

# SCIENCECHRONICLES

April 2012

Image: Dow's Freeport, TX facilities. Image credit: Jennifer Molnar/TNC.



## The Science Behind the TNC-Dow Collaboration

Peter Kareiva: An Open Conversation About Conservation 3

Letters: Two Views (and Two Responses) on Urban Conservation 7

Jonathan Higgins: Puff the Magic Lever 11

Jeanette Howard: How *Do* We Scale Up? 14

Drinking from the Fire Hose 18

The Science Behind the Dow Project: Overview 19

- Dow Analysis 1: Fresh Water 24

- Dow Analysis 2: Coastal Hazards 26

- Dow Analysis 3: Air Pollution Mitigation 29

The Coda Files: Margo Francis 32

Science Shorts, Announcements and New Conservancy Pubs 34

## Editor's Note

By **Bob Lalasz**

Last month I wrote about Alan Alda's "[Flame Challenge](#)" (daring us all to answer the question "What is a flame?" so an 11-year-old could understand it) and how conservation orgs seem to have abandoned science as an audience-building tactic, for kids and adults. I promised this time to list some ways science can lure the masses. Here goes:

**Citizen science:** Participation in citizen science projects has exploded online — through mobile app projects like [iNaturalist](#) and the [NASA meteor counter app](#) as well as to games aimed at getting the most interesting solutions to science problems (like the protein-folding online game [Foldit](#)). *Scientific American* [keeps this list of more than 50 ongoing citizen science projects](#), and of course the Conservancy has its own from New Jersey to Arizona.

Phenology is an especially fertile part of citizen science, and right in our wheelhouse at the Conservancy. Imagine a [Climate Wizard](#) mobile app in which users record

observations for specific ongoing climate studies, see other users' geo-tagged uploads, and then get the results of the study when its ready.

**Maps:** One can make a good case that TNC's business is maps. People love to play with maps, even digital ones — to explore them, to immerse themselves in imagined new worlds. [Maps.tnc.org](#) is not the place for this — it has a different purpose, which it fulfills well. But still: We have no online restoration games. We have no maps that allow people to model future conservation scenarios. We have no maps that allow you to upload that flower you just saw and find out from a network of naturalists what it is and where it might fit into conservation. We simply have not made it a priority to connect with people in this way. As director of science communications, I shoulder my fair share of the blame for these absences. But my point today is that they all lead with science, and they would all attract new audiences.

**Science festivals:** If this sounds like high school, a science fair crammed in between the cheerleader bake sale and the freshman orchestra

concert, time to hang up your letter jacket. The United States alone has more than 30 science festivals this year — from San Diego to Philadelphia to Cambridge to the entire state of North Carolina. The [World Science Festival](#) in New York drew 183,000 people last year. These are the science equivalent of huge walk-runs, and conservation science should be involved in a bigger way.

**Answering questions:** Back to my point last month — if adults are struggle to answer the common, science-based questions their kids ask, shouldn't we be helping them? Why do some animals and birds migrate, and others don't? Why are the azaleas blossoming earlier this year? Why do I hear frogs in the country but not in the city? Imagine an ongoing video series with our conservation staff answering such questions. Imagine the goodwill we'd get back. Not viral; but maybe vital.

OK, enough from me. What are your ideas for how to use conservation science to connect with the public? If I get enough of them, I'll publish the best and start some projects with you. **SC**

### 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.

Editor & Submissions [Bob Lalasz](#)

The Cruellest Month [Peter Kareiva](#)

For Back Issues Visit the [Conservation Gateway](#)

To Manage Your Subscription Status [Contact Nancy Kelley](#)

While *Science Chronicles* is a Nature Conservancy Science publication, all opinions expressed here are those of the authors and not necessarily those of the Conservancy.

## Letter

# An Open Conversation About Conservation

By [Peter Kareiva](#), chief scientist, The Nature Conservancy



The article Bob Lalasz, Michelle Marvier and I wrote about [“Conservation in the Anthropocene”](#) — and the recent follow-up in [Greenwire](#) and [Dot Earth](#) and [CONNECT](#) — certainly created a stir. I do not want to revisit the article — frankly, I am weary of the debate, as I bet many of you are. I am most interested in pursuing the science and analyzing data that can reveal patterns of ecosystem resilience versus fragility.

But I have been surprised by the passion of the responses I got to the article, not just in the public domain, but also through many private e-mails. From within TNC, the response to the article has been about 1:1 favorable to unfavorable. The response from outside TNC has been much more favorable — I’d estimate 3:1 in favor or supportive of our ideas. I have been trying to understand this difference. What I have learned is that many of you, my TNC science colleagues, feel our critique of the broad field of

conservation in the “Anthropocene” piece is a critique of your contributions — somehow devaluing your work.

I apologize that the essay had this effect. Denigrating TNC’s work was not our intent. TNC science staff and other staff have a record of tremendous accomplishment worth taking pride in. But throughout our history, we have pushed ourselves to do more — and that is what we as authors were trying to do, perhaps clumsily. This TNC legacy of constantly seeking to improve and to innovate is one that we talk less about, but we should be equally proud of:

- In the 1950s, when TNC staff protected tiny parcels of land for the sake of unique old-growth forests or rare and endangered plants — those were real and important contributions, and ones we can still see today. But they also represent a type of work we grew beyond.
- In the 1970s, TNC geared up its land acquisition program, a program that eventually transformed into saving the last great places. I am not sure there is anything more easily appreciated than our protection of some of those places. But we now know those places will amount to little if we do nothing about climate change, invasive species and airborne pollutants that can cross entire oceans.
- As TNC built its science and stewardship staff, we became known to federal agencies as the environmental group that did not sue, but instead worked to manage the lands — sometimes in partnership with ranchers and loggers. But stewardship is expensive, and we now recognize the need to share lessons learned from our stewardship more efficiently than through word-of-mouth and direct personal relationships.
- As we gained power and traction and went international, our science and conservation innovations have made a real difference — water funds, trawler buy-back, citizen science scouts for invasive plants, planned burns for grassland management, and much more.
- TNC has probably done more with working landscapes than any other NGO.
- And now we are setting up volunteer leadership councils of different shapes in Latin America, in China, in Asia-Pacific, in Argentina, in Australia and so on — and these descendants of the U.S. trustee program promise to reshape international conservation.

A number of people have told me that they feel we unfairly characterized conservation organizations in the “Anthropocene” piece, particularly those working in the United States. It is true that we were painting with a broad brush, and that there has in fact been much progress both within and outside of TNC toward recognizing the importance of and doing conservation in “working landscapes.” However, we have tended to do this work as a means to a single-minded end — to protect biodiversity. Less often have we approached such work with the explicit goals of enhancing jobs and economic opportunity; these goals are rarely in our plans and only in the last few years have we begun to figure out how to measure these benefits to people. This absence of metrics and goals about human well-being is why one still sees sectors of the public

**“Denigrating TNC’s work was not our intent. TNC science staff and other staff have a record of tremendous accomplishment worth taking pride in. But throughout our history, we have pushed ourselves to do more — and that is what we as authors were trying to do, perhaps clumsily.”**

protest against conservation because of job loss. Most importantly, if one steps outside the United States, conservation in general remains plagued with problematic treatment of human needs.

I am proud of TNC and its scientists. But I cannot write about TNC's many accomplishments when I write an article for publication. And while I can mention some of our accomplishments when I give a public talk, I cannot be a cheerleader in these venues for TNC. Why not? Because if I focus on TNC's achievements, the article will be rejected by editors and referees as a sales pitch rather than a serious analysis, and the public will view the talk as a marketing effort. To get an audience and a journal to treat one's voice as authentic, there has to be some self-criticism and minimal promotion. Secondly, if you want to create a discussion, you have to push the limits — if you pay too much attention to making sure everyone feels good about what you write, then what you write will neither be read nor thought about. Some of the ideas we wrote about have made people uncomfortable. But that was the point of the article. It was meant to be provocative, to get us all to think about the broad conservation movement and where we might do better.

Lastly, I have been challenged in the wake of the "Anthropocene" essay on whether what I say or write speaks for TNC. In one sense, we all represent TNC in our daily professional lives — how we conduct our business in meetings, what we say, whether we come prepared, whether we turn off our smartphones and pay attention — these behaviors all reflect upon TNC. And obviously there is such a thing as a TNC position, including a TNC position on scientific matters. Thus it should be obvious that TNC supports the U.S. Endangered Species Act. It should be clear that TNC believes that human activities are contributing substantially to climate disruption and that this disruption poses significant human, ecological and economic risks. On these matters, each of us can stand up and say in public, *"I am the \_\_\_ scientist for TNC and I and my organization believe climate disruption is an ecological and economic risk and that we need to find a way to reduce emissions to mitigate this risk."* That statement is an unambiguous and proper representation of yours and TNC's position.

But let's take something concrete but more nuanced, like GMOs. I personally feel that some types of genetically engineered crops could be a boon to both food security and to conservation. I write about this and talk about it publicly. I have conducted and published original research in the area of risk assessment for GMOs and thus feel I have some expertise on the matter. But I cannot and do not represent TNC's position on GMOs — because we have no position. Frankly, I wish we did. And one reason I write and talk about the topic is to move us towards at least having on our website a statement that we adhere to the National Academy of Sciences' assessment of GM crops — which is that it is the crop and its traits, not the technology that produced them, that is the issue. I do not expect all scientists to agree with me about GMOs. But I do hope for an open dialogue — ideally through published articles and panel discussions. Similarly, when I write about the need for change in the field of conservation, I am writing for the broad conservation community. Yes, I hope it will stimulate debate and change within

**"I am not dictating TNC policy; I am exploring ideas and approaches through debate in the literature and public talks, and hoping we all question everything we currently do with an eye towards considering alternative approaches."**

TNC, but I am also speaking to our colleagues at other NGOs, in government agencies, and in the academic world.

What makes TNC special is that it has scientists who care about making a difference, and who are impatient and want to see their ideas applied as fast as possible. No other place at which I have worked (and there have been more than a dozen) has this much talent aimed at making a difference using science, with so little regard for personal gain or reputation. That is truly inspiring. We are all trying to do good. But we need to be able to argue and challenge each other and the external conservation community with vigor — because there is no question all conservation organizations need to have a bigger impact if we are to make the world better in the ways we want to. The discussion I am promoting through the “Anthropocene” essay and other articles is not as simple as climate change or GMOs. It is not TNC policy — but it is a discussion that may lead to changes (or NOT) in the way TNC conducts its business. I am not dictating TNC policy; I am exploring ideas and approaches through debate in the literature and public talks, and hoping we all question everything we currently do with an eye towards considering alternative approaches. Reassuring ourselves that “we already knew that” or that “we are on the right track” is no way to be at the top of our game.

**Stripped to its barest essential, here is my hypothesis.** For the last 20 years, conservationists have been advancing their cause by having biodiversity protection as their stated goal. I believe in biodiversity protection — especially when it is defined in terms of species, habitats and functioning ecosystems (as opposed to “biodiversity” in the abstract sense). However, pushing our agenda solely in terms of biodiversity has not and will not be sufficient. We need to be part of a vision for a future world that is better, as opposed to a reactive movement about keeping things the way they were. Specifically, in the communities and places in which we live and work and that we care about, we as conservationists should be solving the problems of how 2050 can be a better world in terms of jobs, equity, health, food security and nature. Arriving at these solutions will require asking many hard questions and having a lot of philosophical and scientific debates.

But I am optimistic we are moving in the right direction. I am writing this from Juneau, Alaska, where I just learned about TNC’s “multiobjective plan” for Prince Wales Island — a plan that includes conservation value, timber supply *and* economic viability. This plan leads me to believe we are not very off from what I would like to see as the next generation approach for TNC: **We, The Nature Conservancy, are the organization that knows how to improve the condition of nature for 2050, and we are willing to work with you to help you achieve your goals for food, jobs, economic growth and energy.** That statement is not a change in mission. It is, however, a recognition that we need alliances and more partners if we are to make 2050 better for nature. If we want the world to embrace our goals, we have to embrace the world’s goals. **SC**

“Pushing our agenda solely in terms of biodiversity has not and will not be sufficient. We need to be part of a vision for a future world that is better, as opposed to a reactive movement about keeping things the way they were.”

# Letters: Two Views (and Two Responses) on Urban Conservation

To the Editor:

I've been following the articles in *Science Chronicles* and elsewhere about urban conservation and the issue of people and conservation more generally. I find myself alternately bemused and perplexed by some of the underlying assumptions that surface in some of these discussions. That people would be saying The Nature Conservancy does not and has not done "urban conservation" perplexes me, and is just not true. Perhaps our work in urban areas is not as well known, internally as well as externally; but this is a marketing issue, not a conservation issue.

My experience with the Conservancy has been that, in accomplishing biodiversity conservation, the Conservancy works in places where important biodiversity exists, whether it is in wild landscapes or near heavily populated areas. Actually, in the United States at least, the Conservancy has a large presence in many regions where land is largely in private ownership, and not in the wildest landscapes that are primarily in public ownership. So the stereotypes about conservation working only on faraway wild places may be true for conservation advocacy groups, but not for conservation land trusts like the Conservancy.

I have been working for the Conservancy in Oregon's Willamette Valley for more than 20 years. The Willamette Valley is home to two-thirds of the state's population, and land ownership is more than 95% private. A big part of the Conservancy's work in the southern Willamette Valley has involved an open space conservation partnership with local and federal government agencies that started with the West Eugene Wetlands Plan. This plan itself is a [multiple objective natural resources/land use plan](#) (and was actually the subject of an article in a 1993 issue of *Nature Conservancy* magazine), but the collaborative effort itself has evolved over the years into the "Rivers to Ridges" open space partnership.

Over the past 30 years, the Rivers to Ridges partnership has been very effective at all of the steps of building an ecologically significant open space network in and around the cities of Eugene and Springfield (see this [Planning Report](#)). About nine years ago, the partnership created a "[Vision Map](#)" as part of the planning process, and it is interesting to now see how many of the areas indicated on the 2003 map as "potential open space anchors" have been conserved in the past nine years. Much has been accomplished in this time period by the open space partnership, including thousands of acres of land permanently conserved, hundreds of acres of wetlands and prairies that have been restored, and numerous other achievements that will benefit the residents of the Eugene-Springfield area. I suspect that our experience in urban conservation in the Willamette Valley is by no means unique within the Conservancy.

Taking a wider view of this article, I do think it is important to avoid creating debates within the Conservancy that are founded on inaccurate characterizations of the topic that are basically “straw men” (i.e. we only work in large pristine landscapes, not urban areas). When this occurs, it may create a work environment that puts staff who know otherwise on the defensive, may harden people’s positions when the differences in opinion are slight, and to some extent makes people in the field question the credibility of our leadership. In times such as now, when resources are tight, the atmosphere that is created can take a bit of psychic toll on staff who, even if they see its value, now have to wonder whether their work will be valued by the larger organization in the future. Our mission is biodiversity conservation in its various forms and places, and as an organization we have always been skilled at developing effective strategies for conserving biodiversity that are adapted to each unique situation. There is a great deal of strength in our varied efforts, and we need to recognize our history as an asset — to be built upon, not ignored.

—[Ed Alverson](#), Willamette Valley stewardship ecologist, The Nature Conservancy

To the Editor:

Ever since I finished reading Rob McDonald’s essay “[Conservation in an Urban World](#)” (*Science Chronicles*, February 2012), I’ve had various movies flickering through my head — scenes from “Blade Runner” and “The Fifth Element” coming to mind. We know that Hollywood is no great predictor of the future, but the visions of the dark, overcrowded, impersonal urban landscapes depicted in those movies may not be far from reality 50 or 100 years from now. It started me thinking — what do we really expect to gain from an emphasis on urban conservation? Conservation for cities makes sense. Conservation in cities? I’m not so sure about that.

As Rob pointed out in his essay, more than 50% of the world’s population lives in urban areas, and the figure is more than 80% in the United States. Population density in urban areas will continue to grow. What does that mean for investments that TNC makes now in urban conservation?

Consider this: if 50-60% of the global population in 2050 lives in relatively concentrated urban areas, and the other 40-50% lives in relatively expansive areas outside urbania, where is the best place for the persistence of natural systems? I know where I’d lay my bet, and it’s not in downtown Gotham (sorry, Batman). If we’re really serious about the issue of urban conservation, then rather than investing in building nature into urban landscapes, we should be investing in acquiring expertise about urban/suburban expansion. I’d bet you dollars to doughnuts that over the next 50 years, population expansion into the watersheds that provide water to metropolitan areas is going to have a greater impact on water availability than climate change will. I grew up in the New York City suburbs and I know how suburban growth has exploded there since the early 1960s. Will New York City eventually expand into the Catskills? I now

reside in Virginia's Potomac River Gorge watershed and have watched the growth of my once-small village of Great Falls over the past 29 years. Happily, the development in my part of the gorge has mostly been done with an eye towards the maintenance of the Potomac River watershed, but will that happen everywhere? Having a better understanding of likely future patterns of urban/suburban expansion into existing areas that are key for the provision of metropolitan ecological services — and taking measures to conserve those areas — will be a better investment for us in the long run than in conserving biodiversity in big cities.

As to the other motive for engaging in urban conservation — building a new conservation constituency — there has to be a better way of doing that than investing in what is likely to be a losing proposition of conserving nature in big cities. TNC programs like LEAF come to mind as a more feasible and cost-effective alternative. Mass and social media allow “access” and connections to natural areas that were not possible 50 years ago without a personal visit. There are better alternatives available to us for connecting people to nature via technology than reorienting our focus to conservation within urban landscapes. The long-term return on investment of conservation in cities, in all likelihood, will be nil.

—[Jerry Touval](#), director of science, Latin America Region, The Nature Conservancy

*Rob McDonald responds:*

Ed Alverson raises a good point in his letter: given the broad definition of urban conservation I used in my previous article for *Science Chronicles*, isn't TNC already doing urban conservation in some projects? The answer is an emphatic “yes”! One of the first things I have done in my informal role as TNC's “urban conservation guy” is pull together a list of everything we are doing that relates to urban conservation. That list has been really helpful in getting a handle on what urban conservation strategies TNC has some unique skills in. And sometimes it is surprising how big our actions have been: for instance, TNC has helped protect around 1 million acres in metropolitan areas in the United States, a track record of open space protection we should be proud of.

I think that 1 million acre figure can counter Jerry Touval's skepticism about “conservation in cities.” Presumably the many OUs that have helped protect that open space have thought some about the viability of the conservation targets on those lands. Granted, these are not lands in the downtowns of major urban areas — they are in the suburbs and exurbs. But we can't afford to write off all the suburbs and exurbs. In the United States, about one-third of imperiled species are located in metropolitan areas, especially in a few hotspots (e.g., southern California, south Florida). Globally, the figure is a little lower, around 10%. Protecting those species is a worthy goal for TNC, even if it is harder for many logistical reasons than protecting imperiled species in rural areas.

I actually share some of Jerry's skepticism, though. Part of the reason there is an increased interest in urban conservation is because there are new funding opportunities and new outreach opportunities (or just because they improve people's lives). There is a temptation sometimes to talk about these urban conservation projects as if they have great benefit to biodiversity. If projects are primarily motivated for other reasons, we shouldn't oversell their biodiversity impact when talking publicly about the project.

Moreover, we should realize in our planning that there are often tradeoffs. The ideal urban conservation project, while it may have some biodiversity benefits, may not be as cost-effective a way to protect biodiversity as working in rural areas. We talk about "win-win" opportunities so much that sometimes I think we forget this point. So a conservation plan that tries to protect or restore ecosystem services will prioritize working in one set of places. And a conservation plan that tries to protect or restore biodiversity will prioritize a slightly different set of places. While there might be some overlap between these two sets, we shouldn't forget that they aren't the same.

*And Ed Alverson gets the final word:*

As a follow-up to Rob's comments, I might add that developing a better understanding of the history of both failures and successes in urban conservation would be a valuable knowledge base for moving forward effectively. There is of course a long history of collaborative parks and open space projects in the United States, going back to Frederick Law Olmsted, but the specific link to TNC probably starts with Henry Cowles, a pioneer in the science of ecology in the late 19th and early 20th centuries. Cowles helped to found the Ecological Society of America, and it was ESA's Committee for the Preservation of Natural Conditions that eventually became The Nature Conservancy. In addition to his pioneering research on ecological succession on sand dunes along the shore of Lake Michigan, Cowles was a leader in an early campaign to conserve those dune habitats as increasing industrial development continued to destroy them. Extensive areas of the dunelands are now conserved as part of the Chicago Wilderness network.

But what were the successes and failures in the century-long efforts to conserve these areas, and why? What lessons can we take from this history, and what have been the most influential factors — funding, marketing, topographic constraints on development, etc. — in leading to success or failure? Similar conservation efforts have been attempted in and around many of the urban areas of North America and elsewhere in the world; in some cases successfully, in others not. I suspect one would find that many case studies focused primarily on human recreational needs and less on the viability of ecological systems, but it would be interesting to know where and why ecological values have best been addressed. Since urban areas, once developed, have relatively "hardened" land uses, we usually only have once chance to get it right. History offers many clues as to how to most effectively move forward. **SC**

# Straight No Chaser

## Puff the Magic Lever

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



I have spent lots of time over the last few months reviewing strategies, measures and business plans for the Conservancy’s system-scale programs. And the most worrisome thing I’ve noticed is — we still don’t seem to understand as an organization how to bring our work to scale.

Almost all of these documents describe the transition from “demonstration” or “proof of concept” conservation sites to “broad acceptance and implementation at scale” with not much, if any strategic thinking or detail about how that transition actually happens. The summary theory of change commonly put forth is this: demonstration projects show good conservation, and as a result, partners and agencies then use and promote the approaches or tools of these projects, greatly expand their implementation...and change the world. Another concept of leverage, explained in the Conservancy’s Global Challenges-Global Solutions documentation, is that the Conservancy will broadly communicate our successes to influence their use by others.

**Image credit:**  
[jimmiehomeschoolmom/Flickr.](#)

**“Straight No Chaser” is an occasional (if not downright odd) column original to *Science Chronicles*.**

Suggesting that our work will somehow go viral because it is so good and important that everyone will see it and want to do it is hopeful at best. To be blunt, it is unrealistic, and has been proven not to be true. Here is a much more commonly held and strategic concept of leverage: You identify the place where you *know* or *have good reason to believe* that one or a few of your actions have the best chance of greatly influencing the broad actions of others...and then you act.

Given the limited time and resources the Conservancy has, we need to be efficient and effective — which is what leverage is all about. But leverage isn't easy. Before you try to demonstrate anything, you need to a) define the scope of impact you want to achieve; b) define your levers (agency, corporation, partner, policy); c) identify the scope of impact that the levers can generate; d) identify the decision-makers who move those levers; e) get clarity on what needs to be demonstrated to whom in what format to move which lever; f) figure out the financing needs for implementation; and g) identify any barriers to having the levers operate. Otherwise, you are just doing conservation, and *there's nothing wrong with that*. (Whatever happened with just doing conservation that is not intended to change the world, but is intended simply to change a place? We should be comfortable with that approach when it makes sense.) However, since the Conservancy's new focus is on system-scale conservation, and that happens primarily through leverage, we also need to understand thoroughly how to achieve leverage, and not simply declare that we will be victorious before knowing the hard work of winning the war.

Unfortunately “demonstration site” and “proof-of-concept site” are buzzwords within TNC now, and everyone wants to be one, like everyone wants to be a priority. And naturally, in the rush to sound as if each of our projects will have leverage, we are too commonly defining as “demonstration” those projects that are not demonstrating anything to anyone in particular other than to TNC or those who fund the project. These sites might generate good conservation results or even a new approach to solving an old problem — and again, there's nothing wrong with that. But we should call these projects “conservation” or “R&D” if they are not clearly linked to a lever. And we should never call them strategies in themselves, as some have taken to doing. Here's a strategy: Leveraging a best management practice (BMP) to 5 million targeted acres and reducing sediment runoff by 35% through a project that demonstrates benefits and provides methods for farmers, the NRCS, and policymakers, changing authority and appropriations through policy work, and having implementation targeted to the appropriate places at the scales necessary through known mechanisms.” The project alone...is not the strategy.

### Why Not Understanding Leverage Means “FAIL” for Conservation

What's the big deal? Why does this mislabeling hurt anybody? Let me give you an example. A common Conservancy project is to create and “demonstrate” that a model or tool we've helped develop will be more efficient at something, like better targeting BMPs

“Suggesting that our work will somehow go viral because it is so good and important that everyone will see it and want to do it is hopeful at best. To be blunt, it is unrealistic, and has been proven not to be true.”

to be more efficient and effective in controlling sediment and nutrient runoff to streams. Sounds good; sounds important and useful and attractive to everyone.

But in developing these projects, we may fail to understand who in the lever will need to operate the model and manage the data — so the model doesn't get adopted because it isn't user-friendly, it isn't consistent with the formatting language or data acquisition of the lever, or it's just too complicated for someone outside of a tech-head to use. Knowing how the lever will use tools and data is critical to understand before moving forward — there are lots of great tools out there that sit on shelves because they fail to take this into account. Despite what Steve Jobs says, Apple understood perfectly well how user-friendly the iPhone needed to be before it was launched. It wasn't just a myriad of applications; it reflected a thorough understanding of the lever.

Agencies and partners do not just adopt new tools or approaches because they are self-evidently good; they are limited by mandated scopes of work, funding and staffing. Most agencies, even if they are willing to use a new approach, are generally strapped for resources. Not having a plan to address these and other barriers — such as changing mandates through regulatory or agency changes — also means that the lever will not function.

How do we solve this leverage problem? We need to get smarter about how we plan our work. The Conservancy has issued very helpful new guidance on conservation and business planning that is bringing us into the modern era. One of the features of this new guidance is being clear about risks and assumptions. While Conservancy staff have gotten better at presenting the steps within theories of change (in written summaries and diagrams such as result chains), they often lack the knowledge about risks and assumptions necessary to clearly define why those steps will work — or understand why they might not. We cannot afford the risk of investing in strategies based on theories of change that are just a flow diagram of arrows linking sets of objectives and hopeful outcomes developed in a workshop with similar-minded people. We need to get real, and thankfully, some people at the Conservancy are.

But our thinking, terms, examples and trainers are still primarily limited to site-based concepts while pretending those concepts are all scale-less. This gap is one of the major reasons we are struggling with the concept of system-scale planning and actions, and the Conservancy needs to address it now. We are not going to achieve leverage through site-based projects and then dropping leaflets out of an airplane. We need to recognize the stakes we are now playing for and step up our game. **SC**

**“We are not going to achieve leverage through site-based projects and then dropping leaflets out of an airplane. We need to recognize the stakes we are now playing for and step up our game.”**

## Article

# How to Scale Up: Notes on a Hierarchy from California

By [Jeanette Howard](#), associate director of science, The Nature Conservancy in California



Scale up. Leverage. Amplify. Broaden our constituency. Think about people. Network socially. Get hip. From strategic plans to global challenges and global solutions, these are the beacons currently guiding the Conservancy's work. We are constantly asked to consider how our work fits into THE big picture.

**Image credit:**  
[Dominic's pics/Flickr](#).

**[Discuss this article](#) on  
the Conservation  
Gateway.**

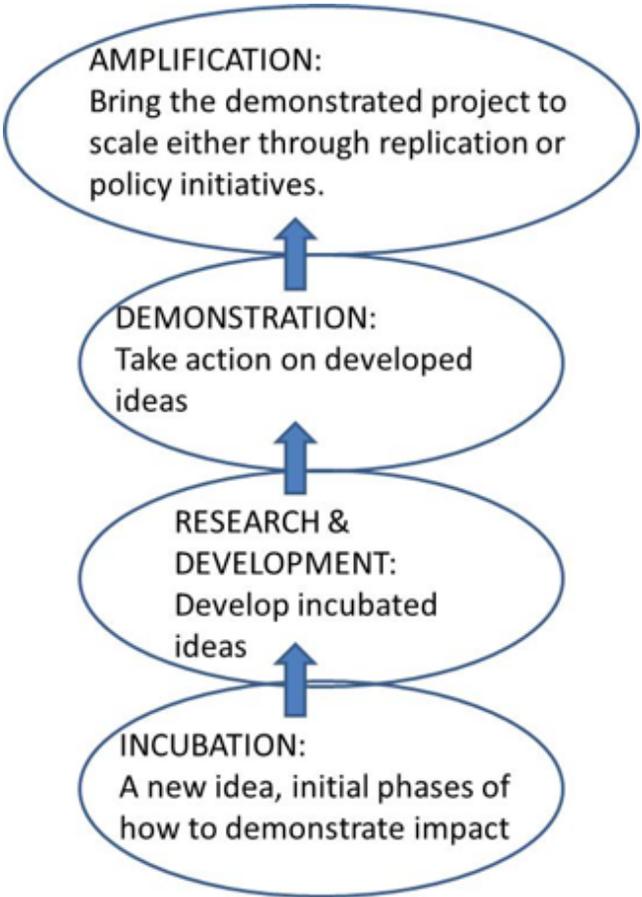
If the biggest challenge we do indeed face in the environmental community is accommodating an additional 3 billion people on the planet, we certainly do need to scale up and/or build a bigger house. We've hired social scientists and economists to help us value nature for people and develop social objectives and indicators. But who are our "scaler uppers," our leverage engineers? What are the mechanisms to make our work bigger? What levers do we pull to catalyze and leverage our efforts? There's little guidance about HOW to scale up, except to work at larger/whole ecosystem scales — in other words, *to scale up*. But how?

In California, we — like the rest of the Conservancy — are trying to figure out what scaling up looks like as we focus our work around six initiatives: salmon, water, renewable energy, migratory birds, groundfish and climate change. In talking with colleagues around the state, we have come up with three, maybe four scaling-up mechanisms:

1. **Replication** – through partner engagements, we replicate methods, solutions, and best management practices to impact bigger geographies;
2. **Policy** – use policy levers (government, funding campaigns etc.) to forge broad-scale changes;
3. **Market mechanisms** – utilize the economic market to generate change (e.g., the Forest Stewardship Council);
4. **Industry standards and practices** – influence industry to adopt standards and practices that benefit people and nature.

Here in California, we see our on-the-ground projects as the foundation for scaling up our conservation efforts via the above mechanisms. To better understand how our on-the-ground assets can be amplified, we’ve been thinking about our projects as phases in a hierarchy as follows:

“When projects are ready to be amplified, we need to have mechanisms available to us to take the projects, ideas and methods to scale. Simple, yes. But it’s helped us with our thinking and strategic planning for our statewide initiatives.”



This hierarchy suggests that not all projects, not all ideas and methods, are at the phase where scaling up is appropriate — for example, an undemonstrated idea with no data to support it. But when projects are ready to be amplified, we need to have mechanisms available to us to take the projects, ideas and methods to scale. Simple, yes. But it’s helped us with our thinking and strategic planning for our statewide initiatives.

Examples of this scaling-up hierarchy within our salmon initiative are shown in the following table:

| <b>Bottleneck (Stress)</b>                | <b>Source</b>                           | <b>Solution</b>                                | <b>Place(s)</b>                             | <b>Mechanism to Scale Up</b> | <b>How to Scale up?</b>  | <b>Project Phase (per above figure)</b> |
|---|---|--|---|------------------------------|--|---|
| Poor instream condition                   | Forestry                                | Wood Restoration                               | Garcia, Ten Mile                            | Policy                       | Permit Streamlining/ Forestry Relationships                        | Demonstration and amplification         |
| High water temperatures at critical times | Ranching practices and diversions       | Dedicate water instream                        | Shasta                                      | Policy                       | Water Rights Dedication (Section 1707 & Adjudication modification) | Demonstration                           |
|   |   | Eliminate hot tailwater                        | Shasta                                      | Replication                  | Water monitoring and irrigation management                         | Demonstration                           |
|   |   | Identify water conservation measures           | Shasta                                      | Replication                  | TBD  | Demonstration                           |
|   |   |  |   |                              |  | Incubation                              |
| Lack of monitoring across life stages     | Lack of government funding and capacity | Lifecycle monitoring                           | Ten Mile (perhaps Garcia)                   | Replication and Policy       | Coast-wide monitoring proposal within DFG                          | Research and Development                |
| Extirpation                               | Various                                 | Reintroduce fish from acceptable genetic stock | Shasta                                      | Replication and Policy       | Supplementation  | Incubation                              |
| Lack of estuary habitat                   | Various                                 | Estuary Habitat Diagnostic and Restoration     | Ten Mile, Santa Clara (and possibly others) | Replication and Policy       | TBD  | Incubation                              |

As the table suggests, most projects (when and if ready to “amplify”) will use a combination of replication and policy mechanisms to scale up. We haven’t quite cracked the market-mechanism or industry-practices lever yet.

Only one project within our salmon initiative is currently ready for scaling up/ amplification: accelerating the pace of habitat enhancement projects to prevent the extinction of coho salmon in California coastal watersheds. Our on-the-ground work in the Garcia River demonstrated an efficient and less expensive way to conduct instream woody habitat restoration that can be replicated across the region. However, we discovered that a critical bottleneck to replicating and amplifying the more efficient method is the onerous permitting process landowners must go through to conduct restoration work. Our science, policy and project staff worked together to define the problem and determine the best course of action for removing that bottleneck — in this case, through legislation. CA State Assembly Bill 1961 (Huffman) is currently working its way through the Legislature to improve the permitting process for restoration projects in coastal California streams. If passed, the bill will allow the state to tap into new collaborative habitat restoration efforts with concerned private landowners, local agencies and NGOs, and will provide a mechanism for scaling up much needed restoration work in this industrial-timber-dominated landscape.

This project is a good example of how an idea that was incubated five years ago went through development and then demonstrated a solution to a critical limiting factor for the rearing life stage of coho salmon. By thinking through the scaling up process, we were able to identify a mechanism for amplification and act on that. The bill was approved on a unanimous vote (on April 11) by the California State Assembly’s Water, Parks & Wildlife Committee, a rare phenomenon in California politics. The next step is the appropriations committee in June, so there is still much work to be done. But we are getting close to a real world example of how to scale up.

Staff working on the salmon initiative will continue to think in this way. They will seek to demonstrate solutions to critical, common bottlenecks that threaten salmon and trout populations through our on-the-ground projects. Then they will work over the coming years to export/scale up those solutions through partner, agency and policymaker engagement.

But tackling the scaling-up problem still won’t make me hipper. How ‘bout if I promise to stop wearing pleated pants, socks with sandals, and fleece while dining out? Or how ‘bout changing our name from The Nature Conservancy to nature.org? We own nature — well at least the URL. Isn’t that still hip? **SC**

**“As the table suggests, most projects (when and if ready to “amplify”) will use a combination of replication and policy mechanisms to scale up. We haven’t quite cracked the market-mechanism or industry-practices lever yet.”**

# 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 [rlasz@tnc.org](mailto:rlasz@tnc.org).

1) [Stephen Colbert, Scientific Pioneer](#) (HuffPost Science): Chris Mooney, author of *The Republican War on Science*, argues that Stephen Colbert's original 2005 idea of "truthiness" ("It's not only that I *feel* it to be true, but that I *feel* it to be true. There's not only an emotional quality, but there's a selfish quality") presaged recent scientific findings on the neurological basis of conservative and liberal political bias. If you're wondering why science can't get a hearing in Congress, you might need to watch more Colbert...

2) [Wind Map](#) (HINT.FM) and [Better Than a Van Gogh: NASA Visualizes All the World's Ocean Currents](#) (Co.Design): Two data visualizations — one of surface wind speeds across the lower 48 United States, the other of the surface current flow of the oceans recorded from 2005 to 2007 — that mesmerize. Don't blame me if you don't get much work done today.

3) [An Idea with Tentacles](#) (Percolator): The hottest ideas in national security and change theory are now being borrowed from biology — specifically, principles of how organisms adapt to environmental threats (e.g., decentralized observation-and-response networks, like the tentacles of an octopus). The big book: Marine ecologist Rafe Sagarin's *Learning From the Octopus: How Secrets from Nature Can Help Us Fight Terrorist Attacks, Natural Disasters, and Disease* (Basic Books). Sagarin got the idea from spending time in D.C. after 9/11 and watching a sclerotic bureaucracy issue rules that seemed all about what had happened, not what would. Biology says: Centralized orders by elites are out; challenges to everyone to help solve problems are in. Be the tentacle, not the head.

4) [Meet the Dolphin Mafia](#) (Science NOW): For most male mammals, life is like a gang movie — your kin are your homies, you fight for your homies, you bleed out in the gutter for homies. But male dolphins (since females give birth to only single calves every few years) have a social system more like Facebook, lots of loose friendships and keeping tabs on everybody, according to a new study in *Proceedings of the Royal Society B* of the male dolphins of Shark Bay, Australia. Hence the dolphins' big brains and slow cruising speeds, reading everyone's status updates. I wonder if they've all switched to Timeline yet...

5) ['Social-Media Blasphemy': Texas Researcher adds 'Enemy' feature to Facebook](#) (The Chronicle of Higher Education): What kind of unsatisfying, Teletubbie world would allow you to declare only your friends, but not your enemies? Facebook, of course. Now Dean Terry, who directs the emerging-media program at the University of Texas at Dallas, has struck back by releasing a Facebook plug-in called [EnemyGraph](#), which you can use to tell the world what you hate (and bond over shared nemeses). World's top enemies last time I checked: Justin Bieber (public figure); Internet Explorer; Rick Santorum; Justin Bieber (musician/band). **SC**

# Science in the TNC-Dow Collaboration

## Overview: The Business Case for Conservation

By [Jennifer Molnar](#), manager, Sustainability Science Team, The Nature Conservancy



**Image: The Gulf of Mexico from Freeport, TX. Image credit: Jennifer Molnar/TNC.**

**[Discuss this article on the Conservation Gateway.](#)**

If the Conservancy is going to be successful moving forward, corporations need to be a part of our conservation solutions. Corporations are *the* major drivers of change in the natural world; the decisions they make heavily impact everything from land use and conversion to water quality and availability to the abundance of fish and other ocean resources. To not reckon with this force would be a dereliction of our mission as a conservation organization.

Fortunately, our leverage with corporations has never been greater. More and more companies realize that they rely on nature to secure the sustainability of their bottom line. Ecosystems provide myriad benefits for corporations — from raw materials (e.g., timber, agriculture, forests filtering water supply) to the protection of facilities from natural disasters (e.g., storm buffers of coral reefs and salt marshes, flood protection from marshes). And how corporations treat nature — or even the perception of how they treat nature — can influence how regulators and the public allow them to do business.

So there are numerous economic reasons for companies to consider how they rely on and impact the environment. Through our 5-year, \$10 million collaboration with Dow Chemical Company, the Conservancy is looking to make the economic case for investing in nature — not just to Dow, but to corporate culture at large. Our hypothesis: If companies consider the often unrecognized benefits from nature, that consideration will lead to improved outcomes for both business and the environment.

### The Value of Nature to Business

Before getting into the guts of the collaboration, let's first define our terms. What do we mean by the "value of nature"?

Our collaboration agreements with Dow refer to "biodiversity and ecosystem services," with ecosystem services that benefit not just the company, but the public as well. Yes, we are analyzing how Dow's decisions affect the private benefits that it receives from ecosystems. But we are also analyzing the benefits nature provides to the public and the ecosystems themselves — and feeding that information to Dow for use in its decision-making as well.

To bring these values of nature into corporate decisions often requires some translation. In some cases, we can assess dollar values of benefits to Dow and communities, but that isn't always the case. For example, when assessing the value of coastal marshes in site-risk management decisions, we can model and value the protection they provide to Dow and communities from storms by estimating avoided property damage or interruption of operations. These data — in dollar values — can be included in decisions about the design of (or need for) levees and other grey infrastructure. Additional benefits from those marshes (e.g., supporting fisheries and recreation) might also be assessed in dollars. But for other benefits and the ecological value of the marshes, dollar valuation isn't possible. So we are learning how we can most effectively inform managers about these additional benefits.

Our analyses also need to produce results that are useful for corporate decision-makers. This means that we need to consider the timelines, scale and precision needed for a given type of decision. For example, data that could inform levee design will likely require greater precision than assessment of the additional benefits from marshes that will inform managers. And if a decision needs to be made in three months, but it takes nine months to run the models that give the most precise answer — the additional precision of the longer run doesn't matter, because the manager won't be able to wait that long.

Finally, including the value of nature into corporate decisions involves more than just using new types of information. It often requires companies to look beyond the scope of how they traditionally have made decisions. They need to step outside of their factory walls and understand their facility's place in a landscape. For example, to ensure water continues to come in a pipe, they could consider the role forests and marshes can

**"To bring these values of nature into corporate decision often requires some translation. In some cases, we can assess dollar values of benefits to Dow and communities, but...for other benefits and the ecological value of the marshes, dollar valuation isn't possible. So we are learning how we can most effectively inform managers about these additional benefits."**

play in a watershed to maintain flow in the river. We're working with Dow to help its staff develop that broader understanding of the critical context of nature for their work.

### Why This Collaboration?

This collaboration is an unprecedented effort by a corporation to bring the value of nature into its decisions. Other companies have mostly considered ecosystem services individually (e.g., Coca Cola and water); or considered the value of nature at single sites (e.g., Syngenta's assessment of the value of native bees as pollinators); or have estimated their company's effects as a whole (e.g., Puma made news last year for committing to report on corporate-wide environmental profits and loss). But we are looking to apply our conservation science and tools to inform Dow's decisions all the way from the site-level to its corporate strategies and sustainability goals.

Precisely because the TNC-Dow collaboration is breaking new ground, the Conservancy is approaching it as a large experiment. It gives us a chance to test our assumptions, learn and report on our results so others can verify, use and build on our work. And we're already learning a lot about how Dow — a Fortune 50 company — makes a wide variety of its business decisions.

But why are we working with a major *chemical* company to do this? Consider this: Dow has both a large impact on natural resources worldwide as well as a commitment to corporate sustainability. Dow has had accidents and pollution at its sites, but it also has a track record in improving its sustainability practices.

Beginning in 1995, Dow has set ambitious 10-year sustainability goals, with metrics and reporting of results on progress toward those goals (read more at: [www.dow.com/sustainability](http://www.dow.com/sustainability)). It was Dow that initiated discussions with the Conservancy about starting this collaboration, because its leaders were interested in expanding how they think about sustainability to include ecosystem services. Through this collaboration, we have the opportunity to influence Dow's next round of sustainability goals, which can drive even more innovation and new thinking around incorporating the value of nature throughout its business. We won't be able to prevent every spill, but we are looking to improve the sustainability of Dow's overall practices.

Dow's visibility as a Fortune 50 company will help our ability to spread the valuing nature paradigm to other corporations — an explicit goal of the collaboration. Dow's Foundation is providing 70% of our funding, and that funding stipulates that we develop and share publicly available corporate decision-support methods. We will be reporting on our results and products in science and management peer-reviewed journals. We intend to be as open as possible about our work on this collaboration.

**“We will be reporting on our results and products in science and management peer-reviewed journals. We intend to be as open as possible about our work on this collaboration.”**

## The Role of Science in the Collaboration

The bulk of the TNC-Dow collaboration's initial work is focused on ecological and economic analyses at three pilot sites where both Dow and the Conservancy work. At these sites, we are tackling how the value of nature impacts tangible business challenges and decisions, ranging from the role of green infrastructure in site-risk management to the sourcing of materials for production. We are able to learn from Dow staff about how they work and then develop and test methods to bring the value of nature into their decision-making. While we're addressing site-specific concerns, we are also viewing these projects as opportunities to develop generalized decision-support methods that can be applied at other Dow sites and by other companies.

Last year, we began work at the first pilot site in Freeport, TX. This site has Dow's largest plant in the world, generating 20% of the corporation's global production, and is located near the mouth of the Brazos River, along the Gulf of Mexico. We are investigating three analyses (see subsequent articles in this issue of *Chronicles* for more details):

***Long-term freshwater planning.*** We are assessing the role that ecosystems can play in maintaining water supply to Dow, other water users and ecosystems in a river basin that has been in severe drought during the past year, and is projected to see more dry years in the future due to changes in water supply (climate change) and demand (urbanization).

***Role of marshes in coastal hazard risk management.*** We are analyzing the economic value of storm protection that coastal marshes provide to Dow and nearby communities, as well analyzing additional benefits from those marshes — such as recreation and fisheries — not provided by engineered concrete protection.

***Forest restoration in air pollution mitigation.*** In a region where air pollution affects both human health and how companies can operate, we are investigating the role that large-scale reforestation could play in corporate air-quality compliance decisions — and how such reforestation might provide incentives for funding forest restoration.

We expect results from our Freeport analyses to be available later this year.

We are currently scoping out a second pilot site in Brazil, where we will be looking at agricultural supply chains. We will identify the third pilot by the end of 2012. At each of these pilots, we will build on previous pilot work as well as address new types of business decisions.

We've found that there are often existing methods and models that we are able to use or adapt at the pilot sites, such as models of freshwater flow. Many of the advances we are making are in the application of these methods or models in a corporate context and

**“If we are successful in showing Dow and other companies that it makes business sense to invest in nature, I see the potential for such collaborations to achieve significant conservation outcomes that the Conservancy wouldn't be able to achieve on its own.”**

in the economic valuation of the benefits from ecosystems. Through these new applications, we are also advancing and improving our conservation tools.

This collaboration is an exciting opportunity for TNC, and leading the science work on the project has been a rewarding experience for me personally. I began my career as an environmental engineer cleaning up toxic sites, and decided to move into conservation to work at larger scales on preventing damage to the environment. Now with this project, my career has made an interesting arc, as we are working with a chemical company to change how they do business to help them be part of the conservation solution. We are drawing on Conservancy expertise to bring strong science to this project — from my team, Sustainability Science, leading ecosystem service analyses with partners in the Conservancy’s Development by Design team, field programs, and global Conservancy teams like Climate Change as well as the Natural Capital Project. And we are working closely with counterparts at Dow. As we come together as two organizations, some of our largest challenges have been cultural. We speak different languages and have different perspectives. But in working toward the shared goals of the collaboration, we are learning from each other and finding joint solutions by drawing on the strengths of both organizations.

And if we are successful in showing Dow and other companies that it makes business sense to invest in nature, I see the potential for such collaborations to achieve significant conservation outcomes that the Conservancy wouldn’t be able to achieve on its own. **SC**

*Access more information about the collaboration — and get a copy of the first annual report — at [www.nature.org/dow](http://www.nature.org/dow).*

*Editor’s note: Next month’s Chronicles will be devoted to essays from authors both from within and outside of the Conservancy on the issues and opportunities faced by conservation organizations when working with corporations.*

# Science in the TNC-Dow Collaboration

## Analysis #1: Long-Term Freshwater Planning

By [Rob McDonald](#), senior scientist for sustainable land use, Sustainability Science Team, The Nature Conservancy



*What is the business challenge at the site that you are addressing?*

Business and communities need access to adequate, consistent supplies of water to operate. But water scarcity is increasingly a problem in many river basins. Human demand for water is increasing at the same time that climate change is altering the amount of water available. It is difficult for businesses to make decisions about water when there is such uncertainty about the future availability or the true value of water.

In this project, we are looking at the likely trends for future water supply and demand for one particular river basin, the Brazos Basin in Texas. We will then work with Dow to help it evaluate its options for responding to future water availability by considering the value of water to its business, to local communities and to ecosystems.

*What role does the value of nature play in your analysis? How is this analysis using/advancing conservation science and tools?*

**Image: Dow Freeport, TX facility and Brazos River.**

**Image credit: Jennifer Molnar/TNC.**

**[Discuss this article on the Conservation Gateway.](#)**

In the Brazos, as in many basins, there is a big difference between what people pay for water and its value. Many water users have water rights, and can effectively have water for free, except for the costs of pumping. However, water is far more valuable. Dow's facility, for instance, couldn't operate without a consistent supply of freshwater, which is currently being supplied from the Brazos. Similarly, local municipalities, farmers, recreational users and ecosystems all depend on the water in the Brazos.

Providing methods for Dow to account for the value of water to its business as well as to other users and ecosystems will be beneficial to improving Dow's decisions about what actions to take in response to increasing water scarcity. For instance, if Dow understands the value of water to its business, this understanding can guide it on how much to invest in securing future supplies of water. Dow can also evaluate alternative investments to secure water — for instance, through on-site efficiency or off-site arrangements with other users in the basin, or through conservation — by considering the costs and benefits of these investments to Dow, other users and ecosystems.

Working closely with the Conservancy's climate change team and with hydrologists at the University of Washington, we have come up with daily forecasts of how river flow in the Brazos will change for a given emissions scenario and general circulation model. The real novelty of our work, however, is providing an example of how a business can incorporate the economic costs of changes in water availability into its decision-making.

*How could this analysis change how Dow does business?*

It's already helped Dow begin considering how climate change might affect future water supply in to the Brazos, which will affect all its future decisions about water use at the facility. Moreover, knowing the value of water to Dow and other stakeholders should help us identify adaptations that might reduce the water crunch in the basin.

*What are the potential conservation outcomes from this analysis?*

We hope this analysis will pave the way for a broader conversation about the implications of climate change in the Brazos and allow for future water conservation programs that lessen the water crunch. Moreover, if more water can be left in the river, it will help the Brazos achieve the environmental flow targets currently being established for consideration by the state of Texas. More water left in the river will likely help several imperiled freshwater species in the Brazos.

*What is the biggest challenge you've encountered doing this work?*

The biggest challenge has also been one of the most exciting parts of the work, which is having to work on a collaborative basis with another organization that has a very different organizational culture. It takes a lot of conversations to begin to speak each other's language, and until you have gained that common understanding it is hard to accurately define the goals and methods of the project. **SC**

**“The biggest challenge has also been one of the most exciting parts of the work, which is having to work on a collaborative basis with another organization that has a very different organizational culture.”**

# Science in the TNC-Dow Collaboration

## Analysis #2: Preserving or Restoring Coastal Habitats & Coastal Risk Mitigation

By [Sheila Walsh](#), senior scientist, Sustainability Science Team, The Nature Conservancy



### *What is the business challenge at the site that you are addressing?*

Over the last three decades, financial losses from natural hazards, including coastal storms and flooding, have been increasing worldwide. In fact, 2011 had the largest such losses on record. These trends present real risks to businesses with coastal sites or that do business with such firms. But ecosystems such as coastal marshes — which play an important role in reducing waves and flooding — might offer businesses a chance to mitigate their natural hazard risks. Unfortunately, such habitats have been in serious decline in many places. So it's important that conservation work with businesses to help them recognize the value of these habitats.

The Conservancy is addressing precisely this business challenge at Dow's operations in Freeport, Texas. Dow's Freeport facility lies along the Gulf of Mexico and is threatened by hurricanes and sea-level rise. However, the facility is also surrounded by extensive marshes, including two large National Wildlife Refuges that are some of the

**Image: Dow Freeport, TX facility.**  
**Image credit: Jennifer Molnar/TNC.**

[Discuss this article on the Conservation Gateway.](#)

most important stop-over sites for migratory birds in North America. We expect that preserving or restoring these coastal habitats may make good business sense and benefit conservation. In order to test this hypothesis, we are developing methods for Dow and other businesses to evaluate green infrastructure solutions (i.e. protecting or restoring marshes, oyster reefs, etc.) alongside gray infrastructure solutions in their coastal natural hazard mitigation planning.

*What role does the value of nature play in your analysis? How is this analysis using/advancing conservation science and tools?*

Understanding the value of coastal habitats is critical to making better business decisions for coastal natural hazard mitigation planning. Without information on the degree to which marshes can reduce flooding and avoid property damage, businesses may miss more cost-effective mitigation solutions such as habitat protection. Or businesses may get the design of levee systems wrong because they don't understand how healthy coastal habitats help levees do their job.

In recent years, our understanding of the ecology and economics of natural hazard mitigation services provided by healthy coastal habitats has increased dramatically. But the science still has a ways to go to link the ecology of processes like wave attenuation by marshes to the economics of property damages or business interruption avoided. And we face an even bigger step before we can link the science of ecosystem service valuation to decision making. This analysis will significantly advance conservation science by linking all three of these pieces: ecology, economics, and decision-making.

*How could this analysis change how Dow does business?*

It's already changing the way Dow is thinking about risk mitigation planning by broadening their view of the "solution space" to include the natural habitats around them. Currently, their modeling of potential damages from storms does not consider the role of habitats. This work will enable them to see how future damages from storms may be mitigated by protecting or restoring coastal habitats. We are aiming to formalize and embed this way of thinking into how Dow does business by enabling them to evaluate the benefits they get from coastal habitats.

We will also show Dow how habitat protection might benefit the local community as well as local biodiversity. Dow can use this information to make better decisions about how to site and design levees or other gray infrastructure and when it may be beneficial to invest in green infrastructure through protection or restoration of coastal habitats. For example, they might discover that it is more cost-effective to protect coastal marshes in front of their properties than to build levees, or that protection of these marshes will improve the performance of levees.

**"The science still has a ways to go to link the ecology of processes like wave attenuation by marshes to the economics of property damages or business interruption avoided. And we face an even bigger step before we can link the science of ecosystem service valuation to decision making. This analysis will significantly advance conservation science by linking all three of these pieces: ecology, economics, and decision-making."**

*What are the potential conservation outcomes from this analysis?*

New tools for businesses to evaluate investments in coastal habitat protection and restoration as part of risk mitigation planning. The application of these tools by Dow and other businesses could lead to widespread investment in coastal conservation. This new information could even lead to policy changes for flood insurance or zoning. Although there will certainly be times when conservation is not the best solution to protect from storms, without these tools conservation may not even be considered as an option.

*What is the biggest challenge you've encountered doing this work?*

One of the biggest challenges in this work is the differences in the information that businesses use to do risk mitigation planning and the information we have on habitats. The types of models that businesses use to forecast potential damages from storms treat habitats like inanimate objects — not like living, changing, resilient features. Similarly, conservation science's habitat models usually don't translate to damages. But this challenge has turned into a great opportunity to marry these models to understand natural hazard mitigation as a function of healthy ecosystems. However, challenges still remain because ecosystems are complex and data on things like wave attenuation by marshes will inherently be noisier than data from analyzing the expected performance of a levee. We need to overcome these data challenges so that risk mitigation planners will not be averse to green infrastructure. If we don't, green infrastructure solutions will at best be chosen as a complement to gray infrastructure, but not as a substitute. **SC**

# Science in the TNC-Dow Collaboration

## Analysis #3: Forest Restoration in Air Pollution Mitigation

By [Timm Kroeger](#), senior environmental economist, Sustainability Science Team, The Nature Conservancy



*What is the business challenge at the site that you are addressing?*

Dow Texas Operations at Freeport is located in the Houston-Galveston-Brazoria (HGB) non-attainment area for federal air quality standards for ground-level ozone, a pollutant that negatively affects human well-being and ecosystem health. Ozone is not emitted directly, but forms through photochemical processes in which precursors interact in the presence of sunlight. To come into compliance with federal ozone standards, the state of Texas has imposed limits on emissions of ozone precursors by large industrial sources in the eight-county HGB area. These limits result in substantial costs to regulated sources of precursor emissions in the form of technology upgrades, production process changes and penalty fees.

**Image: Houston skyline and park.**  
**Image credit:**  
[wickedgiggle/Flickr](#).

**[Discuss this article](#)**  
**on the Conservation Gateway.**

*What role does the value of nature play in your analysis? How is this analysis using/advancing conservation science and tools?*

Reforestation may provide a new compliance approach for industrial emitters while generating a slew of additional benefits for conservation and people. Several studies in the United States have documented the beneficial effects of forests on urban air quality. Trees directly remove atmospheric pollutants such as respirable particulate matter, ozone, sulfur dioxide, carbon monoxide and nitrous oxide through interception on, or uptake through, leaf surfaces. The U.S. Forest Service's widely-used and peer-reviewed UFORE (Urban Forest Effects) model allows estimation of the quantities of six major air pollutants removed by trees in a given location. Urban forests also reduce the so-called urban heat island effect, lowering ambient air temperatures through evaporative cooling and the shading of buildings, roads and parking lots. This reduces evaporative emissions of volatile organic compounds (VOC), an important ozone precursor, and reduces space cooling needs, which in turn can lead to reduced power plant emissions of VOC, nitrous oxides — the other key ozone precursor — and other key air pollutants.

The U.S. Environmental Protection Agency (EPA) has formally identified tree planting as a measure states can use in their State Implementation Plans (SIP) to achieve compliance with federal air quality standards. However, to date, no state has incorporated tree planting into its SIPs. As a result, the potential and comparative cost-effectiveness of the use of tree planting by industrial sources for air-quality compliance purposes remains unexplored.

We will use the UFORE model to estimate the quantities of ozone and NO<sub>2</sub> a Dow-financed reforestation project in the HGB area would be expected to remove directly, and the quantities of VOC that project would emit. This analysis entails the selection of planting sites and tree species based on ecological suitability, cost, conservation value and species-specific VOC emissions, and the prediction of the canopy structure to which the model is applied. Quantities of NO<sub>2</sub> removed and VOC emitted by the project, adjusted for uncertainties as required by EPA, can be translated reasonably straightforwardly into potential corresponding ozone precursor credits/offsets (NO<sub>2</sub>) or debits (VOC) for Dow. In addition, ozone removal by the planted trees effectively is equivalent to avoided emissions of the precursors that would have produced this ozone. Since the quantity of ozone removed by trees exceeds the quantities of precursors removed (NO<sub>2</sub>) or emitted (VOC), it is the dominant determinant of the quantities of precursor credits a reforestation project would generate. Estimation of these equivalent avoided precursor emissions requires knowledge of local atmospheric chemistry, as ozone formation may be either VOC or NO<sub>2</sub> (or sunlight) limited. The expected cost-effectiveness of reforestation for compliance purposes then is estimated using the projected cost of the reforestation project and the estimated precursor credits, and compared to that of standard control approaches.

We also quantify the value of human health benefits from air pollution removal by the reforestation project and the value of selected other ecosystem services, such as

**“If our analysis also shows that reforestation is cost-competitive with conventional precursor control options, Dow and others are likely to incorporate reforestation into their compliance strategy.”**

increased green space supporting recreation and visual amenities, and net removal of atmospheric carbon.

*How could this analysis change how Dow does business?*

The Texas regulatory authorities have expressed willingness to consider the inclusion of reforestation in their air quality compliance strategy if our analysis convincingly demonstrates that reforestation can be an effective tool for reducing concentrations of ozone precursors. If our analysis also shows that reforestation is cost-competitive with conventional precursor control options, Dow and others are likely to incorporate reforestation into their compliance strategy. Our results and methodology will be made freely available, allowing other states and companies to evaluate inclusion of reforestation into ozone compliance plans.

*What are the potential conservation outcomes from this analysis?*

Reforestation for air quality compliance purposes in the HGB area could support restoration of portions of the Columbia Bottomland Hardwood Conservation Area southwest of Houston, which has lost over 70 percent of its historic land cover. Reforestation in other non-attainment areas in Texas and in other states could result in large additional conservation benefits.

*What is the biggest challenge you've encountered doing this work?*

The biggest challenge is to ensure our resulting emission reductions, credits/offsets and cost-effectiveness estimates are realistic. Attaining that realism requires detailed discussions with air pollution authorities on several key methodological issues — above all, how to convert the ozone removed by the planted trees into its equivalent avoided precursor emissions, which in turn depends on the correct characterization of local atmospheric conditions at, and downwind of, the planting sites. **SC**

# The Coda Files

## Margo Francis

**Think being or hosting a Coda Global Fellow is mysterious and unattainable? Think again! The Coda Global Fellows program enables staff to apply their talents beyond their regular job to forward the Conservancy's global priorities. Coda Fellows can be anyone. They can be anywhere. They could even be...you. So step with us into...The Coda Files.**

What happens when you get seven TNC state directors, two country programs, and their trustees in a room with a bunch of staff scientists and partners and ask them to debate what we want to do for conservation and how we'll know if we are getting there? Add TNC's new [whole systems approach](#) and [Planning Evolution Team \(PET\) recommendations](#) into the mix...and you'll find the initiative to create conservation measures for the Great Lakes Project was an experiment in more ways than one.

"I learned a lot about leadership: how do you get things done and move things forward, dealing with risk and change?" says Margo Francis of her Coda Global Fellowship for the Great Lakes Project, which was hosted by Great Lakes Project Board of Directors Chair Helen Taylor.

"We had been working off one version of planning guidance, and then the PET released their report in September [2011], which was when we were wrapping up the process," she adds. "While getting the new guidance earlier would have been great, it is only one of the challenges you face in implementing measures on a whole systems scale — we had no idea at the time the value and impact the measures initiative would have for our work in the Great Lakes. The conference spurred a rigorous scrubbing, honing and prioritization of strategies as well as measures, and a much stronger Great Lakes Project moving forward."

### Coda Fellow: Margo Francis

**Day Job:** Project Information Manager, Amazon Program, Latin American Region

**Assignment:** Great Lakes Project

**Duration:** March 2011 – July 2012

**Task:** Manage a major initiative to create conservation measures for the Great Lakes Project, including a 120+-person Great Lakes Measures Conference.

**Most Important Lesson Learned:** "Business planning and measures at a whole systems scale is challenging. Programs like the Great Lakes Project are boldly taking these challenges on to integrate measures and assure accountability at all levels of their work."



Most trustees, says Margo, “liked the sausage-making aspect of peer review.” And she urges future endeavors to be thoughtful about the way trustees may best contribute their skills to assist Conservation Business Planning, strategy development and measures.

Content-wise, “teams struggled with what good socioeconomic objectives are and how we integrate them more explicitly to our planning,” she says. “Everyone realizes how important they are, but we are still learning how to do it.” More guidance would help.

Margo’s fellowship has been extended to help integrate the constructive feedback the Great Lakes Project received from staff, trustees and partners into the next iteration of business plans. **SC**

— [Jensen Montambault](#), applied conservation scientist, Central Science, The Nature Conservancy

*The Coda Global Fellows program enables staff to apply their talents beyond their regular job to forward the Conservancy’s global priorities. Burning science needs? Want to share your skills with a global priority? Contact [Jolie Sibert](#), director of the Coda Global Fellows program!*

## Science Shorts BINGO!

Armstrong, P.R., I.S. Fishburn, Z.G. Davies, J. Gilber, N. Leaver, and K.J. Gaston. 2012. [The size, concentration and growth of biodiversity-conservation nonprofits](#). *BioScience* 62(3): 271-281. (Conservancy staff may access full text through [Conserve Online](#).)

Ever cringe when our executives describe TNC as the biggest conservation non-profit...and wonder where the data came from? Well, quail no more. The authors of this independent article find that “among the conservation nonprofits, one organization alone — TNC — controls more than 25% and 16% of overall assets and revenues, respectively. To put that into context, TNC has an annual revenue that exceeds the gross national income of some countries, while still representing only a small fraction (0.3%–6.6%) of the annual revenue enjoyed by a Global Fortune 500 company.” Room to grow.

In general, those biodiversity-oriented non-profits are bigger that have a diversity of focuses (i.e., terrestrial, freshwater, marine), benefiting different kinds of species (i.e., cross-kingdom) and geographies (read “international.”) Check, check, check. But those that are *in situ*, such as aquariums, tend to be more expensive. We are still renegades in our own way. **SC**

— **Jensen Montambault**, applied conservation scientist, The Nature Conservancy

## Forest Carbon Geek-Out Fest

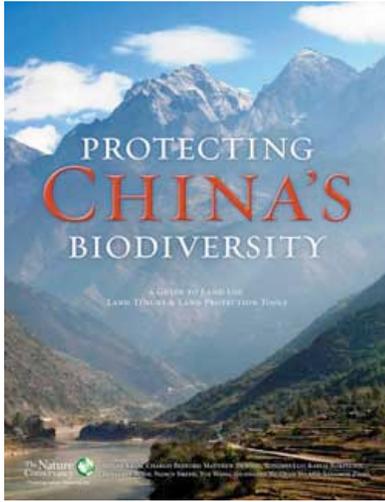
Houghton, R.A., G.R. van der Werf, R.S. DeFries et al. 2012. [Chapter G2 carbon emissions from land use and land-cover change](#). *Biogeosciences Discuss* 9:835-878.

This synthesis of 13 recent forest carbon studies makes for surprisingly good reading if you are feeling geeky. The studies reviewed estimate net global/tropical emissions from deforestation, forest degradation and other direct human land management impacts (the technical term for this is Land Use and Land Cover Change, or LULCC). The authors found that the net contribution of LULCC to human carbon emissions was 12.5% over the period 2000-2009, but that gross LULCC emissions represent over 33% of human carbon emissions. Around 90% of the net emissions are from deforestation, while majority of gross emissions are from degradation (esp. logging). There is considerable uncertainty — such as unaccounted emissions (logging, peatland drainage, loss of mangroves, which could bump number over 15%) and unaccounted sinks (erosion/deposition, woody encroachment) which could bump the number down. However, LULCC emissions are declining as percentage of total human C emissions, mostly due to increases in fossil fuel emissions, but also with recent trends of declining LULCC emissions since 2000. Yet the highest rate of tropical deforestation in recent history occurred in 2010, the year Indonesia replaced Brazil as the country with the largest area deforested (and a year that more than 80% of tropical deforestation occurred outside of Indonesia and Brazil). **SC**

— **Bronson Griscom**, director, forest carbon science, The Nature Conservancy

## Announcements

### New Book! *Protecting China's Biodiversity*



Two years ago, The Nature Conservancy began significantly expanding our land protection efforts in China partnership with the Chinese government. Accordingly, it became necessary to enhance our understanding of trends in Chinese land use, land tenure and land protection. The answers to most of our questions were surprisingly hard to come by. Thus, we embarked on journey to compile the disparate information on Chinese land issues into a condensed format. We created *Protecting China's Biodiversity: A Guide to Land Use, Land Tenure, and Land Protection Tools* for anyone with an interest in Chinese land issues, and especially for those undertaking land protection initiatives. This book is the first of its kind, providing a comprehensive yet digestible overview of the following topics:

- The “lay of the land” — an orientation to Chinese biodiversity values and land use practices.
- Land tenure system — a description of China’s land tenure

system, including government agencies involved in land use decisions; the primary factors affecting land use; and how land use decisions are made and implemented.

- Land protection in practice — a description and analysis of case studies and land conservation tools, including land trust reserves, conservation developments, and national parks.

TNC’s China program is pleased to share our research with you and hope that it sparks more land protection action in China and beyond. [Download the book now](#) or [read the executive summary](#). Contact lead author Megan Kram ([mkram@tnc.org](mailto:mkram@tnc.org)) with comments or requests for hard copies.

### Working on Significant Research? Let Us Know NOW So It Can Get Some Attention When It’s Published

If you’re working on a piece of research that a) you think will be significant for conservation, either on a regional, national or international basis, and b) that you or a co-author will be submitting for publication to a peer-reviewed journal in the next six months, TNC Science Communications wants to know about it so that we can work with you and any partner institutions involved to prepare any potential media outreach. We’d especially like to know about it if you’re the lead author, of course, but even if you’re one of several and even if the lead author is at another institution, please let us know. Send your contact info, the name of the paper, and where you think you might be submitting it

to me at [rlalasz@tnc.org](mailto:rlalasz@tnc.org) and I’ll coordinate with TNC-Media Relations, you and your co-authors and their institutions to build a strong media outreach plan for the paper.  
—Bob Lalasz SC

### Incredible But True: *Chronicles Summer Book Issue is Right Around the Corner*

Take one book, any topic; read. Write 250-300 words, distilling your opinions about said book. Send to [rlalasz@tnc.org](mailto:rlalasz@tnc.org) by May 25 for inclusion in the now famous Summer All-Book Issue of *Science Chronicles*. (Send me the titles you want to review first, so I can avoid duplicates.) Prepare to be read and discussed by beautiful people on beaches from Maui to Lake Michigan. Prepare to be recognized. —Bob Lalasz SC

# New Conservancy Publications

Conservancy-affiliated authors highlighted in bold.

Please send new citations and the PDF (when possible) to: [pkareiva@tnc.org](mailto:pkareiva@tnc.org) and [rlalasz@tnc.org](mailto: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/or 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.

Anadón J.D., C. D'Agrosa, **A. Gondor**, and L.R. Gerber. 2011. Quantifying the spatial ecology of wide-ranging marine species in the Gulf of California: Implications for marine conservation planning. PLoS ONE 6(12): e28400. doi:10.1371/journal.pone.0028400

**Groves, C., E.T. Game, M.G. Anderson, M. Cross, C. Enquist, Z. Ferdana, E. Girvetz, A. Gondor, K. R. Hall, J. Higgins, R. Marshall, K. Popper, S. Schill, and S.L. Shafer.** 2012. Incorporating climate change into systematic conservation planning. Biodiversity Conservation DOI 10.1007/s10531-012-0269-3.

**Lombard, K.B.,** D. Tomassi, and J. Ebersole. 2012. Long-term management of an invasive plant: lessons from seven years of *Phragmites australis* control. Northeast Natural History Conference 2011: Selected Papers. Northeastern Naturalist 19 (Special Issue 6):181-193.

**Kram, M. C. Bedford, M. Durnin, Y. Luo, K. Rokpelnis, B. Roth, N. Smith, Y. Wang, G. Yu, Q. Yu, and X. Zhao.** 2012. Protecting China's biodiversity: A guide to land use, land tenure and land protection tools. Beijing: The Nature Conservancy.

**McCarthy, P. D.** 2012. Climate change adaptation for people and nature: A case study from the U.S. Southwest. Adv. Clim. Change Res. 3(1). doi: 10.3724/SP.J.1248.2012.00022.

**Pocewicz, A.,** M. Nielsen-Pincus, G. Brown, and **R. Schnitzer.** 2012. An evaluation of Internet versus paper-based methods for Public Participation Geographic Information Systems (PPGIS). Transactions in GIS 16(1):39-53.

Putz, F.E., Zuidema, P.A., T. Synnott, M. Pena-Claros, M.A. Pinard, D. Sheil, J.K. Vanclay, P.Sist, S. Gourlet-Fleury, **B. Griscom,** J. Palmer, and R. Zagt. 2012. Sustaining conservation values in the selectively logged tropical forests: The attained and the attainable. Conservation Letters DOI: 10.1111/j.1755-263X.2012.00242.x.