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# Environmental Valuation

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# Environmental Valuation

- What is it?
- Why value environmental quality / ecological goods and services?
  - A few examples
- What are the challenges / difficulties in valuing ecological goods and services?
  - A comparison between environment and health
- Why we should still try to do it

# Economic Values

- Economic value is based on individual preferences (what people want)
- Values express tradeoffs – how much of one thing to give up for another
- Value – expressed in monetary terms – is the amount of money an individual would give up to obtain something,
  - Or accept in compensation to give something up.

# Economic Values

- Values apply to things that can be purchased (ipods, coffee) as well as things that cannot.
- Many ecosystem goods and services are not traded in markets, thus we have little information on what people would be "willing to pay" for them.
  - Scenery, water or air quality, farmland amenities, open space, protected areas, recreation, etc.
- Markets are not required to measure economic values, we can use a variety of economic techniques

# Goods and Values

- Types of goods
  - Private goods (rival, excludable)
  - Public goods (non-rival, non-excludable)
- Who benefits from an “improvement”?
  - From a pure public good – everyone
    - Total value is the sum of benefits
  - From a pure private good – specific individuals / groups in society

# So what is Environmental Valuation?

- Figuring out what people would be *Willing to Pay* for changes in environmental quality
- For example: What's an improvement in water quality worth?
  - May generate an increase in property values
  - May generate increases in recreational value
  - May generate improved drinking water quality

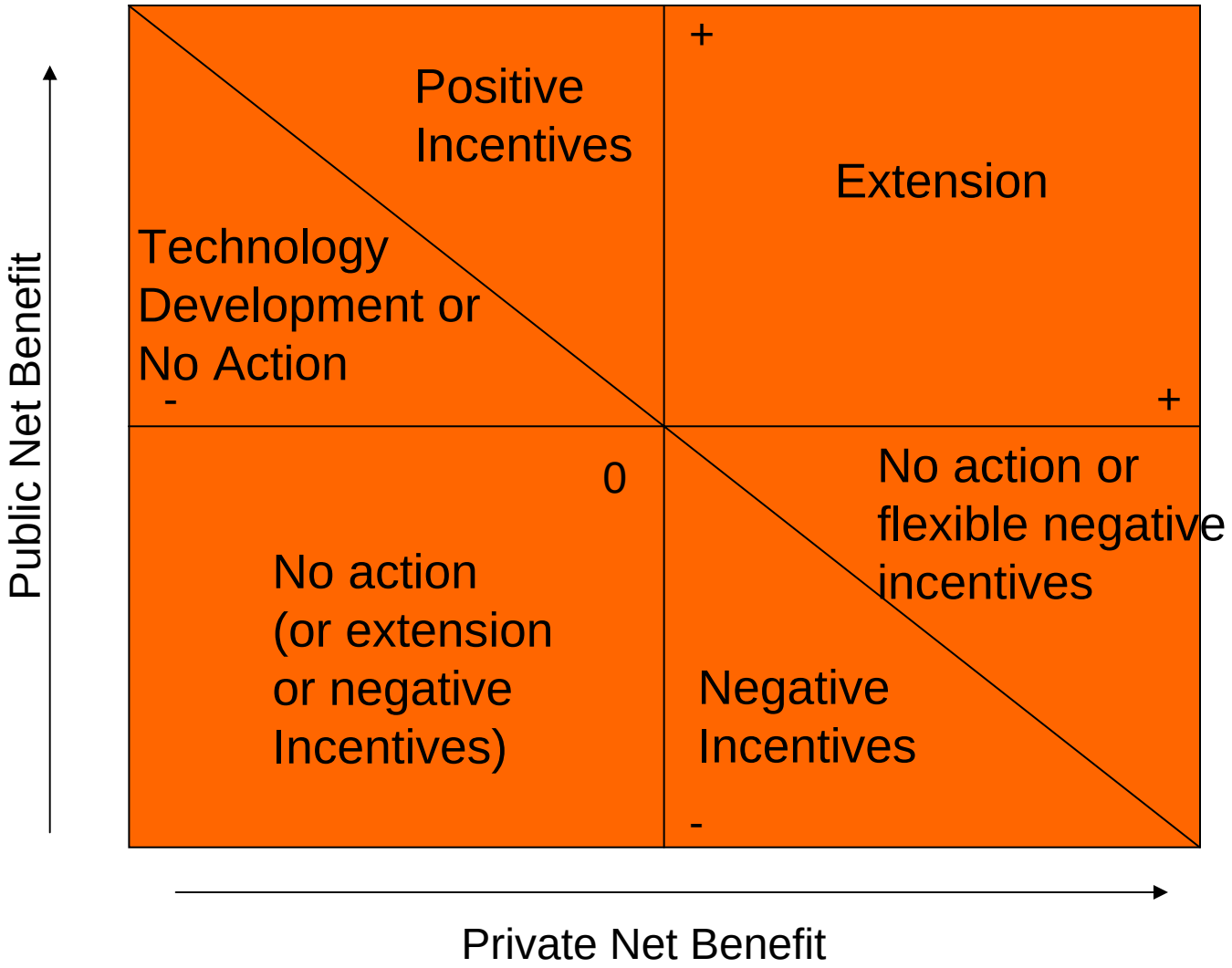
# What is not “value” in this framework

- What it costs to improve the value of the environment
- What it would cost to replace the services that the ecosystem provides.
- Administratively set amounts to pay for ecosystem goods and services
  - e.g. fishing license fees

# But why would we want to know what the monetary value of environmental quality is?

- Making a case for investment in environmental quality or natural capital.
- How much should we invest in helping landowners with Beneficial Management Practices?
- How much protected area is “enough”?
- How stringent should water / air quality guidelines?
- How much should we charge for water, carbon, etc.?
- How much compensation should be paid for damage to ecological goods and services?

# Valuation and Policy Design




Pannell (2008), Land Economics

# How do “values” for EGS arise?

- Direct valuation (market)
  - A company pays landowners to improve water quality through BMPs
- Environmental valuation
  - Observe behaviour (recreation, property values, etc.)
  - Highly structured surveys
- Values implied by regulation / government action
  - Offset programs, no-net-loss, cap-and-trade programs
  - Payments for environmental services / BMPs
  - Water or air quality standards
  - Note – these are not “values” in the sense of consumers willing to pay for ecosystem services – they are determined by agency actions.

# So what's "The Environment" worth?

- Recreation – influenced by water, landscape, etc.
- Open space – farmland amenity
- Wetlands
- Protected areas

# Highwood Little Bow B/C Analysis (EIA Summary, Page 2-7)

| | **Reservoir and Canal** | **Agriculture** | **Recreation** | **Total** |
|---|---|---|---|---|
| | Millions of 1992 Dollars (undiscounted) | | | |
| Benefits | | 302.8 | 42.1 | 344.9 |
| Costs | 49.6 | 155.7 | | 205.3 |
| Net | -49.6 | 147.1 | 42.1 | 139.6 |

Source: Alberta Public Works Supply and Services, 1995.

# Impact of Open Space on Property Values, and Referenda on Open Space – An Example from Minnesota

- Impact of Open Space on a $150,000 house
  - Natural Space - $6,000
  - Lake View - $46,000
  - Values vary by distance to the property
- 16 of 20 Referenda on Open Space Passed – raising $85M for Open Space projects.
- Source: Anton, P.A. 2005. The economic value of open space: implications for land use decisions. Wilder Research

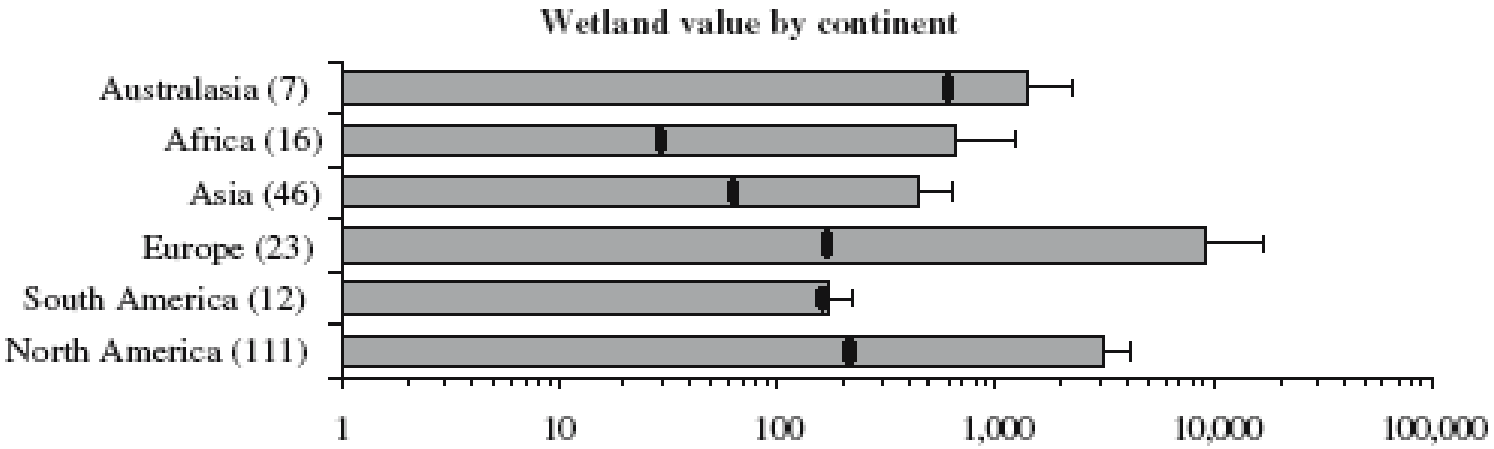
  http://www.wilder.org/download.0.html?report=1901

# Value of Farmland Amenity in the U.S. (Bergstrom and Ready, 2009)

- Value of preserving farmland a function of:
  - Scarcity of farmland
  - Public access
  - Intensity of surrounding development
  - Income and age of local population
  - Intensive agriculture (negative)
  - Distance from residential locations / urban fringe (confounding effects)
- Source: Bergstrom, T and R. Ready. 2009. What have we learned from over 20 years of farmland amenity valuation research in the U.S.? Review of Agricultural Economics. 31 (1) 21-49.

# Brander et al 2006 – Wetlands Value Meta-analysis (1995 US$ / Ha / Year)






Source: Brander et al, 2006 The Empirics of Wetland Valuation: A Comprehensive Summary and a Meta-Analysis of the Literature. Environmental and Resource Economics. 33:223-250. Page 235.

# Example: Protected Areas Planning in Ontario
# Sverrisson, Boxall and Adamowicz

- Protected area in a region - how much is enough?
  - Costs of program (land values)
  - Benefits of program
    - Structured survey of Ontario residents to identify how much they would be willing to invest.

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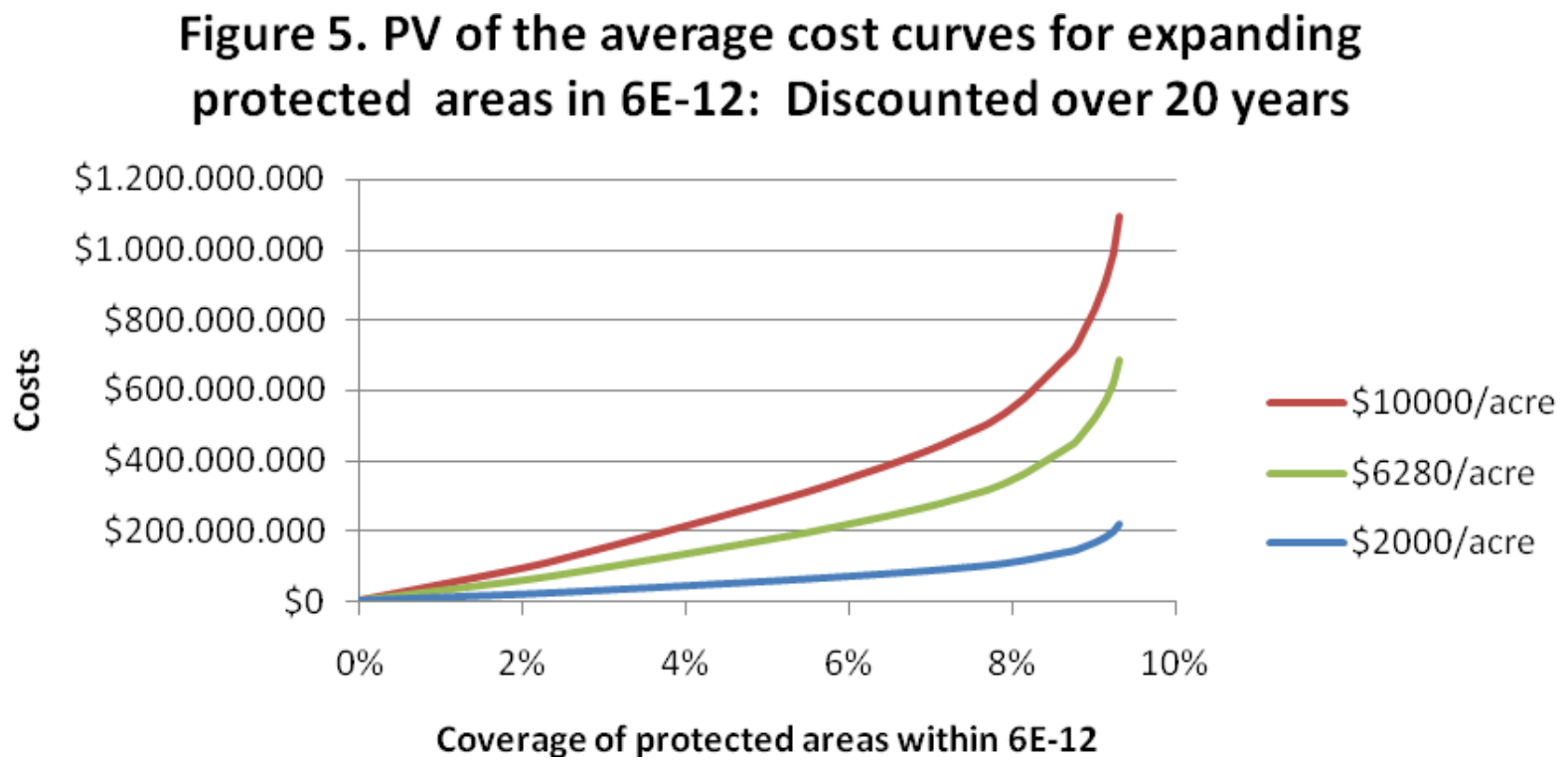
# Estimated Cost Curve for Expanding Protected Areas in Ecodistrict 6E-12

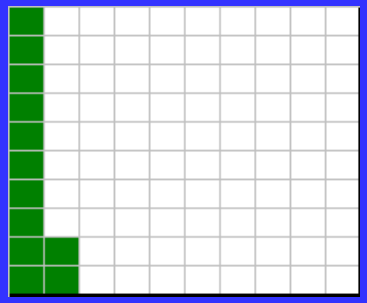
**Figure 1.** Present value of the cost curves for expanding protected areas in 6E-12: Discounted over 20 years



# Valuation Survey

- Structured “referendum question” asking respondents to vote on investments in protected areas
- Ask a sample of the public whether they would vote to support payments for an enhancement of the protected areas program.

# Sample Valuation Scenario

| Vote | Current Situation | Proposed Program |
|---|---|---|
| Protected area targets<br>Protected land<br>Normal land | 0.6% (630 km²) of the Mixedwood Plains protected<br>  | 12% (12,600 km² approx.) of the Mixedwood Plains protected<br>  |
| Year when protected area target is reached | Not applicable | 2026 |
| Your household's share of the annual investment paid through increases in taxes for the next 5 years, 2007-2011 | $0/Year for 5 years | $25/Year for 5 years |
| | Current Situation | Proposed expansion |

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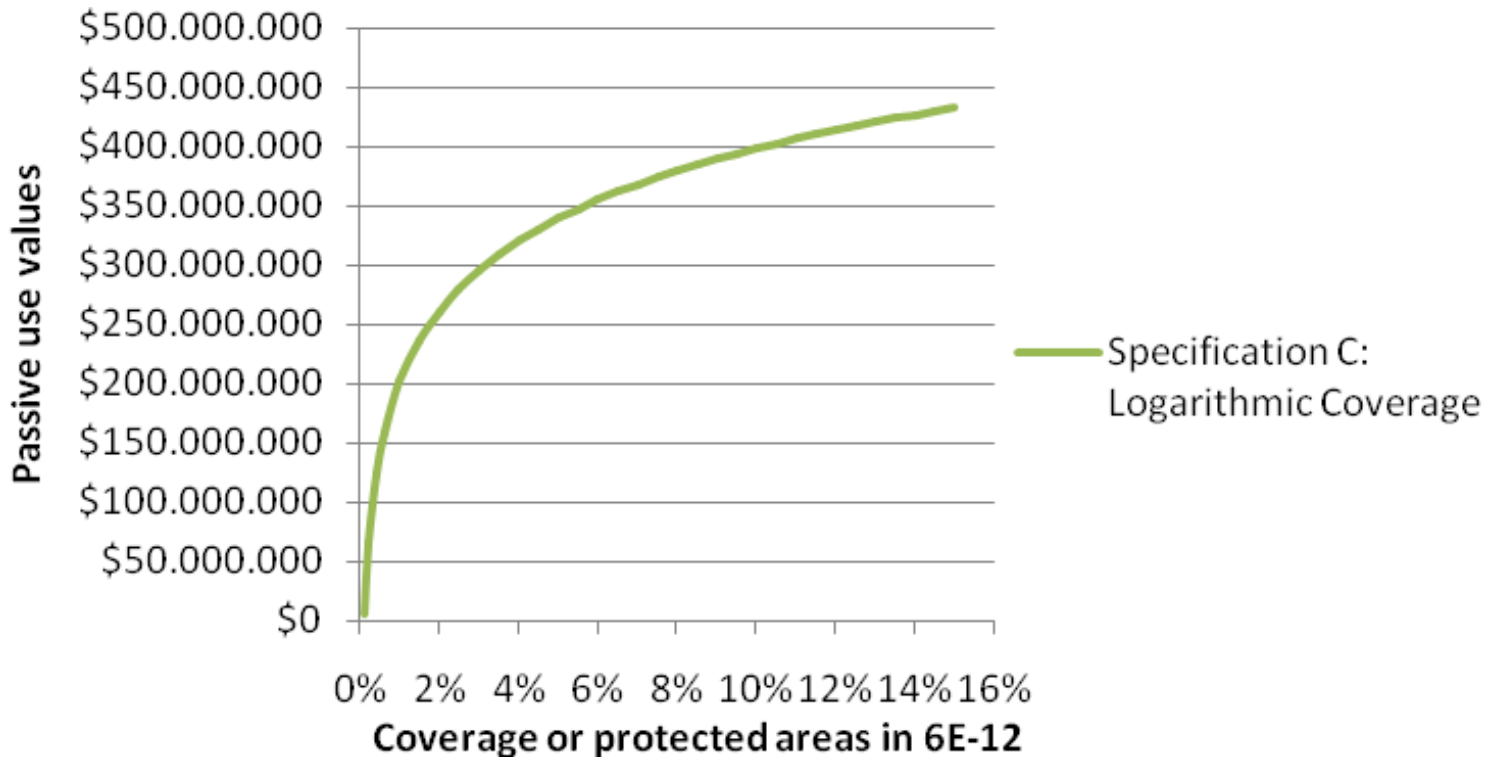
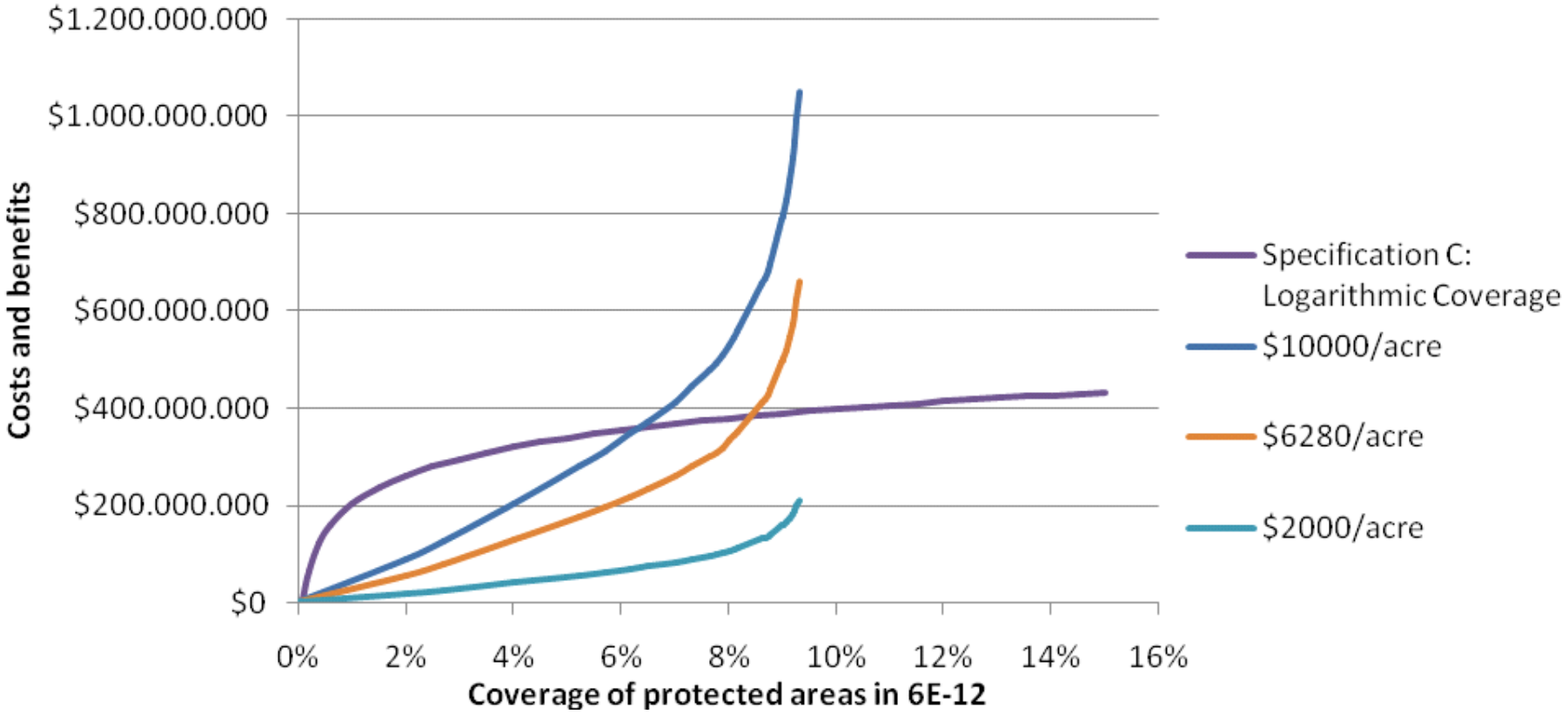
# WTP for the Mixedwood Plains

**Figure 1.** Benefits from expanding protected areas in ecodistrict 6E-12



# Costs and Benefits

**Figure 1**. Present value of costs and benefits from expanding protected areas in ecodistrict 6E-12: Costs discounted over 20 years



# So what's so hard about this?

- Environmental values vary
  - Across space
  - Over time
  - By person (and personal characteristics)
  - … just like other values do, but other values have markets to help identify them
- For example,
  - what's the value of a BMP at a particular place, time?
- Environmental valuation requires data
  - Natural science – ecological linkages
  - Social science – behaviour, property value, preferences, etc.
- …and capacity to do the work

# What do they do in “Health”?

- Similar “non-market” problems
  - What is the value of improved health?
    - Cost effectiveness?
  - What’s the value of reducing the risk of illness or death?
    - Reduced health care costs, other costs of illness?
    - Willingness to pay for reduced risks
    - Infer values from markets, surveys
  - Do these values get used?

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# The Benefits and Costs of the Clean Air Act, 1970 to 1990

*Prepared for*
*U.S. Congress*

*by*
*U.S. Environmental Protection Agency*

Table ES-4. Total Estimated Monetized Benefits by Endpoint Category for 48 State Population for 1970 to 1990 Period (in billions of 1990 dollars).

| Endpoint | Pollutant(s) | Present Value | | |
|---|---|---|---|---|
| | | 5th %ile | Mean | 95th %ile |
| Mortality | PM | $2,369 | $16,632 | $40,597 |
| Mortality | Lead | $121 | $1,339 | $3,910 |
| Chronic Bronchitis | PM | $409 | $3,313 | $10,401 |
| IQ (Lost IQ Pts. + Children w/ IQ<70) | Lead | $271 | $399 | $551 |
| Hypertension | Lead | $77 | $98 | $120 |
| Hospital Admissions | PM, Ozone, Lead, & CO | $27 | $57 | $120 |
| Respiratory-Related Symptoms, Restricted Activity, & Decreased Productivity | PM, Ozone, NO2, & SO2 | $123 | $182 | $261 |
| Soiling Damage | PM | $6 | $74 | $192 |
| Visibility | particulates | $38 | $54 | $71 |
| Agriculture (Net Surplus) | Ozone | $11 | $23 | $35 |

Source: US EPA 1999. The benefits and costs of the clean air act amendments Of 1990. Washington DC. Page ES-7

Table 18. Quantified Uncertainty Ranges for Monetized Annual Benefits and Benefit/Cost Ratios, 1970-1990 (in billions of 1990-value dollars).

| | 1975 | 1980 | 1985 | 1990 | PV |
|---|---|---|---|---|---|
| Monetized Benefits | | | | | |
| 5th percentile | 87 | 235 | 293 | 329 | 5,600 |
| Mean estimate | 355 | 930 | 1,155 | 1,248 | 22,200 |
| 95th percentile | 799 | 2,063 | 2,569 | 2,762 | 49,400 |
| Annualized Costs (5%) | 14 | 21 | 25 | 26 | 523 |
| Net Benefits | | | | | |
| Mean benefits - Costs | 341 | 909 | 1,130 | 1,220 | 21,700 |
| Benefit/Cost ratio | | | | | |
| 5th percentile | 6/1 | 11/1 | 12/1 | 13/1 | 11/1 |
| Mean estimate | 25/1 | 44/1 | 46/1 | 48/1 | 42/1 |
| 95th percentile | 57/1 | 98/1 | 103/1 | 106/1 | 94/1 |

Notes: PV=1990 present value reflecting compounding of costs and benefits from 1971 to 1990 at 5 percent.

Source: US EPA 1999. The benefits and costs of the clean air act amendments Of 1990. Washington DC. Page 56

# 25 Years Ago – the Health Literature…

- Using costs of illness or lost wages as measures of health risk reduction values.
- Consider "willingness to pay" values nearly impossible to measure
- Measures viewed as not ready for "prime time"
- Now – routinely used in policy decisions
  - Trans-fat regulation, pollution regulation, food safety, etc.
  - Less controversy about measurement techniques

# 10 Points about Environmental Valuation

- Valuation is useful for setting goals and making "investment" decisions, reflecting the value of the natural environment
- Policy decisions that set "caps", thresholds, limits, targets, taxes / fees often implicitly assign values
  - Are these "correct"?
- Valuation fits into a continuous improvement model for assessment of options (prospective) or evaluation of past performance (retrospective)
- Valuation is not always necessary for implementation of policies, MBIs, etc.
  - Consider other criteria or "benefit transfers"
- Information on the costs of environmental improvements is necessary, but not sufficient to assess policy effectiveness

# 10 Points about Environmental Valuation

- Values for ecological goods and services are typically location specific, time specific and specific to the surrounding community preferences
- Be careful about using value estimates from other regions, places, time periods.
- Be careful about using values “per hectare”
- Valuation is built on a foundation of natural science and social science.
- We’ll get better at valuation as we learn, collect data, build capacity and recognize that natural capital is scarce and becoming more so.

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