

*BENEFITS AND COSTS OF
PROTECTING
FOREST BIODIVERSITY:
CASE STUDY EVIDENCE*

Department of Land Economy,
University of Cambridge

IUCN

European Environment Agency

Background

Objectives:

- collate and review case study estimates of benefits and costs of conserving forest biodiversity
- assess what is known about values relating to different types of forest and different locations, and determine what gaps exist
- consider policy options for conserving forest biodiversity

Framework for study

Benefits of conserving forest biodiversity

Total Economic Value:

- Direct use – non-timber forest products; recreation/tourism; bioprospecting
- Indirect use – watershed services; carbon sequestration; pollination
- Non use – existence; bequest; altruism
- Option value

Issues:

- Biodiversity vs biological resources
- Marginal values
- Only look at instrumental/anthropocentric values

Framework for study

Costs of conserving forest biodiversity

Types of cost:

- Opportunity cost – best alternative land use; usually logging timber or conversion to agriculture, possibly urban development
- Implementation costs – administration, monitoring and enforcement, creation of appropriate institutions, transactions costs

Measurement methods

Benefits: market and non-market valuation methods used, depending on type of value

Costs: actual or estimated land values, surveys of actual costs

Results – NTFPS

Types of benefit:

- Food for humans and livestock, fibre, fuel, medicines
- Harvested for subsistence or commercial purposes

Methods:

- Mainly household surveys combined with actual or imputed market prices
- Sometimes net of time spent on harvesting
- Mainly developing country examples

Values:

- Majority of values less than \$100/ha/year, many less than \$10/ha/year (actual flow)
- Likely to be studies where NTFPs are important – lower values for less accessible locations

Results – recreation/tourism

Temperate forests/developed countries:

- Walking, fishing, hunting, wildlife viewing
- CV, choice experiment or travel cost methods
- Short, but frequent visits – values usually less than \$5 per visit; annual values \$10-62/person
- Wide variation in per hectare values – potentially very high for easily accessible forests
 - \$7582/ha/year for Southern Appalachians (Kramer et al, 2003);
 - \$2290/ha/year in Oxfordshire (Bateman et al, 1996)
- Positive value on increased diversity in forests e.g.
 - Mill et al (2007) – WTP \$51/hh more for recreation in natural vs managed forests;
 - Hanley et al (1998) – WTP \$22/hh/year more for mix of evergreen, larch and broadleaved vs only evergreen
 - exception: Horne et al (2005), Finland – prefer lower diversity forest for recreation

Results – recreation/tourism

Tropical forests/developing countries:

- CV, Choice Experiment or Travel Cost
- Mainly studies of foreign visitors, some of domestic tourists
- Single visits for multiple days – most estimates \$10-50/visit for foreign tourists, lower for domestic tourists
- Don't account for cost of travel to reach
- Wide variation in per hectare values
 - Schultz et al (1998), Costa Rica - \$1000-2000/ha/year;
 - Garrod and Willis (1997), Malaysia - \$740/ha/year;
 - Ellingson and Seidl (2007), Bolivia - \$2-3/ha/year
- Determined by accessibility, characteristics of site, economic and political situation in country

Results - bioprospecting

Methods

- Model return to additional species, based on search costs, probabilities of success, and revenues from successful products
- Focus on biodiversity hotspots

Values

- Simpson et al (1996): \$0-\$20/ha/year
- Rausser and Small (1998): \$0-\$9000/ha/year
- Costello and Ward (2006): \$1-\$265/ha/year – same methods but differences due to parameter values
- Social benefits may be higher – Simpson and Craft (1996): \$29-\$2888/ha/year

Results - Indirect use values

- Mainly related to presence of forest resources rather than forest biodiversity
- Estimated using production function approaches with actual or imputed market prices

Watershed protection

- Includes maintaining agricultural productivity, reducing flooding damages, and effects on water treatment costs or reservoir storage capacity
- Variable results: some studies \$200-\$1000/ha/year; others \$0-\$50/ha/year
- May be negative e.g. Clinch (1999) – reduced water flow rates from forest land
- Values depend heavily on physical characteristics of landscape and nearby human activity

Results – Indirect use values

Carbon sequestration

- Highest storage in tropical forests (Houghton, 1999)
- Studies based on abatement costs or production function with damage costs of carbon
- Values depend on assumptions about sequestration process, discount rates and social cost of carbon
 - Van Kooten and Bulte (1999), Canada - \$24-120/ha/year
 - Bulte et al (2002), Costa Rica - \$102/ha/year

Other indirect uses

- Pollination:
 - \$361/ha/year (Ricketts et al, 2004);
 - \$3-35/household (Kramer, 2001)
- Removal of urban air pollution by trees:
 - \$447-663/ha/year (Nowak et al, 2007)

Results – Non-use values

Temperate forests

- Most studies from USA, UK and Scandinavia
- Non-use values average around \$50/household – aggregate values can exceed \$1000/ha/year
- Higher values for habitats of endangered species
- Positive values for increases in forest biodiversity specifically, as well as protection of particular forest types

Tropical forests

- Foreign residents WTP for protection of tropical forests: \$7-42/household
- Domestic residents WTP for protection of tropical forests: \$56-130/household (few studies)
- May include some use values

Results – Opportunity costs

Methods

- Land prices, estimated land values or household surveys
- Alternative uses: timber harvesting, conversion to agriculture, NTFP collection, urban development

Values

- Variation depending on location and alternative use - \$2-\$6000/ha/year
- Developing countries:
 - usually <\$100/ha; often <\$5/ha
- Developed countries:
 - Australia, NZ and Canada - \$30/ha;
 - USA and SE Asia - \$100-200/ha;
 - Europe - \$1200/ha;
 - Japan - \$6000/ha (Lewandrowski et al, 1999)

Results – Other costs

External costs

- Costs imposed on local communities due to forest biodiversity protection – mainly damage to crops or livestock
- Crop damage by animals from Mount Kenya Forest reserve: \$5/ha/year (Emerton, 1999)
- Crop and livestock damage by animals from Bhadra Tiger Reserve: \$0.8-\$1.6/ha/year (Madhusudan, 2003)

Management costs

- Tropical forests: \$3.5-\$13/ha/year (Grieg-Gran, 2006)
- EU, Natura 2000: \$56-\$94/ha/year (Markland, 2000)
- Function of accessibility of land and size of programme

Results - Expenditure

Total expenditure

- \$4.8 billion/year on forest biodiversity conservation (Bruner et al, 2003)

Average expenditure

- Developing countries and Australia and NZ - <\$3/ha/year
- North America - \$9/ha/year
- Europe - \$21/ha/year
- East Asia - \$131/ha/year (James et al, 1999)

Individual programmes

- Proano (2005), watershed protection, Ecuador - \$3-\$22/ha/year
- Rojas and Aylward (2003), PES, Costa Rica - \$38-\$94/ha/year
- Van Kooten and Sohngen (2007), various projects - \$7-\$21,000/ha/year

Conclusions and ongoing work

Initial conclusions from case studies

- Assessment of relative magnitudes of different types of benefit and cost
- Costs and benefits both higher in accessible locations near populations – although exceptions
- Both costs and benefits highly location specific – how to transfer values?
- Other conclusions..?

Gaps in knowledge

- What information is lacking – is it possible to obtain?

Policy direction

- What is total size of benefits not captured by market and which types of value are relatively more or less important?
- To what extent are large values accounted for by market or policy institutions?
- If values can be captured, which are likely to give highest returns?

Next phase - Policy Options

Alternative policy options for conserving forest biodiversity:

- Regulatory instruments:
 - Land use and land management regulations
 - Protected areas
- Incentive based instruments:
 - Payments for ecosystem services
 - Tradable biodiversity credits
- Market creation instruments:
 - Ecotourism, NTFPs, eco-labelling, bioprospecting, watershed protection, carbon sequestration

Assessment criteria:

- Cost effectiveness and environmental effectiveness
- Distributional impacts
- Sources of funding – including potential size of the market for market creation options
- Long-term sustainability