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Mainstreaming

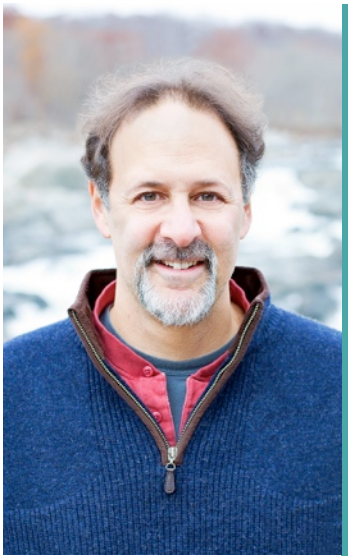
Editor's Note

By Jonathan Adams

In the bizarre political culture of the day, the word "mainstream" is now an epithet of both left and right. To be mainstream is to be a captive of the status quo, dull, unthinking, stodgy, mass-market, commercial, corporate. The opposite of edgy, mainstream is inimical in the minds of some to that other phrase that really should be banned from all polite society, "thinking outside the box."

Conservationists would be well-advised to take set aside the cultural baggage of the word and consider why biodiversity needs to be mainstream. A good place to start would be the first two articles in this issue of the Science Chronicles. The first, from Kent Redford, takes the subject head on. Many of you will remember Kent from his days at TNC, at the Wildlife Conservation Society, and from his diverse contributions to the conservation science literature, including many articles that remain touchstones of our field. Here, Kent offers some insights into how the idea of mainstreaming biodiversity is playing out in one key institution, the Global Environment Facility (GEF), and why that matters to the rest of us.

The second article, by Scott Morrison and Peter Kareiva, will no doubt be of great interest within The Nature Conservancy, but its potential impact is far broader. That impact is at least in part a reflection of another way to understanding the concept of mainstreaming as developed and applied at the GEF.



Conservationists would be well-advised to take set aside the cultural baggage of the word and consider why biodiversity needs to be mainstream.

Consider, as just one example among many, this thought from Scott's conceptual framework: "It's not enough to work in important places; we need to design our work to also have impact beyond those places. And, as we work, we must help set the broader social, economic, political and cultural conditions necessary to sustain the diversity of life on Earth and the ecosystem services that this diversity provides."

Mainstreaming is crucial to that idea of design. Read these two articles in tandem, and see if you don't agree. In fact, I don't think it is too much of a stretch to suggest there is an element of mainstreaming in every article in this issue.

At the end of this issue you will find a complete list of all publications from TNC staff in 2013. I hope you find it useful. Beginning with this issue we are moving to a bimonthly schedule (plus the two book review issues in June and December), so look for the next issue in March. As ever, feel free to contact me with ideas, improvements, good jokes, and bad puns. I look forward to hearing them all. **SC**

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Article
The Largest Conservation Investment You've Never Heard Of

By Kent Redford, Archipelago Consulting, Portland, Maine

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Most conservationists I talk to have never heard of "biodiversity mainstreaming." Sure, they've heard of "mainstream," as in mainstream jazz, or mainstream news, and some have even heard of mainstream as it relates to hipsters (look up "mainstream hipster" in images.google and you will find jokes like: "I drowned a hipster in a tributary. It wasn't mainstream.")

Here is the reason you need to know about biodiversity mainstreaming: in the last 10 years the Global Environment Facility (GEF) has spent $1.6 billion with $5.3 billion in co-financing on 327 mainstreaming projects. That's almost $7 billion dollars — it would even get the attention of Dr. Evil.

When you read the definition for mainstreaming you're going to be surprised because you do know what the term means. A recent workshop in South Africa convened by the Scientific and Technical Advisory Panel (STAP) produced the best definition: "Biodiversity mainstreaming is defined as the process of embedding biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that biodiversity is conserved, and sustainably used, both locally and globally."

The Convention on Biological Diversity (CBD) mandates mainstreaming. The Convention uses the sense of mainstreaming, though not the term itself, when it calls on parties to "integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programs and policies." Mainstreaming also contributes toward fulfilling article 10(a) of the Convention, which calls on parties to "integrate consideration of the conservation and sustainable use of biological resources into national decision-making" (Petersen and Huntley 2005).

There are a couple of key points to keep in mind. First, this is about biodiversity conservation, but it is about effecting conservation by working with those institutions that rely on using biodiversity but are not good at conserving it. The process of mainstreaming is one of getting these institutions to incorporate the value of biodiversity into their business models and thereby change their practice. Mainstreaming is regarded by GEF as a complement to protected area funding (in which, over the last 21 years, they invested $2.2 billion with $5.5 billion in co-funding, GEF 2013).

The GEF divides mainstreaming into four sets of activities:

- developing policy and regulatory frameworks that remove perverse subsidies and provide incentives for biodiversity-friendly land and resource use that remains productive but that does not degrade biodiversity;
- spatial and land-use planning to ensure that land and resource use is appropriately situated to maximize production without undermining or degrading biodiversity;
- improving and changing production practices to be more biodiversity friendly with a focus on sectors that have significant biodiversity impacts (agriculture, forestry, fisheries, tourism, extractives); and
- piloting an array of financial mechanisms (certification, payment for environmental services, access and benefit sharing agreements, etc.) to help incentivize actors to change current practices that may be degrading biodiversity.

Mainstreaming is about biodiversity conservation, but it is about effecting conservation by working with those institutions that rely on using biodiversity but are not good at conserving it.

Mainstreaming is part of the language of the CBD; the GEF (which is the financial mechanism for the CBD, along with a few other international environmental conventions); the United Nations Development Program; the U.S. Agency for International Development and the like. They know about, talk about, and most particularly spend money — lots of money — on biodiversity mainstreaming. The rest of the world, particularly the conservation community, is just catching on. You have heard of "mainstreaming" but not "Mainstreaming" — just think of TNC's relationship with Dow.

You have also have heard about Payment for Ecosystem Services (PES), Reduced Emissions from Deforestation and Degradation (REDD), environmental certification, offsets, climate change adaptation — all of them are considered Mainstreaming activities. You may not have heard though of some of the financial applications of Mainstreaming, that include:

- Green Accounting and the World Bank;
- Green Growth and OECD;

- The United Nations System of Environmental and Economic Accounts (a system for organizing statistical data for the derivation of coherent indicators and descriptive statistics to monitor the interactions between the economy and the environment and the state of the environment to better inform decision-making); and
- The Wealth Accounting and the Valuation of Ecosystem Services program of the World Bank that promotes sustainable development by ensuring that the national accounts used to measure and plan for economic growth include the value of natural resources.

To me it was extraordinary to have been invited by STAP to write a paper on biodiversity mainstreaming and to find out how much was being done on it and how little our community knew about this work — including me. We know a lot about things that are considered part of Mainstreaming, but the term and its scope are largely unknown. I even had to argue with a conservation biologist co-author to include the term in a recent manuscript because he said no one has ever heard of the term.

I think it is important for you to know about Mainstreaming biodiversity for three reasons:

- It is important to know that almost $7 billion is being spent on something that is, or could be, what you're working on. Maybe there might be some money for you if you only knew what to call it.

- All countries that are parties to the CBD (that leaves out the U.S.!) are required to develop National Biodiversity Strategy and Action Plans (NBSAPs). Mainstreaming is meant to be one of the key tools to be used in these plans. If you're involved in conservation outside the U.S., you should be familiar with mainstreaming and take an active role in seeing that your conservation perspectives are incorporated (if possible and politic).

It is important to know that almost $7 billion is being spent on something that is, or could be, what you're working on. Maybe there might be some money for you if you only knew what to call it.

- For all the money that has been spent there is just about nothing written in the peer-reviewed literature — or even gray literature, where there is some, especially from South Africa. There is a great opportunity to work with practitioners involved in mainstreaming activities to help in constructing a research framework for further work or analyzing what has been done. As Miteva et al. (2012) have pointed out, billions of dollars have been spent on biodiversity interventions and we don't really know much about what works.

And besides, if you start work on mainstreaming then you can tell hipster jokes and be doubly rad. **SC**

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Article
Refreshing *Conservation by Design*

Above: Oaks in Ojai, California. Credit: Flickr user Chuck Abbe via Creative Commons

Introduction

Peter Kareiva, chief scientist, The Nature Conservancy

Many people who have been hired at TNC within the last four or five years have not heard much about *Conservation by Design* (or CbD for short). But if you were hired at TNC 10 years ago, you would have been served CbD at breakfast, lunch, and dinner. At first, coming from academia, I thought CbD was just a slogan, or at best a simplistic recipe. I learned quickly. *Conservation by Design* was instead a concise expression of how science meshed with management and our conservation business to generate better results. The Conservancy was not as global 10 years ago as it is today, but CbD — created by a team of scientists and senior conservation leaders — helped us become global in a way no other conservation NGO could rival because it sketched a roadmap for applying science that anyone, anywhere in our organization, could follow.

But that was then, and now is now. There was no Global Challenges/Global Solutions (GCGS) framework when CbD was born. The spatial priorities developed through CbD provided practitioners little guidance on how to think about cities or intensively used lands such as wind farms or agriculture — land uses with huge direct and indirect ecological footprints.

CbD also did not emphasize the imperative to address global drivers that might overwhelm our good results. For example, all of the place-based conservation in the world is not going to address the greenhouse gas emissions problem.

Then there is the issue of relevance. We in conservation talk a lot to ourselves and those who think like us — we know biodiversity and nature conservation are relevant to people. We learned these connections in school, or maybe by direct experience, or intuitively. But the immediate relevance of nature conservation to the lives of more than 7 billion people is probably known by at most 100 million people (and that estimate is generous). Making the link between people and nature was a weak point of CbD, even

though many of our best place-based projects actually used that link to be successful on the ground.

The Conservancy's ALL SCIENCE 2013 gathering in California in December was all about the new science needed to tackle GCGS. We need engineers, economists, political scientists, hydrologists, and cognitive psychologists. And concrete, compelling science communication is as important as the science itself. We cannot do it all and hence will increasingly draw on academic partners.

Perhaps most importantly, we need to refresh *Conservation by Design* to help all this new talent and new thinking navigate its way to making sure the science serves GCGS the way it served previous TNC efforts. For this reason Brian McPeek and I have asked Scott Morrison and Heather Tallis to lead a "CbD refresh task force." They are building their team now — it will include science and conservation leaders, and things will go rapidly. We are not rebuilding the engine; we are doing a tune-up. Expect to see material on CONNECT shortly, and to have some first draft results by June and everything wrapped up before the end of the year. Scott got the conversation started with a presentation and handout he prepared for ALL SCIENCE. This conceptual framework (see below) is not the new CbD — it is Scott's way of getting the thinking going. Like so much of our innovation, it comes from the field. I congratulate him for taking this step and look forward to what he and the task force produce.

Conceptual Framework

Scott Morrison, director, conservation science, The Nature Conservancy in California

A defining attribute of The Nature Conservancy is its science-based approach to setting priorities and advancing strategies. Another is its constant drive to increase the pace and scale of conservation. Global Challenges, Global Solutions presents a compelling hypothesis of how the Conservancy can have even greater impact — which is an imperative given the unprecedented strain on the natural world. And to rise to that calling, the Conservancy must adapt and fortify its science foundations with the data and analyses needed to guide and support conservation action in a world that is increasingly human-dominated.

We need engineers, economists, political scientists, hydrologists, and cognitive psychologists. And concrete, compelling science communication is as important as the science itself.

Almost two decades ago, *Conservation by Design* clarified the goal of the Conservancy and the science foundation it would use to set priorities, and asserted the importance of a science-based vision for a sustainable planet (Box 1). That vision did more than just inform Conservancy decisions; it drove the broader conservation agenda. Could a 20th anniversary *Conservation by Design* — reinvigorated for the Global Challenges, Global Solutions era and that describes the scientific underpinnings of the Conservancy's current theory of change — similarly help position the Conservancy for influence and impact?

Any core science framework would need to address the realities of conservation in the 21st Century:

• There is no past tense of "conserve." For every conservation gain, there will always be new challenges, new threats that need to be managed. Conservation requires vigilance and adaptation — in perpetuity. But, the Conservancy cannot be everywhere, forever. Indeed, if "conservation" is reliant on the Conservancy's eternal presence in a place or issue, arguably we have not achieved conservation. Thus, we need to be smart about both where and how we work. It's not enough to work in important places; we need to design our work to also have impact beyond those places. And, as we work, we must help set the broader social, economic, political and cultural conditions necessary to sustain the diversity of life on Earth and the ecosystem services that this diversity provides.

Box 1: Excerpts from *Conservation by Design* (1995): "The Nature Conservancy's conservation goal is the long-term survival of all viable native species and community types through the design and conservation of portfolios of sites within ecoregions… We are guided by the best available conservation science to take site-based action that makes a significant and lasting difference… We work in a non-confrontational manner, emphasizing the effectiveness of collaborative efforts… We recognize the imperative of developing ways to enable humans to live productively and sustainably while conserving biological diversity."

• People are integral to any conservation solution, and conservation can be an important means of enhancing human well-being. But to be most effective, the Conservancy must be clear about its ultimate objective. Is the organization's ultimate objective to improve conditions for nature, recognizing the importance of providing and demonstrating co-benefits to people; and if so, what "nature"? Or, is our objective to improve conditions for people, recognizing that nature conservation can be an important means to that end; if so, which "people"? Or, is our objective to meet the needs of people and nature as co-equal goals? A prerequisite to fortifying our science foundation is clarifying how Conservancy teams should "solve the people and nature equation."

Nature cannot be relegated to the "last great places." We also must enhance the conservation values of lands and waters where people live and make their livelihoods.

• To be durable, conservation needs a constituency, and that means we need to focus not only on conservation outcomes but also on institutionalizing the enabling conditions necessary to maintain the conservation values of a place through time (e.g., by creating or fortifying the market, regulatory, or cultural mechanisms that will sustain any gains.) Because we need to protect nature in places we will never control or even have access to, we need to encourage and empower resource users be more effective advocates of conservation. We need to harness the drivers of threats and turn them into drivers of conservation. We need to mainstream conservation.

• Nature cannot be relegated to the "last great places." We also must enhance the conservation values of lands and waters where people live and make their livelihoods.

Indeed, a "conservation solution" will likely require integrating efforts across the spectrum of human use intensities, including the highly altered and engineered environments.

Nature conservation can be a solution to many problems on the planet. A key strategy of the Conservancy is to demonstrate those solutions. Combining place-based demonstration of conservation that works for real people, with a deliberate and credible theory of change of how that solution can be replicated, amplified, or otherwise scaled beyond that place of demonstration, is a tremendously powerful idea. Let's build the science to deliver on it. **SC**

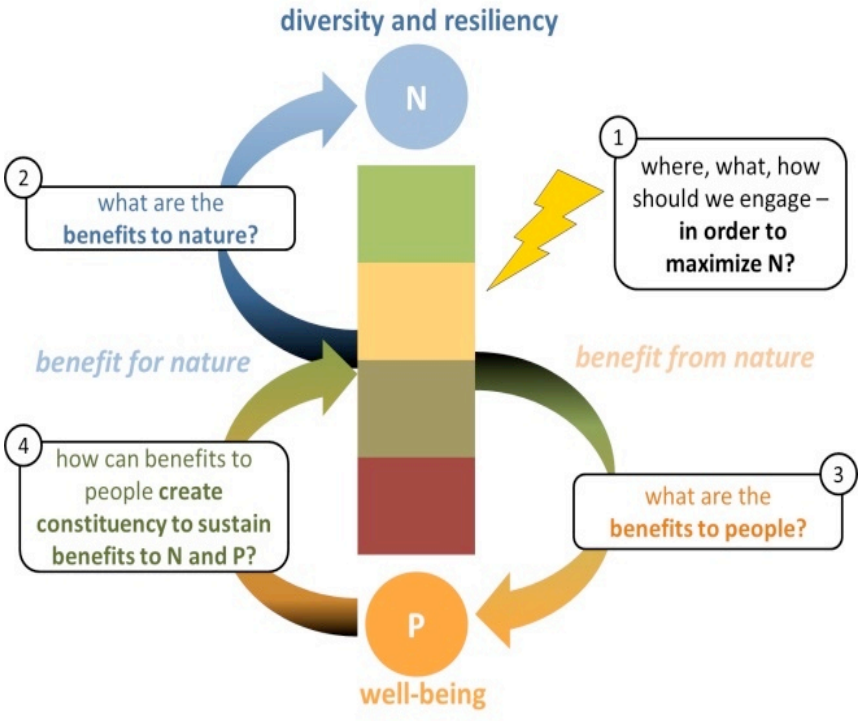


Figure 1. An example of how the relationship of "nature objectives" and "people objectives" in conservation could be described. We can divide the world into four broad categories of human use intensity, depicted by the four colored boxes: the more natural landscapes (wild/"intact" areas, and "working" lands where native species – forests, forage, fish – are harvested), and the more engineered, human dominated landscapes of commodity agriculture and urbanization. Meeting a goal of "maximizing diversity and resiliency" would require working across all of these landscapes and seascapes. In this model, conservation engagements would be designed to enhance habitat values in those places for native species and so improve conditions for diversity and resiliency. Co-benefits for humans would be identified, planned for (to maximize, as possible), quantified, and communicated, so that a constituency for those benefits – to nature (N) and people (P) – is cultivated. The constituency is then mobilized to institutionalize a virtuous cycle that sustains those benefits through time. A model like this could help clarify where science inputs would be expected.

Article
Behavioral Science and Natural Infrastructure

By Sheila Walsh Reddy, ecosystem services analyst, The Nature Conservancy

Above: Hong Kong Wetlands Park. Credit: Flickr user mk_is_here via Creative Commons

Like many scientists, I spent a lot of time during graduate school immersed in the field. I learned that the real world is rarely what you expect. For instance, the standard economic model I had in my mind did not at all explain how people were responding to the conservation-development program I was studying in the South Pacific.

Probably many conservation scientists, at TNC and elsewhere, had similar ah-ha moments. These moments taught us that science is a powerful tool for learning about the world and guiding decision making. But if science is so powerful, why don't we use it more to guide our theories of change? Why are we leaving our muddy boots at the door?

We are excellent at building the evidence base and tools for nature conservation. But we are not leveraging the latest science from behavioral economics, cognitive science, and psychology to understand how people make decisions to invest in nature.

We are excellent at building the evidence base and tools for nature conservation. But we are not leveraging the latest science from behavioral economics, cognitive science, and psychology to understand how people make decisions to invest in nature.

This is extremely important now because conservationists are increasingly trying to get others to decide to invest in nature rather than doing it ourselves by buying land.

So how can we better use science to promote others to invest in nature? I propose that we implement a research agenda of what I am calling "behavioral conservation science" that draws on the new and unexpected findings from behavioral economics, cognitive science, and psychology. A key focus of this research will be to provide empirical evidence on decision making to guide our theories of change around natural infrastructure.

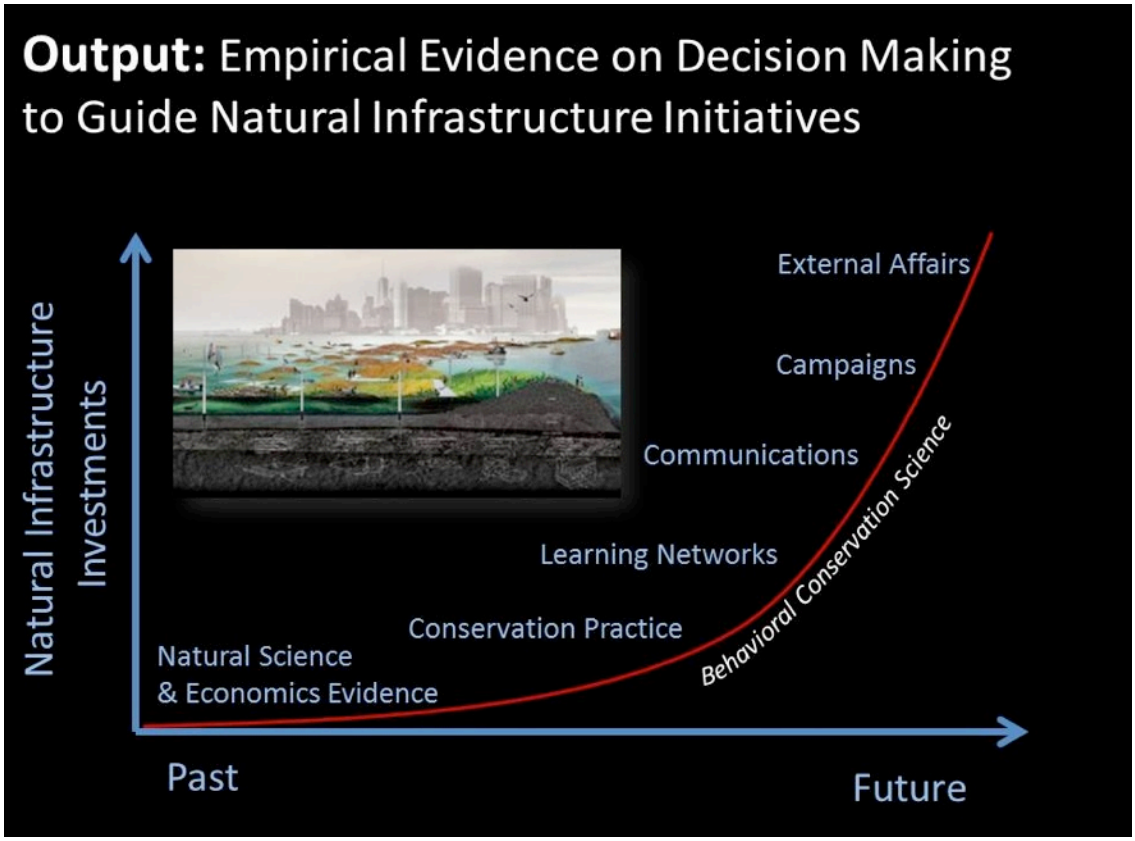
Not doing so can have dramatic consequences — just look at what happened with constructed wetlands: despite evidence that they work, a few stinking wetlands gave them an image problem we are still struggling to overcome. We need to learn from this

example so we can avoid the same pitfalls for our other natural infrastructure initiatives such as water funds, floodplain restoration, and coastal defenses.

We can chart a better, more successful path for natural infrastructure if we use behavioral conservation science to understand 1) how knowledge about natural infrastructure spreads and 2) how it influences decisions to invest in natural infrastructure.

To answer this first question, we are going to use Google analytics and other data sources conduct a knowledge network analysis that answers these questions: where is information on natural infrastructure coming from? What type of information is spreading? How is information spreading? Who is spreading it? We know from previous studies that who the messenger is can be as important as the message.

To answer the second question, we will conduct a decision analysis by interviewing a sample of pairs of decision makers in the US that did and did not invest in natural infrastructure. We will ask questions like: What was the perception of natural infrastructure before and after? What type of information and tools were used? How did actions of others affect the decision? How did internal policies affect the decision? How did external policies, practices, conditions created by FEMA, the reinsurance industry, and the US Army Corps of Engineers affect the decision?



By answering these questions we will have empirical evidence to help key natural infrastructure initiatives, such as TNC's North America Risk Reduction and Resilience Priority, as they implement and refine their theories of change. Science will no longer just provide the evidence that natural infrastructure supports biodiversity and human well-being. Behavioral conservation science and cold, hard, empirical data will underpin our theories of change. This way we can have more coordinated, science-based plans for influencing natural infrastructure investments.

Ultimately, a research agenda and core competency in behavioral conservation science will help us achieve our mission by helping us better understand how to make the sort of systemic changes that we need. We held a session on behavioral conservation science at the recent TNC All Science meeting that highlighted on-going and new research in this area inside and outside of the Conservancy, including the research I just described. Hazel Wong, Director of Conservation Campaigns, surprised us with polling results. Jensen Montambault, Senior Scientist, Central Science, and my co-organizer, told us about how and when people use big data to solve big conservation problems in Micronesia. Judy Dunscomb, Senior Conservation Scientist, Virginia, highlighted how new data on nature and kid's brains may help support urban conservation. Bob Lalasz, Director of Science Communications, scared by showing us that scientists are perceived as cold and competent, but being warm and competent could help us better communicate. The excitement in the room for this new science was a great reminder that none of us has forgotten the lessons we all learned that the world is a surprising and fascinating place and science is a tool for us to understand it. **SC**

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Article
Risky Conservation

By Eddie Game, conservation planning specialist, The Nature Conservancy

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Conservation projects occur under many types of uncertainty. Where this uncertainty can affect achievement of a project's objectives, there is risk. For conservation projects, there is likely to be risks in both social and environmental space, ranging from invasive species outbreaks and climate-driven events like coral bleaching, to community reactions, policy changes, and insecure or inadequate funding streams. As with all complex projects, the delivery of conservation outcomes is influenced by our capacity to assess the risks associated with our investments, and by our ability to manage and respond to these risks through time.

Despite the important link between risks and project outcomes, assessment of risk and use of this information has not featured prominently in conservation planning guidance or practice, either inside or outside the Conservancy. When asked to review our business planning process in 2010, the Conservancy's cohort of Sawhill Fellows identified the absence of risk assessment as the most significant and consistent weakness. This finding was echoed by the Planning Evolution Team. I know the same is true for other major conservation organizations.

Many conservation agencies and organizations (including ours) undertake risk assessments for legal, compliance, and reputational issues associated with potential projects (e.g., the risk of engaging with corporate partners or undertaking controversial strategies). Although these risks are undeniably bound up with long-term conservation success, their principal focus is not on the cause of failure of the project but the potential consequences of this failure. Some conservation planning efforts in the Conservancy and elsewhere have assessed the likelihood of success of different projects or activities (which is roughly the inverse of risk of project failure), but have not further decomposed risk into the causes of failure. This matters because we are not passive hostages in the face of risk. The economist and historian Peter Bernstein has argued compellingly that this understanding of risk has been one of the most influential achievements of human consciousness.[1]

Risks to project success are rarely immutable. For example, the risk of a conservation project being derailed because of community opposition can be reduced through more substantial engagement with communities. However, there will almost always be a cost associated with ameliorating any risk. Despite the broad influence that risk has on conservation outcomes, there has been relatively little discussion about how to identify these risks, and still less about how organizations should prioritize investment in monitoring and ameliorating these risks.

A useful way to think about risk is to consider two dimensions: likelihood and consequence. Likelihood is essentially the probability that the risk will materialize (although not always expressed as quantitatively as a probability), while consequence is a measure of a risk's impact in terms of deviation from expected project outcomes should the risk occur. Although knowledge of both dimensions is important, comparative analysis of risks is often accomplished by combining the two dimensions to give an overall rating or rank. This is the basis of publically endorsed risk assessments in most countries, and in most corporations.

Despite the broad influence that risk has on conservation outcomes, there has been relatively little discussion about how to identify these risks, and still less about how organizations should prioritize investment in monitoring and ameliorating these risks.

In an ideal world, assessments of risk likelihood and consequence would be informed by objective data. However, the complexity of the social–ecological systems in which conservation takes place means that most projects must contend with continually shifting contexts. Conservation projects thus will rarely have extensive historical data regarding the likelihood (probability) and consequence (impact) of risks to draw upon. In some cases, conservation agencies or organizations might look to comparable experiences in other jurisdictions to inform base rates, such as violation rates of conservation easements in another state, or alternatively look creatively at tactically relevant data, for example, corporate non-compliance with other regulations might be used as a base rate for the risk that a company fails to live up to its expectation under some conservation agreement. More commonly, however, I expect that conservation project risk assessments will involve subjective or semi-quantitative assessment of risks.

Drawing on research in the fields of risk assessment and expert elicitation, Central Science and the Conservancy's Australia Program developed a rapid subjective risk assessment approach for conservation projects. We applied the approach as part of the conservation business planning process for northern Australia. The risk assessment includes techniques to help identify risks, tools for the evaluation of likelihood and consequence in the context of project objectives, and ways to analyse and interpret the results. A detailed description of the approach and the results in northern Australia can be found in a paper that we published in the open access journal *Environmental Research Letters*.[2]

We evaluated the overall risk results, both dimensions of each risk (likelihood and consequence), as well as the level of uncertainty in our evaluation of these risks. The overall risk results are shown in Figure 1 (the higher the score the greater the risk). Staff capacity and sustainable funding came out as the two highest risks for achieving the Conservancy's vision in northern Australia. From a management point of view this is about the best news we could hope for from a risk assessment, because both of these are to a large extent within our control. It also means we can tell potential donors that we've looked carefully at the risks, we're taking these steps, and what we need to really deliver on our visions is staff and sustainable funding.

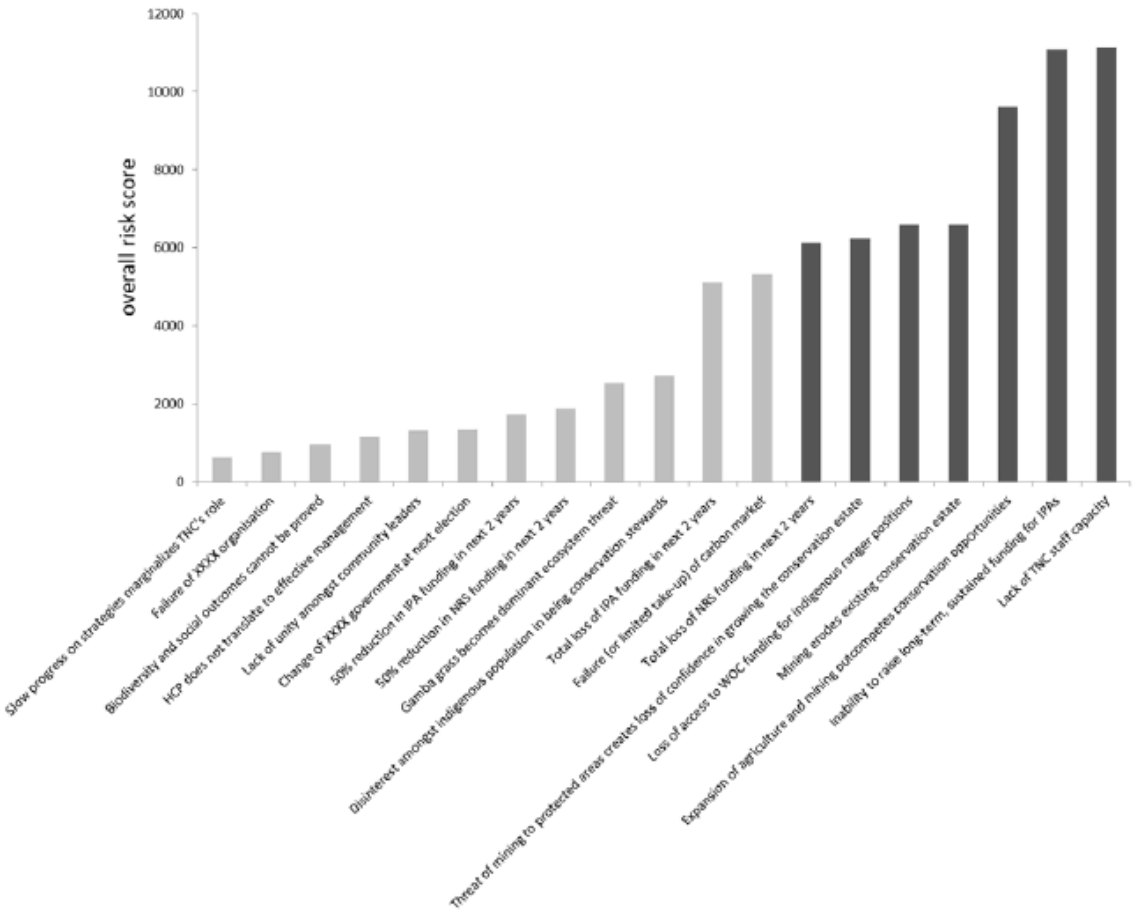

Figure 1 Mean risk score, summed across all four project objectives in northern Australia. Higher scores indicate greater risk. The acronyms used in risk labels are explained here.

What can we do with this sort of information about risks? Conservation projects must inevitably live with risk; not all risks can be eliminated. Rather, risk assessment methods can help conservation projects prioritize which risks to manage. Broadly speaking, risk management involves four options:

(1) Actively ameliorate through strategic adjustment,
(2) Gather information to better understand a risk,
(3) Monitor a risk in order to respond rapidly when it occurs, or
(4) Do nothing.

Which of these options is most appropriate depends on both the level of risk and the around the estimates of this risk (Figure 2).

A quirky thing about risk assessments is that if done well we hope they actually prove a poor guide to the subsequent occurrence and impact of risks. This is because ideally organizations will respond to these risks by making programmatic changes that serve to reduce their likelihood or impact. For example, in northern Australia the Conservancy has already responded to the issue of staff capacity and long-term financing, with the aim of reducing exposure to these risks.

Figure 2 Four responses to conservation project risks depending on the relative importance (risk score) and level of uncertainty around the assessment of a risk.

Unlike most other aspects of conservation planning that almost invariably benefit from being conducted in an open and collaborative fashion, an honest risk assessment may itself pose a risk to institutional relationships and funding opportunities.

Conservation funders do not expect the strategies and projects they support to be fail-safe, and my experience has been that they value honesty about the risks involved. However, there are barriers to the explicit acknowledgment and presentation of risks. Effective risk assessment requires those involved to be candid about the project (and it provides a forum to do so). Unlike most other aspects of conservation planning that almost invariably benefit from being conducted in an open and collaborative fashion, an honest risk assessment may itself pose a risk to institutional relationships and funding opportunities, especially when risks refer to the reliability of key institutions or organizations or failures of leadership. Given that building trust between organizations is frequently cited as one of the strongest outcomes of a conservation planning process[3], risk assessments need to be handled carefully (for instance you'll

notice that in Figure 1 we anonymised some of the organizations and political parties in question).

Identification, prioritization, and where possible, management of risks are important elements of using conservation resources in an informed and accountable manner, and will increase the likelihood of a project achieving the stated objectives. An assessment of risks to conservation success can be accomplished rapidly and effectively using the approach we've developed. So conservation planners out there, add risk assessment to your skills and practices. **SC**

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Viewpoint
Teaching Climate Change

By Annick Cros, Coral Triangle Program Coordinator, The Nature Conservancy

Image credit: Flickr user alexindigo via Creative Commons.

When it comes to climate change, I've always been a sceptic about the attempts of NGOs to reach out to the "public." Sure, WWF's drowning polar bears have made me shed a tear, but not once have I traded my car for the bus because of them — and I am someone whose work is dedicated to finding solutions to the threats of climate change. So if the polar bears don't get to me, what does make me switch from jumping on a plane to Indonesia to video conferencing? Well, truthfully, it is making savings to my small project budget, not missing yet another ukulele class, or being there for my friend's special birthday. The justification to my supervisor? Cutting down on CO_2 emissions.

So, if I can't be convinced to adopt a certain lifestyle for the sake of polar bears, or any other wildlife for that matter, but would gladly make the effort if it saves me money, maintains my current lifestyle or even improves it, why are NGOs still trying to convince the public with the same of teary-eyed strategy? And who actually are they targeting?

I taught a Biology 101 class this past fall to non-biology majors at the University of Hawaii. The students were a mixture of majors, ages 19 to 23 with a few more mature students that had just finished serving in the army. There were students from Hawaii, the mainland, and abroad (mostly Japan and China). One of the topics I had to cover was climate change. Out of 60 students, only 5 knew that climate change was an issue. Out those, two thought climate change was an issue created by scientists to manipulate the American people. Out of the last two, one 20-year-old woman had gone to Punahou, one of the best high schools in Hawaii and the other woman was 45. Incidentally, the 45-year-old was the only one who knew about the hole in the ozone layer.

I asked my colleagues to lend me the essays their students had written on climate change. Out of 180 students about 75% wrote that they felt that they didn't take an interest in climate change because:

- They didn't know it was an issue,
- They didn't feel it concerned them,
- They didn't understand it, they thought it was too scientific for them.

Of those, about 30% thought that melting icebergs were the main consequence of climate change and that they did not feel concerned about cute polar bears (the students were not prompted to talk about polar bears).

About 90% of my students didn't know that the major cause of global warming was CO_2 emissions, or that burning fossil fuel was the main source of CO_2 emissions. Asked what a carbon footprint was and why it was interesting, only one person had heard about it. You might think I am exaggerating, but I wouldn't have had the audacity to give so little credit to students at the University of Hawaii. I was completely taken aback by the total lack of knowledge, but far worse, by the lack of concern shown by these young adults. These future business managers, entrepreneurs, consumers and educators are the very people who most need to be convinced that the world has to change because they will be the people making the decisions. Yet, not a single message from NGOs or the scientific community had reached them.

The silver lining in this story is that the same students were easy to talk to, were open to learning about the issues of climate change and were curious enough to ask questions. I don't expect them to read the next National Geographic or any scientific paper, but maybe they'll think about our discussion next time they have to decide between buying a locally grown mango or one flown in from Ecuador. Even if they do buy the mango from Ecuador because ironically it is about half the price of the locally grown ones, they might eventually either have the money to make the "right" choice, or get tired of making the "wrong" choice and want to see changes in the system.

About 90% of my students didn't know that the major cause of global warming was CO_2 emissions, or that burning fossil fuel was the main source of CO_2 emissions.

Next semester, with the University of Hawaii, I will be helping to organize a week-long seminar for high school teachers on climate change and its impacts. Targeting education at the high school level will help students feel confident that they have the capacity to understand these issues and hopefully grow into adults that understand the consequences of their choices. At University level, I would make certain classes, such as environmental ethics, mandatory for future leaders of industries, politics and education. You are interested in business? You want to develop or manage a large company? Well, this is what you need to know about the impacts of your actions on the planet. But most importantly, this are the impacts of your choices on your money, your lifestyle and your family.

PS. If anyone is interested in coming to speak about climate change adaptation and environmental strategies for the seminar, please contact me. I have funding to bring in a guest speaker — or we can video conference you! **SC**

Article
Small May Not Be Beautiful for Dams

By Jeff Opperman, senior freshwater scientist, The Nature Conservancy

Image credit: Pigg River Dam, Virginia. USFWS Northeast Region via Flickr via and the Creative Commons.

Small is beautiful? Or tiny but terrible?

Economist E.F. Shumacher popularized the phrase "small is beautiful" to evoke appropriate technology that minimized social and environmental impacts. When it comes to hydropower, Shumacher's aphorism is often taken as an article of faith.

It's easy to see why: small hydropower generally evokes a quaint New England mill dam, in stark contrast to the hulking behemoths — hydro dams such as Hoover, Kariba and Three Gorges — that change the face of the earth as viewed from space.

But does small hydropower warrant its reputation as being environmentally friendly? Beyond the elegant aphorism, what's the evidence?

Answering that question is increasingly urgent. Globally, dozens of policies reflect an underlying assumption that small hydropower is "green." In the U.S., several states with Renewable Portfolio Standards disallow electricity from large hydropower dams but

embrace that produced from small projects (defined inconsistently as a megawatt capacity less than 30 or 50 or some other double-digit number), in part due to a perception that small equals low impact. The Clean Development Mechanism, launched under the Kyoto Protocol and intended to reduce greenhouse gas emissions, promotes small hydropower and streamlines its review due to perceived lower environmental impacts. Countries across the globe — from China to India to Mexico — have passed policies promoting small hydropower and subject its development to far less planning and regulatory oversight compared to large projects.

In one respect the answer is obvious: a 10 gigawatt project is going to have different — and much larger — impacts than a 10 MW project. It's like comparing apples to… apple seeds.

But that is not a terribly helpful insight. To be more useful, comparisons require scaling impacts to the energy that the dams produce.

A recent study (Kibler and Tullos 2013) looked at scaled hydropower impacts in the Nu River basin of southwestern China (the Nu becomes the Salween as it flows into Burma). The researchers calculated impact per MW of capacity across 14 metrics between small and large hydropower projects, with a threshold of 50 MW, as defined in Chinese policy.

If nothing else, these results clearly indicate that small hydropower can't get a free pass. We can no longer assume that small dams are environmentally benign.

They found that small hydropower dams had greater impact per MW for 9 of the 14 metrics, including length of river channel affected and impact on habitat designated as conservation priorities.

These results were summarized in media reports as, "small dams can pose a greater threat to ecosystems and natural landscapes than large dams." Because their study site includes one of China's last major rivers without a large dam across it, this isn't necessarily the most appropriate, or helpful, headline from their study. After all, a 9-5 score in "impact metrics" in the David vs. Goliath battle of the hydros isn't as straightforward as 9-5 in runs for baseball: perhaps cutting a mainstem river in half, as a large dam can do, outweighs all other impact metrics, like catching the golden snitch in Quidditch (don't laugh, I couldn't think of another sport with a scoring event so disproportionate).

But, if nothing else, these results clearly indicate that small hydropower can't get a free pass and be presumed to be environmentally benign.

By standardizing impacts across power generation, the results are relevant to a somewhat obvious problem with small hydropower projects: the cumulative impacts of their proliferation across a river basin or region.

But even more disconcerting than cumulative impacts are examples that illustrate that even individual small hydropower dams can cause significant impacts. In other words, just like two-year old children, small hydropower dams don't require strength in numbers to be naughty; they can be tiny and terrible on their own. And like an overtired toddler on a plane stuck on the tarmac, a small dam's bad behavior usually results from being in the wrong place.

You've no doubt heard a great deal about the breakthrough project on the Penobscot River that removed two hydropower dams and will decommission and bypass a third. The numbers associated with this project are somewhat astounding, including the kilometers of river that will now be accessible to a dozen species of migratory fish, and their projected population increases in response to that increase in habitat. For example, fisheries biologists forecast that Atlantic shad will increase from a few thousand to over two million.

And what about the dams that were suppressing these millions of fish? The size of these dams is just as astounding: 8.4, 7.7, and 1.9 MW — so small that using the tenths place is relevant! That's right, fish populations in the most important Atlantic salmon river in New England were dramatically depressed for a century by dams that are far below the cutoff often presumed to equal "low impact" (e.g., 30 MW).

A modeling exercise (Kuby et al. 2005) also illustrates the extreme naughtiness of tiny dams in the wrong place. Assessing strategies to increase connected channel network for salmon in Oregon's Willamette River basin, they compared removal options from among 150 dams in the basin. They found that removing only 12 dams could reconnect 52% of the drainage basin with a loss of less than 2% of the basin's hydropower and water-storage capacity. This was a modeling exercise, so these 12 small dams remain, each having an outsized impact on river connectivity.

Without a system approach, even tiny dams can cause huge environmental impacts. Clearly they can do so as a rambunctious crowd, but even sometimes as a solitary terror.

The take-home message? Whether small or large, it's all about location in a river basin. Small hydropower dams can certainly be part of a sustainable hydropower system. But so can large hydropower dams. For both large and small, the key word is system: sustainable hydropower requires planning, siting, and operating dams within an overall system that seeks to balance a range of resources and values. Without this system approach, even tiny dams can cause huge environmental impacts. Clearly they can do so as a rambunctious crowd, but even sometimes as a solitary terror. **SC**

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Viewpoint
Internationalizing Our Science

By Mark Spalding, senior marine scientist, The Nature Conservancy

Credit: Flicker user Wonderlane via Creative Commons.

I didn't go to the All-Science meeting, because it was too far away, and I'd already made the 11-hour flight to California twice in 2013 (alongside a host of other trips) and had two more such trips already for 2014. But here's a plea to all of us, but especially those in the U.S. Let's not forget that we are international in our science partners and let's facilitate our internationalism by internetworking, not more travel.

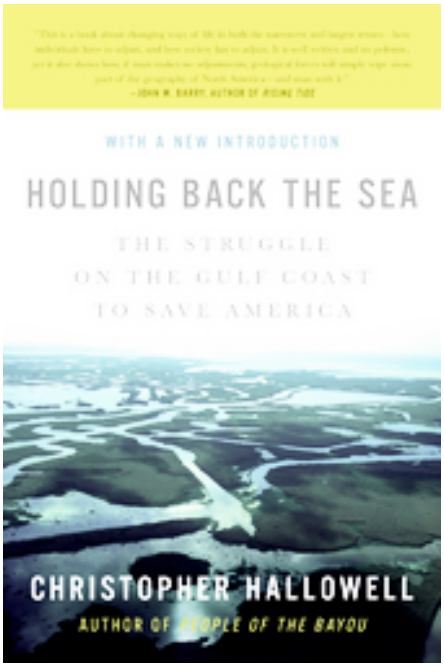
I was struck by Mark Tercek's recent blog, which included a list of external science engagement at the meeting: "UC-Berkeley, Brown, Stanford, Yale, Princeton, Cornell, Columbia, University of Minnesota, University of Washington and NatCap." That would be a GREAT list for a discussion about U.S. issues, but it's neither comprehensive nor representative. I'm based in the University of Cambridge, UK and actively engaged with work in two departments here. I'm also working with Wageningen University in the Netherlands. The coastal resilience team is working with University collaborators in Spain, Italy and Germany, we're engaged with Australian universities, and perhaps others. The full list across our field programs and Central Science would be impressive, but it also might help us all to realize just how international we are and might further our connectivity, while also pointing to gaps. Why don't we compile the list and put it all on a website — with live links to all the relevant departments and projects?

My second point is a concern. We are a leading environmental organization. We believe climate change may be the greatest threat ever to nature and people. And yet the only way you can participate in an All-Science meeting (or many others, including the forthcoming Marine Aggregation) is by being there. In an age where we can access the internet on smart phones while on top of mountains, it is now trivial to broadcast talks live. Our Management host "Town Halls" for all staff regularly (who said "too regularly"?) Surely it would make us a more convincing operation if we limited physical attendance at such meetings and offered live presentations with internet-based interactive Q & A. Virtual attendees could still register, and a small fee might be a good means of ensuring attendance. Physical participants likewise should be ready to see 25% of talks being broadcast to the meeting directly from our field offices. And all participants would have the huge advantage of being able to watch any overlapping/parallel talks or others that they missed as downloads afterwards. **SC**

Book Review
Canute on the Gulf

***Holding Back the Sea*. By Christopher Hallowell. Harper Perennial, 2005. 304 pages.**

Reviewed by Bryan Piazza, director, freshwater and marine science, TNC Louisiana, Baton Rouge



Holding Back the Sea is a book about change. By taking the reader on a tour of Louisiana's coastal wetlands loss crisis, Hallowell shows how intimately linked all Americans are with the Louisiana coast, and how the changes happening there will affect all of us. From the bayous of the Atchafalaya River Basin to the bowels of public meetings, to the kitchen tables of common folks who are most affected, Hallowell poignantly illustrates the ultimate gifts this immensely rich landscape provides, the apathy with which this catastrophe had been viewed, and the crisis that the problem has become. And he chronicles the change in attitude that has resulted and also the immense conflicts that change brings to the surface. Hallowell's storytelling is phenomenal and the depth with which he understands the linkages and importance of the Louisiana coast is impressive. Not only is this landscape important to the Cajun family that survives on hunting and trapping, but also to the family thousands of miles away that heats their home with fuel that is produced in it or transported through it. Hallowell also chronicles the story of the solution to coastal wetland loss, from the first realization of the problem to programs and projects to solve it.

As a scientist concerned with and working on these issues in Louisiana for many years, I related strongly with Hallowell through his journey. In fact, this was my second read of this book. The first was in 2001 when it was published. I worked with and know many who he follows in the book, so it was fun to read. This time, it was interesting to look at the issue 12 years later to see where we've come. But this book does not only resonate with those who live and work in Louisiana. I think this book will resonate with anyone who is interested in our human linkage to nature and concerned about the loss of a nationally important landscape. One thing that I particularly liked about Holding Back the Sea is that Hallowell focused on the problem from multiple perspectives by focusing on the people involved from all different walks of life — from politicians and decision makers to scientists, and families who love to eat crawfish on Sunday afternoons. And in doing this he also illustrated not only the complexity of the problem but also the complexity of several of the proposed solutions. Through it all, Hallowell shows his deep connection to the Louisiana coast and how a landscape can transform a New York writer into a lover of the people, culture and way-of-life on the bayou. A good read indeed. **SC**

Drinking from the Fire Hose

A quick monthly roundup of interesting articles, websites and other experiences collected by your editor. Send your suggestions for future roundups to pangolin19@gmail.com.

1) What on Earth has happened to poor old Alfred Russell Wallace? His life, brilliantly animated in paper.

2) If you want to build an effective solution, you have to identify the real problem first. If that sounds rather obvious, as I imagine it should, read this cautionary tale on the best laid development plans, and consider the implications for evidence-based conservation (and be sure to check for more on that topic in the March issue).

3) More on the diversity-resilience hypothesis. The idea that more diverse systems are more stable as well has become a foundational argument for biodiversity conservation. But much of the evidence has focussed solely on alpha diversity (a simple inventory of how many species are in a particular location), which is not often a great measure of biodiversity. This study is an elegant look at whether species turnover (beta diversity) supports the relationship across an entire landscape, in this case the entire breadth of the Australia's Great Barrier Reef. Bottom line: greater spatial turnover leads to lower temporal fluctuations — fewer invasions, disease events, or die-offs from extreme climatic events — over 16 years of data collection.

4) Can Business Help the World Become More Sustainable? Since all of you have read *Nature's Fortune* (right?), the answer to this question will come as no surprise. Still, this report from the World Economic Forum is yet more evidence that the idea is becoming, ahem, mainstream.

5) New test of an old idea. Namely, that islands make animals tamer. Darwin knew it as soon as he went for a ride on the back of Galapagos tortoise. But it has taken a while to get the data. Full article if you are interested is here.

6) Save the Keeling Curve! You may need to be a climate data geek to know what the Keeling Curve is, but that doesn't mean it isn't important. The Keeling Curve is the world's longest unbroken record of atmospheric carbon dioxide concentrations, dating to 1958. And the project is running out of money. Is crowdfunding the answer?

7) It was long overdue, but was it right? Alan Turing, one of the great minds of the 20th Century, or perhaps any century, received a pardon just before Christmas from Queen Elizabeth for the crime of being gay, more than 60 years after he was convicted. Hard to argue with that, but this article makes an interesting case, and perhaps not for the reasons you might expect.

8) The Genius of ZeFrank. Just because. His description of how an owl hunts at night makes this one worthwhile all by itself. **SC**

Announcements

Recruitment of Two Members of the Scientific and Technical Advisory Panel of the Global Environment Facility

The Global Environment Facility (GEF) is the world's largest funding mechanism addressing global environmental challenges in biodiversity conservation, climate change, international waters, safe management of chemicals, and land degradation. The Scientific and Technical Advisory Panel (STAP) of the Global Environment Facility is currently accepting applications for three positions from highly qualified candidates with outstanding academic and technical credentials, and experience in making science relevant for policy and decision-makers in the areas of Biodiversity and Chemicals and Waste and Waste. To review the detailed Terms of Reference for each position, please click on the appropriate link.

STAP is an independent group of seven experts working together to provide objective scientific advice on policies and strategies of the GEF. The Panel implements a results oriented program of work – developed in collaboration with GEF Partners – designed to address important challenges within the GEF Program, and provide operational advice on individual GEF projects.

The successful candidate must have:

Professional:

An advanced degree, preferably a PhD in a field directly related to the position;

Minimum 15 years experience in scientific research with demonstrated success in applying research results to real-world issues;

Ability to work cross-sectorally in areas of importance related to their field of expertise;

Capable of bridging scientific, technological, and policy issues;

Demonstrated capacity to formulate scientific advice that integrates findings from relevant bio-physical sciences as well as socio-economic disciplines (e.g. economics, geography, anthropology, etc.) on policy and project/program issues.

Experience working in developing countries and in the context of multi-lateral environmental assistance;

Demonstrated ability to manage scientific research undertakings involving multiple stakeholders;

Excellent communication skills, orally and written.

Understanding of the assigned GEF focal area, its strategic objectives, and linkages with other GEF focal areas is an asset.

Leadership:

Extensive access to scientific networks, and demonstrated ability to engage these networks;

Demonstrated expertise and leadership in one of the thematic areas noted above, supported by (but not restricted to) the candidate's peer-reviewed publication record;

Knowledge of the scientific processes required for the implementation of relevant conventions in developing countries for which the GEF supports.

A STAP Panel Member is expected to provide 60 to 90 days per year to the work of STAP. Remuneration is based on UN scales for senior consultants. A full description of responsibilities, and application forms, are available here. Applications along with a cover letter should be sent to: Recruitment.STAPGEF@UNEP.org quoting the relevant vacancy reference number in the subject line of your email. All applications should be sent on or before the deadline of January 31, 2014.

March 13 at 2PM ET: North America Region Science Spotlight Webinar

The North America Region is hosting a webinar series to highlight some of the most exciting new TNC science happening in the U.S., Canada and Caribbean, whether it's conducted at the chapter, regional, or global level of the organization.

The March 13 Science Spotlight will focus on Conservancy science behind managing integrated freshwater systems. Allison Aldous will talk about using wetland ecohydrology to set limits to groundwater withdrawal, and Kathy Boomer will present her work on evaluating wetland function and local restoration opportunities throughout regional watersheds. Register and get the call-in info here.

Know of science projects going on in our region that your colleagues should hear about? Please send your suggestions to Brad McRae and visit our site to learn about upcoming webinars. SC

New Conservancy Publications

Conservancy-affiliated authors highlighted in bold (apologies for anyone we missed).

Please send new citations and the PDF (when possible) to: pkareiva@tnc.org and rlalasz@tnc.org. Please include "Chronicles Citation" in your subject line so we don't miss it.

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 science publications since 2009.

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