

Landscape Conservation Cooperatives: Working Beyond Boundaries to Tackle Large-Scale Conservation Challenges

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THE LARGE EXTENT, VOLATILITY, AND SPEED OF STRESSORS impacting our ability to conserve natural and cultural resources—climate change, habitat fragmentation, cultural and socioeconomic changes, land use change, rapid increases in invasive species, sea-level rise, and other stressors—have led to a growing consensus that conservation efforts need to work across boundaries at larger scales with multiple partners, consider longer time frames, understand and incorporate new kinds of science, and better incorporate uncertainty to be successful (McKinney, Scarlett, and Kemmis 2010; Halofsky, Peterson, and Marcinkowski 2015; Groves and Game 2016). Human activity, including climate change, has altered landscapes more substantially since the mid-20th century than at any time during history (NRC 2010). These changes threaten species and biodiversity; in fact, it is estimated 10–20% of known species are now threatened with extinction (Pimm et al. 2014).

Conservation has of course been accomplished across boundaries and at large scales. This is confirmed by a brief look at the Interagency Grizzly Bear Committee, working across five large ecosystems to restore grizzly bear populations and habitats (IGBC 2016); the Joint Ventures Program, working throughout North America at large scales to conserve and restore bird populations and habitats (NAWMP 2012); and America's Longleaf Pine Initiative, working to restore America's longleaf pine forests in the southeastern states (Figure 1; ALRI 2014).

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But each of these efforts, as large-scale and successful as they are, focuses on a single species or single resource. Working at large scales across jurisdictions to conserve a suite of resources—land, water, wildlife, and cultural resources—is a relatively new venture (McKinney et al. 2010). This is being driven by large-scale stressors and the recognition that our existing models of conservation are going to be increasingly powerless against the volatile, often unpredictable nature of the changes in our socioecological systems (National Park System Advisory Board 2012). Working together, partners can achieve conservation successes that cannot be accomplished alone. For example, federal land management agencies increase area, latitudinal range, elevational range, and connectivity—all important metrics that

conserve biodiversity and ameliorate loss from climate change—by partnering with even one other agency (Monahan and Theobald 2012). Conservation strategies that maintain biodiversity in human-modified landscapes outside of protected area borders, particularly those aiming to maintain or restore connectivity between remaining habitat patches, are now considered critical in the face of future landscape change.

Ecological connectivity has become a cornerstone of conservation science and practice. Since the introduction of wildlife corridors as a game management strategy in the early 20th century, habitat loss and fragmentation have widely been agreed to constitute the single greatest threat to biodiversity worldwide and climate change is expected to exacerbate these effects as species' ranges must shift across fragmented landscapes to track suitable conditions. Federal land management agencies are now mandated to consider connectivity, or working across boundaries in larger landscapes, and climate change in conservation plans such as US Forest Service forest plans (Code of Federal Regulations 2012), National Park Service (NPS) foundation documents (NPS 2012), Bureau of Land Management (BLM) land management plans, and US Fish and Wildlife Service (USFWS) refuge comprehensive conservation plans (Czech et al. 2014). A landscape conservation approach works across boundaries to answer the questions: (a) What do we want to conserve?; (b) Where are the best places to conserve this resource?; (c) What should we protect to ensure the resources are connected?; (d) Will our conservation strategy hold up into the future?; (e) Who should be involved in this conservation?; and (f) What science is needed to inform conservation? This approach has four major components: (1) convening stakeholders to articulate a vision, a set of goals, and targets; (2) conducting landscape assessments of current and future conditions; (3) determining a spatial conservation design; and (4) identifying strategies to implement the conservation design. These components are not necessarily linear (USFWS 2015).



Figure 1. Longleaf pine stand. Photo courtesy of Randy Browning, USFWS.

This conservation approach is growing rapidly around the globe in response to large-scale environmental change. From marine seascapes to terrestrial landscapes, ecological connectivity conservation is the preferred approach for sustaining the ecological processes that sustain nature and people. In North America alone, there are over 300 self-identified large-scale conservation efforts that embody ecological connectivity from the Canadian Boreal Forest to the Yellowstone to Yukon Conservation Initiative to New England's Wildlands and Woodlands effort. In other parts of the world, there are a similar number of large-scale connectivity efforts. The reality of large-scale conservation is that ecological connectivity conservation embodies multi-jurisdictional and multi-stakeholder collaboration, utilizes the best available science and local knowledge, and supports collaborative conservation practice.

Landscape Conservation Cooperatives: A forum for supporting landscape-scale, multi-jurisdictional conservation

Landscape Conservation Cooperatives (LCCs) are public-private partnerships involving states, tribes, federal agencies, nongovernmental organizations (NGOs), universities, international jurisdictions, and others working together to address landscape-scale conservation issues. The Department of the Interior created LCCs to provide a framework and capacity for facilitating landscape-scale conservation. Twenty-two LCCs cover the entire US and trans-boundary Canada and Mexico and the Pacific Islands and serve as bridging organizations to build conservation partnerships (DOI 2009; Jacobson and Robinson 2012). Although a self-directed steering committee guides each of the LCCs, they all (1) use applied science in collaboration with partners in a defined geographic area; (2) function as a fundamental management partnership that help frame decisions made at the unit level in a larger landscape partnership; and (3) working together, provide a national (and international) network of land, water, wildlife, and cultural resource managers, as well as interested public and private organizations, to respond to landscape-level stressors such as climate change and land use change (Austin 2011).

Each LCC provides illustrations of successful collaboration to strengthen conservation, including the Mississippi River Basin/Gulf Hypoxia Initiative, led by the Eastern Tallgrass Prairie & Big Rivers LCC; the California LCC's Central Valley Landscape Conservation Project; the North Atlantic LCC's Connect the Connecticut; and the Pacific Islands LCC's Setting the Path for Climate Adaptation in the Pacific Islands. Here we focus on two representative examples, one from the Great Northern LCC (GNLCC) and the other from the South Atlantic LCC (SALCC), to provide an in-depth view on the types of projects that LCCs support. Visit <https://lccnetwork.org> for more stories, projects, examples, or to learn how to get involved with the LCC in your area.

The Columbia Plateau conservation design strategy

The Columbia Plateau is one of eight socioecological areas identified as a cooperative partnership in the partner-rich GNLCC (Finn et al. 2015). The Columbia Plateau covers most of eastern Washington, with a large swath in Oregon and smaller areas in Idaho and British Columbia, Canada (Figure 2). It encompasses 20 million acres and includes nearly 500 miles



Figure 2. The Columbia Plateau ecoregion. From Miewald, Hall, and Steele 2013.

of the Columbia River, as well as the lower reaches of major tributaries such as the Snake and Yakima rivers and the associated drainage basins. The arid sagebrush steppe and grasslands of the region are surrounded by moister, predominantly forested, mountainous ecoregions on all sides. Where precipitation allows, the area has been extensively cultivated for wheat. Water from the Columbia River and tributaries is highly regulated and subject to diversion. Consequently, the Columbia Plateau is one of the most fragmented ecoregions in the GNLCC due to human development (Theobald et al. 2016), where no entity has the authority and resources to achieve landscape-scale conservation goals. In addition to fragmentation, existing habitats are currently threatened by invasive species, altered fire regimes, declining water tables, and other stressors (ALI 2014a). Climate change impacts are expected to further alter the long-term viability of the current distribution of habitats and species across the entire landscape (Theobald et al. 2016).

The GNLCC is a voluntary network of partners working to address common landscape conservation goals. Its business model is to create the conditions that enhance individual and collective partner implementation of landscape-level conservation. It tries to create efficiencies and reduce the challenges of working in complex ecological and jurisdictional systems through information-sharing, capacity-building, developing effective analyses and decision-support tools, and supporting collaborative networks. In the first year of operation, the GNLCC began to support collaborators developing a spatially explicit, science-based, landscape-scale conservation program in the Columbia Plateau that led to a conservation design strategy that (a) identifies conservation goals, conservation targets, landscape stressors,

and agreed-on methods for assessing current and projected future conditions; (b) includes a scientific baseline assessment of current and predicted future landscape patterns; (c) identifies priority areas and management actions (mitigation, acquisition, or restoration) to address conservation needs; and (d) develops a coordinated approach towards implementing the design to reduce biodiversity loss and ecosystem service vulnerabilities, maintain ecosystem resilience, and increase social–ecological systems’ sustainability for future generations.

Developing the Columbia Plateau strategy has been a sequenced, iterative process, supported by the work of multiple initiatives, led by a variety of partners who convened local stakeholders. In 2010, the GNLCC began to support the Washington Wildlife Habitat Connectivity Working Group (WHCWG) a science-based collaboration of land and resource management agencies, NGOs, universities, and Washington treaty tribes. This collaboration, initiated in 2007 and co-led by the Washington state departments of Fish and Wildlife and Transportation, was completing a broad-scale wildlife habitat connectivity baseline assessment across Washington state and adjacent landscapes in Idaho, Oregon, and British Columbia. In 2011, WHCWG refined the statewide methods to conduct a fine-scale connectivity baseline assessment for the Columbia Plateau ecoregion, including increased local participation, higher-resolution data sources, and assessment of features impossible to consider at the level of any single state. This analysis included focal species and ecological integrity-based approaches, and incorporated climate-smart connectivity methods in areas most likely to facilitate species movements in response to climate change. In 2012, this science analysis was published and made available to organizations implementing landscape conservation (WHCWG 2012).

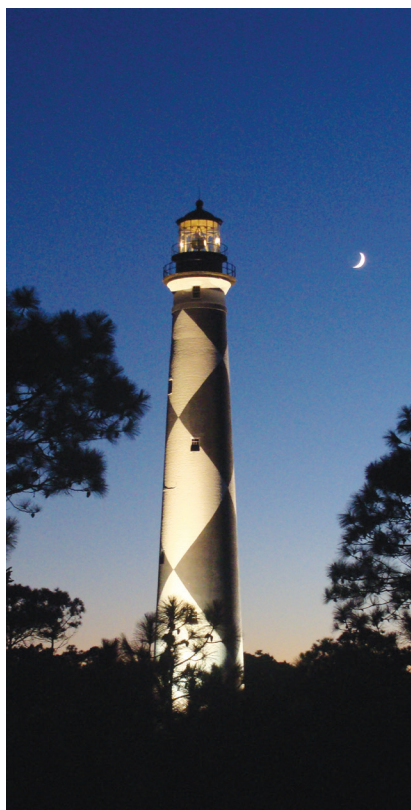
That same year, with GNLCC support and LCC network guidance, the USFWS Region 1 national wildlife refuge system (NWRs) and the Arid Lands Initiative (ALI), a private–public partnership initially convened in 2009 to address the challenges that landscape-scale conservation in Columbia Plateau must overcome (ALI 2014a), pooled resources to pilot a spatially explicit landscape conservation design for the Columbia Plateau ecoregion. They used the science foundation and tools created by the WHCWG and earlier ALI efforts, and added additional partners and analyses to develop a clear picture of landscape priorities, along with data and decision-support tools. Over the course of three years, the partnership produced a comprehensive Columbia Plateau landscape conservation design strategy that (a) identified a set of eight priority focal systems, and species and places, for further land protection planning to increase connectivity; (b) developed data infrastructure, decision-support tools, and a process for landscape-scale planning that can be shared with partners in the region; and (c) created a spatially explicit conservation database in coordination with other agencies, universities, and NGOs (ALI 2014a; ALI 2014b; Crawford and Rocchio 2014; USFWS 2015). GNLCC support in 2014 allowed the cooperative to integrate riverine/riparian landscape analyses into the strategy. This design, and the supporting documentation, is meant to inform on-the-ground partner action, not dictate specific decisions. Partner organizations must fit collaborative action into their own missions, priorities, resources, and planning processes.

With this strategy in hand, collaborators from federal agencies, state agencies, and NGOs, along with private lands biologists, are now beginning to implement complementary,

coordinated management actions. For example, the Mid-Columbia National Wildlife Refuge Complex is using the strategy to establish and maintain connectivity with neighboring habitats; Audubon Washington, in its Saving Important Bird Areas and Sagebrush Ecosystem Initiative; and BLM, in its draft Eastern Washington Resource Management Plan. In addition, new collaborators are being recruited to implement the strategy (e.g., the Yakima Nation and Colville Confederated Tribes, energy industry and county government representatives, and conservation entities active in north central Oregon).

The South Atlantic Conservation Blueprint

The South Atlantic LCC spans parts of six states, from southern Virginia to northern Florida, including US waters to 200 miles offshore. The region supports a complex mix of biological richness and human activity; since over 90% of the land is privately owned, balancing the two poses a challenge. The Piedmont harbors hardwood forests and amazing aquatic diversity, both threatened by rapid urban growth. In the Coastal Plain, agriculture and pine forestry thrive, and many military installations balance mission readiness with rare species habitat. Along the shore, ships unload freight in ports near historic lighthouses (Figure 3) and beach-nesting birds—all while sea level rises and storms intensify. Offshore, energy exploration is underway. Recreational and commercial fishermen harvest their catch while whales migrate up the coast.



Dramatic changes such as urbanization and climate change are sweeping the lands and waters of the South Atlantic. If growth trends continue, recent research predicts that Southeast urban areas will double in size by 2060, creating a megalopolis connecting Raleigh to Atlanta (Terando et al. 2014). Within the South Atlantic geographical area alone, roughly 2 million acres of coastline are predicted to transition due to sea-level rise by 2050 (SALCC 2015a). SALCC and the Conservation Blueprint emerged out of growing recognition that addressing such large-scale changes would require unprecedented partner coordination.

The staff of SALCC spent several years reaching out to people and organizations working on conservation within the geographical area. The conservation community converged on the need to improve cooperation so that the impact of partners' combined efforts would surpass what each could

Figure 3. Cape Lookout Lighthouse, Cape Lookout National Seashore, North Carolina. Photo courtesy of National Park Service.

achieve independently. To formalize its role as a forum for collective conservation action, SALCC hosted workshops to identify a shared mission, priorities, and goals. The resulting mission was to develop blueprint for sustaining natural and cultural resources for current and future generations. This blueprint is a living spatial plan that identifies conservation priorities across the region. As SALCC evolved, this mission grew to encompass facilitating conservation action guided by the blueprint.

The first step in creating the blueprint was identifying shared indicators of ecosystem health—shared metrics of success. These indicators allow SALCC to measure the condition of natural and cultural resources. SALCC currently supports about 30 different indicators, including those measuring the status of species, habitats, and abiotic factors. The natural resource indicators reflect ecological integrity, while the cultural resource indicators capture intact cultural landscapes. These metrics either correspond to a specific ecosystem, or are intended to capture the connections across terrestrial and aquatic systems. All the indicators can be modeled using existing data and accurately reflect other components of healthy ecosystems. Currently, more than 200 people from at least 50 organizations have participated in selecting, testing, and providing data for the ecosystem indicators. SALCC updates the indicators annually based on the results of rigorous validation, and to incorporate the best available spatial data.

The next step was to use the indicators to assess the current condition of the South Atlantic region. The *State of the South Atlantic 2015* report, released in April of that year, is a SALCC publication designed to help us all understand our living landscapes (Figure 4; SALCC 2015b). It measures and scores each of the ecosystem indicators in the style of a report card. This captures a snapshot in time that will serve as a baseline for future assessments, enabling us to track trends and monitor progress. In addition, the *State of the South Atlantic* highlights the region's conservation successes and challenges, describes all the South Atlantic ecosystems, and includes forecasts for the future.

The final step was to develop the Conservation Blueprint plan itself. Blueprint 2.0, released in June 2015, is a totally data-driven plan based on terrestrial, freshwater, marine, and cross-ecosystem indicators. It uses the current condition of the indicators to identify the areas of the South Atlantic most important for

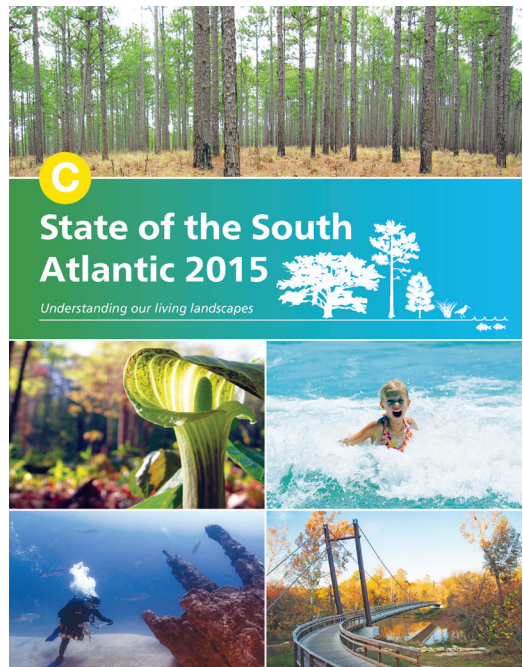


Figure 4. Cover of the *State of the South Atlantic 2015* report.

natural and cultural resources. Through a connectivity analysis, the blueprint also identifies corridors that link coastal and inland areas and span climate gradients. The blueprint reflects extensive feedback from the broader conservation community, with more than 400 people from over 100 different organizations actively participating in its development so far.

The blueprint has already been used in at least 20 different projects. For example, in June 2015, the blueprint, ecosystem indicators, and strong partner relationships in SALCC helped secure \$770,000 from the Department of Interior Wildland Fire Resilient Landscapes Program in the first year alone. The second year of funding brought the total to \$1.75 million in support of prescribed burning in longleaf pine focus areas within SALCC's geographical area. The ecosystem indicators also serve as shared measures of the project's success, demonstrating the impact of the burns on the integrity of the pine and prairie system.

In the summer and fall of 2015, staff from the Georgia and South Carolina departments of natural resources used Blueprint 2.0 to protect coastal and riparian habitat. In South Carolina, the blueprint was referenced in two successful proposals for funding from the National Coastal Wetlands Conservation Grant Program and Forest Legacy Program, which secured about \$2 million to conserve high-priority conservation lands on South Fenwick Island and alongside the Savannah River. In Georgia, Blueprint 2.0 helped win \$2 million in coastal wetlands grant funds to protect important habitat on the lower Altamaha River and St. Simons Island.

In September 2015, Conservation Blueprint 2.0 was also used to prioritize fish and wildlife habitat across the South Atlantic region for the National Fish and Wildlife Foundation (NFWF). Drawing on lessons learned in the wake of Hurricane Sandy, NFWF recognized the need to identify conservation priorities before the next disaster strikes. SALCC helped connect a coalition of partners who collaborated on a successful proposal, including the Cape Fear River Partnership, NatureServe, and the North Carolina Natural Heritage Program. The assessment anchored a local Cape Fear River watershed prioritization around North Caro-

Delivering a Landscape Approach to Conservation: The National Academy of Sciences Evaluation of Landscape Conservation Cooperatives

The Landscape Conservation Cooperatives (LCC) Network was established in 2009 to provide a framework and capacity for facilitating landscape-scale conservation. Federal agencies provide staff and funding that enable the LCCs to serve this function. In 2014, Congress mandated a National Academy of Sciences (NAS) report to evaluate the purpose, goals, scientific merit, and outcomes of the LCC Network; the resulting report was released in December 2015. The LCC Network is currently using the report to address the committee's recommendations and set a trajectory for improvement.

The committee defined the landscape approach as seeking to "provide tools and concepts for allocating and managing land to achieve social, economic, and environmental objectives in areas where agriculture, mining, and other productive land uses compete with environmental and biodiversity goals...." This approach is needed when landscapes are expected to provide for both conservation and nonconservation val-

ues and resources are affected by factors that cross land ownerships and jurisdictional boundaries. The committee concluded that the nation needs to take a landscape approach to conservation.

The committee found that the LCC Network's strategic plan includes the critical elements of the landscape approach—stakeholder engagement, adaptive management, and delivery of landscape-scale designs—and that the network's goals are consistent with the scientific literature. The report noted both the importance of developing scientific information and applying it to conservation actions, and that this can be facilitated by boundary-spanning organizations such as the LCC Network. The committee concluded that the concept of the LCC Network is correctly based on conservation science, and that in implementation, its structure and function is appropriately designed to address landscape-scale conservation challenges.

The committee compared the LCC Network to other landscape-scale programs and concluded that it is unique in that “no other federal program is designed to address landscape conservation needs at a national scale, for all natural and cultural resources, in a way that bridges research and management efforts.”

The report described the importance of establishing metrics and evaluating outcomes, and noted the challenges of doing so at the landscape scale. It recommended that the LCC Network better distinguish ends, means, and process objectives, and better account for partner contributions. The committee found that it is too early to expect the LCC Network to have generated measurable improvements in ecological health, given the newness of the program and the scale of the challenge. The report found that current LCC Network accomplishments align with the types of process outcomes—developing steering committees, collaborative governance, shared conservation objectives, extensive science developed and used to improve resource management decisions, and landscape conservation designs—expected during program inception.

The report noted that the LCC Network needs to catalyze conservation actions by those steering committee members that have management authorities in order to move from planning to conservation delivery. The landscape conservation design efforts of the Network provide processes and products for informing strategies and actions by conservation practitioners. The report acknowledged the importance of landscape conservation design efforts and provided recommendations for improving their utility for conservation decision-making at landscape scales.

Finally, the committee outlined important components to achieve long-term outcomes from the practice of large landscape conservation, including: a unifying theme or common vision, partnership development and stakeholder engagement, adaptive management, and a plan to move from vision to action. They also identified the important role of governmental agencies in serving a convening function to facilitate collaborations across organizations. The committee concluded that the LCC Network has the components and structure necessary to deliver on the national need for a landscape approach to conservation.

lina Natural Heritage data, and anchored the broader South Atlantic prioritization around Conservation Blueprint 2.0 and the Florida Critical Lands and Waters Identification Project.

SALCC intends the blueprint to eventually become a “gold standard” for guiding large landscape conservation. To learn more about the South Atlantic Conservation Blueprint, visit www.southatlanticlcc.org/blueprint/.

Advice from the field

Working across boundaries, with multiple partners that have mandated jurisdictions, at landscape-level geographic scales, and projecting trends of resources decades into the future can be difficult work indeed. Several common lessons cut across these partnerships in the Columbia Plateau and the South Atlantic, including:

1. Working together around a shared plan and measures of success can help bring in new funding for on-the-ground actions.
2. Participating in landscape partnerships can be particularly helpful if you’re new to the area. It’s a great way to meet other people near you with a shared interest in a healthy natural and cultural landscape.
3. Think about natural and cultural resources as the core of what makes a healthy ecosystem and community. Greater overlap of the natural and cultural resource management communities can lead to benefits for everyone.
4. You are the cooperative. The true power of a cooperative comes from the energy, experience, and ideas of everyone involved.
5. Don’t underestimate the challenge of data integration. Data collected and analyzed by different organizations are often difficult to combine, scale up to a larger collaborative, and to match across jurisdictional boundaries.
6. Partnerships take time: time to build a science foundation for collaboration; time to build trust; time to gather everyone together, hear their stories, find common goals, and plan for the future. And partnerships don’t move along in a linear fashion. Be willing and ready to circle back to engage partners that have not participated.

Conclusion

If the North American Wildlife Management Model (Organ et al. 2012) and ecosystem-based management (Grumbine 1994) were the models of 20th-century conservation, conservation at landscape scales across jurisdictional boundaries is becoming the conservation approach of the 21st century. By collaborating with partners through LCCs, federal land management agencies, state and provincial agencies, tribes, NGOs, and private landowners can enhance the overall health of the shared landscape, improve conservation potential, increase connectivity, improve links to communities and culture, and build a scientific foundation on which to establish adaptation actions. Serving as an active contributor to a larger conservation design means that federal land managers will be able to continue to preserve and protect resources for future generations.

Despite strong rationale and support for landscape approaches in the conservation literature, and mandates to work across boundaries at larger scales for federal land management

agencies, this new model is still in its infancy, and most conservation actions continue to be single-unit, single-place activities. If the potential for landscape conservation is to be fully realized, agencies and organizations must continue to push toward this model through policy and guidance, and individuals within organizations must be willing to spend at least a part of their time contributing to these collaborations.

The National Academy of Sciences was mandated to convene an *ad hoc* committee to examine the LCC program in 2014 (see text box, above). The committee concluded that the LCC network is unique among federal programs, designed to address landscape conservation needs at a national scale, for all natural and cultural resources, in a way that bridges science and management (NRC 2015). The report concludes:

The nation needs a landscape approach to conservation. Implementing landscape approaches in the United States is challenging because of the multitude of federal, state, local, and tribal jurisdictions, as well as numerous private landholders and stakeholders. The LCC Network initiated by the Department of the Interior aims to address this national need. Many other programs are also striving to address regional conservation challenges. However, only the LCC Network is designed to address this need at a national scale for all natural and cultural resources, and to bridge from research to management.

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