FACT SHEET 13: THE FUTURE VALUE OF ECOSYSTEMS

New Hampshire's Changing Climate, Land Cover, and Ecosystems

New Hampshire's ecosystems provide a host of services, such as clean water, food, wood for fiber, fuel, or timber; protection from flooding, climate regulation (via carbon storage and changes in surface reflectivity), recreational opportunities, and cycling of key nutrients such as nitrogen.

Management decisions with respect to the protection or restoration of multiple ecosystem services commonly requires some consideration of their relative importance. However, not all ecosystem services can be readily expressed in monetary terms, thus precluding the application of traditional cost-benefit analysis. Additionally, since most ecosystem services embody characteristics of public goods, it is crucial that they be evaluated in a social context.

We developed a novel valuation framework based on Deliberative Multicriteria Evaluation and applied it to value the ecosystem services provided by the Upper Merrimack River Watershed (above Manchester, New Hampshire). The provision of ecosystem services was considered for the next century under two different climate change scenarios and two different land use change scenarios. We organized eleven separate groups of residents to act as trustees on behalf of future generations. The task of participants in these groups was to deliberate and reach consensus on the relative importance of ten specific ecosystem services within the land, water, and climate domains (**Table 1**).

DOMAIN	TRADEOFF WEIGHT	ECOSYSTEM SERVICE	TRADEOFF WEIGHT
Land	30%	Farm Land	38%
		Forest Cover	34%
		Forest Type	28%
Climate	30%	Hot Days	48%
		Snow Days	37%
		Recreation Days	15%
Water	40%	Fish Habitat Loss	27%
		Coastal Health	28%
		Water Shortage	28%
		Flooding	16%

Table 2. Tradeoff weights across domains and across attributes.

In general, participants placed greater importance on those ecosystem services that concern basic human needs (e.g., farmland, heat stress, water provision; **Table 2**). The results can be used to evaluate the relative desirability of alternative futures or to inform decisions that impact multiple ecosystem services in possibly conflicting ways. By integrating modeling, scenarios, stakeholder engagement, valuation and governance, this DMCE effort integrates the research outputs of multiple teams of the Ecosystems & Society project.

DOMAIN	ECOSYSTEM SERVICE	DESCRIPTION	WORSE LEVEL	BETTER LEVEL	UNITS
Land	Farm Land	Total area of agricultural land (both cropland and pasture) divided by the population	0.05	1	acres per person
	Forest Cover	% of total watershed area that is forest	60	80	% of total land area
	Forest Type	% of forest suitable for maple trees	26	48	% of forest
Climate	Hot Days	Days per year with temperature > 90° F	71	15	days
	Snow Days	Days per year with snow > 6 inches	7	25	days
	Recreation Days	Days per year with temperature between 70° to 90° F	109	123	days
Water	Fish Habitat Loss	Total upstream river length and duration impaired by temperature, chloride, or discharge	50	10	% river miles
	Coastal Health	Nitrogen export to estuary exceeding regulatory threshold	3.3	0.2	tonnes N per year
	Water Shortage	Population duration of water supply stress	4.5	1.5	million person-days
	Flooding	Population duration of potential flood impact	5	0	thousand person-days

Table 1. Ten specific ecosystem services for the Upper Merrimack River Watershed that were the basis for discussion and ranking by watershed residents.

METHODS

We employed the "swing" weighting method to assess the tradeoff weights across attributes. This method is similar to conjoint analysis in that hypothetical, multi-attribute states of the world are discussed and scored by participants, and the weights are then inferred from these scores.

LAND USE DATA

Two land cover scenarios encompass the widest divergence in land-cover change: present-day land cover and Backyard Amenities, which prioritizes large building lots and increases impervious areas dramatically. More info at **ddc-landcover.sr.unh.edu.**

FUTURE CLIMATE DATA

Future climate projections used statistically downscaled climate simulations derived from the Geophysical Fluid Dynamics Laboratory CM2.1 model (Hayhoe 2007). Two scenarios represent a wide range of potential future climate: lower emission (B1, 550 ppm CO_2 by 2100) and higher CO_2 emission (A1FI, 970 ppm CO_2 by 2100).

REFERENCES

Borsuk M and others (In Preparation) Comparative valuations of ecosystem services across a variety of plausible land-use, socioeconomic, and climate scenarios. To be submitted to *Ecology and Society.*

Mavrommati G (In Preparation) A novel deliberative multicriteria evaluation approach to ecosystem services valuation. To be submitted to *Ecology and Society.*

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