Biodiversity Conservation and Wildlife Management in the Anthropocene

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Reconsidering Strategies of the Anthropocene

In the Anthropocene epoch, “The Age of Man,” everything on earth is influenced by human actions, either by direct contact such as clearing forests for agriculture or indirectly through climate change or other global system effects. We’ve been thinking, talking, and writing a lot about the Anthropocene at the Pinchot Institute lately because in this new era of planetary change we are being forced to reconsider the contours of forest conservation and management. This includes a new role for humankind: from a species that had to adapt to changes in their natural environment to one that must be a steward of other species as we drive global change. Anthropocene stewardship, now that has an interesting ring to it. But what guides this thinking?

Recently, at a Resilience Alliance conference in Montpellier, France, C.S. (Buzz) Holling was reflecting on his early field studies and his search for an empirical basis to his theory of resilience. He recalled moments and months of uncertain anticipation as he watched, and waited. His manuscript, “Resilience and Stability of Ecological Systems,” was already written (Holling 1973) and the postage paid, just waiting for validation before he mailed it off to the editors. Finally, the evidence he was waiting for came and resilience theory was born. Soon after publication, hundreds and then thousands of other researchers studying other systems provided further

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From the President

Climate, Energy, and Forests: The Need for a Comprehensive Strategy

On June 2, the US EPA released its long-awaited proposed federal regulations aimed at reducing greenhouse gas emissions from electric power plants to 30 percent below 2005 levels by 2030. The actual mechanisms by which these reductions are to be achieved are left to individual states to decide. California and states in the Northeast will move forward more assertively with their existing carbon cap-and-trade programs, and other states may join them. Some states may opt for a carbon tax. Most every state is likely to adopt President Obama’s unofficial national energy policy of an “all of the above” strategy in terms of shifts toward wind energy, solar power, biomass, natural gas, and other reduced-carbon energy sources.

Reflecting some of the key findings in the 2014 National Climate Assessment, EPA’s proposed rule notes specifically that “biomass-derived fuels can play an important role in CO₂ emission reduction strategies,” perhaps offering a glimpse into the agency’s development of an accounting framework for biogenic carbon emissions, due later this year:

“The plant growth associated with producing many of the biomass-derived fuels can, to varying degrees for different biomass feedstocks, sequester carbon from the atmosphere. For example, America’s forests currently play a critical role in addressing carbon pollution, removing nearly 12 percent of total U.S.
greenhouse gas emissions each year. As a result, broadly speaking, burning biomass-derived fuels for energy recovery can yield climate benefits as compared to burning conventional fossil fuels... Many states have recognized the importance of forests and other lands for climate resilience and mitigation and have developed a variety of different sustainable forestry policies, renewable energy incentives and standards and greenhouse gas accounting procedures. Because of the positive attributes of certain biomass-derived fuels, the EPA also recognizes that biomass-derived fuels can play an important role in CO₂ emission reduction strategies. We anticipate that states likely will consider biomass-derived fuels in energy production as a way to mitigate the CO₂ emissions attributed to the energy sector and include them as part of their plans to meet the emission reduction requirements of this rule and we think it is important to define a clear path for states to do so.”

The conservation community has always been of two minds about the potential role of wood biomass in the nation’s future energy portfolio. Substituting renewable wood biomass energy for fossil fuels while maintaining the overall volume of carbon stored in forest ecosystems can help achieve significant net reductions in carbon emissions over time. In addition to helping reduce the nation’s dependence on fossil fuels, factoring biomass energy into existing sustainable forestry programs can help improve the resiliency of forest ecosystems to the effects of climate change. On private lands, expanding markets for thinned materials and wood waste helps improve the economics of forest conservation in the face of increasing development pressures. On public lands, markets for wood biomass could help offset at least some of the costs of forest restoration and hazardous fuels treatments urgently needed to reduce wildfire risks, or to enable forests to better withstand the increased vulnerability to insects and pathogens that comes with prolonged droughts and temperature stresses.

On the other hand, there are concerns over “too much of a good thing”—new biomass energy facilities that, when added to existing forest industry and other sources of wood demand, begin having unacceptable impacts on wildlife habitat, biodiversity, water, and other essential values and environmental services provided by ecologically-intact forest ecosystems. Limiting the development of any new biomass energy capacity in the US is seen by some as the surest means of avoiding these potential impacts.

Since the passage of the Energy Independence and Security Act in 2007, which established highly ambitious goals for “advanced biofuels” including cellulosic ethanol from wood, the Pinchot Institute has led a series of studies focused on ensuring forest sustainability as the use of wood for energy increases. These studies have carefully examined the implications of using wood biomass for electric power generation here in the US; they have also considered trends in Europe and other regions of the world that import large—and rapidly increasing—quantities of wood pellets derived from US forests. Almost monthly, there are announcements of new wood pellet manufacturing and export facilities to be constructed in the US, many of them with a capacity of 500,000 tons or more annually. Where these planned facilities are located—and where their wood comes from—will have important implications for local forest ecosystems and economies, as well the nation’s climate and energy strategy.

The Pinchot Institute remains committed to working with all interests in the development of sustainable sourcing programs that conserve and protect the nation’s forests, even as wood biomass plays an increasing role in climate and energy strategy. American and European interests are both approaching this from their own perspectives—and they are finding more common ground than anyone expected, as described in recent Pinchot Institute reports at pinchot.org/bioenergy. Existing regional biomass harvesting guidelines, best management practices (BMPs), and various forest certification programs will all play a role in facilitating a better understanding by all parties for what is at stake, and coming to agreement on an achievable pathway to clearly defined objectives. Ultimately, everyone shares a common goal—improving environmental sustainability in all of its dimensions. This can be achieved only through an intelligent, comprehensive, and good-faith effort by the full range of stakeholders, each of them committed to finding solutions that address society’s parallel needs in mitigating climate change, shifting to renewable energy sources, and sustaining forests for all the other essential values and environmental services they provide.

— Al Sample
evidence to support the theoretical model of ecosystem resilience and regime shifts.

Interestingly, while Buzz was patiently waiting for the appropriate time to mail off his manuscript, the 93rd United States Congress was debating a landmark environmental law that would change the ways that public lands were managed for generations to come. In 1973, President Richard Nixon signed into law the Endangered Species Act (Public Law 93–205). This act, as amended, recognizes threatened and endangered species of animals and plants, protects habitat of listed species from destruction by federal actions, specifies interagency cooperation, and requires preparation of recovery plans and monitoring of species awaiting listing and those recently recovered.

These two ideas—one from a unique blend of systems and ecological science and the other a crowning achievement of the environmental movement—coexisted at precisely the same time. Yet, these are two different ways of viewing the behavior of systems. On the one hand, individuals die, populations disappear, and species become extinct. It has been noted that the rate of species extinction in the Anthropocene will rival all previous mass extinctions, with as many as 30% of all species going extinct over the next four decades and 75% of mammals being extinct in 300 years (Barowsky et al. 2011). On the other hand, it is not so much the presence or absence of species that matters, but rather the resiliency of a system to sustain a desired structure and function in the face of disturbance and ongoing evolution and change.

These two ideas, while not mutually exclusive, derive from different philosophies regarding nature. What does this mean for biodiversity conservation and wildlife management in the Anthropocene?

Great strides have been made both globally and domestically in biodiversity conservation and wildlife management since the passage of the Endangered Species Act just over 40 years ago. However, our understanding of what it means to “preserve” and “protect” species and habitat is undergoing a transition in this new epoch. Traditional wildlife and biodiversity conservation strategies have relied heavily on the establishment of reserves and other protected areas to conserve habitat, but as climate changes, optimal habitat zones are shifting to different places on the landscape.

This presents a challenge to biodiversity conservation and wildlife management because both plant and animal species are prompted to follow the climate-driven movement of the ecosystems and habitats in which they evolved (Hannah et al. 2002).

As Sample (2014) summarizes in the introduction to Forest Conservation and Management in the Anthropocene, ecological communities disassemble as species capable of migrating do so, and those that are not remain behind. Those that can migrate must traverse landscapes that in earlier epochs were not filled with highways, cities, farms, and other manifestations of a rapidly expanding human population that is relatively new on the geologic time scale. Designated parks, refuges, reserves, and other traditional approaches to protecting habitat are still important (Caro et al. 2011), but may be less effective when the species themselves are on the move (Kareiva et al. 2011). This is prompting biologists, resource management professionals, and policymakers to consider new approaches to conservation planning (Anderson and Ferree 2010), and strategies focused on large landscapes—vast areas that stretch from Yellowstone National Park to the Yukon, or from the southern Appalachians to...
Labrador. These immense landscapes encompass cities, towns, and agricultural working lands, as well as a mosaic of public and private forests that are all managed for different purposes and objectives. For these landscape-scale conservation strategies to be environmentally, economically, and socially sustainable—and politically possible—new governance models must be developed to facilitate an unprecedented level of communication, coordination, cooperation, and collaboration (Bixler 2014; Kareiva et al. 2012).

Multi-stakeholder engagement across public and private boundaries is not only necessary, but increasingly seen as crucial to building resilience and protecting species. Local ecological knowledge must blend with science, and knowledge regarding wildlife and biodiversity must be connected to conservation action. My own understandings and reflections on wildlife management emerge from researching the conservation of mountain caribou in British Columbia and grizzly bears in Montana. These highly migratory and charismatic species illustrate well the complexities of biodiversity conservation in the Anthropocene. In the following, I’ll draw on some of the contributions from our esteemed colleagues in “Forest Conservation and Management in the Anthropocene” (Sample and Bixler 2014) and take these issues and ideas to the ground, so to speak, elaborating on my own engagement and research working with communities and wildlife management.

Conservation Theory and Policy in the Anthropocene
Wilderness, Protected Areas, and Landscape Conservation

As Tim Caro and his colleagues (2014) note, a protected area—“an area of land and/or sea especially dedicated to protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means”—can range from strict nature reserves to those that allow sustainable use of natural resources. From a biological standpoint, the effectiveness of protected areas as a conservation tool depends on their ability to incorporate biodiversity (e.g., Rodrigues et al. 2004) and to buffer plant and animal populations against anthropogenic forces (e.g., Bruner et al. 2001). Most appraisals generally suggest that protected areas are successful in their goal of biodiversity conservation when compared to areas with no formal protection. Nonetheless, plant and animal populations inside protected areas are not immune to anthropogenic forces and expanding, buffering, and connecting existing reserves may be very important.

Gary Tabor, Anne Carlson, and Travis Belote (2014) describe this as large landscape conservation, a science-based response to increasing large-scale habitat fragmentation and degradation that advances the concepts of ecological integrity, ecological connectivity, and wildlife corridors. Large landscape conservation approaches have recently been embraced as a strategy to facilitate the adaptation of biodiversity to the impacts of climate change. In one sense, large landscape conservation is the evolution of the “beyond parks” conservation approach (Minteer and Miller 2011) in which species and ecological processes cannot be satisfactorily sustained within most circumscribed protected landscape parcels. Corridors and linkages that can connect habitat across several degrees of latitude are becoming critically important to facilitate the emigration of some plant and animal species and the immigration of others. However, this still leaves the question of whether something can be done to minimize the emigration of species from protected area reserves, and the dismantling of existing ecological communities. Some species within a given ecological community are able to use their mobility to migrate while others are left behind, thus disassembling existing communities of interdependent species (Schmitz and Trainor 2014).
At the same time, a region will experience the immigration of mobile species from elsewhere, developing species assemblages that may never have existed before. How to regard these “novel ecosystems” is a topic of considerable ongoing debate among conservation biologists. From one perspective, many of these novel ecosystems are highly biologically productive and may also exhibit a high level of species diversity, so they may represent a significant biodiversity resource in themselves. In any case, they are inevitable and will develop with or without biologists’ consent.

Anderson and Johnson (2014) illustrate another strategy, resilient sites, that defines biological and geological characteristics that can be resistant to the influence of climate change and hold their ecological communities intact. These sites tend to have highly specific characteristics of geology, soils, and topography. Identifying, mapping, and then protecting a sufficient number of these resilient sites across large landscapes can be an important component in a comprehensive, portfolio approach to biodiversity conservation and wildlife management in the Anthropocene.

Cross-Boundary and Multi-Stakeholder Conservation

There are significant additional challenges associated with actually implementing a cross-boundary conservation and management strategy on large landscapes, particularly when they are predominantly characterized by private ownership and comprised of many small tracts. These tracts are typically managed for objectives as diverse as the private owners themselves, who may or may not understand or share a commitment to biodiversity conservation. Large landscape conservation strategies can be applied to help achieve biodiversity conservation objectives in regions characterized by mixed public-private or predominantly private ownerships.

Joseph McCauley (2014) describes an innovative approach successfully pioneered by the US Fish & Wildlife Service (FWS) on the Silvio O. Conte National Fish and Wildlife Refuge following its designation by special legislation in 1991. Unlike traditional wildlife refuges at the time, the Silvio Conte encompassed large areas of land that were not directly owned or managed by the FWS—in fact, the entire 7.1 million acres in the Connecticut River watershed, across four states. The model was motivated by the understanding that the important wildlife and aquatic species in this watershed could never be adequately protected by the FWS working only on the agency’s small reserves. It is a model based on outreach to other landowners in the region, facilitating local meetings in which the FWS provided spatial information about key habitat they had mapped throughout the watershed, and about land management practices that could maintain or enhance these habitat values. Landowner actions were voluntary, not done as a matter of law or regulation, and a large number of landowners stepped forward to learn more about how they could protect habitat values that happened to occur on their land. Wildlife refuges in other regions have now adopted this watershed-based large landscape conservation model, and the concept is at the heart of the FWS strategy for wildlife and fish habitat conservation in response to climate change. As climate adaptation strategies such as the identification and mapping of ‘resilient sites’ are developed, especially in eastern regions of the US where forests are primarily in private ownership, outreach models such as that developed on the Silvio Conte Refuge could become critically important to translating the knowledge about where resilient sites are located to actually achieving their conservation and protection, through actions that can only be taken through communication, collaboration, and cooperation with the individuals who actually own the land.

Federal Policy Responses

Federal policy around wildlife management and biodiversity conservation has tuned in to these trends as well. In recent years within the US, various government-led large landscape responses have come to the fore. As Tabor et al. (2014) remark one of the more notable efforts was the 2008 Western Governors’ Association initiative on crucial wildlife habitat and wildlife corridors, initiated in response to large scale energy planning and development. All 17 western states within the Western Governors’ Association unanimously agreed on a shared policy framework.
to address the scale and scope of habitat and wildlife movement areas across their jurisdictions in the face of potential conflicts with planned development. This was a milestone event as states recognized the need to conserve their resources at a regional scale through interstate collaboration. Soon thereafter, in 2010, the US Department of the Interior embraced a new landscape partnership program, the Landscape Conservation Cooperatives, which designated 22 large scale cooperative landscape management areas across the nation and adjoining transboundary regions in Canada and Mexico as part of a department-wide coordinated adaptation response to climate change. At the same time, the All Lands Initiative and the US Forest Service’s Collaborative Forest Landscape Restoration Program were established to more effectively address conflicts in natural resource management planning and development at large scales.

More specifically to the point of wildlife, as Mark Shaffer (2014) discusses, the federal government recently undertook a major initiative to develop the National Fish, Wildlife, and Plants Climate Adaptation Strategy (NFWPCAS 2012). In 2009 Congress requested that the Council on Environmental Quality (CEQ) and the Department of the Interior (DOI) develop a national strategy to “…assist fish, wildlife, plants, and related ecological processes in becoming more resilient, adapting to, and surviving the impacts of climate change” (CEQ/USDOI 2009). As DOI’s wildlife bureau, the US Fish and Wildlife Service (FWS) took the lead in structuring a process to fulfill this request. Because of the complementary nature of US wildlife law, the FWS invited the National Oceanic and Atmospheric Administration (NOAA) and state wildlife agencies to co-lead the effort. Ultimately, a steering committee was formed that included representatives from 15 federal agencies, five state fish and wildlife agency directors, and leaders of two inter-tribal natural resource commissions.

The NFWPCAS is an unprecedented effort by all levels of government that have authority or responsibility for wildlife in the United States to work together collaboratively to identify what needs be done in the Anthropocene epoch. It was developed by teams of managers, researchers, and policy experts drawn from federal, state, and tribal agencies organized around major ecosystem types. The strategy identifies seven major goals that must be achieved to give wildlife the best chance of surviving the projected impacts of current and anticipated future climate change. Numerous strategies (23) and actions (100+) are identified that are essential for achieving these goals.

All of the seven major goals identified in the NFWPCAS are things that the wildlife management community already does (e.g., conserve habitat, manage species and habitats, enhance management capacity, etc.). What will be new, and what the NFWPCAS tries to illustrate, is that these things will need to be done in new ways, or in new places, or at new times, or in new combinations for conservation to be effective. Species stewardship in the Anthropocene must embrace four broad themes discussed in the NFWPCAS:

- **Be Inclusive and Collaborative.** Climate change is so pervasive, and its impacts potentially so far-reaching, that no single agency, no single level of government, indeed no single sector will be able to mount an effective response on its own. All affected agencies and interests need to be at the table working collaboratively to be effective.

- **Think, Plan, and Act at the Right Scale.** The days of believing that a single set of best management practices universally applied will automatically lead to a biologically functional landscape are over. Different agencies and organizations work at different scales. Entities that operate at the local scale need to do so in the context of the broader physical, biological, and institutional landscape of which they are a part. Entities that operate at the national or regional scale need to be mindful of the needs, realities, and differences of the many landscapes in which they operate.
Integrate Across Sectors. A corollary of being inclusive within the conservation sector is to also be inclusive of other sectors. Much of what governs the fate of wildlife is not the actions or inactions of the wildlife management community, but actions by other sectors that affect the natural world (e.g., agriculture, transportation, energy development, construction, etc.). Starting an adaptation planning process by including everyone and everything may be too large a burden for any one sector to bear, but as each sector develops a working understanding of its needs relative to adaptation, it needs to reach out to the other sectors relevant to its interests to identify commonalities, synergies, conflicts, and resolutions.

Engage, Communicate, and Act. The effects of climate change on species are beginning to be readily apparent. Because projections of future conditions and impacts come with great uncertainty it is tempting to wait until more is known and the models improved so there is less uncertainty before we act. Unfortunately, like many large systems, Earth’s climate has great inertia, and once change is entrained it will not be quickly or easily restrained. There is unequivocal evidence that the climate is changing, that the underlying cause is the growing accumulation of greenhouse gases (GHGs) in the atmosphere resulting from human activity, and that there is no plausible institutional or policy framework in place to restrain additional GHG emissions which will increase the impacts on wildlife. Species are already responding; it is time for the wildlife management community to engage, communicate, and act on what we do know, even if the rates and patterns of change and the future status of species and communities remain uncertain.

Local Realities: Where the Rubber Meets the Road

Redefining Problems, Transforming Practices, and Learning to Live with Grizzlies

I’m in Ovando, Montana (population 71) about to enter Trixie’s Antler Saloon for an annual meeting of local ranchers. They spend a lot of time engaged in discussions of grizzly bears and wolves and the management and conservation of those once endangered species. By doing so, this local group has developed innovative solutions to complex challenges. I know these ranchers, but I’m always hesitant to start talking about landscape conservation, the Anthropocene, the Endangered Species Act, resilience, and the like. Especially over a beer at Trixie’s. The residents of this part of Montana, just south of the Bob Marshall Wilderness, have known endangered species since long before the adoption of the eponymous act, and have learned to live with first the grizzly bear, and now wolves. When given opportunities, they’ve been incredibly innovative in their approaches to species stewardship.

Grizzly bears don’t recognize the human demarcated boundaries that we as societies have constructed. The political (counties, municipalities), administrative and managerial (USFS, BLM, NPS, etc.), and the institutional boundaries that shape our actions are not recognizable to a grizzly. They move across the landscape in search of suitable habitat in disregard of these boundaries. Interestingly though, by doing so, grizzly bears have served as a social catalyst for networks of actors to communicate with each other across these very same socially constructed boundaries. Here in the Blackfoot Valley of Montana, and beyond, grizzly bear conservation has connected local projects to a broader sense of the landscape. That is, local level action and habitat conservation is linked to landscape-scale science assessment and conservation planning.

In many ways, grizzly bears are the iconic North American species for ecological connectivity and connectivity conservation. Grizzlies have become the symbol of ecological connectivity and drivers of the push to think at the landscape scale (Bixler 2014). Grizzly bear habitat corridors that link “islands” have been extensively mapped and are valuable and necessary conservation tools; scientists are increasingly looking to identify land that connects big wild areas, keeping in mind where species are expected to move and persist as the climate changes.
population viability is anthropogenic mortality. One study tracked 388 radio-collared grizzly bears and found that people killed 77–85% of the 99 grizzly bears known or suspected to have died while radio-collared (Wilson et al. 2014). Half of those 99 grizzly bears were killed for being too close to human habitation (while the other half was permitted hunting and legal harvesting).

Often, private lands in valley bottoms and foothills adjacent to grizzly bear habitat on public lands are problematic zones, where conflicts or incidents include bears killing livestock, destroying beehives, foraging for garbage close to homes, or, in rare cases, threatening human safety (Wilson et al. 2014). Repeated incidents typically lead to more severe conflict, habituation, and eventually to removal of the bear through trapping, relocation, or killing.

As grizzly bears re-expand their range onto private lands (the Montana Department of Fish, Wildlife, and Parks suggests grizzly bear populations have grown at approximately 3 percent per year since population trend monitoring began in 2004), the chances for conflicts or incidents and anthropogenic mortality of grizzlies increase significantly. As discussed earlier, part of biodiversity conservation and wildlife management in the Anthropocene will require not only local stakeholder engagement, but also local innovations. This is precisely what happened in Ovando.

The local community-based conservation group there, the Blackfoot Challenge, brought together the rural landowners, wildlife agencies, and conservation groups to determine exactly what the problem was and how best to address it. Through a series of meetings like the one I witnessed at Trixie’s, the Blackfoot Challenge sussed out as many definitions of the “problem” as there were bears in the area. As Wilson et al. (2014) reflect: some people felt that there were simply too many bears, some celebrated new grizzly bear activity, some defined the problem as primarily one of risk to human safety, and some linked the increased grizzly activity to an erosion of personal rights and freedoms exacerbated by the regulatory burdens of the Endangered Species Act.

Through a process of authentically engaging key stakeholders, which officially began in 2002, the Blackfoot Challenge implemented a participatory GIS program that mapped land use practices, bear attractants, and other relevant features and took that information back to the community to collectively re-frame the problem. Recognizing that the traditional practice of dumping dead livestock carcasses in “bone yards” was attracting bears onto ranches and driving much of the human-grizzly conflict, the Blackfoot Challenge started a carcass removal program. In the past three years, an average of 633 carcasses were removed annually, and the program now engages nearly 80 ranches covering more than 600,000 ha. In the Blackfoot watershed from 2003 to 2009, grizzly bear-human conflicts decreased 93 percent.

By clearly and accurately identifying the underlying problem, local people working with state and federal agencies found solutions. And by finding solutions, they are increasing their social connectivity across the landscape, helping other landowners in Alberta, Wyoming, and other places in Montana (Bixler and Taylor 2012), and now conservation practitioners are talking about it in the High Divide region around Salmon, Idaho.

Grizzlies have become a symbol of ecological connectivity in North America.
Working Towards Integrating Science and Local Practices: The Challenge of Caribou Conservation

Moving across the International Boundary of the 49th parallel, mountain caribou conservation in British Columbia helps highlight one of the key lessons learned from grizzly bear conservation in Montana: that species conservation and wildlife management in the Anthropocene must utilize local knowledge and community practices. Scientific understanding, while a critical ingredient, is no longer independently sufficient to solve these conservation challenges.

In the upper Columbia River Basin, wedged between the Columbia and Kootenay Mountains, the population of mountain caribou (the arboREAL lichen feeding ecotype of woodland caribou known scientifically as Rangifer tarandus caribou) has persistently declined in spite of a robust understanding of the species’ ecological dynamics. In fact, it is one of the most rigorously documented examples of the negative effect of anthropogenic disturbances on the dynamics of an endangered species. Since the early 1980s, more than 550 individual caribou have been captured and fitted with VHF telemetry or GPS collars (roughly one-third of the approximately 1600 remaining individuals), and through this research, recovery strategies have been developed based on habitat requirements for mountain caribou at multiple spatial scales. Recommendations usually involve protecting remaining suitable habitat from logging, implementing predator control (either lethal or non-lethal), as well as control of alternate prey species (achieved mostly by increasing hunting quotas). However, populations continue to decline not from lack of scientific understanding, but rather an inability to capture a broad range of stakeholders and human motivations for engaging in conservation.

In my time working with communities and groups there, I found that local stakeholders very often constructed a variety of competing narratives to explain the decline of mountain caribou. These narratives reflected the multifaceted nature of relationships between these people, the caribou and the landscape. Moreover, these local explanations illustrate the ways that people combine multiple types of expertise, such as technical information and personal experience. Developing conservation strategies that utilize both types of knowledge systems will be necessary in the Anthropocene.

We must develop and deploy multiple and intersecting conservation strategies in the Anthropocene, and providing the decision-making space for local communities to innovate policies and practices is a powerful venue to do so. This is evident in the Blackfoot, but other landscapes such as the upper Columbia, are ripe for similar locally driven solutions to large-scale biodiversity challenges.

The Future of Biodiversity Conservation and Wildlife Management in the Anthropocene

In many ways, I feel like Buzz Holling must have while he was waiting for his evidence of ecological system “tipping points.” While evidence is mounting, we seem to be waiting to officially send the manuscript off to publish “we are now in the Anthropocene.” It will be necessary to assess all aspects of forest conservation as we transition into this era, wildlife management and biodiversity conservation included. Thinking about biodiversity at a larger spatial scale (i.e. landscapes) can help ensure that the appropriate key species for ecosystem functioning are recruited to local systems after a disturbance or when environmental conditions change. However, as Tabor and his colleagues note, we shouldn’t “throw the Wilderness baby out with the Holocene bathwater.” Present protected areas are important and may be resilient sites that can increase the capacity for species to adapt to changes in the landscape. Current protected areas, however, should be complemented with dynamic reserves and an authentic engagement with stakehold-
ers across a variety of scales, importantly including local communities who live and work in the landscape. Local stakeholders are going to be critical for sustainable conservation success over the long-term, and can drive innovation if we facilitate the appropriate blending of local and scientific knowledge and narrative building.

The Anthropocene presents to us an incredible opportunity to break down the boundary between human societies here, and nature over there. Embracing the responsibility of stewarding other species and managing wildlife is a perfect segue in dissolving this nature-culture divide. Hopefully, like Buzz Holling, soon after publication, hundreds and then thousands of other researchers studying other systems will be providing further evidence to rethink biodiversity conservation and wildlife management in the Anthropocene.

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Notes:

1 http://www.resalliance.org/

2 Crawford Stanley (Buzz) Holling, is an Emeritus Eminent Scholar and Professor in Ecological Sciences at the University of Florida. Holling was an early pioneer in blending systems thinking with ecology and introduced a number of important concepts, including resilience, the adaptive cycle, and panarchy.

3 This discussion is informed from research in the Blackfoot from 2010 and 2013, published as (1) Bixler and Taylor 2012, and (2) unpublished dissertation, Bixler 2014.


References:


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The US EPA recently proposed a regulatory framework to cut greenhouse gas (GHG) emissions from domestic power plants. Critics and supporters alike recognize that this move, as precedent-setting as it is for the world’s second largest emitter, will do little to curtail the damaging effects of climate change unless similar actions are taken by other nations across the globe. Recent studies suggest that the effects of climate change are appearing faster than previously expected, and that even reducing global GHG emissions 50 percent by 2050⁴ may still not prevent some of the more dangerous impacts of climate change (IEA, 2010).

The role of forests and forest-based bioenergy in climate change mitigation strategies is an intensely debated topic. Wood bioenergy plays a significant role in the national energy strategies of many European nations, and these net biomass importers are looking to North America for their biomass supply. Additionally, pending action by the US EPA relating to the carbon accounting of bioenergy⁵ could result in increased domestic use of biomass for energy. Mixed into the debate over the climate change mitigation benefits of forest bioenergy is the multitude of other values that forests represent, especially the conservation of native plant and animal species. People are concerned about the effects of increased demand for wood for energy on wildlife habitat and biodiversity at both the local and landscape level.

Increased Demand for Biomass: Potential for Additional Pressures on Conservation

The majority of activity in the US bioenergy sector is developing in the Southeast, which is also the most biologically diverse region of the country. The high net primary productivity of the region results in high biodiversity and also high forest productivity, making the US South the largest producer of wood and fiber in the world. The forests of the Southeast are also among the most dynamic in the US, with forest cover increasing in areas being retired from agriculture, but being lost in other areas of rapid economic development and suburban expansion. Likewise, the presence of strong forest product markets—as represented by areas harvested and regrown—can be
Demand for wood and fiber has resulted in private investments that have increased tree cover in the region over the past several decades. The USDA Forest Service estimates that the region could support even higher levels of timber production, up to a 40 percent increase over 2006–2007 levels (Wear & Greis, 2013). Where would such an increase come from? There are nearly 40 million acres of intensively managed pine plantations in the region, most of which are located in the coastal plain, with some also in the Piedmont region. Most of these plantations are on land previously deforested for agriculture, and subsequently replanted to forest by private landowners anticipating a higher return than from agriculture. The growth in new plantation acreage has leveled off in most places, but the USDA Forest Service projects that plantations could increase by as much as 27 million acres by 2050 depending on future market demand (Wear & Greis, 2013). While the future interaction of various land uses and markets is difficult to predict, such an increase in plantation acreage could be expected to come at the expense of mixed hardwood and longleaf pine forests. These forests provide habitat for species and ecological communities not typically found in single-species forest plantations. Wood biomass demand, coupled with existing demand for wood and fiber, add to the concerns over habitat protection.

But there are other forces at work in the South’s forests that may have a far greater impact on biodiversity and wildlife habitat. By 2060, as much as 23 million acres of forest in the South could be lost to urbanization as the region continues to grow (Wear & Greis, 2013). A relatively small proportion of the South’s forests are subject to conservation easements, or are in some other status that would protect them from development. The greatest loss is expected to occur in areas where forest product markets are weak and development pressures are strong. The economic values associated with the South’s forests may be a critical factor in keeping private lands as forest, and maintaining the conservation values provided by a mosaic of native and plantation forests, in a variety of ages and successional stages.

**Sustainable Sourcing: New Territory for the Wood Bioenergy Industry**

The number of wood bioenergy facilities in the Southeast continues to increase, in response to demand from both domestic and international markets. While much of their wood biomass supply still comes from plantation thinnings and wood waste, the continued expansion of this industry will begin to significantly increase overall wood demand in the region. The existing forest industry in the Southeast has devoted significant time and resources to understanding environmental concerns, and designing sustainable sourcing and supply chain certification programs to ensure that their operations remain compatible with protecting the region’s conservation values. The wood bioenergy industry now shares this responsibility.

Considering how rapidly the wood bioenergy industry is expanding through the construction of entirely new facilities, it is important to recognize that this responsibility begins before a proposed facility is even built. This involves accessing ecological data from state Natural
Heritage programs and other sources to become informed about rare, threatened, and endangered species and ecological communities occurring within their projected supply areas. It also involves a genuine and ongoing dialogue with key stakeholders so that important concerns are understood, internalized, and effectively addressed. As leaders from throughout the US forest industry can attest, siting new facilities depends not just on regulatory permits, but also on earning the “social license” to operate.

Given the forest land ownership patterns in much of the South, a large wood bioenergy facility will be supplied from hundreds of privately-owned forest tracts, so a sustainable sourcing program will involve working proactively with landowners to promote the conservation of ecological resources. Private forest landowners, especially family woodland owners, consistently mention a desire to conserve and enhance wildlife habitat and biodiversity as one of their objectives in managing their forests sustainably (Butler 2008). However, a large proportion of these private landowners do not have a forest management plan to assist them in managing for these objectives, often because of the cost of consulting services needed to develop such a plan. The traditional forest products industry has played an important role in providing outreach, education, and services to forest landowners, through tree farm certification and other landowner assistance programs (Ellefson, 2004).

The wood bioenergy industry must be similarly proactive in engaging forest landowners and the conservation community in a manner that reflects the complexity of conservation issues in the South.

If current trends in renewable energy development continue, wood bioenergy companies will invest billions of dollars in new plants and equipment in the South. To be economically viable, these companies will also need to invest in the sustainable management of the region’s forests. Regional biomass harvesting standards, best-management-practices guidelines, and existing certification programs will all be useful in informing this process. But it will be important for wood bioenergy companies to make their own public commitments to sustainable sourcing programs that recognize the important conservation values of the region’s forests, that specify the standards under which their facilities will and will not accept wood biomass from suppliers, and that verify compliance with these standards at every point in their supply chain.

The new EPA-proposed rules for reducing carbon emissions from power plants, and the rules for carbon accounting under the Clean Air Act expected later this year, will sharply focus the public policy debate over the role that wood bioenergy will play in US energy policy and in international markets for wood biomass for energy. Whether that role will be large or small, it will be important for wood bioenergy companies to demonstrate their commitment to sustainability through credible, verifiable programs providing public assurance that the conservation values of the region’s forests are well understood and adequately protected.

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Notes

1 This recommended target established by the International Panel on Climate Change (IPCC) is to reduce net global GHG emissions 50 percent by 2050 compared to 2000 levels.


References


In October 2013, the Pinchot Institute brought together more than 60 participants including representatives of US pellet producers, European purchasers, US, Canadian, and European policymakers, and conservation organizations to analyze and debate complex sustainability issues related to the growing trade in wood pellets between the US and Europe.

Download the summary report and workshop proceedings at: pinchot.org/pellets
Introduction

The recently passed 2014 Farm Bill refined the conservation programs that reward farm and forestland owners for conservation practices. Although the funding pie is smaller, the present need for such programs is greater. The nation faces ongoing challenges that threaten to not only degrade wildlife habitat and water resources, but also diminish the amount of land in forests. Climate change will also introduce challenges, placing water resources and wildlife in jeopardy and in some cases reducing the efficacy of certain conservation practices. In these uncertain times, innovation and efficiency are paramount to achieve desired outcomes with taxpayer investments in conservation. One of the innovations that could potentially optimize the federal investments in farm and forestland conservation is beginning to experiment with “outcome-based” incentives over “practice-based” incentives; if successful this approach could be expanded. Performance-based approaches are not new and the idea is simple: pay landowners (also known as “producers”) for the ecological conditions they create, rather than the practices they follow. In the era of fiscal austerity, such a reform would likely have broad political appeal.

A Novel Innovation for Public Conservation Programs

Many existing Farm Bill programs that pay for ecological benefits do so by rewarding landowners for implementing or adhering to a specific set of practices known, or assumed, to result in biodiversity or wildlife conservation benefits. In a practices program, a producer needs only to follow the pre-determined set of steps. Landowners are paid for successfully implementing these steps and not based on an assessment of whether the steps produced the outcome for which the practice was designed. For example, the USDA Natural Resource Conservation Service pays landowners to plant trees by streams in order to reduce erosion, stabilize streambanks, filter nutrient runoff, and improve water quality—all being benefits long-proven to result from these kinds of projects. Some projects perform exactly as hoped, but not always to the same degree, even when the prescription is strictly adhered to. Still, simplification by prescription has helped deploy practices across the countryside at large scale.
Some existing practices work well at achieving environmental outcomes. For example, restoring riparian vegetation is a common practice that results in a variety of benefits to fish and wildlife, water quality, and to people more directly by providing aesthetic and recreational values. Other practices do not work well at achieving environmental outcomes. For example, riparian plantings can go awry when such practices are required in an area where trees do not naturally occur. A program that pays for this practice expends resources without achieving meaningful ecological results, and could inadvertently cause harm.

Rewarding the actual result instead of the intended result can mean greater accountability for dollars invested. Overall, there is a reciprocal relationship between the certain but rigid approach of using practices and the flexible but necessarily indefinite and risky approach of using outcomes and performance measurement to target conservation programs and to guide the design and implementation of individual conservation projects. Under the 2014 Farm Bill, the US Department of Agriculture may have the administrative flexibility to incorporate biodiversity and wildlife outcomes into its existing practice-based programs, even if only on a limited or experimental basis to begin with. Paying landowners for outcomes, in addition to paying for practices, could result in a greater return for our public investment in Farm Bill conservation programs in the form of greater achievement of biodiversity and wildlife goals.

The idea of reframing public investment in conservation towards outcomes requires clear and practical outcomes and measurements. In such an approach, a payable outcome could be a single indication of habitat quality, such as the presence of beaver dams; multiple species and habitat characteristics that represent biodiversity collectively; or, the outcome measurement could be presented as a tiered system or index, such as ecological integrity assessments, into which land parcels are placed according to various criteria. There is a tradeoff when selecting payable outcomes, between constructing the perfect detailed system (which is costly and narrowly focused, but perhaps easier to recognize) and general outcomes (which are less costly and have a wider focus, but may prove unwieldy for monitoring and payment purposes).

The payment structure should incentivize overall production of tangible outcomes and delivery of ecological benefits. A program aiming to pay for ecological benefits should reward actions that enhance benefits (also known as net gain or ecological lift), as well as actions that maintain lands with existing value (no net loss), and lands that have been restored to provide improved habitat. By strategically coordinating with other sources of conservation support in a given area, Farm Bill programs will enhance their potential for achieving specific outcomes and reaching broader conservation goals. An overall goal in transitioning toward an outcome-based orientation is to reframe public conservation investment to be more strategic rather than opportunistic.

**Evaluating the Tradeoffs: Performance-based vs. Practice-based**

There are tradeoffs to favoring either practices or outcomes. Outcomes are theoretically more accurate than practices in achieving an environmental goal because the payment is tied as closely as possible to the achievement of the goal itself. Also, the producers themselves will calibrate a project to better suit local conditions, applying their own knowledge to tailor practices to the site, using information only they have. In a similar fashion producers might locate projects in places that have inherently greater ecological value, as these will yield a higher payment. The tradeoff of course is that often high site productivity is as valuable to crops as wildlife, but the farmer or forester would have to make this decision. Conversely, practice-based approaches in many cases allow the landowner to use poorer quality land.

For conservation organizations, orienting conservation programs towards outcomes may present opportunities to work more closely with landowners to experiment with the methods to best achieve the stipulated outcome. Overall, an outcomes-based approach places greater responsibility with the producer, as opposed to treating the producer as an implementation instrument, while conveying more flexibility and autonomy to farmers and forestland owners.

As is often the case, greater responsibility or autonomy means greater risk. A producer will sacrifice the certainty of practice payments, but have more flexibility to consider their options and diversify their land’s “products” into environmental goods as well as traditional crops. A major challenge to the outcomes-driven approach is that outcomes link an individual landowner’s management actions to ecological benefits that may only be realized or be detectible over longer time frames or broader scales. Outcomes may also be overly broad and difficult...
to explain or costly to measure; payments for practices are generally simpler and easier to conceive.

This article does not call for the complete abandonment of practices-based programs. Instead, it is important to recognize that outcomes and practices nurture a close, and at times nearly inextricable, relationship. Measuring the outcome in some capacity, whether overt or unacknowledged, is a critical part of developing a standardized practice. Where a practice successfully achieves a conservation objective, the success arises because the practice leads to the outcome it originally was designed to achieve, even when the desired outcome may have not been clearly stated in a USDA practice description. Where a practice does not achieve the desired conservation goal, the connection to the outcome has failed, and the practice requires further refinement. For example, in the Chesapeake Bay watershed, improvement of riparian forest buffer practices took place when better science on the outcomes of practices adjusted standards for buffer width. Where a practice consistently achieves a result, such practices may come very close to being perceived as an outcome itself. For example, the practice of flooding agricultural fields may turn into an outcome, the presence of flooded fields, that itself represents the biodiversity and hydrological integrity of a functioning wetland ecosystem. A narrower but more specific outcome could be presence of waterfowl or shorebirds at the flooded field.

The close relationship between practices and outcomes suggests that well-structured conservation programs can benefit from integrating each approach to a certain degree. Practices that refine their methods within the context of a conceptual outcome are more likely to deliver ecological benefits than practices operating without such guidance. A program that pays for straightforward practices, but uses a conceptual outcome to guide those practices, with an added bonus payment for measurable outcomes attained through implementation could be a practicable solution that results in greater assurance in achieving ecological results. Paying a bonus for tangible outcomes allows creativity and experimentation to flourish, and provides greater incentive to holistically incorporate ecological benefits into farm or land production, rather than relegating conservation values to the fringes of the economic venture. Phasing in an outcomes approach to an existing practices program can result in innovation without abandoning the administrative and financial security of practice payments.

Introducing this New Approach to Conservation Investment

Ideally a carefully selected tangible outcome guiding the implementation of a conservation practice plays a major role in supporting the ecological integrity of its ecosystem. Selection of outcomes to adapt conservation programs can readily borrow from conservation planning which directly links overall ecosystem integrity to local conservation objectives. Refined outcome-based conservation programs could be tiered towards achieving the fish and wildlife conservation goals explicitly articulated in regional or national level conservation frameworks, such as State Wildlife Action Plans, State Forest Resource Assessments and Strategies, and other eco-regional plans. To the extent that these documents represent some level of agreement concerning conservation goals, they add value to Farm Bill programs by providing important ecological and social context. Significant resources were directed towards these conservation plans over the last decade and it makes good sense to consider how the conceptual outcomes articulated in such planning documents can be used to steer, and where necessary refine landowner assistance programs. Ideally, both broad goals and specific local outcomes would be re-evaluated periodically to track effectiveness.

The current USDA payment programs authorized in the 2014 Farm Bill should be evaluated to determine whether there is flexibility in their implementation to have a greater focus on outcomes. Applications to
Habitat for the threatened gopher tortoise is conserved by landowners with financial assistance from the Wildlife Habitat Incentive Program.

By paying bonuses for outcomes or for regional conservation, the 2014 Farm Bill is poised to introduce outcomes as a feasible method for rewarding conservation activities, and could ultimately bring enhanced guidance and effectiveness to ecological benefit payment programs. Refining the focus of Farm Bill programs toward environmental outcomes offers a way to connect payments to tangible results on the ground. Early iterations of outcomes-based payments will in all likelihood be imperfect, however, and phasing in outcomes to payments under the Farm Bill should therefore be a gradual and collaborative process.

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Notes:
4 See e.g., Astrid Zabel & Brian Roe, Optimal design of pro-conservation incentives, 69 Ecological Economics 126-134, at 131, table 2 (2009); Butler, S.J., L. Boccaccio, R.D. Gregory, P. Vorisek, and K. Norris, Quantifying the impact of land-use change to European farmland bird populations, 137 Agriculture, Ecosystems and Environment 348-357 (2010).
7 2014 Farm Bill, Sec. 1271B(d)(4)(B).
8 See 2014 Farm Bill, Sec. 1271A(1)(B)-(D) (defining “covered program” as including Stewardship Program, Incentives Program, and Forests Program); Sec. 1271B(d)(3)(C) (requiring an application to the Regional Program to include an indication of which covered programs will be used).
9 7 C.F.R. § 1470.24(a); 16 U.S.C. § 3839aa(3)(B), 2014 Farm Bill, Sec. 2201(1)(C); 16 U.S.C. § 3839aa-2(f); 2014 Farm Bill, Sec. 2203(4); 16 U.S.C. § 3839aa-2(g); 2014 Farm Bill, Sec. 2203(5); 7 C.F.R. § 625.9(b)(4); 16 U.S.C. § 6573(b).
10 7 C.F.R. § 1470.24(c); 16 U.S.C. § 3839aa-8(a)(2)(E); 2014 Farm Bill, Sec. 2207(1)(C).
Adapting Conservation to Climate Change—Perspectives from the Field

Will Price

As governments, businesses, and conservation organizations debate what can be done to decelerate emissions of greenhouse gases, they are already mobilizing to deal with the repercussions. More and more, strategies to conserve biodiversity and sustain ecosystem functions take into consideration how conditions and disturbance regimes will change going forward, thinking about where flora and fauna will need to move, or how to identify and secure places that have always proven to harbor biodiversity.

In the last few years a number of studies have begun to paint a picture of how ecosystems of North America will be affected by shifting seasons: more droughts in some places and floods in others, higher tides, bigger storms, and many other possibilities. However, climate models are still hard to interpret at the scale at which we must make conservation decisions and investments. Some changes at this point seem certain (like the rising seas) or are already being observed (average annual temperatures). Other changes are harder to predict, in many cases because they rely on complex climatic interactions that do not yet downscale reliably to specific regions—especially when the variable of interest is inherently dynamic (e.g., intensity of storm events). Yet despite these uncertainties many organizations are finding ways to take actions that are needed to conserve biodiversity and ecosystem services.

For our part, the Pinchot Institute seeks to further the dialogue and move new thinking to the ground where it is needed. Last year the Institute hosted a major national symposium on “Conservation in the Anthropocene” inviting scientists and land managers to share their thinking on how conservation must evolve during this new epoch. We are also working with organizations in various parts of the country to identify adaptive conservation strategies and help grow the capacity and expertise to facilitate their implementation.

Among the most influential organizations working on this challenge in North America are the Open Space Institute, The Nature Conservancy, Defenders of Wildlife, and the US Forest Service, though many others are doing similar thinking and adapting their strategies and actions to a new world. What follows are a few vignettes on how these organizations are coping with the challenges of climate change in the field.

Will Price is Director of Conservation Programs at the Pinchot Institute in Princeton, NJ.

Notes:

Conservation in a Changing World

Peter Howell — Executive Vice President Conservation Capital Programs, Open Space Institute

Climate change poses vexing challenges for the land trust community. Chief among them is the issue of permanence. Land trusts like the Open Space Institute are primarily focused on permanent protection, through the purchase of land and easements. But given climate change, which lands should we protect? And how can we be assured that the lands we protect today will harbor or attract biodiversity tomorrow? How can we deliver on this larger concept of permanence?

Of course, not every land trust is focused on conserving biodiversity. Many trusts protect lands for recreation, their aesthetic value, or for water quality and quantity. But as the climate warms, there is increasing pressure on land trusts to demonstrate that their work is relevant to climate adaptation—of both wildlife and humans—and thus is addressing the major issue of our time.

The good news is that advances in science are illustrating the important role for land protection in facilitating wildlife adaptation to climate change. With support from various foundations and the US Fish and Wildlife Service’s Northeast Landscape Conservation Cooperative, my organization is wrestling with understanding and translating a range of cutting edge climate science that can help land trusts determine which are the most important places to protect and why.

There is no shortage of information available about climate change. Various organizations, including The Nature Conservancy and the National Wildlife Federation, have released helpful guides on how to understand and facilitate climate-smart climate adaptation. It’s the subject of many sessions at land trust gatherings, and few land trust practitioners can afford to ignore the evolving science about climate change.

New research on terrestrial resilience developed by The Nature Conservancy is helping to identify places where natural communities will thrive well into the future. The idea is to protect those places most likely to harbor a wide variety of natural communities even though the composition and location of those communities will most likely change in ways we cannot predict. In a nutshell, resilience boils down to three things: complexity, connectedness, and geology. The more “complex” a landscape—the more slopes, valleys, cliffs it has—the more species can adapt when change occurs. The more “connected” a landscape—the fewer the roads, buildings, etc.—the more species can move around and access these complex features. Geology plays a critical role, as different geologies and soils support different kinds of plants and animals. Protecting a range of geology types is critical to maintaining the full suite of biodiversity. Indeed, as a community, we have protected a lot of mountain peaks and coastal landscapes. We now need to do a better job of protecting, for example, lower level mountains, limestone valleys, and silt flood plains that could be crucial to facilitating wildlife adaptation to climate change.

With funding from the Doris Duke Charitable Foundation, the Open Space Institute is testing the application of this science by providing capital grants to land trusts to protect resilient landscapes in four focus areas of the east, and providing smaller grants to incorporate the science into conservation plans and guide public and private funders. It’s a grand experiment that both requires a new way of thinking about “place” and very practical ground-truthing to make sure the science makes sense.

This approach—focusing on the enduring features of the land—provides a complement to the more species-based approach that underlies traditional vulnerability assessments. The latter are used frequently to identify how changes in temperature and precipitation are likely to affect the distribution of species across the landscapes. While predicting such changes can be problematic and the focus on species movements may obscure what’s enduring about certain places, such assessments are an important piece of the puzzle. With the support of the US Fish and Wildlife Service, we’re hoping to utilize these and other science and data to provide decision-makers with the information they need to make better choices about conservation on the ground.

In the end, to paraphrase hockey great Wayne Gretzky’s comment about skating and the puck, we will measure our success by whether we can help land trusts to protect the lands where biodiversity will be, not just where it has been.
Climate Change and Conservation — A Fish and a Marsh

Noah Matson — Vice President for Landscape Conservation and Climate Adaptation, Defenders of Wildlife

Climate change is upending conservation. To illustrate, I will tell a story about a fish and a marsh. The Silvio O. Conte National Fish and Wildlife Refuge is a unique wildlife refuge—established as much to catalyze conservation throughout the Connecticut River watershed as to protect land. One of the Refuge’s establishing purposes was to restore imperiled Atlantic salmon to the river where they once swam.

There are many challenges with this conservation objective, but perhaps the biggest today is climate change. The Connecticut River is in the southern end of the historic range of Atlantic salmon, and this mighty river will become increasingly inhospitable for this cold water fish. The US Fish and Wildlife Service needs to evaluate its basic conservation purposes for this refuge in light of climate change.

Further down the eastern seaboard, the Blackwater National Wildlife Refuge in Maryland was created in 1933 to protect marshes important to migrating waterfowl and other species. Since establishment, a third of the refuge’s marshland areas have become open water as a result of a combination of influences, including the highly-erosive habits of the invading nutria (a wetland rodent) population; subsidence of the land, and sea level rise. In its now decade-old management plan, the refuge set out to restore the marsh to its historic conditions—a bold, expensive, and perhaps impossible task in light of the rising waters of the Chesapeake Bay.

But now the Fish and Wildlife Service is working with partners to strategically think through its conservation options given both the experienced and projected impacts of climate change. The refuge is beginning to look at not where the marshes used to be, but where they might be going to make sure the refuge continues to provide this important habitat type.

Five to ten years ago, in places like these we often saw managers wrestling with how to deal with the complex impacts of climate change on their own, and often within the context of their own boundaries and jurisdictions. Today that is changing.

Last year, the Obama administration released the National Fish, Wildlife and Plants Climate Adaptation Strategy.1 This unprecedented strategy is the product of more than 20 federal and state agencies and tribal organizations making it the first national level intergovernmental climate adaptation plan. It provides a foundation for tackling the complex, large-scale issues of climate change. It recognizes that no single individual, organization, or agency can practice conservation alone, and that we need to work collectively, across large landscapes, in order to address extreme weather events, larger and more intense wild fires, and species on the move.

There are now increasing science and technical resources available for wildlife and land managers to tackle climate change. The USGS National Climate Change and Wildlife Science Center and its associated regional climate science centers are now a $25 million a year venture providing applied adaptation-related science. The National Oceanic and Atmospheric Administration, USDA, and other federal and state programs have similar science-driven entities relevant to land and resource management.

The foundation has been laid for a more comprehensive and effective response to conservation in an era of climate change. It has taken over a century to build the conservation movement and institutions we have today, and it will take time to adjust to the new reality of an ever-changing climate. We can and we must adapt the way we do conservation if we are to succeed in passing along this world’s incredible biodiversity to the next generation.

Can a Federally-led Partnership Facilitate Regional Change?

Sarah Low — US Forest Service, Northern Research Station, Philadelphia Field Station

The Delaware River Watershed, specifically Philadelphia and Chester, Pennsylvania, Camden, New Jersey, and Wilmington, Delaware, was made an Urban Waters Federal Partnership site in June 2011. In developing this Partnership the lead agencies for this site, the USDA Forest Service, NOAA, and Department of Interior National Park Service, decided to convene gatherings of federal agencies, community nonprofit organizations, and local agencies to find out from communities what the pressing issues and needs are. Several themes emerged across the four cities—brownfields, parks/trails/open space, habitat and river restoration, water quality and quantity, and climate resilience. The first four themes are easily connected to existing or possible projects, the kinds of projects that can be delineated on a map, funded, monitored, and completed, but climate resiliency projects are not as easy to identify.

Connecting climate change projection models, studies, and reports to local action at the scale of a city or region can be challenging; however, it may be possible to use existing local efforts to create climate resiliency. In our meetings in Chester, Camden, Wilmington, and Philadelphia, we heard about work already happening that contributes to climate resiliency, such as the conversion of former industrial sites into parks. One site in particular is the future Phoenix Park located on the Delaware River in Camden and led by the Camden County Municipal Utility Authority. When the park is completed, it will infiltrate on-site stormwater, thereby reducing the runoff entering the Delaware River and reducing Camden’s impact to cities downstream, such as Chester and Wilmington. The site is currently devoid of vegetation but once the construction is completed, trees and other vegetation will be planted—at the very least reducing heat island effect.

Phoenix Park also brings together a variety of partners, including the Partnership for the Delaware Estuary, a nonprofit that has been planning and monitoring living shorelines throughout the Estuary. A living shoreline will be created at Phoenix Park to reintroduce mussels, which may improve the water quality of the Delaware River for downstream communities that depend on the river for drinking water. If the conversion of one brownfield to a park can carry with it the potential for regional benefits, what could happen if brownfields throughout the watershed were converted to green space?

While climate resilience may not be the initial impetus for projects like Phoenix Park, it may be an important outcome. If projects like Phoenix Park were completed throughout the region in a way that compounds benefits at each site, perhaps a strategic approach to climate resilience could come from the act of gathering and sharing. For this reason, the Urban Waters Federal Partnership has been developing Communities of Practice that link Federal agencies with local and regional organizations and agencies.

Communities of Practice are not only valuable to their region, but they also offer lessons learned that can be shared with the network of 17 other Urban Waters Federal Partnership sites throughout the country. These Communities of Practice are intended to create real, sustained change that improves peoples’ lives by increasing access to information about existing resources and elevating regional knowledge through the sharing of lessons learned.
The Nature Conservancy’s Strategies for Climate Change

Chris Topik — Director, Restoring America’s Forests, North American Region, The Nature Conservancy

The Nature Conservancy is one of the world’s leading conservation organizations, working in 33 nations with a large and dedicated staff in the United States implementing a broad array of conservation work. Our mission is to conserve the lands and waters on which all life depends. We are now focused on a new global framework that provides a discrete set of strategies to respond to global challenges we all face: conserving critical lands; securing fresh water; restoring our oceans, and reducing the impacts of climate change. As one of the largest private land owners in the United States our land stewards have the opportunity to pioneer many innovative land use practices to help maintain habitats, including forests, so our lands and waters can be more resilient to climate change stresses.

In the United States we remain concerned by the likelihood climate change will greatly impact nature, by changing normal stresses that help shape our natural communities, such as fire and disease. We recognize that long term forecasts suggest in a few decades we will see dramatic reductions in the ability of America’s forests to sequester carbon, so it is vital we figure out how to make forests adapt in order to keep forests as major carbon mitigation tools. Sample efforts in the United States include:

- Our North America priority project, Restoring America’s Forests, includes 13 large forest restoration demonstration sites, sitting in 22 states that focus on federal forest management that fosters community engagement, science applications and collaboration to foster projects and planning that make forests more resilient in the face of disturbances and extreme natural processes, such as unnaturally extreme wildfires. Project areas include the Southern Blue Ridge area (TN, NC, SC), central and southern Oregon, the northern Sierra Nevada range (CA), the Colorado front range, Arkansas short-leaf pine and oak forests, and the longleaf pine in the southeast, among others.

- Our leadership in the Fire Learning Network provides communities, local agencies, and various industry and conservation practitioners the tools to better understand and use beneficial fire to promote ecosystem resiliency that benefit the places where people live. We are co-leaders of the Fire Adapted Communities Learning Network, which now has 17 pilot communities across the United States. These locally-driven partnerships are determining which combinations of tools are most effective in certain social and ecological contexts to best support an individual community’s efforts to become more fire adapted over time.

- The Southwest Climate Change Initiative enhances science-management partnerships in the Four Corner states and focuses on managing for change while searching for ways to increase the pace and scale of conservation activities. We are working on innovative funding tools to support projects to enhance water security for large population centers that depend on healthy forests so they can resist damage from increased, unnaturally damaging wildfires.

- Other efforts, such as in the Northeast, are providing resiliency analysis that identify focal regions that will best promote regional resilience to stress. This helps us prioritize projects that help manage essential core forests and linkages areas that will presumably foster species movement as climate change affects various species at differential rates.

The Nature Conservancy recognizes that climate change is affecting nearly everything we do and impacts all the aspects of nature. A substantial effort outside of the Unites States is focused on demonstrating low-carbon development models can be successfully implemented at a large scale, thereby enhancing the maintenance of forests vital as carbon sequestration engines. We are deeply engaged in these efforts to reduce deforestation and degradation in places such as in Indonesia, Mexico, and Brazil. We also see that climate change is exacerbating disasters that can have tremendous, negative impacts on nature and society, so we help develop and advocate for green infrastructure solutions that can be economically efficient and reduce disaster risk to people, water, and wildlife.
The EcoMadera community forestry enterprise is a Pinchot Institute pilot project—combined with a for-profit business—testing an innovative strategy for conserving Ecuador’s coastal rainforests. The EcoMadera project was established in 2002, when a group of landowners in a small rainforest community in northwestern Ecuador partnered with a US Peace Corps volunteer, David Smith, and with Pinchot Institute Senior Fellow Peter Pinchot, to create a community forestry enterprise. The goals set by the community members were to conserve the forests that were being lost to persistent illegal logging and conversion to agriculture, and to improve the standard of living of families living within the local watershed.

Twelve years later, EcoMadera has grown into a small, but rapidly growing forest products company. It manages forest plantations and native forests, manufactures wood products in a facility located in the community, markets them internationally, and provides full-time employment to 55 community members. This kind of success, relatively rare among community forestry projects in the tropics, is inspiring others to learn more about this approach and apply it in other locations in tropical forests. EcoMadera is now updating its community forestry business model to demonstrate how a project like this can have a greater impact on mitigating climate change.

**Global Context**

Debates about climate change focus largely on the role of coal, oil, and natural gas as the primary sources of greenhouse gas emissions. However, over the last 150 years, forest exploitation and deforestation have been responsible for 30 to 40% of the human-generated carbon emissions contributing to global climate change. This trend is continuing, with tropical deforestation and forest degradation in Latin America, Africa, and Asia still producing roughly 15% of global annual carbon emissions. Temperate forests, having significantly recovered from forest loss in the 19th and early 20th century, are currently acting as carbon sinks, but are predicted to become carbon emitters as the climate continues to get warmer.1 These trends make it clear that reducing forest carbon emissions is essential to our ability to make the transition to a low-carbon economy and to return to a sustainable climate regime.

An additional 50 years of tropical deforestation, without any further fossil fuel emissions, would put us close to a 2°C increase, the estimated threshold for avoiding the worst impacts of climate change.

In 2008, recognizing the need to develop an effective strategy to control tropical deforestation, the United Nations established a program for Reduced Emissions from Deforestation and Degradation (REDD). During the past six years, 51 tropical nations (including Ecuador, where EcoMadera operates) have partnered with the UN to develop national REDD strategies.

A key obstacle to putting REDD into practice has been the failure to create a global carbon market that can provide sufficient funding to support national programs to control...
deforestation. The UN estimates that it will cost $30 billion a year to reduce deforestation sufficiently to stay within the 2°C limit. In the absence of a global carbon market, no international consensus has emerged to provide this funding.

There are several factors that have to be addressed to reduce deforestation in developing countries:

- Unlike temperate forests, most native tropical forests are populated by rural communities who make their primary living from their land.

- Families in most tropical rural communities lack full legal rights to their land, which inhibits sustainable management.

- Over 80% of deforestation is caused by conversion of forests to agriculture.

- Tropical forests are very diverse, and there has been little research in silviculture, wood products, and markets for most species. Diverse native tropical forests typically have low timber value.

- If the economic opportunities from agriculture appear to be greater than what landowners can gain from managing native forests, they make a rational decision to convert their forests to agriculture.

Thus the key elements of reducing tropical deforestation include helping forest communities gain legal rights to their land and ensuring that they can gain equal or greater benefits from managing their forests sustainably than they can from agriculture. This strategy is the foundation for the UN REDD program and for the EcoMadera community enterprise.

While waiting for the emergence of REDD carbon markets, EcoMadera has focused on raising the value of community forests through sustainable forestry, on managing native forests and forest plantations, and on local manufacturing of valuable wood products. The Pinchot Institute has played a central role in the evolution of this enterprise, with major support from the MacArthur Foundation, Overbrook Foundation, and Prince Albert II of Monaco Foundation, and from USAID and private donors. These funds have supported basic studies that are the foundation of sustainable forestry, including conservation planning, taxonomy and silviculture of 300 tree species, low impact timber harvest, and design of innovative wood products that can utilize 60 to 80 largely unknown wood species in products that can drive value back to forest communities.

**Low Carbon Economy, Green Markets, and Impact Investing**

The dramatic growth of the green economy, focused on sustainability and on mobilizing “impact investing”—venture capital invested with a commitment to achieving social and environmental outcomes—provides important new opportunities for addressing both climate change and tropical deforestation. Exciting examples include: the California cap and trade program, which is creating the first formal carbon offset market for preventing tropical deforestation; the rise in global investment in renewable energy projects to nearly $300 billion annually; the rapid growth of energy-efficient, low-emission housing design and commercial construction; and growth of impact investment funds to nearly $1 trillion in capital. These trends create an unprecedented business opportunity for community forestry to scale up to the point where it can have a major impact on deforestation and carbon emissions—if we can help community forestry enterprises to access these markets.

For decades, the conservation community has supported community forestry projects through multilateral and private foundation funding, and many nations have developed policies friendly to community forestry. These actions have been necessary, but in many cases insufficient to slow deforestation. Why? Because deforestation is driven largely by the opportunity cost of agriculture and other non-forest uses.
To reduce deforestation, communities have to connect their forests to markets which will provide returns to landowners that are economically competitive with the most valuable non-forest opportunity.

To become competitive, community forestry has two options: 1) accessing government incentives for conservation and 2) establishing a viable business enterprise that can drive value back to forests and their owners. Where opportunity costs are high (soy beans, cacao, African oil palm, and even cattle), conservation incentive programs cannot compete effectively with agriculture. Thus EcoMadera believes that, where the deforestation threat is high, the combination of a competitive business venture and government incentives is the most viable option.

EcoMadera has built its forest product business by accessing two of the green markets described earlier: global wind energy and the US green construction industry. First, we grow balsa tree plantations and manufacture balsa wood laminates which are transformed into the core material for industrial composites used in wind turbine blades. EcoMadera exports to balsa composite markets in Europe, the US, and China. The wind industry demand for balsa is growing rapidly, and EcoMadera is currently raising capital to expand its manufacturing capacity and to establish more balsa plantations.

Second, based on the Pinchot Institute’s program of R&D in forestry and wood products, EcoMadera is starting up a second business line in mixed-species hardwood products. Our first product is butcher block countertops. This product has grown out of EcoMadera’s “whole forest design” strategy, which is based on utilizing the harvestable species in the native forest in the relative abundance in which they can be sustainably harvested. We let good silviculture drive our product design, which then drives the maximum value possible back to the forest. The types of wood used will vary according to the mix of species in the latest timber harvest, with 6 to 8 species per countertop, and a balance of colors and textures. We are working with green architects, designers, and contractors to develop the most appealing species mixes, and we are negotiating a contract with a national distributor of countertops.

The Value of Empowering Local Women as Leaders

EcoMadera’s manufacturing facility is run by three female employees from the local community. One manages the entire manufacturing facility, another is production foreman, and a third manages kiln drying—the most technically demanding skill set. Since these highly capable women assumed their new posts a year ago, the manufacturing process has been made more efficient, achieving a 25% increase in wood yield, and employee productivity has been dramatically improved.

New Partnerships—A Multiple Benefit Community Forestry Model

Despite the progress in establishing a viable community forestry enterprise, EcoMadera is still struggling to control deforestation elsewhere in the 125,000-acre watershed where it operates, settled by 500 colonist families in the late 1970s. Although EcoMadera has become a viable forest products business, until recently, we had not evolved an effective strategy for connecting the families to markets that can compete with agriculture.
In the past eight months, EcoMadera has developed a strong partnership with the Ecuadorian Ministry of Environment that will allow us to integrate government incentives into a comprehensive set of benefits to landowners. We have developed an memorandum of understanding between EcoMadera and the Ministry with the following conservation strategy:

- EcoMadera partners with the Ministry to help landowners gain legal land titles to land parcels, allowing them to access bank credit and participate in government incentive programs.

- We help families enter the Ministry’s Socio Bosque forest reserve incentive program, with annual payments to avoid all timber cutting and agriculture.

- EcoMadera establishes lease contracts with families to implement sustainable forestry on the rest of their native forest. The contracts are based on revenues from the sale of wood products such as countertops, sold in US green construction markets.

- We help families gain a forest plantation subsidy from the Ministry of Agriculture by providing technical assistance and a contract to purchase the future timber (balsa and hardwood).

- We help families gain subsidies from the Ministry of Environment for forest restoration on abandoned agricultural lands.

Our business model estimates that, with these multiple sources, families can realize revenues of between $3,000 and $4,500 annually from their 125-acre parcels, which is close to the median Ecuadorian family income and equal or greater than revenues from cattle and most local agricultural crops.

EcoMadera is now expanding this multiple benefit conservation model, with continued strong support from the MacArthur Foundation, and more recently from the German development agency, GIZ. Just recently the Ministry of Environment has expanded its Socio Bosque incentive program to include all the elements of this model including sustainable forestry and forest restoration. The Ministry plans to work closely with EcoMadera to develop this strategy as a model for community forestry in Ecuador. EcoMadera also recently hosted a visit by the Rainforest Alliance and representatives of Quichua indigenous communities in the Amazon region of Ecuador, who want to partner with EcoMadera and develop a sustainable forestry program.

Based on this new landowner model and the expansion of the balsa laminate business and the start up of hardwood countertop manufacturing, EcoMadera is updating its business and market plan. We are also working with social investors to raise capital for continued expansion.

More information about EcoMadera and its developing business and market plan can be found at [http://www.ecomaderaforest.com](http://www.ecomaderaforest.com). We would greatly appreciate any comments or suggestions regarding this project.

**Notes**


5. A. Baccini et al. (2012). Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. Nature Climate Change doi:10.1038/nclimate1354 Published online 29 January 2012

**Peter Pinchot** is a Senior Fellow at the Pinchot Institute, and director of the EcoMadera project in Cristóbal Colón, Ecuador. He can be reached at peterpinchot@ecomaderaforest.com.
The Pinchot Institute’s 50th anniversary gave us an opportunity to recognize some of the extraordinary individuals whose vision and leadership helped make the Institute into what it is today. Ed Vandermillen, who passed away on June 3, played a pivotal role as Director of the Pinchot Institute for Conservation Studies at Grey Towers 1983–1987, and then again 1988-1990 following an assignment to the US Forest Service office in Washington. In cooperation with Gifford Bryce Pinchot and the Pinchot family, Ed strove to realize the vision of the Pinchot Institute as a catalyst for conservation and a think tank for new ideas designed to resolve the many looming environmental problems facing the country and the world. He believed strongly that the Institute’s work must be “science-based and impartial,” and helped establish the reputation of Grey Towers as a neutral forum at a time when controversies over natural resource conservation and environmental policy were exceptionally contentious. Ed helped craft the vision for the Pinchot Institute that has guided our work, and that will continue to inspire generations to come.

— Al Sample
The Pinchot Institute for Conservation opened its new Western Regional Office in June, naming Brian Kittler as its founding director. Kittler was formerly with the National Fish and Wildlife Foundation. “The Western Regional Office will allow the Pinchot Institute to work more closely with our federal, state and regional partners throughout the West to improve the conservation and sustainable management of forests on both public and private lands,” said Institute President Al Sample. “Population growth, energy development, and climate change are making conservation more difficult than ever before, and it is all the more important to engage communities and other stakeholders in developing enduring solutions to these challenges.”

“New kinds of working relationships will be needed to confront the unprecedented conditions on public lands in the West, especially the federal lands,” said Brian Kittler. “Communities all over the West have a common interest in finding ways to get ahead of wildfires and insect epidemics. New developments in science and policy won’t mean much if we don’t find practical and broadly supported ways to implement these ideas on the ground.”

The Western Regional Office will also advance projects focusing on private lands, such as the Institute’s innovative Forest Health-Human Initiative which seeks to provide family forest owners with additional health care assistance in exchange for their commitments to conserve and sustainably manage their woodlands. “New and exciting innovations are emerging at the local level; our objective is to show they can work, and then apply them on other locations across the country,” said Kittler.

“The Pinchot Institute has contributed to improving knowledge of important conservation issues, including bioenergy, ecosystem services, climate change, forestry education, and community forestry, said Kent Connaughton, the Pacific Northwest Regional Forester for the US Forest Service. “All are relevant across the United States, but the perspective provided by the Institute has been particularly important in the Pacific Northwest, where a number of these issues are in their infancy, and promise to become dominant in influencing public policy in the future.” Connaughton added, “I particularly appreciate the Institute’s work on stewardship contracting, which has become an influential tool in achieving environmental, community, and economic goals on the national forests in the region; I believe the new office in Portland will only strengthen the Pinchot Institute’s influence and impact on the conservation policy.”

Clear Lake, Willamette National Forest
Kent Connaughton, Wade Mosby Elected to Pinchot Institute Board of Directors

The Pinchot Institute for Conservation has announced the election of Kent Connaughton and Wade Mosby to its board of directors. “Wade and Kent bring exceptional knowledge of forest conservation and management to the Institute, with broad experience in economics and policy matters on both public and private lands,” said board chair Nels Johnson.

“Kent and Wade have been bold leaders on emerging issues such as forest certification, bioenergy, and climate change that are both challenges and opportunities for forest landowners and managers. We are pleased to have their innovative leadership to strengthen the Institute’s influence and impact on conservation policy,” said Al Sample, President of the Pinchot Institute.

Kent Connaughton served until recently as Regional Forester for the Pacific Northwest Region of the US Forest Service. Connaughton began his 36-year career with the Forest Service at the Pacific Northwest Research Station as a forest economics researcher. He has had assignments as Forest Supervisor on the Lassen National Forest in California and as Deputy Regional Forester in the Pacific Southwest Region. He also served as Associate Deputy Chief for State & Private Forestry in Washington, DC, and as Regional Forester for the Eastern Region.

Connaughton holds a Bachelor of Arts degree from Stanford University, a Master of Forestry degree from Oregon State University, and a Doctor of Philosophy degree from the University of California, Berkeley. He is a member of the Society of American Foresters, and was elected Fellow of that professional society in 1991. Kent and his wife Sue reside in Portland, Oregon.

Wade Mosby served most recently as Senior Vice President for Collins Companies, an integrated forest products company headquartered in Portland, Oregon, with certified forestry operations in Oregon, California, and Pennsylvania. His 35-year career in the forest industry includes positions at Kimberly-Clark, Bohemia, and Roseburg Forest Products. Mosby is a founding member of the Forest Stewardship Council, co-founder and director emeritus of Forest Trends, founding director emeritus for the Oregon Natural Step Network, and served on the boards of Sustainable Northwest, American Forest Resource Council, Keep Oregon Green, and Biomass Power Association. Wade and his wife Susan are long-time residents of Portland, Oregon.

Fellowship Focuses on Increasing Capacity for Community-Based Conservation

Patrick Bixler has been appointed to a postdoctoral research fellowship at the Pinchot Institute, following the recent completion of his Ph.D. in Sociology at Colorado State University. Bixler will continue his research on factors that contribute to increased capacity in community-based conservation, leading to more effective conservation outcomes.

His dissertation illustrates that landscape conservation outcomes can be attributed to relationships, flows of information, and resource linkages that constitute conservation networks. His research illustrates this effect through three different problem case studies: invasive species, grizzly bear conservation, and climate adaptation. Throughout each, the analysis highlights key mechanisms that increase capacity for community-based conservation engaged in cross-scale networks to bring information and resources to implement local conservation efforts. His research highlights that conservation outcomes are more likely when there is alignment in the ways that stakeholders “frame” the problem, illustrating the range of uncertainty in the decision-making process in landscapes characterized by change and variability. While at Colorado State, Patrick was twice a Center for Collaborative Conservation Research Fellow, selected for a competitive summer school program for environmental governance in Aas, Norway, and worked closely with Pinchot Institute Senior Fellow, Tony Cheng.
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