



Duke University Workshop Summary
Tools for Joint Production of Ecosystem Services: NC Case Study
January 19, 2007

Nicholas School for the Environment and Earth Sciences
and Nicholas Institute for Environmental Policy Solutions

A workshop was convened on January 19th at Sarah P. Duke Gardens on Duke University's campus to initiate the work of Duke University's team on the Assessment of US Habitat Conservation and Provision of Ecosystem Services for the Wildlife Habitat Policy Research Program project. The objectives of the workshop were:

1. Discuss the state of science, valuation, and management for different ecosystem services and the joint production of multiple ecosystem services (also known as stacking or bundling)
2. For each service and for joint service assessment, outline what a tool would look like and how we would build such a tool (i.e., metrics, data, challenges)
3. Initiate a conversation and collaboration with NC practitioners and experts, and link to other efforts of ecosystem service tool-building.

The overall goal for the day was to develop an initial structural outline of a multiple ecosystem service tool for NC and a network of people to work with on its development. The Duke team is working on a white paper to describe the initial ideas for tool development to share with participants at the workshop. The full agenda and participant list are attached at the end of the summary.

The participants included Duke Faculty and students, North Carolina natural resource managers, land trusts, and other stakeholders as well as national experts from academia and NGOs in the field of ecosystem services.

The morning was spent on an overview of the biophysical aspects, economics and valuation options, and management needs for each service. Three ecosystem services or types of ecosystem services were discussed: carbon, water (including watersheds, wetlands, and runoff and coastal impacts), and wildlife/biodiversity. In the afternoon we separated into two working groups: one focused on water services and the other on wildlife and biodiversity. These working groups were brainstorming based on a set of questions designed to guide the discussion toward tool development. (See questions) and were followed by a final discussion with the whole group to discuss what the breakout sessions had discussed and how to think about bundling these services together.

Morning Session

Dean Urban, Professor of Landscape Ecology, Nicholas School of Environment and Earth Sciences, provided an overview of the Wildlife Habitat Policy Research Program

(WHPRP) project and the goals for the end result of this one component, including packaging a compilation of the ecological and economic value of ecosystem services into useful tools first for North Carolina, but eventually applicable across the U.S.. The intention is to create tools for wildlife biodiversity, watersheds, carbon sequestration, and recreation/aesthetics and to maximize leverage from the bundling of services. The project will rely on available information, both field data and GIS data layers, in order to relate the physical data to economic values and create a benefits transfer model between the economic value and the GIS proxies, such as land cover type, topographic position, etc.

Bill Ross, Secretary of the North Carolina Department of Environment and Natural Resources, gave an eloquent and inspired introduction. He provided information on the state of data and ecosystem services development in North Carolina. Pieces that will be crucial for more effective management of North Carolina's ecosystems coming out of this project include: gaining a more inclusive and long-term political base to support conservation, tapping into the extensive networks and connections across the public/private landscape and integrating better prioritization into conservation, and providing the power of the market to drive objectives beyond policy and state level management.

Lydia Olander and Brian Murray, both with the Nicholas Institute, gave an overview of the science and valuation of carbon, an ecosystem service for which a market already exists. We initiated the discussion with carbon sequestration, because in many ways it is the most easily defined ecosystem service, the producers and beneficiaries are clear, and the development of the policy management and valuation for carbon sequestration in the U.S. are fairly well developed. Carbon sequestration, measured in metric tons of carbon, can be determined for different land uses changes in land use, including different agricultural practices, reforestation, or perhaps the creation of wetlands. They showed a software tool designed and built by Brian Murray and John Fay (Research Associate with the Nicholas School of the Environment and Earth Sciences) which can help individual land owners assess the potential carbon sequestration for different afforestation options. The tool incorporates parameters for land use permanence, leakages, and baseline – all key determinates for assessing additional carbon sequestered. Valuing of carbon credits is currently based on a voluntary system, but value may increase substantially if land use is incorporated as an offset into federal regulation in the US. Land uses such as afforestation and forest management in the Southeast and nationally have a huge carbon market potential.

Jon Goodall, Assistant Professor of the Practice of Geospatial Analysis at Duke, began the discussion of water by providing an overview of the National Hydrography Dataset and SPARROW, Spatially Referenced Regression of Watershed attributes, which uses regression to calculate the physical processes of overland and in-stream nitrogen transport. Together these might provide a database that could be general across the US and a model that will allow finer scale tuning with other data and models. Randy Kramer, Professor of Resource and Environmental Economics at Duke noted that valuing of water resources data is largely based on recreational benefits and has been done for few basins in North Carolina. He suggested that the tool use the benefit transfer method to take

existing benefit estimates in NC and elsewhere and adapt them as needed. Bill Holman, Visiting Senior Fellow at the Nicholas Institute and former director of the North Carolina Clean Water Management Trust Fund explained that the primary state wide management scheme in North Carolina is basin wide plans created every five years through a public consensus process. While these plans provide a snapshot of current water resources in each river basin they provide no way to evaluate future growth impacts and water demand.

Dean Urban, Timm Kroeger, Defenders of Wildlife, Shannon Deaton, North Carolina Wildlife Resources Commission, and Linda Pearsall, North Carolina Natural Heritage Program, focused on wildlife and biodiversity. Dean Urban described the state wildlife and biodiversity tools, which use habitat patches, the surrounding matrix, and networks that connect them. This structure may lend itself well to complementary tools of water services. Timm Kroeger outlined how wildlife can be and is valued: as an input to the production of other ecosystem services, as a direct output of ecosystems valued by humans passively for existence, or by habitat. By combining these values it is possible to calculate the total economic value of wildlife and biodiversity. To value species in North Carolina this project will have to rely on research done elsewhere and use the Benefit Transfer Method. The Wildlife Resources Commission created the North Carolina Wildlife Action Plan which prioritizes species and habitat conservation needs. They are just beginning to use this as a management tool. The North Carolina Natural Heritage Program has data on numerous rare species and designated natural heritage areas in the state which it will share for our efforts. Also, they are establishing a “Green Infrastructure” plan for biodiversity which will eventually incorporate data on agriculture, forests, parks and recreation, and water quality.

Afternoon session

In the afternoon we separated into two working groups: one focused on water services and the other on wildlife and biodiversity. These working groups were brainstorming based on a set of questions designed to guide the discussion toward tool development. (See attached guideline questions) and were followed by a final discussion with the whole group to discuss what the breakout sessions had discussed and how to think about bundling these services together.

From the water break-out group, Randy Kramer presented the results of discussion:

- Water quality and how water quality changes with the landscape, flood risks, and flows are the ecosystem service likely to be mapped in the short-term, for the initial tool
- The available data include measurements of nitrogen and phosphorous, data from USGS flow gauge stations, and small scale site studies from research projects such as those for hydropower relicensing. Because these data are located within different agencies, it will require a big effort to pull it all together.

- To capture these services, will need to use macroscopic indicators such as land uses, dams, point source dischargers, and the NPDES list.
- These services that can be valued may be water quantity and nitrogen loading.
- The data available for the valuation component of the tool will be attained through the benefit transfer approach from avoided cost and willingness-to-pay studies conducted in other parts of the state and country.
- The critical challenges to valuing this service will come into play when the services are bundled with other services such as nutrient reduction or carbon storage.
- Some of services that should be included in future projects or in an expansion of the short-term tool, include drinking water, industrial processes, recreation, fisheries, navigation, the floodplain ecosystem, and the salinity gradients in estuaries, fisheries and spawning areas.

From the wildlife/biodiversity break-out group, Dean Urban presented the results of discussion:

- The services being mapped include recreational hunting and wildlife viewing, which is easiest for the short-term, but could also map services such as biodiversity and rarity.
- The ecological value of these services can be mapped by creating distribution maps of target species and their ‘users’, such as birders or hunters. The macroscopic indicators that would be crucial to capture these services are generally remotely sensed images, land cover maps, network positions and landscape context.
- The final goal of data collection and tool creation is to have a SPARROW-like model (as referred to by Jon Goodall in the ‘Water Overview’) for wildlife and biodiversity which will model wildlife dispersal and flow among habitats and patches.
- The data that exists for wildlife comes mainly from North Carolina’s Natural Heritage Trust Fund office, and includes heritage species distribution data, habitat patches and populations.
- Services from wildlife and biodiversity can be valued according to the number of species, and they can be weighted according to rarity/endemism or function as game species. These aspects can be valued at the patch level and the network level.
- These services can be valued through recreational user fees for natural heritage areas or licensing fees for hunting and recreation. There is also the potential to implement fines for degrading habitat, including the costs to repair. To determine this economic value requires willingness to pay data, replacement cost, consumer surplus value, and a comparison with the highest-return developed use, all of which will likely require the benefit transfer method.
- Some of the main challenges to valuing these services include poor data, mainly land cover and species occurrence data, and simplifying the data to diversity and economic metrics.

The workshop closed with a discussion of the potential for bundling and ways to overlap the ecosystem services discussed. Discussion centered around the challenges and complexities between land conservation and development, and using ecosystem services and values as incentives for conservation prioritization. Prioritizing land and other services for conservation is difficult partly because the value of the service, especially land, is directly connected to the level of threat from human encroachment that change and rearrange over time. One advantage to discussing bundling services in North Carolina is that the services conveniently overlap in many areas of this resource rich state. Though bundling is important, it is also important to be able to un-bundle the services for marketing purposes.

This tool would be useful to stakeholders present at the workshop if it was resilient and dynamic, and could be used as a baseline map of land use and land cover which managers could use to monitor changes over time. The tool should also set the stage for future market development of ecosystem services, as trust funds and public agencies will never be able to buy and conserve everything.



WORKSHOP - AGENDA
Tools for Joint Production of Ecosystem Services: North Carolina Case Study
January 19, 2007 at Duke University

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Objectives:

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- (2) For each service and for joint service assessment, outline what a tool would need to look like and how we would build such a tool (i.e., metrics, data, challenges)
- (3) Initiate a conversation and collaboration with NC practitioners and experts, and link to other efforts of ecosystem service tool-building.

Goal:

Initial structural outline of a useful multiple ecosystem service tool for NC and a network of people to work with on its development. A white paper will be produced from this workshop.

Location

The Sarah P. Duke Gardens
(<http://www.hr.duke.edu/dukegardens/>)

Agenda

8:00 am Coffee and Breakfast

8:20 am Welcome by Lydia Olander (day's agenda)

8:25 am Around the room Introductions

8:35 am Dean Urban (overview of NCSE program and what we are trying to accomplish in our project)

8:50 am Bill Ross (overview of new planning initiatives and the role of ecosystem services for North Carolina)

9:00 am Carbon

9:00 am Science - Lydia Olander

9:10 am Valuation and Management - Brian Murray

9:20 am Discussion

9:45 am Water (watersheds and water quality; wetlands and water quality; runoff and coastal impacts..etc;)

9:45 am Science - Jon Goodall

9:50am Valuation - Randy Kramer

9:55 am Management - Bill Holman

10:00 am Discussion

10:30 am BREAK

10:45 am Wildlife & Biodiversity

10:45 am Science - Dean Urban

10:50 am Valuation - Tim Kroeger

10:55 am Management - Linda Pearsall or Shannon Deaton

11:00 am Discussion

11:30 am Discussing breakout groups for tool design

- Define what is/are the ecosystem services of focus?
- What are the metrics we would use? Biophysical and value
- What are the available data? Other needed data?
- What are critical challenges and opportunities for this/these services?
- What are the hooks to link in other services? For linking to other services?

Noon – Lunch

1:00pm Break out sessions begin

- Water (leader: Randy Kramer and Bill Holman; scribe: Leslie Kleczek)
- Wildlife/Biodiversity (leader: Dean Urban and John Fay; scribe: Joe Sexton)

2:00pm Reconvene – Progress reports from each group

2:00pm – objective of rest of session

2:05pm – Water - Randy/Bill

2:10pm – Wildlife/Biodiversity – Dean

2:15pm – Carbon –Lydia/Brian

2:20pm – flex time (discussion, longer overviews, or quick break)

2:30 pm – Group session outlining a tool for joint production

3:30pm- End Formal Workshop

4:00 -5:30pm SEMINAR by Steve Polasky (open to outside attendees)

5:30-6:30pm Reception



WORKSHOP PARTICIPANTS
Tools for Joint Production of Ecosystem Services: North Carolina as the Prototype
January 19, 2007 at Duke University

Nicholas School of the Environment and Earth Sciences
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Wiley Barbour	Executive Director, Environmental Resources Trust
Kristen Barker	Principle Software Engineer, NatureServe
Ben Best	Research Associate GIS, Nicholas School of the Environment and Earth Sciences, Duke University
Jim Boyd	Director, Energy and Natural Resources Division, and Senior Fellow, Resources for the Future
Frank Casey	Economist, Defenders of Wildlife
Lisa Creasman	Preservation Project Manager, Conservation Trust for NC
Shannon Deaton	NCWRC Division of Inland Fisheries, Habitat Conservation Program
Kate Dixon	Director, North Carolina Land for Tomorrow
Martin Doyle	Assistant Professor, Geography, University of North Carolina-Chapel Hill
John Fay*	Associate in Research, Nicholas School of the Environment and Earth Sciences, Duke University
Jon Goodall*	Assistant Professor of the Practice of Geospatial Analysis, Nicholas School of the Environment and Earth Sciences, Duke University
Derek Halberg	Director of Land Protection, Tar River Land Conservancy
Pete Harrell	Research Associate, Nicholas School of the Environment and Earth Sciences, Duke University
Mac Haupt	Monitoring Supervisor II, North Carolina Ecosystem Enhancement Program
Bill Holman	Visiting Scholar, Nicholas Institute, Duke University
Leslie Kleczek	Associate in Policy, Nicholas Institute, Duke University
Randy Kramer*	Professor of Resource and Environmental Economics, Nicholas School of the Environment and Earth Sciences, Duke University
Timm Kroeger	Conservation Economics Program, Defenders of Wildlife

Brian Murray	Director for Economic Analysis, Nicholas Institute, Duke University
Robin Naidoo	Conservation Scientist, World Wildlife Fund
Lydia Olander*	Senior Associate Director for Ecosystem Services, Nicholas Institute, Duke University
Linda Pearsall	Director, North Carolina Natural Heritage Program
Steve Polasky	Fesler-Lampert Professor of Ecological/Environmental Economics, Department of Applied Economics, University of Minnesota
Eben Polk	Associate in Policy, Nicholas Institute, Duke University
John Preyer	Executive Vice President and Project Manager of Operations, Restoration Systems, LLC
Tim Profeta	Director, Nicholas Institute, Duke University
Ken Reckhow	Professor of Water Resources, Chair, Division of Environmental Sciences and Policy, Nicholas School of the Environment and Earth Sciences, Duke University
Curt Richardson	Professor of Resource Ecology, Nicholas School of the Environment and Earth Sciences, Duke University
Bill Ross	Secretary of the North Carolina Department of Environment and Natural Resources
Joe Rudek	Scientist, Environmental Defense
Rafe Sagarin	Associate Director for Ocean and Coastal Policy, Nicholas Institute, Duke University
Jim Salzman	Professor of Law and Nicholas Institute Professor of Environmental Policy, Duke University
Kathryn Saterson	Assistant Director for Ecosystem Protection and Water Quality Programs, National Health and Environmental Effects Research Laboratory, U.S. EPA
Joe Sexton	Doctoral Student in the University Program in Ecology, Duke University
Rebecca Shaw	Director of Conservation Science, The Nature Conservancy's California Program; Visiting Scientist at the Carnegie Institution's Department of Global Ecology, Stanford University
Rob Sutter	Senior Conservation Ecologist, Southeast Division, The Nature Conservancy
Jennifer Swenson	Assistant Professor of the Practice of Geospatial Analysis, Nicholas School of the Environment and Earth Sciences, Duke University

Dean Urban* Professor of Landscape Ecology, Nicholas School of the Environment and Earth Sciences, Duke University

Will Wilson Associate Professor, Department of Biology, Duke University

* Member of Duke University research team on the Wildlife Habitat Policy Research Program grant that is funding this workshop and subsequent tool building effort

Guidelines for Brain storming session.

What is/are the ecosystem services being mapped in the initial tool?
How can we measure the ecological value of the service (field data)?
What macroscopic indicators can we use to capture this service (ie. land use and location in watershed)?
What data are available?
What is/are the ecosystem services being valued in the initial tool? (same?)
How do we assign economic value to the service?
What are the valuation metrics we can use?
What data are available for this?
What other data are needed?
What are the critical challenges for valuation of this/these services?
What are the hooks to link to other services?