A *Superior* Research Reader

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Greetings and welcome to A *Superio*r Research Reader, a monthly reader on what we believe is current and relevant research to science and resource management on the Superior.

This Month's Edition: Ecosystem Services

We hear the term "ecosystem services" used all of the time but what do those words actually mean and how do they relate to our work on the Superior? Ecosystem services are simply the benefits people obtain from ecosystems. These include *provisioning* services such as food and water; *regulating* services such as flood and disease control; *cultural* services such as spiritual, recreational, and cultural benefits; and *supporting* services, such as nutrient cycling, that maintain the conditions for life on Earth. Because some of these services can be hard to actually measure and quantify, their value can often be overlooked. This month's Reader highlights studies with both local and global implications for ecosystem services and we hope it will raise awareness of the incredible resources and benefits we receive from our Forest.

And in case you are interested, here is how the Forest Service is currently embracing ecosystem services. Locally, you can take a peak at The Value of Nature's Benefits in the St. Louis River Watershed, a study commissioned by the Fond du Lac Band of Lake Superior Chippewa, which provides a valuation of the economic benefits of ecosystem goods and services provided by our very own St. Louis Watershed. We hope you continue to enjoy natures benefits and find a new appreciation for all the services the Superior offers.

PS. Check out this bonus Halloween article...if you dare! Watch your head tonight, these bats are back!

Happy reading!
Pooja and Katie
Editors of A *Superior* Research Reader
poojaskanwar@fs.fed.us and kfrerker@fs.fed.us

1. A study from the University of Minnesota reveals surprising results regarding the impact of land-use change on ecosystem services, biodiversity and returns to Minnesota landowners.

2. Nature as Capital explores advancing and incorporating an ecosystem services framework into US federal policy and procedures — for all you planning geeks NEPA and the 2012 Planning Rule are discussed!

3. A collaboration with the Forest Service and Northern Research Station explores cultural ecosystem services through the generation, transmission and nature of ecological knowledge used by tribal and non tribal management on the The Leech Lake Indian Reservation, partially located on our sister forest, the Chippewa NF!

4. The Gund Institute for Ecological Economics offers a more detailed look to date at how biodiversity and ecosystem services are related, illuminating the varying dynamics between biodiversity and management.

The Impact of Land-Use Change on Ecosystem Services, Biodiversity and Returns to Landowners: A Case Study in the State of Minnesota

Polasky et al. 2011. Environmental and Resource Economics.

ABSTRACT: Land-use change has a significant impact on the world's ecosystems. Changes in the extent and composition of forests, grasslands, wetlands and other ecosystems have large impacts on the provision of ecosystem services, biodiversity conservation and returns to landowners. While the change in private returns to landowners due to land-use change can often be measured, changes in the supply and value of ecosystem services and the provision of biodiversity conservation have been harder to quantify. In this paper we use a spatially explicit integrated modeling tool (InVEST) to quantify the changes in ecosystem services, habitat for biodiversity, and returns to landowners from land-use change in Minnesota from 1992 to 2001. We evaluate the impact of actual land-use change and a suite of alternative land-use change scenarios. We find a lack of concordance in the ranking of baseline and alternative land-use scenarios in terms of generation of private returns to landowners and net social benefits (private returns plus ecosystem service value). Returns to landowners are highest in a scenario with large-scale agricultural expansion. This scenario, however, generated the lowest net social benefits across all scenarios considered because of large losses in stored carbon and negative impacts on water quality. Further, this scenario resulted in the largest decline in habitat quality for general terrestrial biodiversity and forest songbirds. Our results illustrate the importance of taking ecosystem services into account in land-use and land-management decision-making and linking such decisions to incentives that accurately reflect social returns.

Nature as Capital: Advancing and Incorporating Ecosystem Services in United States Federal Policies and Programs

Schaefer et al. 2015. Proceedings of the National Academy of Sciences.

ABSTRACT: The concept of nature as capital is gaining visibility in policies and practices in both the public and private sectors. This change is due to an improved ability to assess and value ecosystem services, as well as to a growing recognition of the potential of an ecosystem services approach to make tradeoffs in decision making more transparent, inform efficient use of resources, enhance resilience and sustainability, and avoid unintended negative consequences of policy actions.. In the United States, universities, nongovernmental organizations, and federal agencies are actively collaborating to develop and apply ecosystem services concepts to further national environmental and economic objectives. Numerous federal agencies have begun incorporating these concepts into land use planning, water resources management, and preparations for, and responses to, climate change. Going forward, well-defined policy direction will be necessary to institutionalize ecosystem services approaches in federal agencies, as well as to guide intersector and interdisciplinary collaborative research and development efforts. In addition, a new generation of decision support tools are needed to further the practical application of ecosystem services principles in policymaking and commercial activities. A greater national and international financial commitment to advancing ecosystem services and natural capital accounting would likely have broad, long-term economic and environmental benefits.

"A Lot of It Comes from the Heart": The Nature and Integration of Ecological Knowledge in Tribal and Nontribal Forest Management

Bussey et al. 2015. Journal of Forestry

ABSTRACT: This article explores the generation, transmission, and nature of ecological knowledge used by tribal and nontribal natural resource management agency personnel who collectively manage a 666,542-acre forest in northern Minnesota. Using key informant interviews and an adapted grounded theory analysis, we documented the forms of knowledge participants expressed in their descriptions of the forest and forest management, including traditional and western scientific ecological knowledge. We found that study participants across agencies use multiple forms of knowledge, that this knowledge is generated and transferred in distinct ways, and that participants acknowledge several challenges and opportunities to integration of traditional and western scientific knowledge in forest management. Overall, ecological knowledge expressed by study participants revealed multiple ways of knowing the forest. Knowledge varied most distinctly in the influence of cultural identity and spiritual or metaphysical connections to the forest on knowledge generation, transmission, and content. Formalizing existing informal knowledge integration efforts with attention to power structures, institutional culture, and knowledge application is recommended.

Disaggregating the Evidence Linking Biodiversity and Ecosystem Services.

Taylor et al. 2016 . Nature Communications

ABSTRACT: Ecosystem services (ES) are an increasingly popular policy framework for connecting biodiversity with humanwell-being. These efforts typically assume that biodiversity and ES covary, but the relationship between them remains remarkably unclear. Here we analyse 4500 recent papers and show that reported relationships differ among ES, methods of measuring biodiversity and ES, and three different approaches to linking them (spatial correlations, management comparisons and functional experiments). For spatial correlations, biodiversity relates more strongly to measures of ES supply than to resulting human benefits. For management comparisons, biodiversity of 'service providers' predicts ES more often than biodiversity of functionally unrelated taxa, but the opposite is true for spatial correlations. Functional experiments occur at smaller spatial scales than management and spatial studies, which show contrasting responses to scale. Our results illuminate the varying dynamics relating biodiversity to ES, and show the importance of matching management efforts to the most relevant scientific evidence.