) serves as a foundation to develop deeper connections among stakeholders in landscapes. It is a means to develop partnerships and coalitions, pool resources and share knowledge. Conveners and facilitators of an MSP need to have the trust of other stakeholders to play a neutral platform role, and MSP membership and processes need to be explicitly defined to meet the expected roles and functions.⁵⁷

The application of MSPs specifically for climate change adaptation is now being evaluated. For example, Acosta, et al. (2018) concluded from a study of eight cases in Uganda and Tanzania, that MSPs are vital to developing a viable climate-smart agriculture policy in East Africa.⁵⁸ Winter, Bijker and Carson (2017) drew lessons on implementation from 12 existing multi-stakeholder initiatives for smallholder resilience to climate change that were active in the inter-related areas of youth, climate resilience and agriculture, financial inclusion and agriculture.⁵⁹ CATIE has evaluated MSPs for climate-smart territories in Latin America.⁶⁰

4.2. A structured process is used for cross-sector landscape analysis, goal-setting, and strategic planning

The ILM process is loosely defined as having 5 cyclical steps, illustrated in Figure 4. After establishing the initial landscape MSP (which will later further evolve), stakeholders work together to develop a shared understanding of the landscape challenges and opportunities. Most landscapes are mosaics of different land uses, with different land managers. So understanding the spatial patterns and interactions among them, and the ways they are expected to change, is critical in evaluating vulnerabilities and designing responses to climate change. Goals should be informed by rigorous, multidisciplinary climate risk and vulnerability assessments tailored to the specific landscape, with explicit planning to mitigate landscape-scale risk, and support communities to reduce and respond to local risks.

Box 3 provides an example of one tool, landscape-scale visioning and scenario development, which can inform multi-stakeholder planning. A core part of the process is sharing perspectives of different stakeholder groups, to deepen the analysis and build mutual understanding as a basis for concrete agreements.

A multi-stakeholder landscape scenario modelling exercise was undertaken in Kilombero Valley, Tanzania in 2018 to assess different development pathways for achieving the Sustainable Development Goals by 2030. Rice and sugarcane are produced in the lowland areas, transitioning into banana, some cocoa and maize in the boundary area, interspersed with teak plantations; with pastoralism in drier areas. The population is predominantly composed of smallholder farmers who are largely dependent on rivers, springs and streams for their water supply for both domestic and productive uses. Much of the population is food insecure as a result of low crop yields due to climate change, soil degradation, poor inputs, pests and disease, and insufficient water and external factors such as inadequate access to markets and financial services, human-wildlife conflicts, insufficient land, and conflicts over control of natural resources.

Based on stakeholder consultations, scenarios were developed to 2030. The Business as Usual scenario was based on the continuation of past trends in land use, climate change, population and economic development, without significant actions for adaptation to climate change, resource degradation and population growth. The Integrated Landscape Management scenario, in contrast, included a set of land use and policy changes designed for climate change adaptation and resource regeneration, and greater provision of ecosystem services (based on available technologies and institutions). The scenarios showed outcomes under Business as Usual with accelerated resource degradation and threats to food security. Under the Integrated Landscape Management scenario, some but not all of the indicators for production and ecosystem services under climate change were significantly better, although in some cases resource conditions only stabilized (versus sharp declines) and there still high (but better) levels of food insecurity.⁶¹

Scenario evaluation generally is followed by negotiations to define long-term vision and ambitions for the landscape, a broad strategy to pursue, and the creation of an initial action plan. In the context of climate change adaptation, landscape action plans need to mobilize and support community-level adaptation and resilience strategies. Following its preparation, the plan needs to be implemented, coordinated and funded. Many tools and methods have been developed to support these processes for ILM.⁶²

Kenya's Ending Drought Emergency Plan (in the Arid and Semi-Arid Lands by 2022) is a good example of a cross sectoral plan focused on climate resilience, bought into by County governments, the private sector, the UN, donors, and others. The plan mapped out interventions spatially (using GIS) and sequentially (e.g., support for more intensive agriculture only following provision of basic health services and feeder roads to move product).⁶³

The last step in the cycle is to track changes in the landscape over time, in order to continuously adapt and improve the action plan. This monitoring is central to effective collaboration among stakeholders—it must be transparent and subject to collective review and assessment. Methods have advanced with the recent availability of

low-cost remote sensing tools, methods for tracking flows of ecosystem services and species movements, and soil quality, as well as geo-referencing of social and economic indicators; and new traceability tools for agricultural and forest products. Participatory stakeholder-based and qualitative assessment methodologies have also been refined. The new LandScale initiative led by Rainforest Alliance, Verra the Climate, Community and Biodiversity Alliance, for example, provides guidance on how to set up integrated landscape impact assessments.⁶⁴

4.3. Farm and landscape interventions for climate change adaptation are designed for synergies and co-benefits

Three key features characterize farm and landscape interventions adapted to climate change: climate-smart practices at the field and farm scale; diversity of land use across the landscape; and management of land use interactions at a landscape scale.⁶⁵ Each of these features is explained below.

CLIMATE-SMART PRACTICES AT FIELD AND FARM SCALE THAT MEET MULTIPLE GOALS

Landscapes are comprised of a variety of field and farm

practices, in different land and tenure types that can explicitly support adaptation to climate change, while also providing benefits for food production, water quality, biomass energy and/or biodiversity. They can also lead to maladaptation if done incorrectly. These resource improving practices include managing cropland soils to improve water holding and infiltration capacity, reduce erosion, increase soil organic matter, and manage water and nutrients, along with agroforestry, livestock husbandry, and forest and grassland management, and biomass energy techniques.

DIVERSITY OF LAND USE ACROSS THE LANDSCAPE MOSAIC

To enhance production and ecological resilience as the climate changes generally requires a high level of diversity—in land cover, land use, and species and varietal diversity of plants and animals. This diversity reduces overall ecological risks of pests, diseases and vulnerability to unexpected weather conditions. Having a portfolio of diverse food and income sources from crops, livestock, trees and non-cultivated lands can cushion households and communities from climatic (and other) shocks. Diversity also enhances livelihood resilience through access to diverse sources of food, feed and employment during episodes of adverse climatic conditions.⁶⁶ “Famine foods” such as wild greens, tree fruits and roots, and bushmeat, and fish from freshwater and coastal resources can supplement diets. Communities and local authorities can allocate lands for grazing reserves.⁶⁷ Maintaining a significant expanse of native perennial habitats (grasslands, woodlands, forests, wetlands) improves ecological resilience in terms of watershed functions and wildlife habitat important for livelihoods, tourism or biodiversity conservation, as well as sequestering and storing carbon in the landscape.⁶⁸

MANAGEMENT OF LAND USE INTERACTIONS AT LANDSCAPE SCALE

Stakeholders and planners must identify, negotiate and manage the impacts of different land uses and users on others in the landscape to maximize adaptation benefits. Intentional planning of the spatial arrangements of landscape elements can enhance field-level results. For example, field margins, riparian buffers and forest edges can harbor pest predators or beneficial insects. Forest fragments adjacent to cropland can increase and stabilize pollination services. Landscape-scale interventions around irrigation, natural and built infrastructure for drainage, flood control and water-harvesting

can reduce crop losses during extreme events and sharply increase returns to farm-level investments. Furthermore, natural and semi-natural habitats, like riparian areas, woodlands and wetlands, can be sited to provide ecological connectivity for water and nutrient flows, and improve habitat conditions for wild plant and animal species and beneficial microorganisms. As climate change intensifies, connectivity of wildlife habitats and hydrological resources will become increasingly important as an adaptation strategy.⁶⁹

4.4. Public policies and programs are aligned to support integrated adaptation strategies

Governments can support landscape-scale climate change adaptation through public policy in a variety of ways. These include providing a compelling vision to guide integrated landscape-scale action; incorporating landscape approaches into government planning; and aligning regulatory frameworks. The advent of polycentric governance, which focuses on bottom-up approaches, offers new opportunities for climate action.⁷⁰

VISION AND LEADERSHIP

Political and other leaders need to position climate action as part of broader sustainable development initiatives, craft an inspiring vision, and ensure co-benefits from adaptation activities. This means incorporating objectives and programs for landscape-scale efforts to adapt to climate change into national programs to meet not only commitments under the Paris Climate Agreement, but also for the SDG’s, the Bonn Challenge, the Aichi biodiversity targets, Land Degradation Neutrality, and overall green and inclusive growth strategies.

Notable examples are El Salvador (see Box 4) and Rwanda, which have made national commitments to ‘border-to-border landscape restoration’, to meet broadly defined development, climate change adaptation and environment objectives. Leaders of numerous other countries have championed sustainable landscape and established supportive policy, from Ethiopia to Australia.

SECTOR INTEGRATION AND LANDSCAPE APPROACHES IN GOVERNMENT PLANNING

Stakeholder platforms need to act with the participation, or at least passive support of, local, provincial, and/or national governments if they are to achieve their potential

scale and scope.⁷¹ However, the benefits of multi-stakeholder landscape planning, even when recognized and endorsed in principle by public agencies, often are not sufficiently supported by business-as-usual policy. Constraints to integration include the familiar ones of weak incentives, short-term cost, perceived inefficiency, short time horizons and uncoordinated operations and financing. But for ILM they also include limited capacities and training in systems thinking, spatial analysis, and landscape 'literacy'.

Any vision or plan developed to support landscape approaches must be embedded in governmental strategies for agriculture, water, biodiversity conservation, energy, employment, etc. High-level buy-in can help mediate traditional conflicts between economic growth and conservation interests. With this support, agencies can work to integrate sectoral plans so that at the landscape scale, stakeholders are working in concert, and are not impeded by government institutions. Box 4 describes how El Salvador coordinated cross-sector landscape planning and climate change adaptation policy.

Governments can also put in place mechanisms to facilitate local-to-national policy dialogue to assist national government actors to incorporate policies supportive for sustainable landscapes and landscape platforms.

A successful example was the Kenya policy dialogue between national policymakers from multiple sectors and five local landscape initiatives to identify ways that national actors could support landscape MSPs.⁷³

REGULATORY FRAMEWORKS THAT ENABLE COLLABORATIVE LANDSCAPE-SCALE ACTION

Governments at national and sub-national levels establish and enforce the 'rules of the game' that underlie climate-resilient landscape planning and investment. ILM processes can help shape regulations that respect local priorities, innovations and informal agreements, rather than relying solely on technical analysis.

Governments may also choose to develop regulations based on achievement of landscape goals, instead of imposing standard management practices on individual farms, thus motivating collective innovation. Regulations can also be harmonized and coordinated at a landscape scale so that they do not overlap or work at cross-purposes. For example, in a critical upland watershed in Thailand, strict government regulations on the location of farming were challenged by farmers and community organizations who argued that a combination of annual crops, agroforestry, and permanent forest cover in specific critical areas would be sufficient to prevent soil erosion and flooding downstream in the landscape. The regulations were subsequently modified to allow these sustainable farming

BOX 4

Development of policy for integrated landscape management in El Salvador

Much of El Salvador's natural resource base and economy is vulnerable to climate change due to environmental degradation, e.g. deforestation in riparian zones, aquifer recharge areas, and areas with high risk of landslides. In response to extreme events and climatic variability, El Salvador formulated the National Environmental Policy in 2012. For the purposes of climate change adaptation, this policy aims to restore and conserve critical ecosystems. The policy was designed in coordination with the National Program for Restoration of Ecosystems and Landscapes. However, the National Environmental Policy itself also aims to integrate climate change adaptation strategies, including with biodiversity, sanitation and water resources objectives.

Implementation of this policy started with generation of a map of areas with restoration opportunities in El Salvador, totaling 1,253,077 hectares. Landscape restoration actions were prioritized by overlaying the map of restoration areas onto a map of current land uses. Financial analyses were conducted to project job growth, financial return, and ecosystem benefits for each prioritized action; financial instruments were then assessed the viability of priority actions, including bonds, subsidies, impact investments, and ecosystem benefit compensation. Financial analysis of the policy allowed them to understand the transitions required to shift natural resource management under this new policy.⁷²

practices in areas that were previously restricted, creating conservation and economic benefits.⁷⁴

Secure systems of land and resource ownership, use and access rights and property rights are also critical for successful, long-term management and adaptation to climate change. Secure tenure allows land managers to look towards a future where they can build profitable, climate-resilient systems. Governments can recognize and enforce locally-legitimate rights adapted to a given landscape context and agreed upon by landscape stakeholders.⁷⁵

4.5. Finance is mobilized for a coordinated landscape investment portfolio

Spatially-targeted and coordinated landscape investments are needed to support adaptation. Thus stakeholders need to develop a landscape finance strategy. This could range from a loosely coordinated set of actions to a more formalized action plan.

Landscape initiatives and their collaborators need the capacities and resources to create and implement these strategies. They will need to facilitate processes that build 'landscape investment readiness' to translate these landscape action plans into investable business ideas and facilitate local entrepreneurs, companies, community groups or government agencies to access appropriate sources of finance.

One critical aspect of a landscape investment is business engagement. In most productive landscapes, businesses have a major impact on natural resources, so landscape-wide goals are difficult to achieve without their involvement. Yet, out of 428 multi-stakeholder landscape partners documented in studies cited earlier, only a quarter involved private companies.⁷⁶ This is changing rapidly, as the business case for landscape investment coordination becomes clearer. Agribusiness, food industry and other resource-dependent companies participate in response to corporate sustainability commitments, and to growing local business risks of natural resource degradation, climate change and community relations in their operations and sourcing regions. Businesses with fixed assets in an area, or those that must secure a critical supply of a resource that cannot easily be sourced elsewhere, especially benefit.⁷⁷

Some major companies have begun to integrate landscape approaches into their business strategies. For example, Olam International has developed a Living Landscapes policy in which they will work with their partners 'to create and sustain Living Landscapes, where prosperous farmers, thriving rural communities, and healthy ecosystems coexist'.⁷⁸ The Tropical Forest Alliance, the World Business Council on Sustainable Development and other business organizations have also endorsed landscape approaches to sustainability, including climate change adaptation.⁷⁹

BOX 5

Landscape investment planning in Cagayan de Oro, Philippines

The catchment of the Cagayan de Oro River, on the north coast of the island of Mindanao, Philippines has faced pressure from increases in water abstraction and conversion of forest to agriculture to meet the needs of an expanding population. With the disappearance of the vegetation, the natural protection against flooding and mudflows in this extremely vulnerable landscape has diminished as well. The Cagayan de Oro River Basin Management Board has emerged as a partnership between conservation organizations, universities, companies, communities and local authorities that works together to restore natural climate buffers that offer much-needed protection against the increasingly severe impacts of climate change.

In order to access financing for their action plan, this group has begun to use the Landscape Investment and Finance Tool (LIFT), which is designed to help landscape partnerships develop investment ideas, assess their financing needs, scope potential sources of financing, and devise a clear finance mobilization strategy. Based on their initial work with the tool, stakeholders were able to identify potential business ideas including cocoa agroforestry, payments for watershed services PES, and sustainable pineapple production. Meetings based on this process were set with Kennemer International, Land Bank, and FMO (the Dutch Development Bank) to plan to better understand how landscape investment deals might be structured.⁸⁰

Even with strong business engagement and investment, it is valuable to have an organization advise or guide investment planning and coordination in a landscape. This entity can help attract financing from diverse investors to support the implementation of agreed landscape plans, steer existing financing to activities aligned with the plan, aggregate investment opportunities and play a financial intermediation when appropriate.³⁶ Box 5 describes the initial efforts of the Cagayan de Oro River Basin Management Board to play this investment coordination role, using the Landscape Investment and Finance Tool (LIFT).⁸¹

5. Recommendations for action

This paper has described the importance of using a multi-sector landscape approach for climate change adaptation as well as the key elements of ILM, a framework to implement the approach. Five recommendations are proposed here to support the scaling of climate change adaptation through ILM:

1. Foster and strengthen ILM platforms for action on climate change adaptation;
2. Improve mechanisms for inter-agency planning and monitoring at landscape scale in support of climate-resilient ILM;
3. Build integrated landscape investment portfolios and mobilize funding for them;
4. Mobilize the business community to incorporate ILM in adaptation strategies; and
5. Build research and knowledge systems for climate-resilient ILM.

Meeting the challenge of climate change adaptation in land and resource use will require strategic policy and support at national and international levels. But effective adaptation, in the end, depends on shifting millions of local resource use and management decisions by farmers, businesses, urban centers and other land managers. Only strong local institutions that have fully incorporated adaptation objectives into their sustainable development plans, business models and civil society programs will be able to deliver that. These locally-led climate change adaptation strategies need to consider not only the trends in climate, but also in demographics, economies and social systems. There is thus an important role for the Global Commission on Adaptation to advise and mobilize national governments and inter-governmental agencies on how to support and institutionalize such local leadership.

The recommendations below support those in the Commission's 2019 report⁸² and proposed 2019-20 Action Tracks on food security and smallholder livelihoods, natural environment, water, city-regions, infrastructure, disaster risk management and financing, by promoting integrated landscape strategies to scale and inter-link these actions. The Commission should further integrate these recommendations into its Action Track on "Locally-Led Action", specifically to build institutional capacities and support integrated landscape/territorial analysis, planning and action on adaptation, and to develop new financing instruments for integrated landscape investment portfolios that respond to locally-led development-with-adaptation strategies.

5.1. Foster and strengthen ILM platforms for action on climate change adaptation

Farm and natural resource management systems will need to be resilient to successfully manage the impacts of climate change. Adaptation is not just about making direct changes in soil, water and forest use and management practices, but about shifting economic paradigms, business models and social norms and information systems that determine those use and management decisions. The Commission's Adapt Now report highlights the importance of decentralization and local response in adaptation strategies. Integrated landscape initiatives provide a practical mechanism for implementing such a response. Building social capital among the diverse actors in the landscape will be essential for mobilizing collective responses to climate-induced problems and opportunities. Thus fostering and strengthening long-lived local institutions that facilitate knowledge-sharing, negotiation, and collaboration among resource users and across sectors—voluntary landscape-scale platforms and partnerships—should be a priority for national and international policymakers.

The Commission should call on national and sub-national government agencies to be more active in these local landscape platforms as conveners and as participants. These agencies can play critical roles in supporting the platforms, supplying information to other stakeholders, and providing a two-way channel for information-sharing, providing input and feedback on policy ideas, and facilitating public-private-civic partnerships and co-investment. National governments can be encouraged to put in place programs to provide long-term co-funding for the coordina-

tion functions of these landscape platforms, build training programs for landscape facilitators, and adapting policies and regulations that welcome and facilitate their role in both local leadership and in helping to adapt national policies and programs to local contexts. Countries should put in place legislation that facilitates locally-led development and adaptation planning. The Commission could inform and track such legislation. Lessons can be learned from national government programs to support landscape platforms, such as the experience of Landcare in Australia.⁸³

A model for capacity building is Landscape CSA, a six-module, one to two-week course designed by EcoAgriculture Partners, the University of California, Davis and the United States Department of Agriculture, to support landscape stakeholder groups—including local government agencies, farmers' organizations, conservation NGOs and businesses—develop climate-smart landscapes. The course provides technical content on CSA practices at the farm and landscape scale, policy formation and landscape investment and finance strategies, with exercises guiding participants to develop joint landscape action plans. Piloted with sub-national government leaders from 10 landscapes in Tanzania, the course is being rolled out now across East Africa.

5.2. Improve mechanisms for inter-agency planning and monitoring at landscape scale in support of climate-resilient ILM

The policy community should prioritize support for integrated place-based, rather than sector-based, development action and investment. This should start at the international level, by further linking the agendas and modalities of the United Nations Rio Conventions on Land Degradation (UNCCD), Biodiversity Conservation (CBD) and Climate Change (UNFCCC), as well as the SDGs. There have been major advances in the UNCCD and Global Environment Facility, with a growing focus on integrated landscape approaches, and this can be further strengthened with an emphasis on long-term governance institutions, and expanded in the Green Climate Fund, Adaptation Fund and other international institutions.

At national and sub-national levels, most government administrations are organized by sector. But new modes of inter-agency knowledge exchange, planning, regulation and investment can be used to coordinate climate change

adaptation efforts at a landscape-scale. The mandate for such joint planning may need to come from a high-level executive office such as a president or prime minister. Targeting national and international adaptation and development funding to multi-agency collaborative efforts can provide a powerful incentive.

Countries should articulate a policy framework for landscape-level action within their NAP design and implementation processes. This framework would articulate how national and local government agencies will strengthen their capacities to coordinate sectoral policies, design spatially-oriented landscape plans and integrate climate change adaptation considerations into these local-level planning processes.

Geographic information system (GIS) capacity is foundational to integrated landscape planning and monitoring, by enabling spatially explicit analysis of ecological, economic and social processes. These systems need persistent sectoral databases for the landscape which can be easily inter-linked and shared with stakeholders as easily-accessible digital public goods. FAO and UNEP should be encouraged to collaborate in developing guidelines and mobilizing technical assistance to enable such combined GIS at municipal and provincial levels.

5.3. Build integrated landscape investment portfolios and mobilize finance for them

The Commission called for a “revolution in finance”. A key element of that revolution should be coordinated public, private and civic finance for landscape investment portfolios. To achieve adaptation and other inter-related goals, ILM requires a wide range of investments aligned with the landscape strategy for sustainable development. Such investments require some degree of strategic planning or coordination through a landscape stakeholder platform. Over the long-term, most funding for these investments will have to come from mainstream financial sources as part of a systemic shift to a more ecologically-sustainable and climate-resilient economy. Moreover, most funding for these investments will be from local and national sources. But during this transition, public international climate and development funding from the Adaptation Fund, the Green Climate Fund and Global Environmental Facility, for example, can

be catalytic, especially for piloting innovative land use and business models.

Financial institutions and investors, at all scales, must play an active role in supporting ILM and climate change adaptation. The Commission should call on them to incorporate landscape criteria into investment decision-making; focus on blending public and private finance to reduce risks from investments with less established track records; engage directly with landscape partnerships; develop landscape investment incubators and monitor multiple outcomes from their investments at a landscape-scale within landscapes that all contribute to climate change adaptation (and co-benefits); and monitor multiple outcomes at a landscape scale. Innovative actors are beginning to move in these directions, but much more effort is needed.

To build integrated landscape investment portfolios will require strengthening several institutions that are currently fairly weak. The first is the service of business incubators for climate/environment-friendly enterprises that contribute to goals of land and resource regeneration, to help them become 'investment-ready'. Such services are being developed by many international environmental organizations (e.g., IUCN-Netherlands, World Resources Institute, Flora and Fauna International), but these services need to be institutionalized in the business community. The second is funding that can be easily accessed by landscape partnerships for coordinated investment planning and finance mobilization. Such 'landscape investment readiness' funding will mainly come from philanthropic and government sources initially, but once established could also be co-funded by private investors.

5.4. Mobilize the business community to incorporate ILM in adaptation strategies

Businesses dependent on sustainable natural resources should invest in analyzing, in specific sourcing regions or operation sites, their climate-related risks, and the business benefits and trade-offs of engaging in landscape partnerships to mitigate those risks. Just as businesses have begun to make public commitments to climate change mitigation, they should do so also for adaptation—in their own companies and in the landscapes where they operate or source. Moreover, private agri-

business, food industry, and forest companies should undertake R&D to incorporate adaptation into their core business models.

These analyses can be used to evaluate if and how engaging in a landscape partnership could be an effective strategy to mitigate business risks, meet commitments to environmental and social standards, and seize new opportunities. Company staff members need to become skilled landscape collaborators. Businesses should contribute to effective ILM planning, for example by providing spatial data, with appropriate safeguards for proprietary information. Business associations should help their members develop the capacities to engage in landscape partnerships, and high-profile business people with experience can share their lessons learned more widely within their companies and with their peers.

Meanwhile, governments and landscape initiatives can enable successful collaboration with businesses on climate-resilient landscape development. Companies need processes that are easy to engage in; low transaction costs, facilitators and conveners knowledgeable about business, some link to finance and metrics for measuring impact.

5.5. Build research and knowledge systems for climate-resilient ILM

There is an enormous gap in locally-adapted knowledge on adaptation across all the priority areas identified by the Commission, and in particular on how they interact and on intervention design at landscape scale. Immediate actions are recommended for scientific mobilization and sharing of existing knowledge.

The Commission should call on all universities to set up long-term partnerships with integrated landscape platforms and partnerships in their region, to support them in climate change adaptation and sustainable development. This would include focusing faculty and student research on key issues and opportunities for adaptation and making research findings available to landscape actors; strengthening curriculum for students so that they can become the next generation of landscape leaders; and providing direct input into analysis, planning and monitoring of ILM.

While there is considerable existing research on climate change adaptation in agriculture and land and water

management, there is a large gap in applying these in an integrated way to achieve landscape adaptation. Most research still focuses on making specific sector adaptations in existing systems. Emphasis should be on improving knowledge for modeling the relationships among landscape objectives under a variety of climate change scenarios and on monitoring impacts of interventions across multiple dimensions at a landscape scale. The CGIAR research system has various strands of landscape research in place, but these need to shape the crop- and resource-specific research, which currently remains siloed. They also need to engage more directly with landscape partnerships. National research organizations need much stronger research linking agricultural production research (seed, field practices) with ecosystem management and off-farm investments like flood, drainage, windbreaks and natural habitat conservation, for different types of agroecosystems, including analysis of costs/benefits.

Mobilizing existing knowledge is meanwhile essential. The Commission can advocate for the UN Decade for Ecosystem Restoration (2021-30) currently under design to coordinate with the UN Decade on Family Farming (2019-28) and Action for Nutrition (2016-25), and with the Global Landscapes Forum, to harmonize their messages and address climate change adaptation in outreach and knowledge-sharing strategies. These should focus on both informing and inspiring policymakers to support integrated landscape partnerships to pursue adaptation, and also provide targeted information to landscape initiative leaders and members.

Systems need to be put in place that enable landscape partnerships to access the results of research, together with peer knowledge exchange among landscape leaders. Access to relevant information that is actionable at the landscape-scale is critical for climate planning as changes can happen quickly and in often unexpected ways. There is a need to strengthen the 'landscape literacy' of all producers, land and resource managers, and landscape and program leaders—so they can better understand different elements within a landscape, their interactions, their vulnerabilities to climate change and their potentials for adaptation. The capacity of extension systems to provide landscape-level planning knowledge and information needs to be strengthened.

ILM is not just a technical challenge for climate change adaptation and other intertwined ecological and economic objectives. Leading and facilitating the diverse actors in landscape partnerships is also challenging. Perspectives, values, ways of working differ greatly among partners; in many cases there is a legacy of misunderstanding and distrust among them. Explicit strategies and tools are needed to overcome the resulting tendency for conflict and stalemate. Leaders thus need access to practical tools on all of the elements of ILM described in this paper to facilitate, lubricate and accelerate these processes. The Commission can collaborate with the new 1000 Landscapes for 1 Billion People initiative, which is mobilizing partners around the world to provide these tools and knowledge support directly to landscape partnerships (landscapes.global). The regional Landscape Leaders Dialogues organized by the Landscapes for People, Food and Nature initiative can be expanded beyond Africa and Mesoamerica, and used strategically to share knowledge and tools for climate change adaptation (peoplefoodandnature.org).

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ABOUT ECOAGRICULTURE PARTNERS

EcoAgriculture Partners, an international non-profit organization registered in the U.S., was founded in 2002 to help communities work together to achieve sustainable landscapes that provide the full range of products and services needed by its people and nature. EcoAgriculture provides analysis, training, tools, and facilitation for locally-owned and -led processes of visioning, planning, and investing that create regenerative economies and landscapes. The organization also works globally to mobilize and innovate policy, knowledge and finance to support these integrated landscape (territorial) management initiatives. EcoAgriculture has convened the Landscapes for People, Food and Nature initiative since 2012, and in 2019 began the new 1000 Landscapes for 1 Billion People initiative with a large group of partners.
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ABOUT THE GLOBAL COMMISSION ON ADAPTATION

The Global Commission on Adaptation seeks to accelerate adaptation action and support by elevating the political visibility of adaptation and focusing on concrete solutions. It is convened by over 20 countries and guided by more than 30 Commissioners, and co-managed by the Global Center on Adaptation and World Resources Institute.