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Editor's Note

“Design” is an interesting word in the context of conservation. It conjures images of detailed instruction, a blueprint or a set of engineering specifications. But that confuses design with planning.

Conservation abounds in plans — schemes, programs, methods for the accomplishment of an objective. Planning is about realization, organization, and execution. Design, on the other hand, is about imagination and interpretation.

Design is the spark of an idea, a starting point for the formation of something that can be executed. In that sense design is closely tied to the ideas of innovation and novelty. Here the application of design to conservation becomes interesting. Conservation tools and tactics can certainly be novel and innovative — two decades ago the application of GIS to conservation was in its infancy and drones were largely limited to science fiction — but the fundamental goal is not to create something new. “[Novel ecosystems](#)” are now

the source of impassioned debate, but they were unheard of at the time the first edition of *Conservation by Design* appeared.

As the articles in this issue by Sally Palmer and Jonathan Higgins make clear, the imaginative spark behind *Conservation by Design* lies not in the formulation of brand new ways of living — though they may be implied — but rather in the creative process of science. The continual formulation and reformulation of hypotheses in the face of new evidence is among the most compelling of human designs, and in fact may be one of the things that define the human condition. The application of that rigor to conservation marked a watershed moment for the field in 1995, and that latest iteration reflects the continuing evolution and sophistication of conservation science.

A key part of that evolution, particularly in the last ten years, has been bringing into the conservation mainstream another meaning of the word design, one that traces its roots to 1969 and Ian McHarg’s classic, *Design with*

Nature. McHarg, drawing heavily on Frederick Law Olmsted, brought together architecture, geology, ethnography, anthropology, geochemistry, hydrology, and ecology to train what McHarg called “applied human ecologists.” *Design with Nature* remains a landmark in the evolution of how to reintegrate humanity into the natural landscape.

McHarg transformed landscape architecture from a narrow, technical specialty into a broad-based view of how people can fit into the places they live without destroying them. *Conservation by Design*, with its ambitious vision of delivering a brighter future for both people and biodiversity, may reasonably aspire to a similarly transformative impact on science and society.

As ever, your comments and contributions are most welcome.[SC](#)
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The Mission(s) of *Science Chronicles*:

1. To bring you the latest and best thinking and debates in conservation and conservation science;
2. To keep you up to date on Conservancy science — announcements, publications, issues, arguments;
3. To have a bit of fun doing #1 and #2.

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Article

Evolving our Science-based Identity for a new era of Conservation by Design

By [Sally Palmer](#), director of science, Tennessee Chapter, The Nature Conservancy



Caney Fork River in Rock Island State Park, Tennessee. Credit: Arthur T. LaBar via Flickr and Creative Commons

Individual thinkers since the days of Ezekiel and Isaiah have asserted that the despoliation of land is not only inexpedient but wrong. Society, however, has not yet affirmed their belief.

Aldo Leopold, *A Sand County Almanac*

For the last year or so I have had the privilege of serving on the Conservancy's task force working to update our conservation approach, as articulated in the [20th Anniversary Edition of Conservation by Design \(CbD\)](#). The opportunity to work on a team grappling with fundamental questions associated with not just how – but why – the Conservancy implements its mission has been simultaneously invigorating and humbling.

Since the original adoption of Conservation by Design, a majority of the Conservancy's science and planning expertise has been directed towards defining what nature to conserve and where. Answering "how" to conserve nature and "how do we know we've succeeded" have also been the realm of scientists to some extent through conservation action planning and conservation business planning efforts.

The new vision of CbD compels us to design and implement our conservation work with the intent to fuel meaningful societal changes, delivering better future outcomes for biodiversity and people across the globe.

The new vision of CbD compels us to design and implement our conservation work with the intent to fuel meaningful societal changes, delivering better future outcomes for biodiversity and people across the globe. Our vision and our updated conservation approach are a call to action for Conservancy scientists to be embedded in the “how” of our conservation work more than ever before, evolving the meaning of our identity as a “science-based” organization.

Through the application of new analytical advances, we can improve the Conservancy’s ability to ask new questions and help guide our work. Through our leadership, we can support one another and foster innovation and collaboration across the organization.

Asking new questions

Conservancy scientists have never simply gathered information related to project design and implementation, but have worked to ensure our projects are asking the right questions to guide investments and create meaningful change. The three key analytical advances in CbD – situation analyses, strategy mapping, and evidence-based assessments -- are all critical to improve how we ask questions from the start and to refine our work as we go.

Several conservation programs have employed these advances in recent years, particularly while developing conservation business plans. The new edition of CbD emphasizes their use across the full range of the Conservancy’s work and describes the benefits of their consistent application. Using these advances will help us improve our understanding of connections between people and nature within systems, synchronize our work on strategies and places, and increase the use of best available knowledge. Some examples of new questions each approach may facilitate are as follows.

Conducting situation analyses:

- Have we fully considered all the social and economic drivers associated with the behaviors of different actors in the system?
- Are there opportunities to create systemic change that will benefit nature and people?
- What outcomes are we driving towards, and are they achievable given the situation?

Mapping strategies:

- Can a proposed strategy touch down on the ground in a way that achieves our conservation goals?
- What are the best places to implement each strategy?

- Are we thinking as broadly as we can about different strategy alternatives which could maximize our impact?
- What types of strategies might be best for achieving a similar outcome in a different place?

Applying evidence:

- What evidence do we have to support the connections we are making in our situation analysis and our strategy results chains?
- How can we invest project monitoring resources to help minimize risk and improve our ability to document the outcomes of our strategies?
- How can we build the evidence base for our strategies in a way that encourages their widespread adoption?

Our science-based decision making should be adaptable and help us in our action – making the leaps of faith we sometimes must take perhaps somewhat less wide or daunting.

The most exciting analytical advance to me as a scientist is the emphasis on consistently utilizing and improving our evidence base as the core of adaptive management. I have always felt that every strategy could be treated as a working hypothesis to be supported (or not!) as we implement our work. I find that notion to be a good frame of reference to sort through how we can do a better job of documenting the evidence supporting our strategies and articulating where we need to pay closer attention through monitoring or research.

I don't believe the application of evidence must be burdensome. Actually, on the contrary – consistently engaging with and improving the evidence allows us to select our most promising strategies, design them more effectively, and track their implementation. Improving the evidence base for conservation is also essential to leveraging our work with partners.

Obviously, we never have perfect knowledge of a situation, and changing circumstances are a constant of our work. A goal of improving our use of analytical approaches and evidence does not override the need to be flexible and prepared to act on opportunities as they present themselves. Rather, our science-based decision making should be adaptable and help us in our action – making the leaps of faith we sometimes must take perhaps somewhat less wide or daunting.

Adapting and innovating

As with previous iterations of CbD, the Conservancy is now creating guidance materials designed to assist the adoption of the conservation approach and its key analytical advances within our organization and, hopefully, our partners over time. The new CbD implementation guidance will be developed by December, 2015, with a selection of early adopter projects testing the guidance beginning in February, 2016.

Like any organizational change, the adoption process will take time, we will learn as we go, and the diversity of our program sizes and capacities will add to the complexity. I believe our history shows us that CbD provides a framework that encourages and supports innovation, and that our organizational diversity is a strength. We have a broad platform to test what works and doesn't work in many different situations and to learn from one another's successes and failures.

Coming from a relatively small operating unit, I often have anxieties about how we will implement any best practice, much less adopt new ones. My science program consists of an army of two: myself and one GIS specialist. But that is one more GIS specialist and one more scientist than many operating units!

As the CbD guidance development process gets underway and I think about how my science program needs to evolve, I try to focus on areas where we are already making progress and where we can build successful incremental change.

Some examples:

- We are mapping biodiversity and major problems at a statewide scale and encouraging our partners to do the same in joint planning efforts.
- We are asking how a strategy applied at a particular place can influence change at more places via partners or policies and mapping the potential impact of the strategy.
- We are identifying a variety of actors and motivations in new situation analyses for our conservation projects.

With our conservation approach in general, thinking about the major challenges facing our statewide biodiversity portfolio as the entry point to strategy development already has been critical for moving our work to greater scales of impact.

For example, in our freshwater work we know that public drinking water withdrawals placed in small and medium-sized rivers can cause ecological stress at lower stream flows, particularly when public wastewater systems are present and depend on having river water available for mixing their discharges so they don't cause pollution.

We also know that the funding and regulatory processes for each water utility in Tennessee are conducted on an individual basis, even those activities happening in the same watersheds. Technical assessments of the cumulative impacts withdrawals and discharges have on a river's water quality are conducted to a certain extent, but planning for the withdrawals and discharges is not done on a collective basis.

When Tennessee experienced a historic drought, the vulnerabilities of several different rivers and water utility systems were brought into sharp relief. Working with our partners – including the Tennessee Department of Environment and Conservation, U.S. Army Corps, U.S. Geological Survey, and the Tennessee Association of Utility

With our conservation approach in general, thinking about the major challenges facing our statewide biodiversity portfolio as the entry point to strategy development already has been critical for moving our work to greater scales of impact.

Districts - we helped launch an effort to develop a new collaborative approach to [regional water resource planning in Tennessee](#).

The two pilot projects chosen by the team for this effort were not high priority freshwater biodiversity sites for the Conservancy; however, these projects gave us the opportunity to work through some of the major regulatory, legal, financial, and technical problems communities face when developing and managing their water supplies.

The outputs of this work include new regional water planning guidance for utilities and an approval process for regional plans that can be applied in any particular water supply planning context. Our emphasis on a water management challenge as the entry point of our conservation approach, and focusing on creating systemic change, even without immediate direct benefits to high priority biodiversity sites, has resulted in outcomes that set the stage for future planning and management improvements for rivers across our entire state.

Moving ahead - leading and collaborating

In addition to focusing on incremental successes, in the midst of change I also gain perspective by reflecting on the progress that has been made by the Conservancy and our partners since the launch of Conservation by Design two decades ago. The influence of ecoregional assessments and conservation action planning and standards on global conservation efforts today cannot be overstated.

In my own sphere of work, I see the effects those analytical approaches have made across public and private sector conservation actors at state and national levels. I know that those approaches, and the methods used to implement them, were developed by the Conservancy and a myriad of partners over time, in a wide variety of operational contexts, and with many successes and failures along the way.

Engagement of conservation scientists and field practitioners always has been, and will continue to be, essential to the evolution of our work and any progress we achieve as an organization. Intentional shared learning through formal and informal networks must support our collective efforts, and we must encourage one another to ask the right questions. The necessity of evolving approaches to achieve our mission presents its own urgency at our doorsteps.

Forward progress will require engagement with different types of scientific, cultural and political knowledge to design and implement our strategies, and this can push the comfort zones of ecologists and biologists. To assist with transformational change, Conservancy scientists need to consider how we transform ourselves as leaders, resource connectors, and communicators. Conservation by Design remains our framework, and pursuing our mission into the future demands that we evolve what it means to be “science-based” across all aspects of our conservation work in new and exciting ways. **SC**

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Straight No Chaser Déjà Vu All Over Again

By [Jonathan Higgins](#), The Nature Conservancy



Credit: Flickr user [Jan Sane](#) via Creative Commons

I was hired by TNC 20 years ago to incorporate freshwater into our conservation planning and strategy development. Even though I may be perceived by a few as something of an organizational dinosaur I was recently brought in to participate in the Cbd refresh process as a freshwater representative and as someone who has a variety of different and new perspectives on planning and strategy development.

I was skeptical, afraid it was to be like the old Yogi Berra saying about it being like *déjà vu* all over again. I was late to my first meeting because of a snow storm in Chicago. I walked into the room while the others were discussing a topic, and poured a coffee, not yet tuned into the conversation because I thought it was going to be the same old questions, same old answers, different crowd. I was pleasantly surprised. They were talking about whether programs should develop ecoregional assessments if they had not been done yet. They asked me what I thought while I was taking my coat off. Some would think I would say yes because I had spent more than a decade working on ecoregional assessments, but I said no, it depends on what conservation planning and strategy design issue they are addressing. I guess I had left the ice age.

Those who have worked with me know I hate process. But this meeting was one of the better ones I had been to in a long time. It was an open, thought provoking, mindful series of discussions. Smart people with different expertise, experiences, and perspectives got to the same place through clarifying the additional questions and issues that need to be addressed through CbD refresh, listening to each other, and having a dialogue that got somewhere other than a 10-page list of parking lot issues.

The refresh process is not suggesting we start our planning and strategy development work all over again, or redoing everything we have done. It provides some valuable and needed components that should be added to any effort. One of the biggest things coming out of the CbD refresh is using empirical evidence, or evidence-based approaches to conservation, to validate and/or inform steps for strategies while designing and implementing them. This aspect of the CbD refresh will transform our organization from one that is faith-based to fact-based and “science-based” as we advertise ourselves. I personally cannot wait for this to happen.

The refresh process is not suggesting we start our planning and strategy development work all over again, or redoing everything we have done. It provides some valuable and needed components that should be added to any effort.

This effort will also lessen the burden of measures at every step while implementing a strategy — we do not need to re-create proof where we have good supporting evidence already (which we commonly do through re-creating the wheel), but we need to indicate that such evidence exists. This will prod many programs to better identify and evaluate sources of existing information, and strengthen their work. This approach in no way stifles new ideas that are not tested, it provides a framework to identify steps that have weak or no evidence, and guides information collection to evaluate such steps as one applies a strategy. This will illustrate the effectiveness of strategies, and offer knowledge for others to use so they do not need to measure the same things in the future. I expect this effort to enhance our funding efforts, since donors are asking for solid foundations of our strategies, and evidence that they work. It will also help us describe the results of our work — the impacts — because right now we predominantly measure our activities, even though we often lack the empirical connections of our strategies to the impacts we seek.

Another issue raised is the need to do a situation analysis before defining strategies and outcomes, and, as many of us believe, goals as well. This is critical sequence that has not been done in most instances. It is not just identifying the source of threats and then going to the step of defining a set of strategies. Situation analyses will help clarify whether a given strategy should be used, and if so, what the potential impact that strategy could make. For instance, if a source watershed for a city has nutrient pollution issues, we might consider implementing a Water Fund. But, imagine if the major source of that nutrient pollution is untreated urban sewage rather than land use or management. Water Funds address land protection and management, not sewage treatment. Why would we work in such a situation and address agricultural runoff if it

was only a small percentage of the problem? And, in places where we are considering implementing a water fund, we should know what the current water quality issues and levels are, and to what extent water funds could address them. No reason to implement a strategy if it is not going to have a significant impact.

Strategies for much of our work beyond individual places generally require policy efforts. Policies and the approaches for implementing them should be mapped so we can evaluate their impacts and cost/benefits. Our work with corporations also could be informed by mapping the corporation's footprint, and overlaying it with biodiversity, social, and conservation priority information. We can look at an integrated set of data and define what the potential leveraged opportunity would be working through a given corporation on a specific issue, and what the global impact to people and nature could be. Right now, we work with those that give us money, and are "big." Those are not bad reasons, but we still have not defined explicitly what the potential impact on people and nature might be through working with them.

These are just two of the important foci of the CbD refresh. I find them refreshing myself. Some in TNC have pushed against making planning more rigorous, either because some say they cannot take the time to have their teams complete such analyses, or they have just been against anything that they see as being complicated, even if it is not. Talk about dinosaurs.

What is most disappointing about such responses has been the result — we are dedicating time and effort as an organization to raise dollars for certain strategies that cannot seem to take the time to do analyses and summarize information to adequately support them in the face of scrutiny. Even if they are well thought out, some strategies have not been organized and presented in ways that make them cogent. How is this possible in this age of financial challenges and the rigor being asked of by our donors? The guidance is not suggesting re-doing what we have already done, it provides a few steps that would strengthen our approach. Some teams are not being taken to task for thinking through their strategies or the leveraged opportunities that exist, the realistic levels of funding that are needed to make them come to fruition, or the actual potential scope of impact of their work.

The Global Freshwater Team is going through many of the new steps of the CbD refresh, and it is making our strategies and our pitch to executive leadership and donors much more refined, providing clarity on the current situation, where TNC fits into the solutions, leveraged opportunities, impacts that TNC can achieve through working with others, and costs that are more realistic.

Our work with corporations also could be informed by mapping the corporation's footprint, and overlaying it with biodiversity, social, and conservation priority information.

The CbD refresh provides an opportunity for TNC to once again be the leader in sound conservation and strategy assessment. The new rigor being suggested is not onerous. It is pretty straight forward and should be simple. This is not just a set of additional processes to go through and check off the boxes, but an approach to strengthen our choices for where and how to conduct conservation and have greater impact through more informed actions. The big question that remains is how the CbD refresh will be implemented. That is out of my hands, but it is an issue that our executive leadership needs to address. Things do not happen most effectively through top-down mandates, but through leadership, support, and evidence that the effort is worth it.

As Yogi Berra once said: "You've got to be very careful if you don't know where you are going, because you might not get there." **SC**

Article

Partnership with the North American Orchid Conservation Center

By [Louisa Phillips](#), legacy club donor relations manager, The Nature Conservancy

The eastern prairie fringed orchid (*Platanthera leucophaea*), Fair Meadows State Natural Area, Wisconsin. (Credit: [Joshua Mayer](#) via Flickr and Creative Commons.



The Nature Conservancy has joined a coalition of public and private organizations throughout the U.S. and Canada, known as North American Orchid Conservation Center (NAOCC), in a broad-based effort to catalog and preserve orchids. NAOCC was established by the Smithsonian Institution and the United States Botanic Garden as the first nationwide collaborative effort to seek ways to conserve the orchids of North America. The initial group of public and private organizations joined forces with a common goal: to ensure the survival of native orchids for future generations.

The ecology of orchids is complex. Specialized habitats, pollinators, and fungi play a critical role in an orchid's life cycle. This complexity is why orchids can be a key indicator of overall health of the environment — and why they are so vulnerable when this cycle is disrupted. North America contains over 200 species of orchids. Before NAOCC, research on temperate orchids had been conducted by a relatively small number of individuals, educational institutions, and botanical gardens. There was no centralized effort to preserve and catalog orchids in the U.S. and Canada and most research focused on tropical species. The current pace of research and conservation efforts is far too slow to ensure the survival of the more than 50 percent of all native orchids that have been listed as threatened or endangered.

NAOCC will focus on orchid research, establishing collections of seeds and fungal associates, developing protocols to propagate and restore orchid species, and creating [Go Orchid](#), an interactive website to provide a mechanism for practitioners and the general public to identify and learn about native orchids. An important goal of NAOCC is to provide the public with opportunities to join the cause to conserve native orchids. Go

Orchid is NAOCC's first effort to reach out to the public and focus attention on orchids throughout North America. Only through a focused large-scale and integrated effort can we hope to ensure the survival of our native orchids.

TNC is a natural and unique partner for NAOCC. NAOCC has created a three-pronged approach to ensuring the survival of native orchids and each area provides opportunities for our involvement:

Preservation: TNC already preserves the habitats in which many native orchids exist. Over the past year and a half, lists of orchids that occur on Conservancy preserves have been collected from across the United States. Many threatened and endangered orchids occur on our land and many state programs already have efforts underway to protect them. The survival of native orchids will be supported by development of national collections of orchid seeds and the fungi that orchids require. Once NAOCC has established these regional seedbanks, the Conservancy will hopefully be a major contributor, and these lists are the first step in the process.

Propagation: The seed and fungal collections will be available to support conservation efforts across the U.S. and Canada. One NAOCC goal is to develop protocols and procedures for the successful production and propagation of all native orchid species. As techniques are developed for the successful propagation of native orchids, procedures will be developed to ensure successful establishment and maintenance in natural habitats where orchids have been extirpated or are declining. Our staff will work with NAOCC to determine properties where restoration work would be beneficial to TNC.

Education: NAOCC will use a wide range of electronic media to share information about their activities. Conservancy staff can stay informed by periodically visiting the news page on NAOCC's website. Many of the species lists for TNC properties are incomplete and outdated. Current orchid lists are very important to the success of this project. Our stewardship staff can use the Go Orchid site to identify and educate themselves on orchids that occur on our properties, and to keep an eye out for potential new species.

Many staff found filling out their chapter's species list to be an interesting exercise. After compiling a list of orchids on TNC properties in Delaware, Land Steward John Graham said, "I actually had a good time looking up records and learned quite a lot about orchids on our TNC Delaware Chapter Preserves that I never knew about. I hope that next year I will at least have some time to get out in the field and hunt down some of those species that I listed."

This partnership will be an important step forward in the preservation of one of our largest and most charismatic plant families. We are extremely grateful to staff that have taken the time to participate in this project already. I encourage everyone to take a few minutes to learn more about this project by exploring NAOCC's website and watching the short informational video. To stay informed on this partnership or learn about ways you can help please contact [Louisa Phillips](#). SC

Many threatened and endangered orchids occur on our land and many state programs already have efforts underway to protect them.

Article

Closing a “Knowing-Doing” Gap

By [Sara Kuebbing](#), postdoctoral associate, Yale School of Forestry & Environmental Studies
[John Randall](#), lead scientist - Protected Area Networks, California Chapter, The Nature Conservancy
[Kris Serbesoff-King](#), associate director of conservation, Florida Chapter, The Nature Conservancy



Photo Credit: George C. Griggs

The spread of invasive species is a hallmark of the Anthropocene. As with so many human-driven changes, from global warming to mass extinction, identifying the problem is easy compared to crafting solutions. Academic critics of invasive species management programs, for example, agree that invasive species are an ecological concern, but persistently complain that conservation practitioners are arbitrary and unsystematic in managing nonnative plant species (Davis et al. 2011, Vince 2011, Valéry et al. 2013), and these criticisms have been making the rounds in the national news sources (Chew and Carroll 2011, Zimmer 2011, Marris 2013). When distilled, they pose two main criticisms:

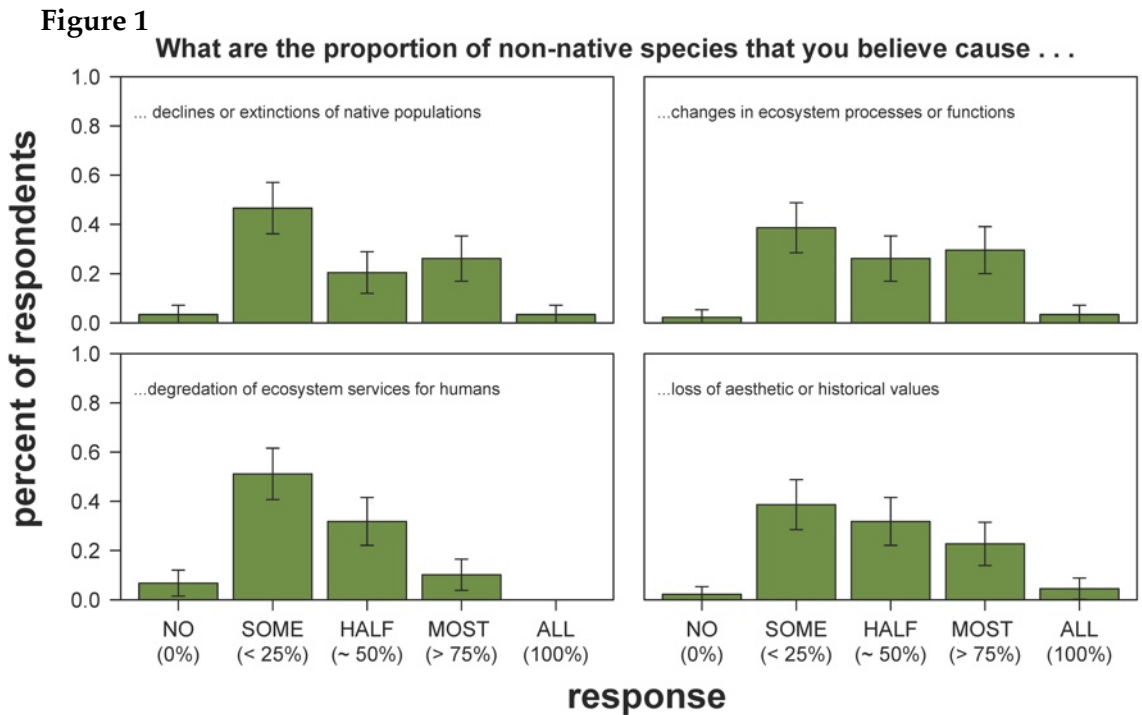
- Managers do not distinguish between nonnative species and nonnative invasive species; and
- Managers should be concerned with native problematic species as much as nonnative invasive species.

Until now, however, no one has tested these assertions by asking managers how they actually deal with nonnative species. A recent study remedies that.

TNC land managers focus their control and prevention efforts overwhelmingly on species that cause ecological impacts. These findings refute critics who argue that land managers are not considering real impacts.

In March 2014, over 40 percent of the members of TNC’s Stewardship listserv (N = 88) completed a survey created by researchers at the University of Tennessee’s Institute for Biological Invasions. These TNC land and water managers (hereafter “land managers”) were asked their opinions and actions concerning nonnative species management. This survey found that TNC land managers focus their control and prevention efforts overwhelmingly on species that cause ecological impacts. These findings refute critics who argue that land managers are not considering real impacts.

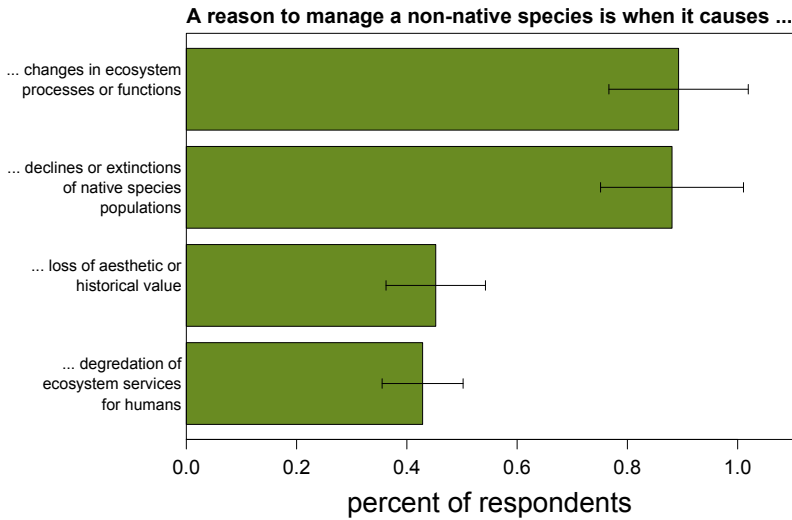
Some critics assert that the “vilification” of nonnative species leads to inappropriate allocation of resources to management of species with little impact. In contrast to this allegation, fewer than 5% of respondents replied that all (100%) of nonnative species caused ecological or aesthetic impacts, implying that the association between “nonnative” and “negative impact” is far from absolute in most TNC land manager’s minds (Figure 1).



Furthermore, TNC managers prioritize among nonnative species. Results show that land managers decide which species to address based on how the species impacts ecosystem processes or functions, or whether the species is deemed responsible for declines in populations of native species (Figure 2). The survey responses provided no support for the allegation that managers blindly throw resources at all non-native species.

The second criticism asserts that land managers are forgetting about potential native species that also have ecological impact. The study results also refute this argument. Twice as many land managers reported that they manage “native weedy” species compared to those who said they manage “nonnative species.” When asked about “non-native species”

Figure 2



as opposed to “non-native invasive species” four times more land managers responded that they prioritize invaders (Figure 3). In other words, land managers do consider the actual impacts, not just the origin, of the species they manage.

These results demonstrate that TNC land managers are using best practices, selectively prioritizing management of species based on

risk assessment of ecological harm. Land managers are already doing what their critics demand. Why this gap between some in the research community and conservation land managers?

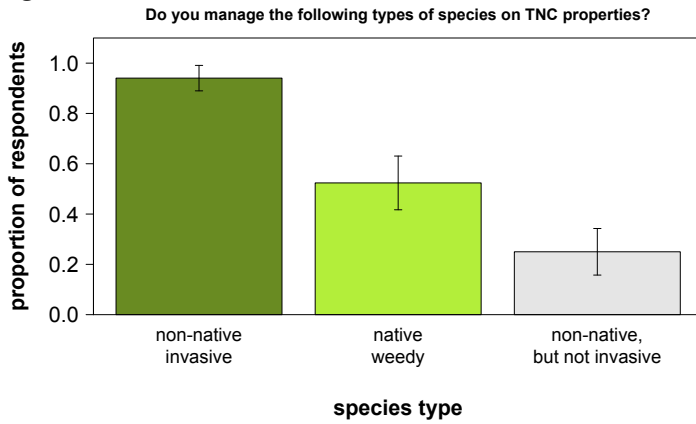
TNC land managers are fairly united in their belief that management of nonnative species with negative ecological impacts is worthy of their limited conservation budgets. Yet, the recurring criticisms show a gap in communication between those making management decisions and those observing and critiquing management. Some of the responsibility for that gap undoubtedly falls on the shoulders of land managers who as a group have apparently not adequately communicated that they prioritize invasive species prevention and control efforts carefully and systematically, focusing on species known or suspected of having significant negative effects on valued native species, communities and ecological processes.

Researchers likewise bear some responsibility for the gap. The phenomenon of communication failure between academic researchers and practitioners, where research findings do not impact on-the-ground actions is so widespread that it is known generically as a “knowing-doing” gap. The existence of a conservation “knowing-doing” gap might imply academic researchers are failing to disseminate their scientific knowledge to practitioners. In this case, however, our results suggest the gap results in part because researchers appear to be uninformed about what land managers are really doing – these academics haven’t done their own homework before offering their insights. In turn, our respondents reported that “personal knowledge” and “peer knowledge” were more influential than academic information, perhaps because they perceive that invasive species management prescriptions from at least some researchers are out-of-touch with the situations they face, and with the actions they are already taking (Figure 4).

This survey’s results indicate that faulty communication lines between academia and land managers could be stoking at least some of the critical views of some academics

The phenomenon of communication failure between academic researchers and practitioners, where research findings do not impact on-the-ground actions is so wide-spread that it is known generically as a “knowing-doing” gap.

Figure 3



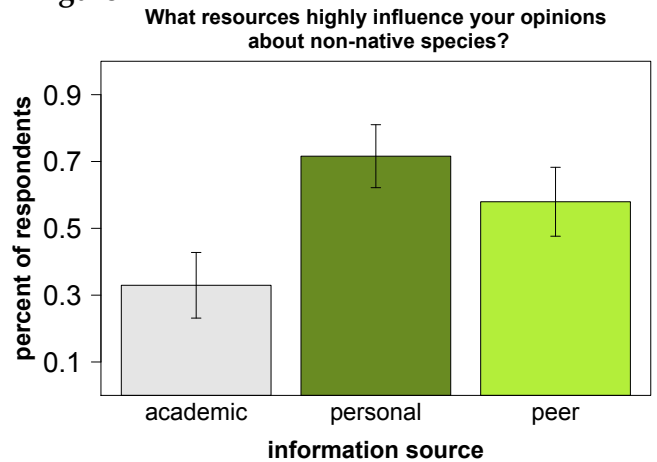
towards conservation management decisions. Indeed, a majority of the criticism of nonnative species management has come in from academic researchers and has been voiced in academic journals (Davis et al. 2011, Valéry et al. 2013). We are concerned that this communication gap could prevent land managers from learning about and adopting findings that could boost their ability to address invasive species threats, and most importantly to protect

biological diversity (Bayliss et al. 2013).

Happily, now that this gap has been documented, academics and land managers can turn their attention to bridging it. This survey indicates that the great majority of TNC land managers are following best practices, but it is not clear that they are getting the word out about this, and they may not be communicating their successes, or corrective measures they have taken following mediocre or failing results. We hope that more researchers will do a better job of learning how land managers actually set priorities and take action. More importantly, we hope that you, the land managers who are reading this, will consider whether you have been communicating your rationale for prioritizing and taking action against invaders, and how you might get the word out about this, and about your successes to academia, other researchers, and other stakeholders such as conservation funders. Peer reviewed papers are one route, but other platforms like popular publications and posts, or online videos, might be even more effective.

We think that it is time for us to revise how conservation land managers—those who directly see and work to address the consequences of nonnative species invasions—communicate about invasion biology. One of the audiences we want to reach is the academic community and other researchers, including the critics cited above. Many already do work on the ecology and effects of invaders or on control techniques that are immediately useful. But we could use more information from studies carried out by researchers who have a better understanding of how land managers actually set priorities and work. We have four suggestions:

Figure 4



We think that it is time for us to revise how conservation land managers—those who directly see and work to address the consequences of nonnative species invasions—communicate about invasion biology.

First, we need be clear about invasive species management goals. One of the criticisms of invasion management is that the large number and abundance of introduced species in most parts of the world means that returning all ecosystems to an “uninvaded” state is an unrealistic goal. That’s true. But it is a straw-man argument, ascribing to land managers a stance that few if any of them hold.

Conservation land managers need to take the discussion back to first principles: 1) their goal is to protect, restore or optimize the health and abundance of a set of species, communities and/or ecological processes, 2) among the threats to that goal are some non-native invasive species known to, or suspected of, causing significant reductions, alterations or elimination of these species, communities and processes and 3) land managers set priorities for management actions following careful consideration of their goals, threats, and the funds and technologies available to address those threats. Often, land managers are warned about impending threats that have caused damage to similar systems elsewhere and they take action to prevent or ameliorate these threats before they become significant. In the case of non-native species this sometimes takes the form of the precautionary principle, in which a non-native species new to a region or preserve is targeted for control or local elimination before there is proof positive that it will cause severe or permanent damage at that site. In other cases, an already widespread and damaging species may be targeted for control only at select sites with highly valued rare species, or they may not be targeted for control at all in acknowledgement that the available tools and resources are not equal to the task.

It is important for land managers to communicate not only what their protection and threat abatement objectives are, but also when they have determined that efforts to control given invaders would be impractical or unaffordable and which they will therefore not attempt.

Land managers tend to be a straightforward lot, which should serve them well here. It is important for land managers to communicate not only what their protection and threat abatement objectives are, but also when they have determined that efforts to control given invaders would be impractical or unaffordable and which they will therefore not attempt. For example, kudzu (*Pueraria lobata**) is widely recognized by much of the public as an aggressive invasive species across much of the eastern half of the US, but some land managers elect not to control it because it is already widespread in their area and usually found along forest edges rather than in the shadier interior where the species and communities they seek to protect are found. Other managers, especially where kudzu has just arrived on the scene, give high priority to preventing its establishment.

Clearly articulating the management goal for each nonnative species at each site should reduce rhetoric about returning an entire landscape to an “uninvaded” state. For example, the volunteers at “weed whack-a-thons” or the journalists inquiring about management choices should understand that the ultimate conservation goal might be limited to keeping the nonnatives out of a nature preserve to protect the species, communities, or processes at that site. In other cases, invasive species removal may be aimed at building awareness of larger invasive species issue. If so, we should be open

about it. Clear messaging of goals could help rein in ill-founded criticisms of “futile” nonnative species management.

Second, we need to highlight management successes when they occur. Continued support for managing invasive species may depend on communicating when and where land managers can succeed in preventing, eliminating or controlling invasives over long periods. It will also require honestly communicating our failures, and where appropriate the corrective actions taken in their wake, or how conservation objectives have been modified following recognition that a particular invasive species cannot be controlled.

Wherever possible, messages about the tangible and real impacts of some nonnative species should be tempered by positive success stories. Often the messaging about nonnative species emphasizes the substantial negative consequences of a certain invasive species and rarely discusses the positive results of management that can reduce these impacts. Think about the last invasive species article you read: Was its message something negative, such as the further spread of a harmful species like Emerald Ash Borer? When was the last time you shared an invasive management “success” story, like the return of breeding migratory ducks to a restored wetland that was once inaccessible to nest building because of dense nonnative Phragmites stands? If messaging to the public is overwhelmingly pessimistic, then criticisms such as “why waste our time and money” might seem justified. Likewise conservation funders are more likely to support a program with real possibility of success than one that is perceived as a lost cause. If we demonstrate that resources invested into invasive species prevention and management can effectively and efficiently achieve important conservation goals then it will be harder for critics to focus on the “impossibility” of managing nonnatives.

Tough choices abound in conservation. It is crucial that TNC managers communicate clearly about their management decisions, and the careful analyses carried out to select objectives and actions that will lead to successful achievement of conservation goals. Many land managers already do this: In a series of [Cool Green Science blogs](#), Matt Miller highlights the decision by TNC staff in Pennsylvania who opted to harvest healthy ash trees that were almost undoubtedly going to be killed in the near future by the invasive forest pest, Emerald Ash Borer. Profits from the logging would go towards protecting another important tree species, the Eastern Hemlock, from another devastating forest pest, the Hemlock Woolly Adelgid. Here, TNC managers weighed options for dealing with multiple nonnative species, and selected the management strategy that could best achieve their conservation goals. Although cutting ash trees for profit was controversial, staffers communicated well about their recommendation and convinced the preserve’s committee members that this tough choice was the best of all available options.

Third, we need to collect better data on management activities to address management challenges. Highlighting successes will hinge, in part, on collecting better data on management activities and management challenges. We need quantitative data on the

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effect of our management efforts. These data will both help managers improve and adapt their management strategies, and allow managers to communicate about and highlight management successes, AND be used to convince funders and others that hold purse strings that paying for invasive species management can be a highly worthwhile, and often vitally important, investment. Here are the big questions that could help achieve these goals:

- What should managers be asking the academic community to study?
- How much leverage do TNC managers get out of management on their property (e.g., do TNC management choices affect other local managers decisions)?
- What data can help you reprioritize/adapt for goal-setting if you don't meet the original goals?
- What's the "return on investment" for management of nonnatives (i.e., Do TNC management choices show positive benefit to human communities)?

Fourth, we must emphasize the importance of preventing new invasions. This is one area where land managers and most in the research community, including the critics, agree. The current set of regulations and procedures in place in the US and across much of the world are not stemming new invasions, or the rapid spread of invaders to new areas. Our society can and must do better.

In closing, we found that TNC land managers who responded to our survey continue to regard invasive species as serious threats to their conservation goals, and give high priority to the management of damaging invasive species. The field of Invasive Biology is rapidly growing and many researchers are interested in improving our understanding of the impacts of nonnative invasive species to provide information for better conservation of native species, communities, and ecosystems. We believe that both research scientists and conservation managers can, and must, do better at communicating with one another and we outline areas where we see room for improvement. We hope you will join us in this dialogue. **SC**

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Article

Oh, Deer

By [Meredith Cornett](#), director of conservation science, The Nature Conservancy in MN/ND/SD

Credit: [USFWS Mountain-Prairie](#) via Flickr and Creative Commons



Quick: Name the deadliest animal in North America.

What pops to mind? Grizzly bear? Mountain lion? Wolf?

No. Their combined danger doesn't equal that of our continent's most fearsome four-legged critter: the white-tailed deer. That's right, Bambi.

Surely there must be some mistake.

White-tailed deer, simply put, do not elicit our fight-or-flight response in the same way that carnivores do. Taken together, wolves, mountain lions, and North America's three species of bear have killed as many as 75 people in the last 15 years. But that number pales in comparison to the number of people killed in deer-vehicle collisions, a whopping 3,000 over the same time period. And add to that 150,000 or so total injuries and roughly \$60 billion in insurance payouts. With tick-borne illnesses also on the rise in recent decades, it's easier to see how poses a serious threat to human health and safety.

Overabundant deer are wreaking similar havoc on our natural habitats. These impacts are exceedingly well-documented. In fact, the devastating, long-term impacts of elevated deer populations on ecosystems are one of the best-documented phenomena in ecological literature. Many experts agree that current deer numbers pose a greater, and

certainly more immediate, threat to forests than even climate change. More than 70 years of research make this point strongly, as do the references at the end of this article. And yet the evidence base — rigorous, voluminous, and spanning decades — has had remarkably little influence on conservation policy and practice.

Know Thyself

As the world's largest science-based environmental organization, TNC values the evidence base more than most. But when it comes to taking action on deer numbers, one of the most pervasive and severe root causes of forest degradation in the US, TNC is at best lukewarm.

How do I know? Because you told me so. I recently conducted a survey of TNC staff within the range of white-tailed deer. More than 350 staff members, representing 10% of our US-based staff, responded. Nearly a third of respondents are hunters, many with a long-standing family tradition of hunting. Nearly 40% of us have been involved in one or more deer-vehicle collision—for a total of 212 accidents. 11% of us have contracted at least one tick-borne illness linked to high deer populations. Twice as many report that someone close to us has fallen ill.

Most of us (66%) describe deer numbers as “Too Many” (Figure 1). An even larger percentage of those of us working at the chapter level (the majority of responses, by design) rate deer populations as too high—around 75%, with ecological impacts rated as “high” or “very high” by more than half of us. In comparison with the general public, we rate ourselves as being much more concerned about deer numbers and impacts. And yet, ranked against other threats, overbrowsing by deer comes in last place (Figure 2).

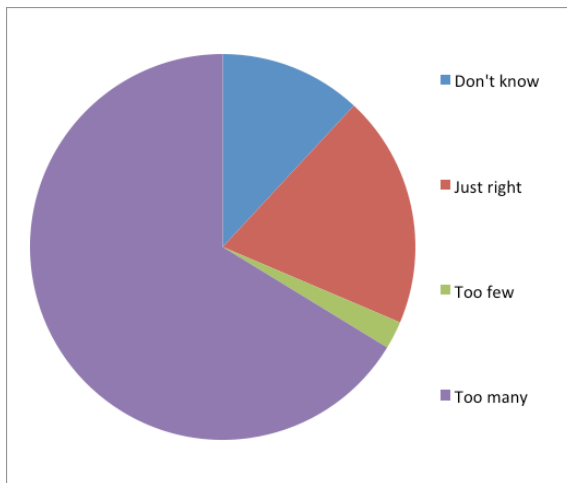


Figure 1. Perception of deer numbers among TNC's US-based staff across 30 chapters. N=303.

herd is estimated at around 1 million. The last decade is in the top three for number of deer harvested in more than 100 years. And yet a vocal minority of Minnesota deer hunters insists that deer numbers in our state are lower than ever. The idea that deer populations are at an all-time low is laughably at odds with the science, earning these disgruntled groups the disparaging title, “barstool biologists.” Minnesota is not alone; a similar story has played out across the nation.

In other words, TNC staff is more likely than the general public to be concerned about elevated deer populations, but not more likely to take action.

Barstool Biology

Let's look outward for a moment at that “general public.” Ask people if they have an opinion about deer numbers where they live. Chances are, they do. And those opinions and values matter more than one would think.

For example, I live in Minnesota, where roughly 10 percent of our citizens (500,000) hunt deer. Minnesota's deer

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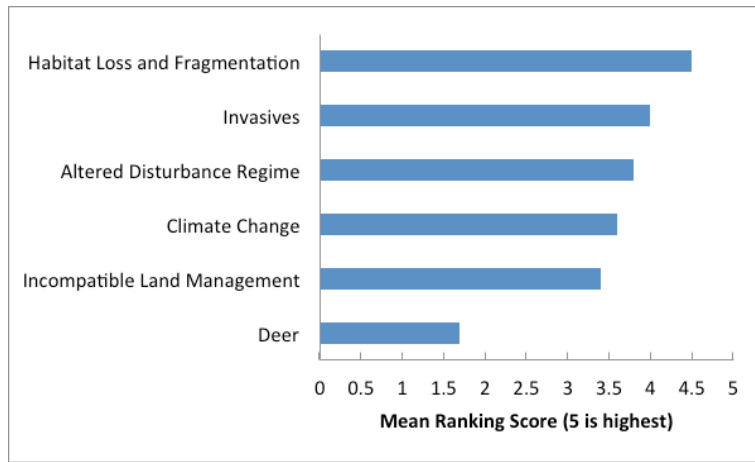


Figure 2. Mean ranking by TNC staff of six major threats across North America from most (5) to least (0) important. N=344.

But we can't laugh this one off. The agencies that set deer population goals give barstool biology equal if not more weight than the scientific evidence base.

Ironically, disgruntled hunters have more in common with animal rightists when it comes to deer policy. Seemingly at opposite ends of the spectrum, these two groups find themselves in lock-step at times of perceived deer

scarcity, both advocating for growing the herd—albeit for very different reasons. They also have this in common: the science will not sway them.

And yet, the science stands. Where does that leave TNC?

(Systemic) Change Begins at Home

TNC recently reaffirmed our role in the conservation arena as one of convening, innovating, and growing the evidence base as a path to systemic change. We can rise to the occasion by advancing some ready-made examples now, as a proof of concept. The combined strength of the existing evidence base and potential big-wins for North America's forests and people make the deer issue rise to the top.

TNC loves to be loved. We've grown accustomed to it. If we are truly to be evidence-based, however, we must be willing to accept that a few groups may love us less for it.

Here is a punch-list for TNC as we reimagine our relationship to white-tailed deer:

Acquaint ourselves with the science. Please. It may not persuade the disgruntled hunters or the animal rightists, but within our own ranks ignoring the science is not an option. Consult the references at the end of this article if you need more background.

Acknowledge the need for informed trade-offs. Like so many of today's global challenges, the solution space for deer overpopulation is multi-dimensional. The ecological evidence alone will not save the day. TNC's role is to ensure the science is not overlooked as society seeks balance among competing values.

Craft an organizational position. Watch this space for talking points that get at the heart of this challenge, pose potential solutions across the country, and emphasize the benefits to people and nature if we can get the balance right.

Resolving human-wildlife conflict is at the epicenter of modern conservation. It's a wicked problem of the Anthropocene, and it is here to stay. Facing the issue of too many deer plays to TNC's strengths in science, collaboration, and communication. Doing it now may save thousands of human lives and bring relief to North America's degraded forests. **SC**

Resolving human-wildlife conflict is at the epicenter of modern conservation. It's a wicked problem of the Anthropocene, and it is here to stay.

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Article

Conserving Nature's Stage

By [Mark Anderson](#), director of conservation science, Eastern North America, The Nature Conservancy

Mapungubwe National Park, a World Heritage site in Limpopo Province, South Africa. Credit: [Martin Heigan](#) via Flickr and Creative Commons



What is the value of explicitly incorporating landform, bedrock, soil, and topography (collectively "geodiversity") into conservation planning as a coarse filter for current and future biodiversity? The approach is attractive because it focuses conservation on the physical factors that create diversity in the first place, while allowing species and communities to rearrange in response to a changing climate. It provides a logical structure for designing conservation networks that assume nature is dynamic and resilient, and challenges us to create arenas for evolution not museums of the past.

Good ideas don't always translate into sound practices. With that in mind, Paul Beier, Mac Hunter and I hosted a workshop in 2013 to hammer out issues inherent in the conserving nature's stage (CNS) approach. With support from the Doris Duke Charitable Foundation, we gathered scientists and conservationist from around the globe who have been testing the approach in a wide variety of situations. After three days of intensive dialog, and two years of writing/rewriting among 33 authors, the result was a collection of papers published in [Conservation Biology in June](#). We don't address all questions, but I hope you'll agree we tackled some good ones.

Is CNS rooted in sound ecological theory? [Lawler et al.](#) provides a history of the approach and abundant evidence that geodiversity is a major driver of species distributions and ecological processes in terrestrial systems. They note that the influence of geodiversity appears strongest at mid-sized spatial extents where conservation planning often happens (landscapes to regions), whereas climate might dominate at continental extents and biotic interactions might dominate at local extents.

How does CNS relate to people and ecosystem services? [Hjort et al.](#) explain that ecosystems are the product of three realms of diversity (geo-, bio-, and climate diversity) and that geodiversity underpins or directly delivers most types of ecosystem services. Thus, although CNS emphasizes geodiversity mainly for its contribution to biodiversity, geophysical features often merit protection for their own sake and for the benefits they provide to people.

Did geodiversity buffer species extinction in past climate change episodes? Summarizing evidence from the last 2.6 million years, [Gill et al.](#) report that although past episodes of climate change produced many local extinctions, geodiversity apparently minimized the number of global extinctions caused by climate change. They conclude that CNS explicitly acknowledges dynamic processes, including extinction, evolution, community turnover, and novelty. That is, it acknowledges change-not as a hindrance to conservation, but as "intrinsic properties of the very nature we aim to conserve."

Are we already conserving nature's stages? [Sanderson et al.](#) provide the first global map of geodiversity types and then estimate how much of each of the 672 types are in protected status in each of eight biogeographic realms. Future conservation efforts should focus on the least protected types: low elevation environments and geology and soils that are also the most productive for agriculture.

Is CNS relevant to marine conservation? [Sutcliffe et al.](#) demonstrate that tropical marine sites selected to span abiotic surrogates would conserve most species in 11 marine phyla. Abiotic surrogates were especially effective when the variables used to define surrogates were weighted according to their influence on species turnover.

If CNS is going to work for future climates shouldn't it also work for current climates? [Beier et al.](#) review many tests of how well abiotic diversity (geodiversity and climate diversity combined) represents current species. They report that abiotic surrogates represent plant species well and that recently improved abiotic surrogates can greatly improve representation of plants, vertebrates, and marine organisms. The results support the use of abiotic surrogates in areas that lack species data.

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How does CNS relate to traditional biodiversity-based conservation planning efforts? In a compendium of eight case studies [Anderson et al.](#) found that geodiversity targets have already been added to many traditional conservation plans, and usually did not increase the total area prioritized or decrease the achievement of other targets. At a minimum, incorporating geodiversity is a low-cost type of bet hedging which results in conservation networks more robust to climate changes and also compatible and complementary to existing plans.

How does CNS relate to the protection of individual species? [Comer et al.](#) describe how geodiversity can be incorporated into the work of agencies with legal, political, and cultural mandates to focus on conservation of particular species. They suggest that landscapes can be classified into four vulnerability classes depending on their current geodiversity, ecological intactness, and connectivity. For each class they suggest particular activities to manage disturbance, restoration, and connectivity. **SC**

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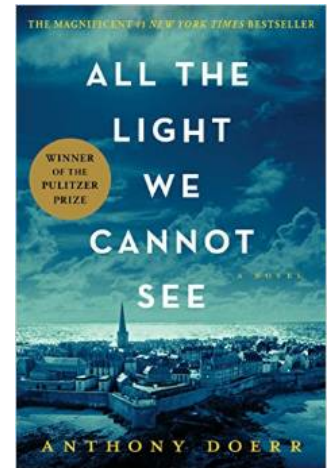
Books: Fiction

More Than a Novel

***All the Light We Cannot See*. By Anthony Doerr. Scribner, 2014. 531 pages.**

Reviewed by [Jeannie Patton](#), communications lead, TNC-LANDFIRE

A success even before ink had dried on the pages, Anthony Doerr's *All the Light We Cannot See* debuted at #10 on the New York Times Best Seller list in 2014, and, within months of its launch, scored a bucket load of awards and honors, including the 2015 Pulitzer Prize for fiction. I knew none of that when I heard Doerr speak last fall at Literary Sojourn, a writers and readers' event that convenes annually in Steamboat Springs. (I learned that the novel had made the short list in the fiction category for the Pulitzer, though.) Having attended Sojourn for more than two decades, I was accustomed to arriving blind and leaving schooled. No big.



That said, after having heard the very civilized Colm Toibin and Karen Joy Fowler read their works and chat with the audience, I was off guard when the wild-eyed, cue-ball-bald, 40-ish author jumped to the stage and with the kind of energy that's so electric it hurts, he launched. Handling the projector like a weapon, with each click he bounded, stood on his toes, gestured, and tossed out comments faster than we could follow. Images sped in quick succession: the Milky Way, mushrooms, diamonds, mollusks, birds, locks, guns, flowers, equations, maps, faces, buildings, graphs, walls, gizmos. As smoothly as a magician working a room, he kept us spellbound and gasping for 45 minutes.

In contrast, *All the Light We Cannot See* moves in apposition to the author's energy: slowly, in high-definition, telling the small stories of a handful of characters whose lives eventually collapse into each other when the Second World War rumbles near Paris and hits the walled citadel of Saint-Malo.

The plot is straightforward: the paths of a blind French girl and a German boy collide in occupied France as both try to survive the devastation of World War II. Marie-Laure lives with her father in Paris near the Museum of Natural History, where he works as the master of its thousands of locks. When she is six, Marie-Laure goes blind and her father builds a perfect miniature of their neighborhood so she can memorize it by touch and navigate her way home. When she is twelve, the Nazis occupy Paris and father and daughter flee to the walled citadel of Saint-Malo, where Marie-Laure's reclusive great-uncle lives in a tall house by the sea, carrying with them what might be the museum's most valuable and dangerous jewel. Her father disappears, taken by powerful people who want the jewel, and a new family forms when Marie-Laure, her uncle and her great aunt find themselves nearly trapped in the house, with only a radio for company and a budding resistance movement outside the door.

Meanwhile, in a mining town in Germany, the orphan Werner Pfennig grows up with his younger sister, enchanted by a crude radio they find. Werner becomes an expert at building and fixing the crucial new instruments, a talent that wins him a place at an academy for Hitler Youth, and then a special assignment to track the resistance. As he grows aware of the human cost of his intelligence, Werner travels through the heart of the war and, finally, into Saint-Malo, where his story and Marie-Laure's converge.

Given the setting, characters, and situation, the novel could have devolved into predictable patterns. However, Doerr illuminates the ways, against all odds, people try to be good to one another. *All the Light We Cannot See* is an epic tale of intertwining lives as the chapters jump between viewpoints, countries, and times. It's a page-turner.

A friend tried to press the book on me, but I demurred, not interested in wartime Europe, a couple of kids and a lost jewel. She persisted. I accepted the hard copy for the sake of sisterhood. Within 10 pages I was a lost soul. For a week, each night after work, I read, rapt, on edge, alive and immersed in stunning language and masterful story telling. I fought sleep to keep on going, re-reading paragraphs because their intricate, detailed beauty deserved more than one glance.

You know how it feels to reach the end of a novel you love: you stretch out the last chapters, willing them to last longer. Then, after you've finished, you read the acknowledgements, the notes, the appendices. When I got to the dust jacket, I did a double-take. It was the wild man who'd paced the stage in *Steamboat* exhorting us to pay attention to details – from the Milky Way to mushrooms -- because they matter. His brilliant novel is proof and testament to that philosophy. **SC**

Check out Doerr's Facebook page: <https://www.facebook.com/anthonydoerr>. And his website: <http://www.anthonydoerr.com/>.

Watch a three-minute clip on YouTube, courtesy of the publisher, Simon and Schuster: <https://www.youtube.com/watch?v=IYBK3Lsx7aI>

And see another on Idaho public television: <https://www.youtube.com/watch?v=zKYPbT3IQc>.

Books: Nature

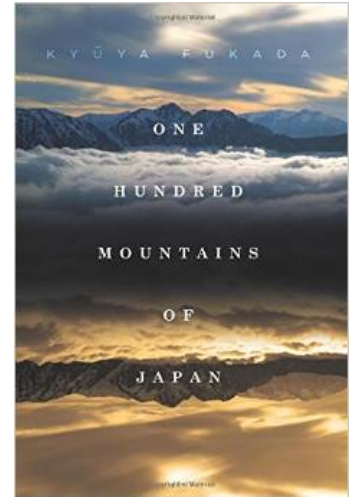
A Poet in the Mountains

100 Mountains of Japan. By Kyuya Fukada, translated by Martin Hood. University of Hawai'i Press, 2014. 240 pages.

Reviewed by [Charles Bedford](#), regional managing director, Asia Pacific, The Nature Conservancy

"The mountain's inexhaustible treasury of riches is like some endless storybook with its pages uncut. As one follows the rambling plot along, one is always looking forward to reading more. Every page yields things never found in other books. Ontake is that kind of mountain."

My own love affair with Japan began five years ago with a ski trip to Japan's northernmost island, Hokkaido. This mountainous island, roughly the same size as Colorado, hosts the best powder skiing on the planet every year from Christmas to mid-February — with the odds of a foot or more of powder on any given day above 50%. My wife is a keen skier also, but a more diverse Japanophile, and has made a dozen pilgrimages to the country over the last six years. I've come to agree with her opinion that Japan is the most advanced and intact human civilization on the planet by any number of criteria.



One of the cultural aspects of Japan that I find so appealing is the love of mountains that runs through the culture and religion and ways of life in Japan. Buddhism and Shintoism both have holy mountains to which pilgrimages and holy walks are taken. The poetry and written literature tradition highly reveres mountain landscapes. And it's no surprise, the country is a long line of relatively young volcanoes, many active, that have created a 2000 mile long string of mountains rising from the sea. There are few flat places in Japan, all used for urban or farming uses, and it is from that flatness that the people of Japan look up to their mountains. Each city and town and village has its home mountain, on top of which is usually a shrine, and about which is doubtlessly written many lines of verse.

From this reverence comes another tradition, getting out in the mountains, hiking, alpinism, quests, skiing, religious purification rituals (*mishogi*), holy circuits and circumambulations. The Japanese Alpine Journal started in the late 1800s and began chronicling some of these exploits, but then an iconic post war author crystallised the Japanese mountain obsession with a serialised set of essays that became a book called 100 Mountains of Japan. Fukada's prose has the classic style of Edward Whymper, who chronicled his exploits in the Alps in the 1800s, or even the modern alpinism writers like John Roskelley or Reinhold Messner or Doug Scott, but each essay, by including the mundane as well as the poetic, elevates the genre to an art. He chose 100 mountains to write about — not necessarily the tallest, merely his favorites — and those mountains, and the book, have become a tick list of sort for many Japanese who want to experience Japan and to get a glimpse back into the not so distant past. His voice recedes into the background and you can feel the mist lift and the horizon clear as he reaches the top of a small peak as daybreak over the pacific lights up the fishing village at the mountains base. This is classic outdoor writing, a practical guidebook written by a poet. If I only had a whole summer.....someday. **SC**

Books: Neuroscience

Just Relax

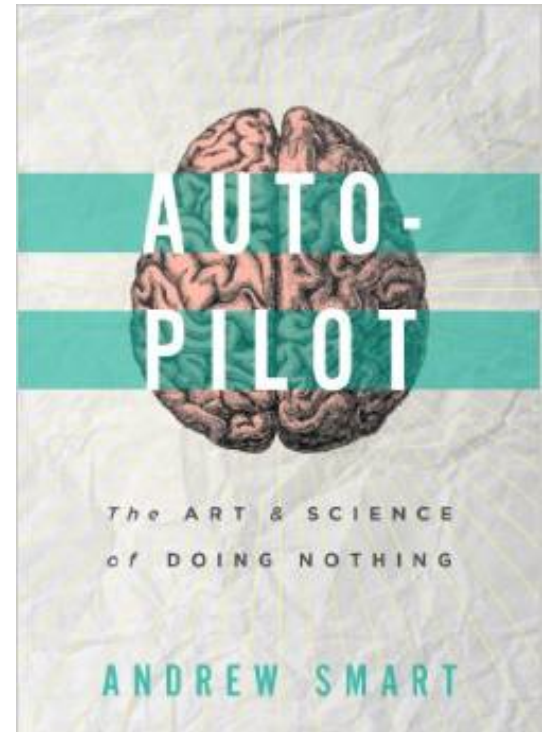
***Autopilot: The Art and Science of Doing Nothing.* By Andrew Smart. OR Books, 2013. 184 pages.**

Reviewed by [Charlotte Reemts](#), research and monitoring ecologist, The Nature Conservancy.

Imagine yourself at your desk, working hard at a difficult task. Now imagine yourself lying in a hammock, just relaxing. When do you think that your brain is working harder? The answer, according to Andrew Smart, is that your brain is working almost just as hard in the hammock as it is at your desk. Neuroscientists had long assumed that an idle brain was just waiting for stimulation from outside. New research suggests just the opposite. When you're not actively thinking or doing something, your brain's Default Mode Network takes over. When this network is active, slow oscillations move through many different regions of the brain, strengthening connections among them.

According to Smart, the best way to strengthen the Default Mode Network is to be idle. This idleness is different from meditation (where you're actively focusing on something) or zoning-out (especially if you're watching a screen). True idleness is day-dreaming, walking somewhere with no apparent purpose, or just staring out the window. Smart is highly critical of time management techniques that schedule a task for every minute of the day, giving your brain no time to reset. Instead, he suggests that short periods of focus interspersed with long stretches of idleness will lead to higher creativity, if not necessarily greater productivity. There is also a fascinating chapter on how noise may help subconscious ideas surface by boosting their signal.

Smart packs a lot of information into this short (~150 pages) book. I recommend reading it quickly, and then finding a hammock in a nice quiet spot. After all, you won't solve that sticky problem any other way. **SC**



Books: History

Lessons in Trust

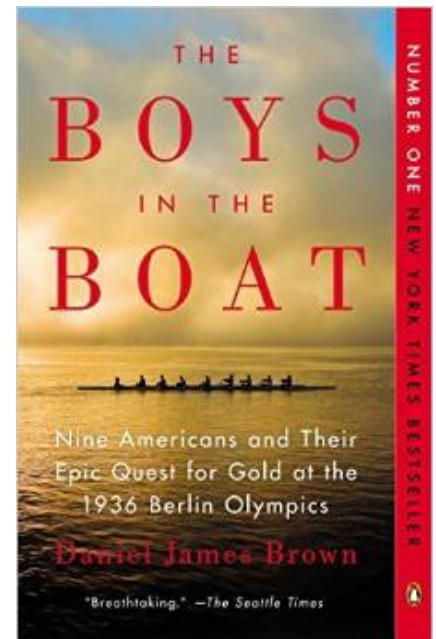
***The Boys in a Boat: Nine Americans and Their Epic Quest for Gold at the 1936 Berlin Olympics.* By Daniel James Brown. Penguin Books, 2014.**

Reviewed by [Randy Swaty](#), LANDFIRE ecologist, The Nature Conservancy

My brother David is 62, I am 44. We grew up in very different times and have always lived hundreds of miles apart. Even still we share many common interests, and recently I learned we love the same book after he sent it to me: *The Boys in a Boat* by Daniel James Brown. It's an exciting and inspiring historical account of the nine young men who rowed to a gold medal in the 1936 Berlin Olympics. While you learn about rowing, Seattle, Nazi Germany and the dust bowl years, more importantly you learn what makes a rowing team, and probably any team work well.

The nine young men who rowed to glory came from logging, farming and other tough backgrounds. Many also came from excruciating personal situations, like that of one of the main characters, Joe Rantz. Joe was abandoned on a farm during the dust bowl years. Left to his own devices he understandably became self-reliant and did not depend on others. These traits are a barrier in high-level rowing. It wasn't until this was noted by one of the most charming characters in the book, George Pocock, who had also been abandoned, that things started to click for Joe. George told Joe that rowing is like being in an orchestra—you must work together. Being a great individual musician (or rower) is not enough. You must trust and give into your teammates or you will not row (or work) synergistically.

Against the backdrop of the dust bowl, Nazism, high-stakes sport and personal strife, these messages are especially potent. They offer us all some lessons in how we might trust, and gain the trust of others to better conserve life on earth or be better people in general. **SC**



Books: Fiction

Master Class in Metafiction

Life After Life. By Kate Atkinson. Back Bay Books, 2013.

Reviewed by [Jeannie Patton](#), communications lead, TNC-LANDFIRE

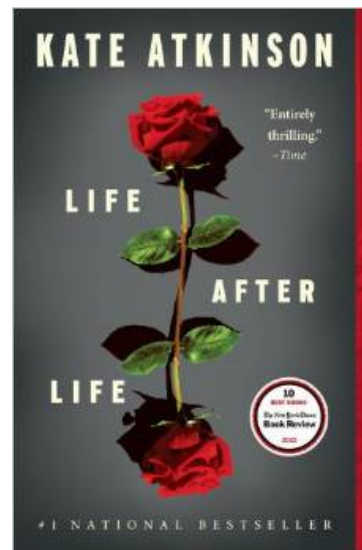
Metafiction amuses me. I encountered the concept in graduate school in one of those theory literature courses, and fell in love with it straight away. Metafiction (thank you, Wikipedia) is “a literary device used to self-consciously and systematically draw attention to a work’s status as an artifact. It poses questions about the relationship between fiction and reality, usually using irony and self-reflection. ... It does not let the audience forget it is viewing a play or reading a novel; metafiction forces readers to be aware that they are reading a fictional work.”

Kate Atkinson’s wonderful novel *Life After Life* is a master class in metafiction. The novel unfolds in a short story kind of way, but not really – chapters are too long for a true short story, yet not long enough for a novella – in that each “chapter” has its own integrity and internal consistency. But that’s the end of that when the novel’s opening section shifts to alternative narratives right off the bat. By the time the novel concludes, readers often consider which of the stories was true, e.g. my book club at TNC in Colorado had a fine time discussing the options. Simple answer: none. Also simple answer: all. *Life after Life* is fiction riffing on fiction. The game is great fun, in no small part because the book is brilliantly written.

Here’s the opening premise: on a cold and snowy night in 1910, Ursula Todd is born to an English banker and his wife. Ursula dies before she can draw her first breath.

Cue the metafiction.

On that same cold and snowy night, Ursula Todd is born, lets out a lusty wail, and gets going on her life. Ursula Todd is born, lets out a lusty wail, and dies. After the multiple birth stories are covered, the story shifts to 1930’s Germany, in a restaurant, where an English woman carefully takes aim at her lover, Adolph Hitler, and shoots him dead. Yes, that’s Ursula, too. But she’s also a run-of-the-mill, forgettable citizen in a nondescript town.



Ursula Todd's continual birth and rebirth frustrates those who enjoy straight-up narrative. As she grows, Ursula dies, repeatedly, in a variety of ways. The novel lives in a magus-type arena of mind games, time shifts, what-ifs, visions and revisions ending in a kind of *Groundhog Day* conclusion.

But, unlike Bill Murray's character in the film, each Ursula is a new Ursula in a unique plot. The Ursulas have no shared continuity, nor do they learn from experience. Atkinson has a great time exploring narrative possibilities, playing with chronology and desire, testing plots and playing with the reader. Thus the self-aware inside joke that is metafiction.

We make up our own stories all the time. We test alternative plotlines, imagine logical progression (one thing DOES lead to another, right?), experiment with options, have conversations with people who don't exist, revisit old actions and revise them. Read this novel in that spirit. Everything is possible. Have fun. **SC**

New Conservancy Publications

Conservancy-affiliated authors highlighted in bold.

Please send new citations and the PDF (when possible) to: science_pubs@tnc.org.

Some references also contain a link to the paper's abstract and a downloadable PDF of the paper. When open source or permitted by journal publisher, these PDFs are being stored on the Conservation Gateway, which also is keeping a running list of Conservancy authored science publications since 2009.

Aldous, A.R., Gannett, M.W., Keith, M., and O'Connor, J. 2015. Geologic and Geomorphic Controls on the Occurrence of Fens in the Oregon Cascades and Implications for Vulnerability and Conservation. Wetlands DOI 10.1007/s13157-015-0667-x.

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Cross, M. D., K. V. Root, C. J. Mehne, J. McGowan-Stinski, and **D. R. Pearsall**. Multi-scale responses of eastern Massasauga rattlesnakes (*Sistrurus catenatus*) to prescribed fire. Am. Midl. Nat. (2015) 173:346-362.

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Hise, C.M. 2014. Point counts surveys of land birds at the Four Canyon Preserve, Ellis County, Oklahoma, 2014. Publications of the Oklahoma Biological Survey, 2nd Series. 13:1-6.

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Polasky, S., **H. Tallis**, and B. Reyers. 2015. Setting the bar: Standards for ecosystem services. Proceedings of the National Academy of Sciences 112: 7356–7361, doi: 10.1073/pnas.1406490112. <http://www.pnas.org/content/112/24/7356.full>. **SC**