Biodiversity and Ecosystems Perspective Paper
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Benefit-Cost Analysis and Biodiversity

- The Copenhagen Consensus 2012 Challenge Paper on Ecosystems and Biodiversity (Hassan et al. 2012) addresses the benefits and costs of three programs:
  - increasing agricultural productivity
  - increasing protected areas
  - reducing deforestation

- Hassan et al. (2012) are to be commended for the magnitude of their effort.

- Our review focuses on the difficulties associated with the measurement of the benefits of ecosystems and biodiversity and the high degree of statistical uncertainty.

Uncertainties of Biodiversity Preservation

- There is no consensus regarding how biodiversity should be measured.

- The Mean Species Abundance metric does not consider the spatial heterogeneity of species richness.

- Spatial heterogeneity and the existence of biodiversity hotspots imply that there are significant benefits to parcel selection based on sampling
  - however, sampling is costly.

- The difficulties of enforcing property rights and the existence of potential strategic behavior may lead to greater uncertainties and a systematic underestimation of the costs of conservation.

Uncertainties about Meta-analysis

Insufficient Identification of the Benefit Types

- Hassan et al. (2012) do not include variables that identify the type of benefits estimated (market, use, nonuse).

- This could lead to an "apples vs. oranges" problem where one type of benefit is estimated and transferred to a policy situation that would generate another type of benefit.

Benefit Transfer Errors and Potential Omitted Variable Bias

- Benefit transfer errors from meta-analyses have ranged from 24% to 71% for recreation studies with relatively low R^2 statistics and 62% to 266% for forest studies with relatively high R^2 statistics.

- Hassan et al. (2012) do not include variables that identify ability to pay, study characteristics and study methodology which could lead to biased coefficient estimates (due to omitted variable bias).

World Values Survey

- Data
  - 2005, 2006, 2007
  - 41 countries
  - N=45,435

- Models
  - "… willing to give part of my income …" = f(concern about "loss of plant or animal species or biodiversity")
  - "… agree to an increase in taxes …" = f(concern about "loss of plant or animal species or biodiversity")

- Results:
  - Worldwide support for protection of biodiversity.
  - Country level fixed effects and temporal variation in attitudes towards biodiversity.

- Implications:
  - Meta-analytic models, even if adjusted for income, socioeconomic variables and attitudes about biodiversity, are likely to be less than 100% accurate when used for benefit transfers.

Sensitivity Analysis

- We conducted an ex-post Monte Carlo sensitivity analysis in order to:
  - provide a mean benefit-cost ratio for each policy over the range of cost estimates
  - assess the sensitivity of the mean benefit-cost ratios to assumptions made in the analysis.

- Our results are suggestive:
  - none of the policies are likely to have benefits greater than costs at the 95% level of confidence when the standard deviation is about 40% of the point estimate of the present value of benefits.

Conclusions

- The benefits of ecosystems and biodiversity are difficult to measure and, when measured successfully, subject to a high degree of statistical and other uncertainties.

- In contrast, the benefit estimates used by Hassan et al. (2012) do not address these uncertainties, relying on point estimates of the present value of benefits for the benefit-cost analysis.

- We raise questions about over-confidence in the point estimates of the present value of benefits presented, and the resulting benefit-cost ratios, in the challenge paper.

- We recommend more extensive sensitivity analyses for each policy, with Monte Carlo simulation conducted, ex-ante, over the large number of explicit and implicit assumptions that led to the point estimate of the present value of benefits.