*Caribbean Foresters: A Collaborative Network for Forest Dynamics and Regional Forestry Initiatives*
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# The Caribbean Landscape Conservation Cooperative: A New Framework for Effective Conservation of Natural and Cultural Resources in the Caribbean

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**Abstract** - Governmental and nongovernmental organizations charged with managing natural resources increasingly emphasize the need to work across jurisdictional boundaries. Their challenge is to manage shifting resources under rapidly changing climate and land-use scenarios. Scientists, resource managers, and conservation planners, and their organizations and agencies routinely collaborate on projects to solve specific problems. Cooperative frameworks to programmatically address complex social–environmental issues and develop shared research, planning, and implementation priorities are relatively new. One such framework includes 22 Landscape Conservation Cooperatives that encompass the US, Caribbean countries, and bordering regions of Mexico and Canada. The most recently established collaboration is the Caribbean Landscape Conservation Cooperative, which is intended to provide land managers with the best available scientific data and to assist them in developing shared conservation priorities and implementing conservation actions.

> "*We, the people, still believe that our obligations as Americans are not just to ourselves, but to all posterity. We will respond to the threat of climate change, knowing that the failure to do so would betray our children and future generations.*"
> - Barak Obama, 44th US President, 2nd inaugural address, January 2013.

## Introduction

Increasing climate variability and large-scale changes in land use and land cover affect resources that humans depend on for food, water, commerce, recreation, and connection with human culture and history. We expect rapid changes in sea level and storm surges, temperatures, precipitation, and seasonality in the upcoming decades (IPCC 2014, PRCCC 2013) that will affect wildlife habitat, freshwater inputs and aquifers, infrastructure, culturally important sites, recreational opportunities, and other vulnerable resources and ecosystem services. Agencies and non-governmental entities have responsibilities to understand and respond to risks in order to sustain resources under their jurisdiction. Many of the forces of change and vulnerability are shared among entities beyond any one country's borders, and likely future scenarios are best understood by assessing global climate-modeling scenarios. However, the impacts and needed responses are inherently local and specific to individual resources. Local resources typically exist within a complex social–ecological matrix. Resources can be affected by large-scale climatic changes

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as well as conflicting decisions and actions by agencies and other sectors in society that govern resources. There is a general recognition that agencies can better manage assets that exist within such interconnected matrices by working collaboratively, and that no single agency can manage resources without considering the wider context and working with partners (Austen 2011, Jacobson and Haubold 2014, Millard et al. 2012).

Collaborative conservation has led to many successes in maintaining viable wildlife populations, preserving habitat, and improving the delivery of clean air, potable water, and other ecosystem services (Chapin et al. 2009, Meretsky et al. 2012, Rich and Hoskins 2010). The collaborative framework requires resources, leadership, support by partners, and sustained effort to achieve shared objectives (Jacobson and Robertson 2012). In the past, conservation has been successful when collaborations were project-based and focused on a single or narrow range of subjects or a local geographic area. Typically, partners identify their interests, allocate resources, and, in the best-case scenarios, monitor results and impacts. Collaborations are formed, frameworks are developed, resources are applied, and the task at hand is pursued until resources become unavailable or objectives are achieved. Over time, agencies and individuals form and reform these collaborative structures with a shifting group of partners as they address conservation issues. Although this approach is a successful model, it fails to take advantage of the collective strength of organizations to tackle broader conservation issues and the interconnectedness of resources, jurisdictions, and land- and seascapes. Inefficiencies result from the lack of structural continuity from one joint project to the next and from the failure to share data among projects. Many cooperative groups have successfully protected or managed particular watersheds, estuaries, species, or resources, but few have developed or sustained a broader context that extends beyond the spatial and temporal boundaries of any one project.

Given the likely changes in climate and resulting cascade of outcomes and consequences related to resources, the challenge of conservation for the future is whether we can develop effective long-term frameworks for collaboration through which agencies and individuals articulate a shared set of values, prioritize resources, and develop the vision, tools, data, and communication needed to restore, conserve, and sustain those resources. There has been a clear recognition of this need from the US and other governments around the world, driven in part by the sustained call for a response to climate change from the scientific community over the last few decades (IPCC 2014). In the US, the Departments of Commerce, Interior, and Agriculture have all agreed that there is a need for better collaboration within their own agencies and among all agencies in responding to climate change. They also agree that this cooperation should be accomplished in a way that works at a national level but maintains regional and local relevance because vulnerabilities and effects are local and responses must address regional and local realities in order to be successful (White House 2013). The pathway from intent to action in implementing policy is very dynamic and subject to many political and economic constraints, which often outweigh scientific considerations.

Each agency has created a network of regional mechanisms for science development and delivery aligned with its mission, and explicitly recognizes the need to work across agency boundaries (Fig. 1). These networks include the National Oceanic and Atmospheric Administration (NOAA) Regional Integrated Sciences and Assessments (RISA), The Department of the Interior US Geological Society (USGS) Climate Science Centers (CSC) and Landscape Conservation Cooperatives (LCC), and the US Department of Agriculture Regional Climate Hubs (Fig. 2). Further, each agency has taken a different approach to initiation of leadership and membership within, and the degree of support for its networks. All of the networks have the goal of connecting science to decision makers and decreasing the vulnerabilities of society to climate change and other large-scale stressors on natural and cultural resources. Additionally, all Federal departments are charged with a new level of internal and external collaboration, and they include the Caribbean region of the US in their efforts to address the regional issues related to climate change

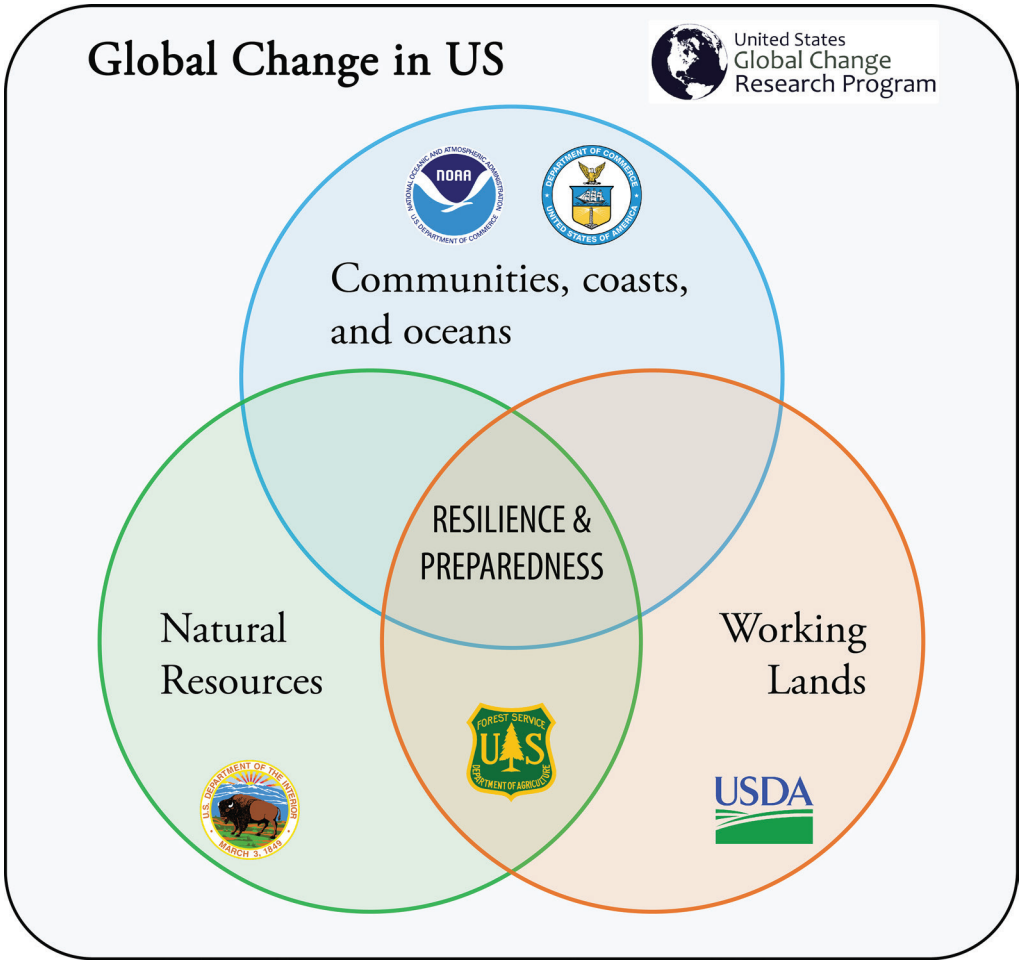


Figure 1. Conceptual overlap in cabinet-level agency responsibilities in federal response to global change in the US in accordance with the President's 2013 Climate Action Plan (White House 2013).

in a collaborative framework. In this report, we focus on the Caribbean Landscape Conservation Cooperative and describe the mission and structure of the cooperative framework, the intent to develop a shared conservation vision, and the challenges and opportunities facing the Cooperative in the future.

## History

On 14 September 2009, US Secretary of the Interior Ken Salazar initiated 8 USGS Climate Science Centers and 21 Landscape Conservation Cooperatives with a Secretarial Order[1]. The Landscape Conservation Cooperatives (LCCs) are applied conservation-science partnerships that provide scientific and technical support for conservation on a landscape scale. The LCCs are intended to inform management of land, sea, freshwater, wildlife, and cultural-heritage resources in response to climate change and other landscape-level challenges. A few LCCs had begun to organize prior to this Secretarial Order, but the Order gave the impetus to develop the national framework of the LCC network. Twenty-one LCCs had been established by 2010, and the Caribbean Landscape Conservation Cooperative (CLCC) was added in 2012 as the 22nd LCC. At a minimum, each of the LCCs has a coordinator, science coordinator, and a multi-partner steering committee. Many LCCs also employ a communications coordinator and technical staff. The LCC network includes an executive national leadership team, 22 LCC coordinators,

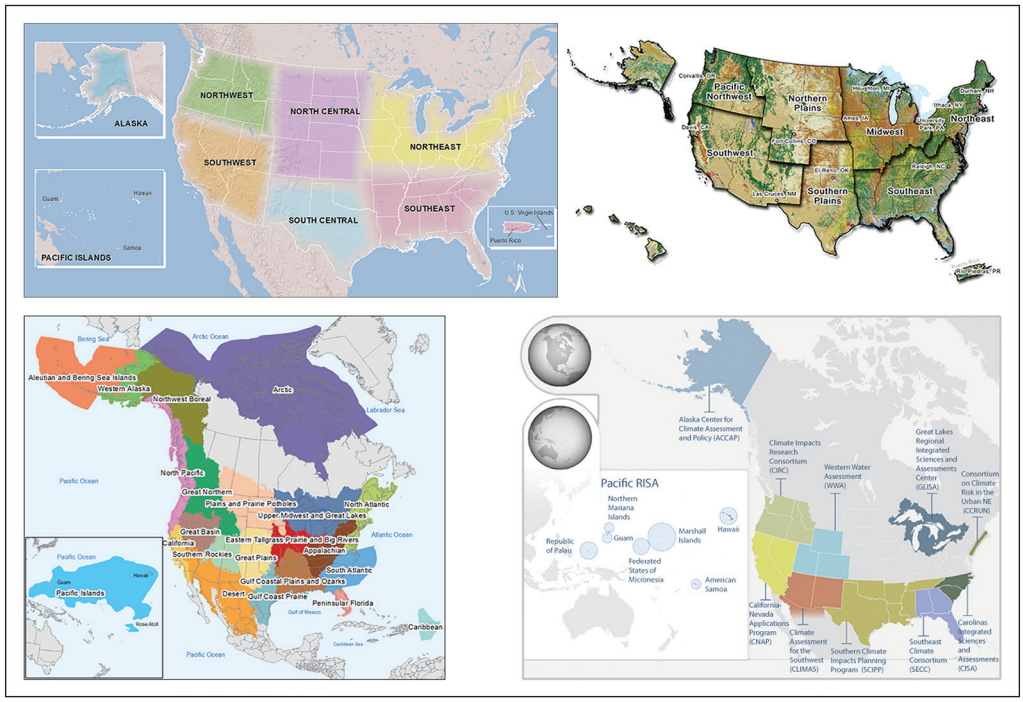


Figure 2. Regional networks established by various agencies to respond to climate change, clockwise from upper left: 8 USGS Climate-Science Centers, 7 USDA Regional Climate Hubs and 3 Sub Hubs, 11 NOAA Research Integrated Sciences and Assessments, and 22 Landscape Conservation Cooperatives (modified from agency websites).

22 science coordinators, and a communications-coordinator team. The network is also advised by the LCC Council with representation by partners from leaders of federal and state agencies, tribes, nongovernmental conservation organizations, and international representatives. The LCC Council has developed a national charter, national strategic plan, and strategic science-plan for the network.

The Caribbean LCC reflects the mission of the LCCs as a whole, and is an alliance of conservation partners with common conservation goals. The CLCC domain includes the terrestrial and marine components of Puerto Rico, the US Virgin Islands, and Navassa Island. The partnership recognizes the connectivity with the greater Caribbean and continental regions through shared species, habitats, and conservation opportunities and goals; therefore, an aspect of the CLCC mission is to work Caribbean-wide with partners as opportunities arise. The CLCC arose out of a meeting of federal and commonwealth partners in San Juan, PR in February 2010 to discuss whether there should be a Caribbean LCC and what it might look like. A subsequent meeting at the US Forest Service International Institute of Tropical Forestry in June 2010 led to the formation of an interim steering committee and the beginnings of the Caribbean Landscape Conservation Cooperative.

## Mission, Vision, and Structure of the CLCC

The mission of the CLCC is to develop and provide the best available conservation science and strategies to agencies, decision-makers, organizations, researchers, and the general public in order to conserve, restore, and sustain natural and cultural resources in the Caribbean. It will be a key resource in all stages, from planning and implementation to monitoring the environment, evaluating the effectiveness of conservation actions (i.e., embracing adaptive-management principles; e.g., Folke et al. 2005), and assessing alternative futures (e.g., Nelson et al. 2009) (Fig. 3). By encouraging the development of a shared vision of conservation objectives, the CLCC is to be a catalyst for collaboration and a primary source for science-based information to sustain natural and cultural resources in Caribbean land- and seascapes. Ten key components of that vision were articulated during stakeholder workshops, with partners sharing concepts of a holistic approach to land- and seascape conservation (Table 1).

The organizational structure of the CLCC includes a steering committee, a staff who work with science and stakeholder advisory-groups, and a partnership community (Fig. 4). The partnership community includes researchers, managers, and practitioners, all of whom work to define decision-making needs and put scientific knowledge into practice. The steering committee has regional representatives from 8 US federal agencies: The National Oceanic and Atmospheric Administration (NOAA), the US Environmental Protection Agency, the US Forest Service, the USGS, the US Fish and Wildlife Service, the US Army Corps of Engineers (USACE), the National Park Service, and the Natural Resource Conservation Service. It also includes representatives from Puerto Rico and US Virgin Islands government agencies involved in agriculture, natural-resource management, cultural preservation, and coastal-zone management, and from both

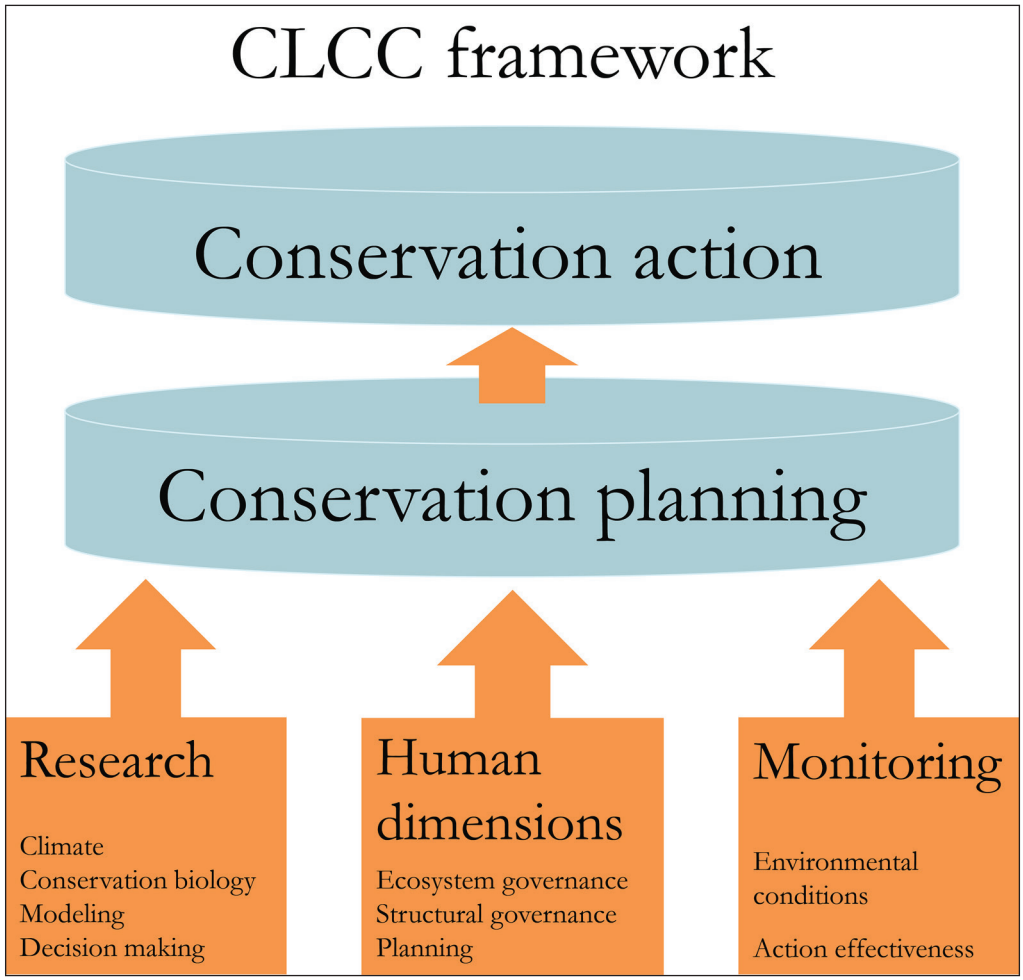


Figure 3. The CLCC platform of environmental and social–ecological science and monitoring for conservation planning and action.

Table 1. Ten components of an all-lands–all-hands approach to conservation derived from a stakeholder meeting at El Yunque National Forest and adopted by the CLCC steering committee in their charter (Gould et al. 2010).

A holistic approach to land and seascape conservation:

1. Is based on an understanding of the natural wealth of the land and sea
2. Applies to a wide range of spatial and temporal scales
3. Is a complex enterprise that addresses issues of life quality, sustainability and economic systems, and the health of the land
4. Encourages best-management practice for all situations
5. Does not tell people what to do, but what options are available
6. Requires open dialogue among all sectors of society
7. Requires information sharing among all sectors of society
8. Is rooted in the past and projects to the future
9. Is flexible, nimble, and adaptive to changing socio-ecological conditions
10. Leverages the talents, knowledge, and contributions of all people.

large-scale and place-based nongovernmental agencies. The staff and steering committee operate under the guidance of a charter they developed and approved in March 2013. They work in the context of a regional network of LCCs that are developing a Southeast Conservation Adaptation Strategy (SECAS 2014) within the national network. In addition to the charter, the CLCC has a science strategy and is developing business and communications strategies. These 3 plans form a set of publicly available, dynamic, and adaptive guides for the CLCC's work towards accomplishing its mission. No one component can succeed without effort and resources applied to the other two, leading to a strategy of balanced support for science, administration, and communication.

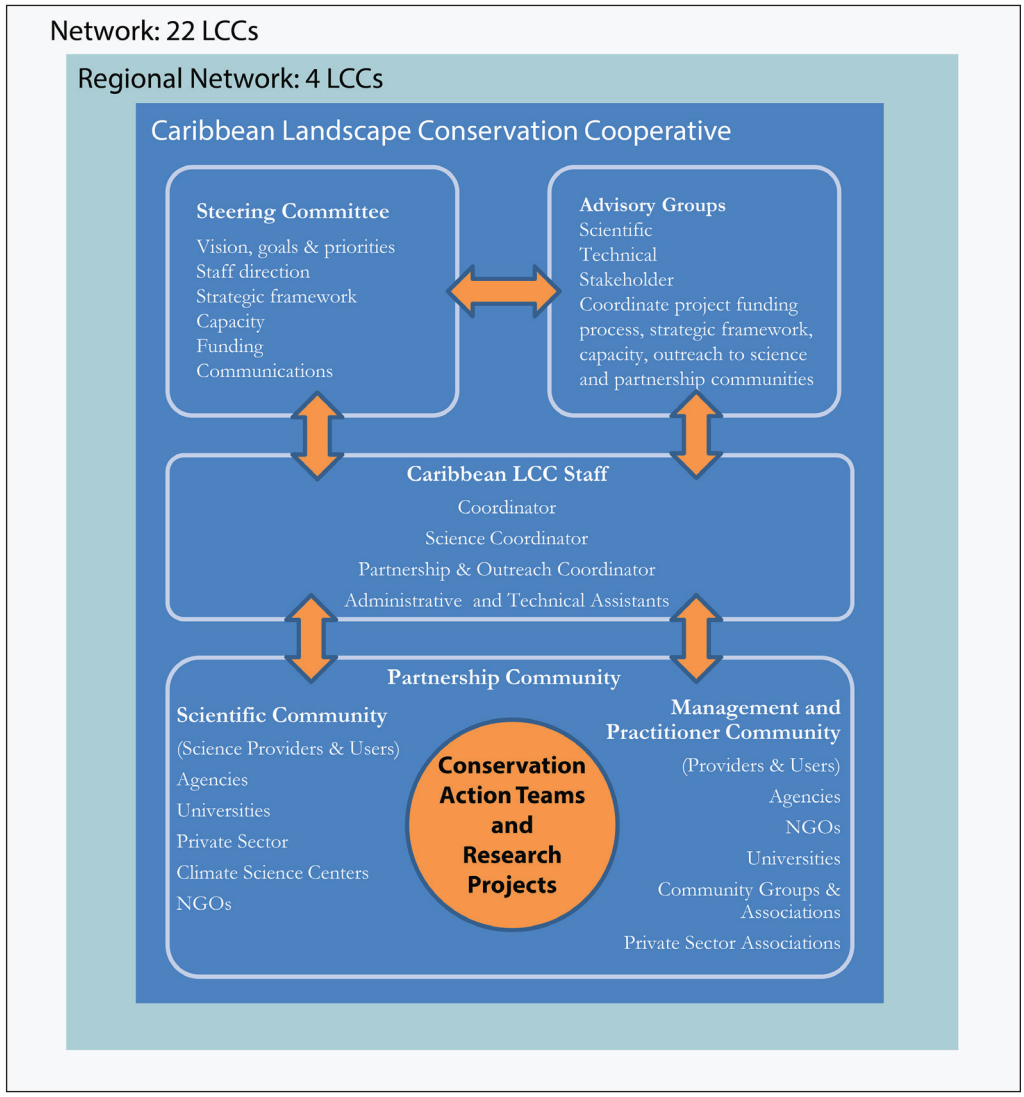


Figure 4. Conceptual map illustrating the organizational structure of the Caribbean Landscape Conservation Cooperative.

## Developing the Caribbean Landscape Conservation Cooperative Science Strategy

Developing a shared vision is time consuming and fraught with obstacles: Are time and resources committed? Are the right sectors included in planning? Are partners committed to concrete conservation actions? The CLCC has articulated a series of steps to guide their actions in the initial years of their work. These steps in collaborative visioning include:

- Articulating a common set of shared priorities.
- Identifying key resources: species, services, habitats, and ecological, social, and economic indicators, and developing spatially explicit representation of priority resources, drivers, vulnerabilities, and capacities in current and future scenarios.
- Developing targets for indicator resources and collaboratively linking spatially explicit action with conservation and adaptation strategies.

A first step was the development of the CLCC Science Strategy: Mission Alignment. This document is an analysis of 45 existing plans and strategies from partner organizations that includes input from the larger CLCC conservation community and a synthesis by a science advisory team. Over 430 identified priorities were distilled to a set of 62 priority objectives and these were further categorized under 5 core fundamental needs that the CLCC steering committee agreed were of the highest conservation importance and which they planned to address in the coming years (Table 2). The CLCC steering committee held a series of workshops to develop a clear hierarchy of objectives that cascade from the overall strategic objective of the cooperative: To conserve, restore, and sustain ecological and cultural resources and human well-being (Fig. 5; Murry et al. 2015).

A second step was identifying key resources and developing spatially explicit representation of resources, drivers, vulnerabilities, and capacities in current and future scenarios. Thus, an essential component of developing a shared vision is a

Table 2. Recognized fundamental needs shared by the CLCC community (Murry et al. 2015).

1. Enhance management, planning, and assessment for natural resource conservation, sustainable land-use and development, historic- and cultural-resource use and preservation, and climate adaptation for natural resources and human communities.
2. Support protected areas and protected-area networks to ensure connectivity, improved management, and to identify a suite of key species in priority ecosystems as indicators of natural and anthropogenic impacts and stressors such as climate change and land uses.
3. Develop and support monitoring and research programs to provide information on cultural and natural resources, ecosystem function, and the impacts of climate and non-climate-related stressors.
4. Increase public awareness about the relationship between people and natural and cultural resources with emphasis on their conservation and economic importance and their adaptation to climate change.
5. Make data, information, and best-conservation practices readily accessible and usable by managers and decision-makers.

common understanding of current land- and seascape characteristics, including the distribution of resources, the condition of populations and their habitats, the governance structure impacting them, assessments of threats and vulnerabilities, land uses, climate, ecosystem characteristics, and potential future scenarios. This pursuit is potentially overwhelming because it requires extensive data collection and synthesis. There is a clear need to (1) reduce complexity through the identification and use of shared-priority resources and (2) develop a platform to collate, visualize, and analyze spatially explicit information so that it is useful for assessing resource-specific scenarios in the context of the surrounding matrix of resources, conditions, and drivers.

CLCC partners envision the development of a library or warehouse of spatially explicit information that is based on the best available science, is adaptable and updatable, and used to answer management-driven questions. This warehouse will provide scientifically sound, well-documented data in a format that can be integrated with data from other sources to aid in the development and coordination of conservation plans. We call this the Conservation Atlas for Management Planning Options, or El Campo (Spanish for The Countryside). The content of the Atlas will be driven by specific management, planning, and decision-maker needs. The process of engaging information-users throughout decision making can highlight information gaps and have partners focus their efforts on delivering data to address specific priority issues. If the CLCC framework is successfully implemented, identification of society's values and management decisions will be inseparable from science development and delivery. A benefit to the investment in the CLCC

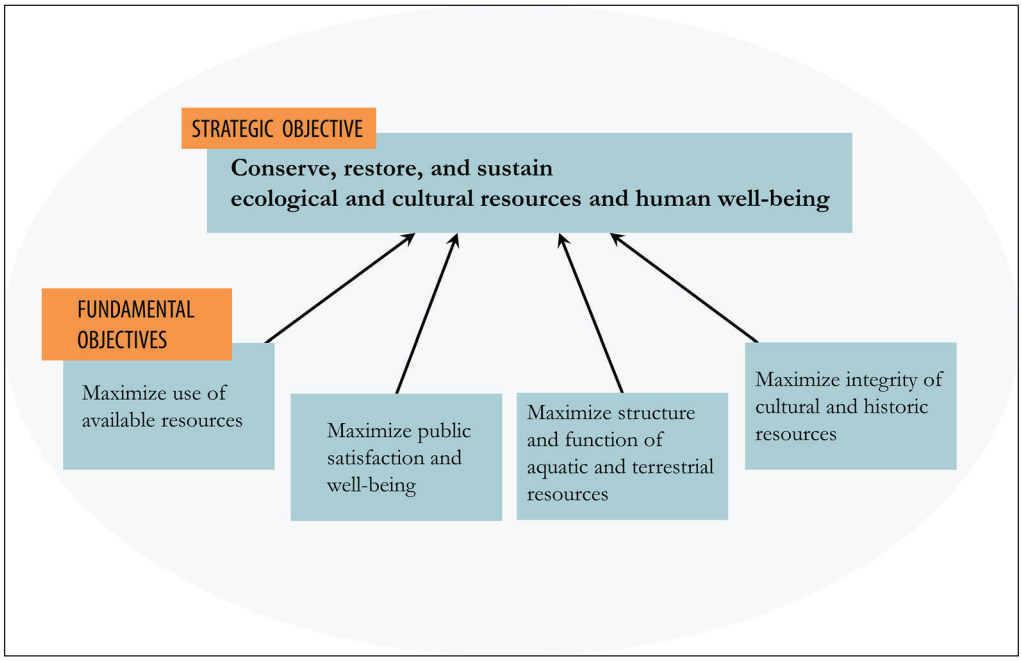


Figure 5. The fundamental and strategic objectives of the Caribbean Landscape Conservation Cooperative as currently envisioned (adapted from Murry et al. 2015).

framework is that the information is cumulative—there is an organizational memory, and information, processes, and learned collaborative skills can be re-used in adaptive decision-making as new priorities arise.

A third step in this collaborative process is getting to the details of priority resources. The CLCC will need to determine conservation targets; conservation and adaptation actions that will help partners to sustain particular species, resources, and services; and ways to monitor success. Partners will work together through Conservation Action Teams to develop and achieve shared objectives, which will enable them to address their individual priorities to a greater capacity than they could do on their own[2]. As projects are completed, the CLCC will build a catalog of success stories that can be disseminated through the local, regional, national, and international LCC network of partners. As the CLCC makes progress, it will develop increasingly sophisticated data and models, more experiential knowledge of what works, and gain a better understanding of conflicts and solutions to bridge the communication gaps among the scientific community, policy makers, general public, and managers. The collaborative network model has great potential for solving large-scale, complex problems in resource management that affect our food, air, water, culture, and quality of life at regional and larger scales.

## Direction Forward: Challenges and Opportunities

The emerging networks are new and members are in a process of learning as they go. Leaders need to effectively communicate the long-term benefits to partners and society in order to maintain support for programs until they are well established and provide useful results. The newness of the LCCs presents both challenges and opportunities for the Caribbean LCC, which are a consequence of the dual position of the CLCC as a component of a federally initiated program centered on US interests and as a group of Caribbean islands and peoples with much to offer and learn from neighboring people, governments, and cultures in the Caribbean.

### Challenges

The scientific challenges of understanding and projecting climate changes, modeling the cascade of impacts on resources and society, and collecting and analyzing increasingly large amounts of data are great but not insurmountable. Each day brings breakthroughs in scientific and technological capacity. A more difficult challenge is in human interactions and communication. It is impossible to develop a shared vision of the future and an agreed upon path to reach that future without clear communication across sectors, cultures, interests, educational levels, expertise, and languages. There are 2 profound challenges faced by the CLCC for bridging the gap between science and action: (1) communicating complex scientific data to decision makers and to the general public so that management implications are clear (Cook et al. 2013), and (2) working across boundaries (Guston 2001), e.g., within agencies; among federal agencies; between federal, state, commonwealth, and territorial agencies; between Puerto Rican and US Virgin Islanders; between

government employees and the general public; and between the US and the wider Caribbean. The challenge is primarily social (Pidgeon and Fischhoff 2011) and its solution will require sustained investment—not unlike the investments in technology and infrastructure that drive our economies.

### Opportunities

The opportunities for success are tremendous. In the same way that technological advances often build on one-another with exponential speed, the learning curve in managing collaborating organizations (Berkes 2009, Jacobs et al. 2016) should allow us to solve problems in conservation that have been intractable. By developing shared awareness, organizations can coordinate to minimize conflicting actions, maximize use of resources, and build a multisector foundation for conservation action capable of overcoming social and political roadblocks.

## Conclusions

The Caribbean Landscape Conservation Cooperative is a framework for collaborative conservation. While initiated by a federal agency, its true potential lies in working as a bridging organization —a tool to get things done in collaboration. The current LCCs, including the CLCC, are in their infancy; partners are still building, testing, and refining the approach. The impetus to continue investing in this process is that many of our resources are vulnerable to climate change and sea-level rise. Most of the world's population lives in low-lying coastal areas subject to flooding. Most of our food security relies on only a handful of crops and varieties adapted to specific growing conditions. Biodiversity, endemic species, and cultures are disappearing at alarming rates. Each of those concerns may be exacerbated by currently projected climate changes. The potential of the CLCC and companion networks is in harnessing the collective intelligence and capacity of people to solve problems and develop a better world in the face of human-created problems.

### Acknowledgments

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## Endnotes

[1]Section 3(c) of DOI Secretarial Order 3289: "Landscape Conservation Cooperatives. Given the broad impacts of climate change, management responses to such impacts must be coordinated on a landscape-level basis. For example, wildlife migration and related needs for new wildlife corridors, the spread of invasive species and wildfire risks, typically will extend beyond the borders of National Wildlife Refuges, BLM lands, or National Parks. Additionally, some bureau responsibilities (e.g., Fish and Wildlife Service migratory bird and threatened and endangered species responsibilities) extend nationally and globally. Because of the unprecedented scope of affected landscapes, Interior bureaus and agencies must work together, and with other federal, state, tribal and local governments, and private landowner partners, to develop landscape-level strategies for understanding and responding to climate change impacts. Interior bureaus and agencies, guided by the Climate Response Council, will work to stimulate the development of a network of collaborative "Landscape Conservation Cooperatives." These cooperatives, which already have been formed in some regions, will work interactively with the relevant DOI Regional Climate Change Response Center(s) and help coordinate adaptation efforts in the region."

[2]The framework of the CLCC has been designed so that collaborative conservation activity is conducted by "Conservation Action Teams". These originate from a wide variety of sources: Individuals, agencies, collaborations, or other organizations both within and outside the CLCC partners and stakeholders. Regardless of the origin, once initiated they are reviewed and approved by the CLCC steering committee to work towards well-articulated objectives that are aligned with the shared objectives of the Cooperative. The combination of research teams and conservation action teams form the human capital that addresses the goals and challenges of the CLCC.

As an example of the concept of the conservation action teams, the *Protected Areas Conservation Action Team* coalesced around ideas proposed from various stakeholders in Puerto Rico and the U.S. Virgin Islands, developed a proposal which was reviewed and approved by the CLCC steering committee, and was inaugurated with an opening meeting led by the Secretary of the Puerto Rico Department of Natural and Environmental Resources. The objective of the team is to provide information and guidance in support of establishment and management of comprehensive protected areas systems in Puerto Rico and the US Virgin Islands.

The team articulated short and long term goals, including in the short term (1 year):

- Building an open-access protected areas database for Puerto Rico and the U.S. Virgin Islands that is consistent with the IUCN classification system
- Determining what lands and marine extents are currently under protection and by what mechanisms.
- Developing a conservation strategy that standardizes the language used for discussing protected areas in the two jurisdictions, details the existing and potential mechanisms and tactics for protection (i.e., acquisition, easements, land use, donation), and working towards the goal of increasing the amount of protected areas or enhancing the current management of areas in the US Caribbean.

And in the long term (5+ years):

- Work with existing groups to provide information and guidance to support the process of considering institutional framework options for the establishment of a protected area system in the US Virgin Islands.
- Develop standardized methodology and review of co-management initiatives in the Caribbean.
- Facilitate collaboration regarding protected areas development in the two jurisdictions.
- Identify marine protected areas (MPAs) that could serve to improve reef resilience.
- Identify sites to be listed under regional and international multi-lateral environmental agreements.
- Collaborate in the development of a comprehensive database of terrestrial and marine protected areas in the Wider Caribbean Region.

The Protected Areas CAT has both a technical group and an advisory group. The technical team has met over 25 times in the first six months of its inception. Based solely on the investment of personnel and existing data of partners and agencies (no specific funding is allocated to the action team itself), the effort has led to an unprecedented collaboration and integration of information across agencies and organizations.