

Stepping up to the Challenge: A Concept Paper on Whole System Conservation^{1,2}

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In a nutshell:

What is our purpose? We intend to foster a broader dialogue in the Conservancy about the benefits and tradeoffs of the whole system approach.

Why focus on whole systems? The scope and magnitude of today's conservation challenges mean that we can no longer afford to limit our conservation practice to collection of sites.

What is a whole system? It has a recognizable unifying ecological feature and includes people. It must be large enough to maintain resilience, sustain key ecological processes and services, and allow for movement of organisms within and through it. It includes conservation areas with high ecological integrity surrounded by a matrix of lands and waters that vary in quality but are important for conservation.

What is whole system conservation? This approach considers the needs of people and an increased emphasis on managing the matrix of lands and waters surrounding portfolio sites. It also requires working at multiple scales, managing for connectivity and a permeable landscape, and tying policy solutions to place.

What's different? Our conservation strategies need to evolve beyond protecting a network of preserves to include strategies based on maintaining ecosystem function and services.

What is success? Success will require the design and execution of strategies to ensure that a whole system can self-maintain its key ecological functions and continue to provide ecological services over space and time. It will be measured by our ability both to build support and capacity with people and institutions to carry out this vision, and to demonstrate that the public sees the relationship between the economy, environment, and our overall welfare.

In its 60-year history, The Nature Conservancy (TNC) has continually worked to improve its methods and strategies to achieve its mission. We have expanded our conservation footprint from acres to bioserves to functional landscapes, and we should be proud of our conservation achievements. However, as the first decade of the 21st century comes to a close, the impacts of global climate change and the growing human footprint are upon us. We are challenged to respond to the large-scale disturbances associated with these impacts while recognizing the increasing importance of trying to maintain the ecological function of landscapes, seascapes, and watersheds. The Conservancy now has the organizational capacity (\$270 million annual operating budget and 2700 staff in the U.S. alone) to address complex problems such as altered river flow or fire regimes across large areas that have long represented barriers to mission success. Taken together, these factors compel us to step up to the conservation challenges we face today. In a growing number of places across North America, we are finding that these challenges are best confronted using a "whole system" approach.

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² The authors acknowledge that much of what we describe here is not new to conservation, and indeed has been in practice for years by our many partners, our international Conservancy colleagues, and in some cases domestically as well. Our intent is to build upon that foundation of work to promote further discussion about the whole system approach.

In the remainder of this concept paper, we outline the rationale for whole system conservation, define some of its characteristics, discuss the implications for the Conservancy's work, and suggest what success may look like. Our aim is to foster dialogue about the benefits and tradeoffs of the whole system approach, as well as the uncertainties around the science and strategies, and how we may align our work to meet the challenge. It should be noted that this document largely reflects experiences drawn from TNC staff based in the U.S. and is not meant to represent our international programs.

Why focus on whole systems?

Why are some TNC programs developing goals and organizing their work at larger scales? The short answer is that we can no longer afford to practice conservation within state lines or among a collection of sites. Whether it's the long distance dispersal of marine larvae, the massive restoration effort needed in response to the Gulf oil disaster, proposed energy development projects across large regions, or the need to redress the problem of ecological flows across entire river basins, the lessons are the same. The solutions to complex conservation problems are increasingly at scales that require the Conservancy to work collaboratively across our own programmatic borders and with key partner institutions. In many respects, we understood this over a decade ago when we transformed the way that we looked at the world – portfolios of conservation areas in ecoregions – and emerged as a leader in large-scale conservation planning. As the human footprint has grown in scope and magnitude, we now realize that achieving conservation in portfolios of priority areas is necessary but not sufficient. Our strategies must transcend portfolios. We need a greater emphasis on the surrounding matrix of lands and waters that vary in quality from mostly natural to working lands, and the large-scale process and functions that sustain biodiversity across these regions.

The scientific framework for whole system conservation is compelling, but there are equally important economic, social, and political dimensions to our work. The global economic collapse of 2008 and subsequent recession and belt-tightening in our own organization as well as within key state and federal agencies means that partner capacity has been reduced, traditional funding sources have been trimmed or eliminated altogether, and the basic infrastructure that kept conservation moving forward is being rethought. All sectors of society are being forced to consider how they can conduct their business in a sustainable fashion in this rapidly changing world. We know that the near future will be very different from our recent past. More than ever our work must be seamlessly melded with the workings of human institutions. Whether it's the Central Appalachians, the Colorado River, or the Great Lakes, the theaters in which the Conservancy and others are now operating are being determined not only by ecological boundaries and problems but also by the identity and culture of their human residents. Working in whole systems is not about abandoning past efforts and successes or moving away from species or ecological community conservation; it is about working towards a more resilient and long-term strategy for their conservation. We envision a future where the ecological stage takes precedence over the actors, and by better connecting people and nature, conservation becomes part and parcel of the larger societal transformation underway.

What is a whole system?

Whole systems encompass the geographical and ecological complexities inherent in the natural world. While there is no simple formula for defining a whole system, e.g., a whole system in one part of the world may look very different from one elsewhere, there are attributes that can be used to identify whole systems in any region.

A whole system will include the following attributes:

Terrestrial, freshwater, and/or marine habitats as well as their inherent interactions.

People as an integrated part of the whole system.

A recognizable, *unifying ecological or physical feature* such as the Great Lakes, the Colorado River Basin, the California Current, Gulf of Mexico, or the Appalachian Mountains.

Sufficient size to *sustain ecosystem services* that human communities rely on as well as *key ecological processes*, including disturbance regimes, water filtration and purification, nutrient cycling, complex food webs, hydrological flow regimes, and upwelling patterns in marine systems.

Allows for *movement and migration* of organisms through the system. This should include movement within as well as between terrestrial and aquatic components of the system.

Sufficient size to be resilient to significant disturbances. *Resilience*, or capacity to change while still maintaining the fundamental identity of the system, will ensure that conservation efforts are successful despite the inevitable changes that the coming decades will bring to these systems. It also means that some attributes of the whole system, such as species composition, will not remain static, but will change through time.

Conservation areas of high ecological integrity surrounded by a *matrix of lands and waters* that vary in quality but are critical for providing habitat, increasing effectiveness of protected areas, and contributing to connectivity.

Several attributes of whole systems are worth highlighting. The first is the inclusion of people. All of nature is influenced by humans. Acknowledging and incorporating the needs of people is fundamental for identifying strategies that will improve the long-term health of whole systems. Second, the size of a whole system is defined by its dominant ecological features and functions; therefore, a whole system could cover an extensive geographic area such as the Central Appalachians, or it could be more localized such as the Delaware Bay. However, correctly defining the outer boundary of a whole system is ultimately a distraction. It is more important to understand the system's unifying features and functions because those are the attributes we want to maintain through time. Finally, we emphasize ecological processes in our definition of whole systems, in part because most of TNC's work has historically focused on maintaining only one attribute of whole systems – species composition – when structure and function, or process, are also important. These three attributes are interrelated; however, species composition is heavily influenced by ecological processes, whereas ecological processes can often be maintained in the face of at least some altered composition. Accordingly, we propose that ecological processes be considered first among equals as attributes of whole systems that can result in a renewed focus on process or function in our conservation approach.

How do we implement whole system conservation?

Understanding the attributes of a whole system is most helpful when it pushes us to reconsider our conservation strategies. Below, we list a suite of considerations for designing whole system conservation projects.

Manage the matrix of lands and waters between conservation areas. The portfolio will continue to be important, but more attention should be given to management of the matrix of lands and waters surrounding areas of high ecological integrity so that the ecological processes that maintain biodiversity and provide ecosystem services are sustained.

Manage for landscape connectivity and permeability. Maintaining connectivity will require identifying key linkages where animal movement may be concentrated as well as the barriers that may prevent that movement. Permeability is a generalized measure of the degree of barriers within a whole system rather than the movement of a particular species within it. Accordingly, this measure indicates how conducive a landscape is overall to range shifts, plant dispersal, and the ability to sustain ecological processes. Strategies that target migratory corridors as well as the matrix of lands with varying degrees of human development will help maintain both connectivity and landscape permeability.

Include the role and needs of people. We cannot achieve the Conservancy's long-term conservation goals by continuing to focus on the most pristine locations and localized biodiversity hotspots. We must expand our approach to include human activities in working landscapes. This includes sustainable harvest strategies, sustainable forestry certification, improved agricultural practices, and so on. We should also focus on those whole systems that resonate with people, capture their imaginations, and inspire action. Increasingly, effective conservation requires that people within and around the system become engaged in strategies to sustain its long term health.

Work at multiple scales. A whole system is comprised of ecological processes and species that occur and interact at multiple scales. Accordingly, conservation strategies designed without consideration of local to whole system scales will be insufficient to maintain the whole system through time.

Tie policy solutions to places. Recognizable systems provide a visible opportunity for demonstrating the importance of good public policy and legislation to accomplish conservation goals. By linking our national policy work to places of national importance we are better able to show the importance of conservation for people and nature.

What is success?

In the end, our conservation success will be judged on the persistence of populations and ecosystem processes, rather than the short-term symbolic collection of species in a few small areas- Salomon et al. 2006³

The Conservancy has invested millions of dollars to complete ecoregional assessments for much of the North America Region, generating “the portfolio,” a vision of the places where conservation action is needed to achieve our biodiversity goals. We are in no way suggesting that a whole system approach to our work replaces or makes that work irrelevant. In fact, ecoregions can be thought of as the Conservancy’s first step towards whole system conservation. Rather, we are suggesting that the current portfolio needs to evolve and expand from an emphasis on place alone to include ecosystem function and dynamics while continuing to preserve the knowledge of important rare species and communities. A rapidly changing climate is causing shifts in individual species distributions, changes in community composition, and alterations in wide-scale processes. The challenge is to build on our ecoregional portfolio foundation and develop a conservation plan that anticipates and allows for dynamics, sustains important functions and processes, and maintains biodiversity in current and future forms. By incorporating whole system conservation features into the existing portfolio, we will have an updated and more durable vision of success (Figure 1).

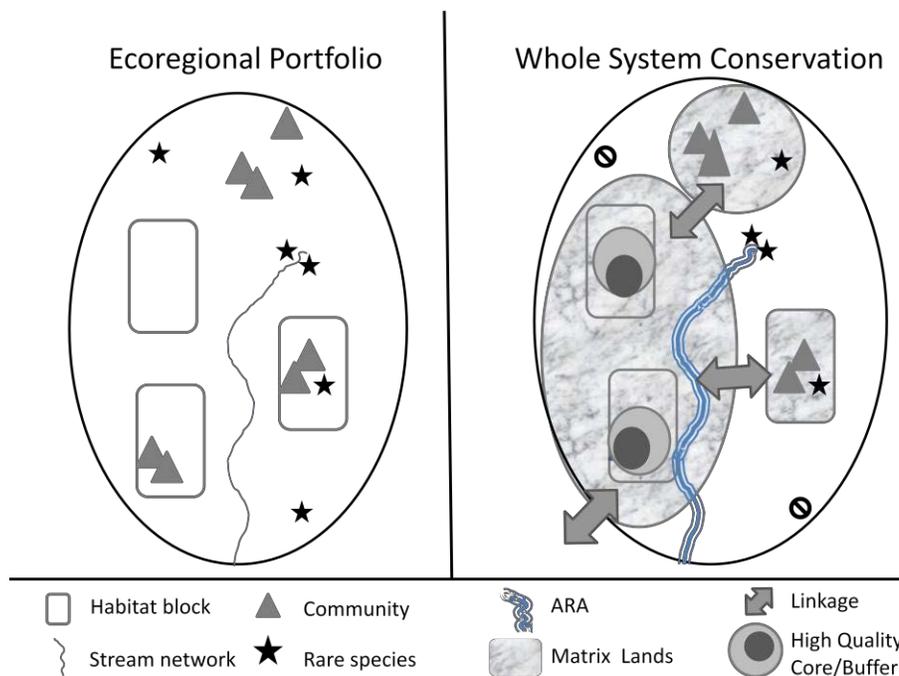


Figure 1. Illustration of how the application of whole system principles changes the traditional ecoregional portfolio. The whole system conservation vision incorporates active river areas (ARA), key linkages, conservation areas with high ecological integrity placed in blocks of habitat and surrounded by matrix lands and waters of varying quality. Small areas that are not resilient are removed (shown by X).

³ Salomon, A.K., J. L. Ruesink, R. E. DeWreede. 2006. Population viability, ecological processes and biodiversity: valuing sites for reserve selection. *Biological Conservation* 128:79-92.

We will describe success for a whole system by using time-tested methods; that is, we will develop measurable objectives that will depend on the unique features of the system. We must clearly articulate where our conservation efforts are taking place and what we intend to accomplish. While the notion of measuring ecological processes may sound novel, nearly all of TNC's whole system conservation projects are actively working on these process-oriented measurable objectives. There is also an established and growing body of work outside of TNC focused on measuring ecological integrity – the composition, structure, and ecological processes of whole systems. Finally, although we can only speak in generalities regarding success, we offer the following guidelines:

Success will require the design and execution of strategies across landscapes to ensure that a whole system can self-maintain its key ecological functions, and continue to provide ecological services over space and time.

Success will require making strategic investments to mitigate threats interrupting the most critical ecological processes and use those investments at the right places and at the right times.

Success will require working with a variety of partners toward greater understanding of our collective work, e.g., how our actions fit together and add up to whole system conservation.

Success will be measured by our ability to build support and capacity from people and institutions to carry out this vision, and to have the public see the relationship between the economy, environment, and our overall welfare.

In conclusion, whole systems are complex, characterized by species and ecological processes interacting at multiple scales. These ecological attributes are coupled with social ones, or the uses and needs of people living and working in the matrix lands and waters surrounding conservation areas. We should not abandon our legacy of great work in priority conservation areas. Instead, we should build upon that success to create a conservation vision that incorporates the needs of people, anticipates and allows for dynamics, that sustains important ecological functions, and that maintains biodiversity in current and future forms. Framing our conservation work around whole systems is one way to achieve this enduring vision of conservation success.