# Conservation Biology

(BI2509)

## Value of Biodiversity:
## *Direct & indirect economic values*



**Vasilis Louca**

v.louca@abdn.ac.uk Office: Cruickshank Building, Room: 1.10

# **Biodiversity**: why bother?

# **Biodiversity**: why bother?

**Scientific**: biodiversity is inherently interesting

# **Biodiversity**: why bother?

**Scientific**: biodiversity is inherently interesting

**Citizen**: biodiversity is important for lots of reasons: biological, aesthetic, political, ethical

# **Biodiversity**: why bother?

**Scientific**: biodiversity is inherently interesting

**Citizen**: biodiversity is important for lots of reasons: biological, aesthetic, political, ethical

**Why bother**: biodiversity is irrelevant!

# **Biodiversity**: arguments for protection

**Intrinsic value**:
biodiversity is important
in living systems

*Emphasis*: conservation of
ecologically equivalent
species; **redundancy allowed**

# **Biodiversity**: arguments for protection

**Intrinsic value**: biodiversity is important in living systems

*Emphasis*: conservation of ecologically equivalent species; **redundancy allowed**

**Anthropocentric**: humans benefit because biodiversity supports ecosystem services

*Emphasis*: conservation of ecologically non-equivalent species; **redundancy avoided**

**Biodiversity**: **Definition?**

# **Biodiversity**: ‘total and irreducible complexity* of life’

Natural History Museum

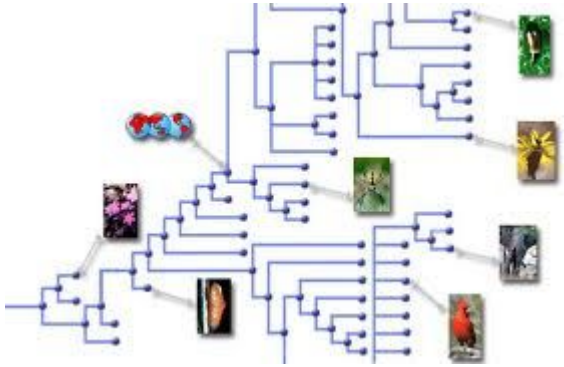
* Complexity includes **all aspects of living systems**, not just species richness

Single objective ‘measurements’ impossible or useless

**Contextual values** used
–determined by usage (who/what it’s for)

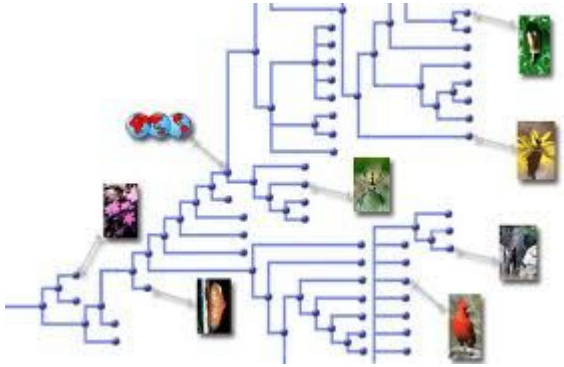
Valuing biodiversity occurs at levels:

1. **Genetic diversity:**
raw material for adaptation



Valuing biodiversity occurs at levels:

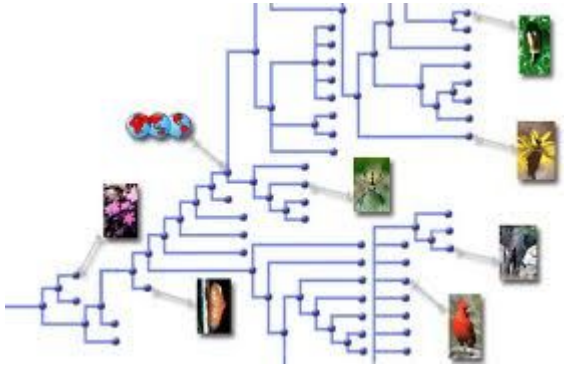
1. **Genetic diversity:**
raw material for adaptation



2. **Species diversity:**
raw material for population growth

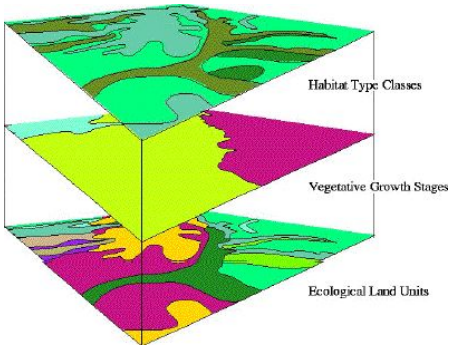
Valuing biodiversity occurs at levels:

1. **Genetic diversity:**
raw material for adaptation



2. **Species diversity:**
raw material for population growth

3. **Ecosystem diversity:**
matrix within which species (and genes) operate



# Direct use values I

*(via harvesting or destroying a resource)*

**Consumptive** use value

Assigning value: *Replacement cost approach*

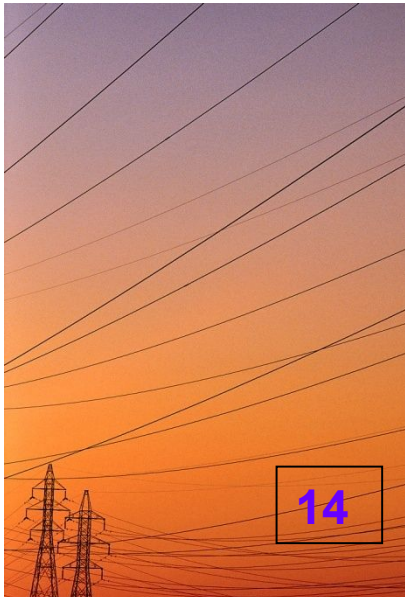
- consumed locally (subsistence)
- generally not traded

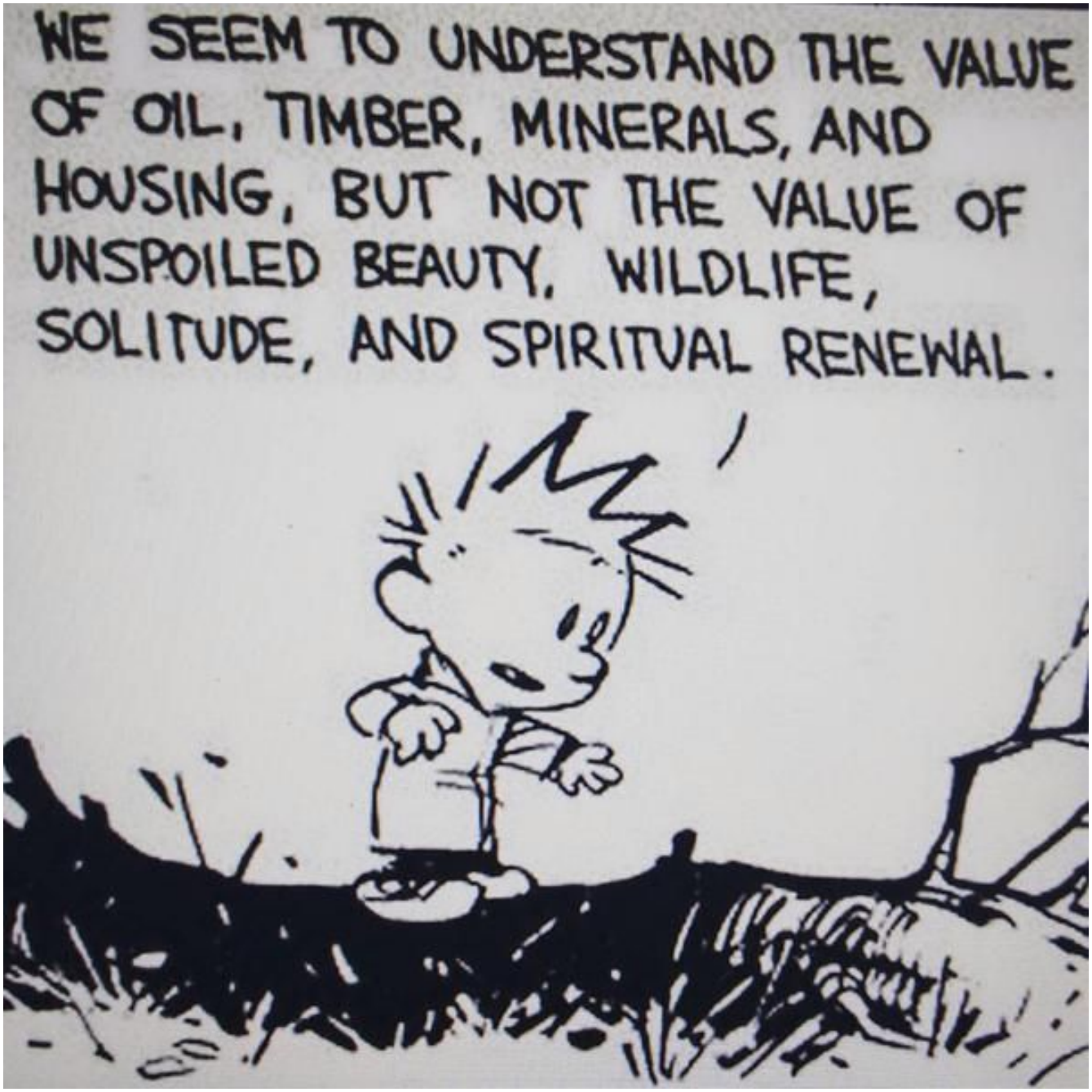
# Direct use values II

*(via harvesting or destroying a resource)*

**<u>Productive</u>** use value

- traded in national and global markets
- first or last sale value
- Final value: (raw materials, labour, transport, energy, cost of other material etc)




WE SEEM TO UNDERSTAND THE VALUE OF OIL, TIMBER, MINERALS, AND HOUSING, BUT NOT THE VALUE OF UNSPOILED BEAUTY, WILDLIFE, SOLITUDE, AND SPIRITUAL RENEWAL.

# Indirect use values

*(non-consumptive)*

1. ecosystem productivity
2. protection of water and soil resources
3. climate regulation
4. waste treatment and nutrient retention
5. species relationships
6. environmental monitors
7. recreation and ecotourism
8. educational and scientific value

# Assigning economic value

# Assigning economic value

Asian wild gaur
*Bos frontalis*

# Assigning economic value

Asian wild gaur
*Bos frontalis*

meat harvested from wild populations

# Assigning economic value

Asian wild gaur
*Bos frontalis*

meat harvested from wild populations

nature tourism

# Assigning economic value

Asian wild gaur
*Bos frontalis*

meat harvested from wild populations

nature tourism

future potential in domestic cattle breeding programs?

# Assigning economic value

Asian wild gaur
*Bos frontalis*

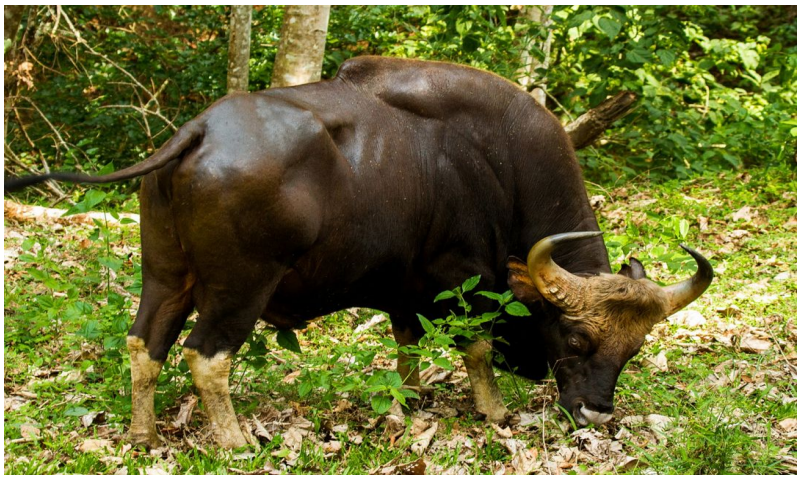
meat harvested from wild populations

nature tourism

future potential in domestic cattle breeding programs?

Intrinsic / cultural / aesthetic value

# Assigning economic value



Asian wild gaur
*Bos frontalis*

meat harvested from wild populations

nature tourism

future potential in domestic cattle breeding programs?

Intrinsic / cultural / aesthetic value

**Direct use**

**Indirect use**

**Option value**

**Existence value**

| Use | Non-use |
|---|---|

**Direct value**

Consumables

**Indirect value**

Ecological services ('coldspots'), Flood control
C-offset
Climate control

**Option value**

Premium paid to maintain resources for future use

**Existence value**

*Intrinsic value*: Cultural, Spiritual, Aesthetic, Bequest

More difficult to quantify, more easy to ignore

# **Costs** of maintaining biodiversity

**Management costs**

- Equipment
- Wages
- Infrastructure
- Monitoring

**Collateral costs**

- Income foregone
- Displaced communities
- Other areas affected
- Civil unrest

# Valuing biodiversity economically

Common Property Resources
('Global Commons')

Owned by everyone or no-one

'Tragedy of the commons'
(Hardin 1968)

# Economic discounting

Value of resources will be lower in the future

Why?

- harvesting now = greater wealth now
- uncertainty – may not be there later

Resources in developing countries tend to have high discount rates

Encourages unsustainable resource use

# Valuing biodiversity economically

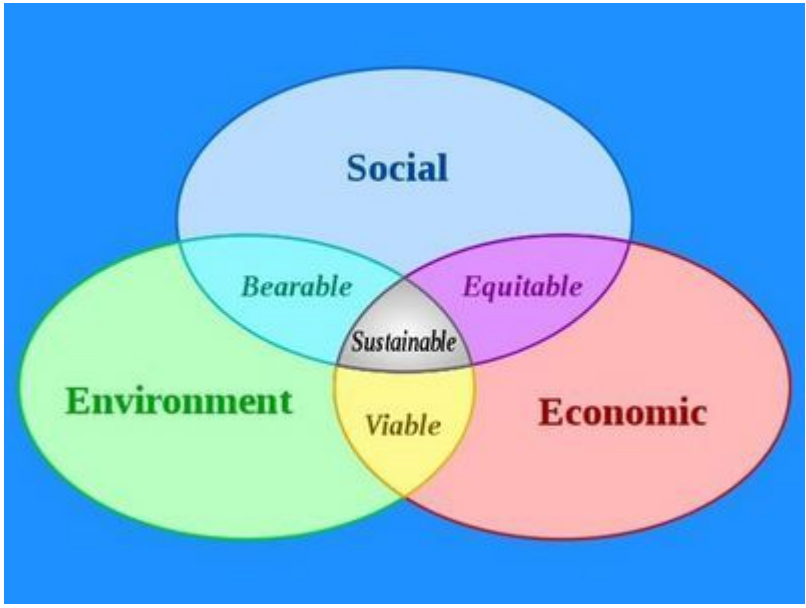
## Environmental / Ecological Economics

* Effort to integrate economics, environmental science, ecology & public policy

* Factoring full costs into market long term

* difficult to assess

* difficult to assign




**Ethical issues ???**

# Factoring true costs into economic activities

## COST-BENEFIT ANALYSIS

Compares values gained against costs

# Factoring true costs into economic activities

## COST-BENEFIT ANALYSIS

Compares values gained against costs

### Environmental Impact Assessment

Considers present and <u>future</u> effects on environment

Reduction of potential for future activities

*or*

Restoration costs

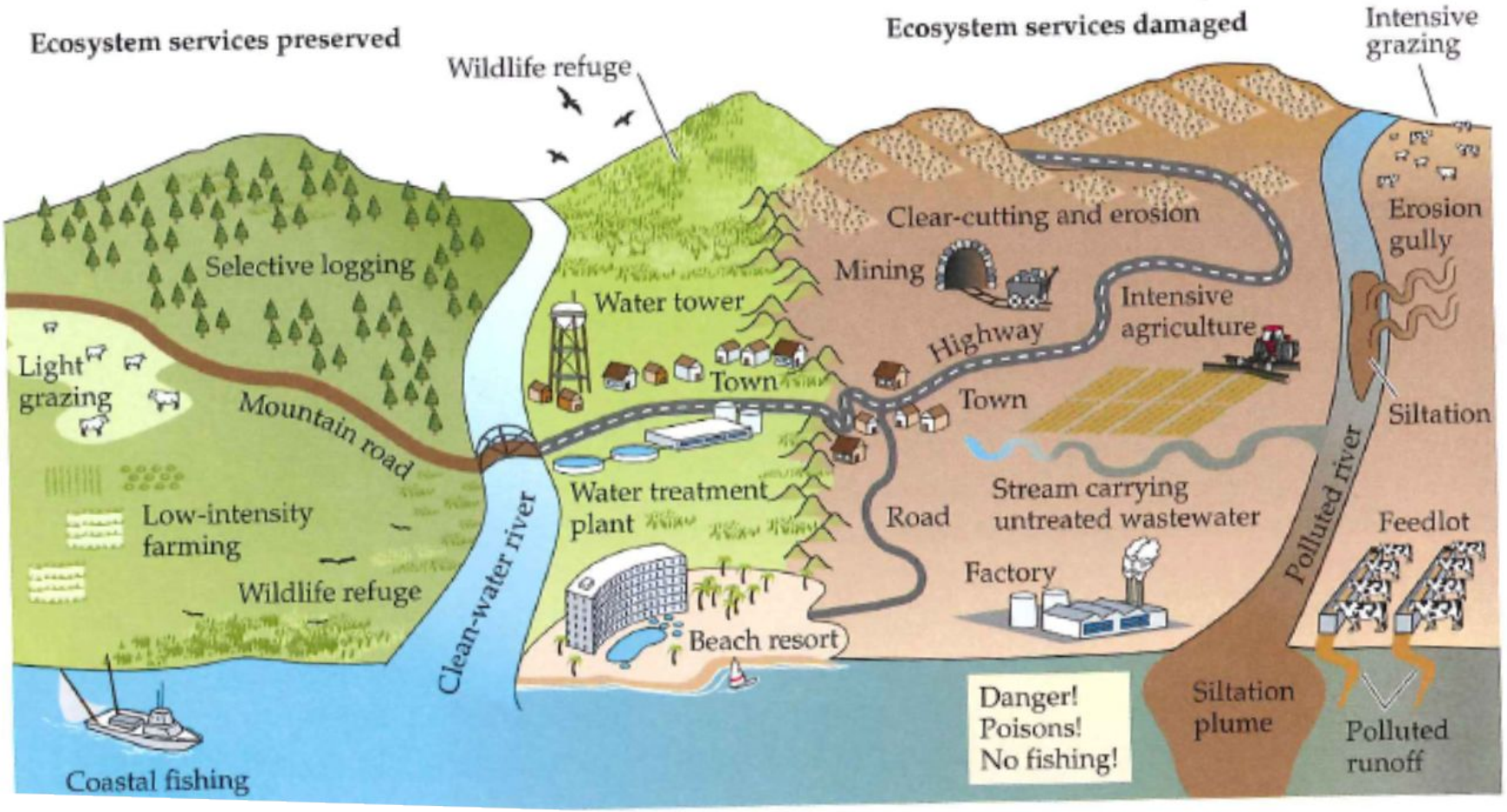
**Precautionary principle**

# Direct use values:
## *Externalities*

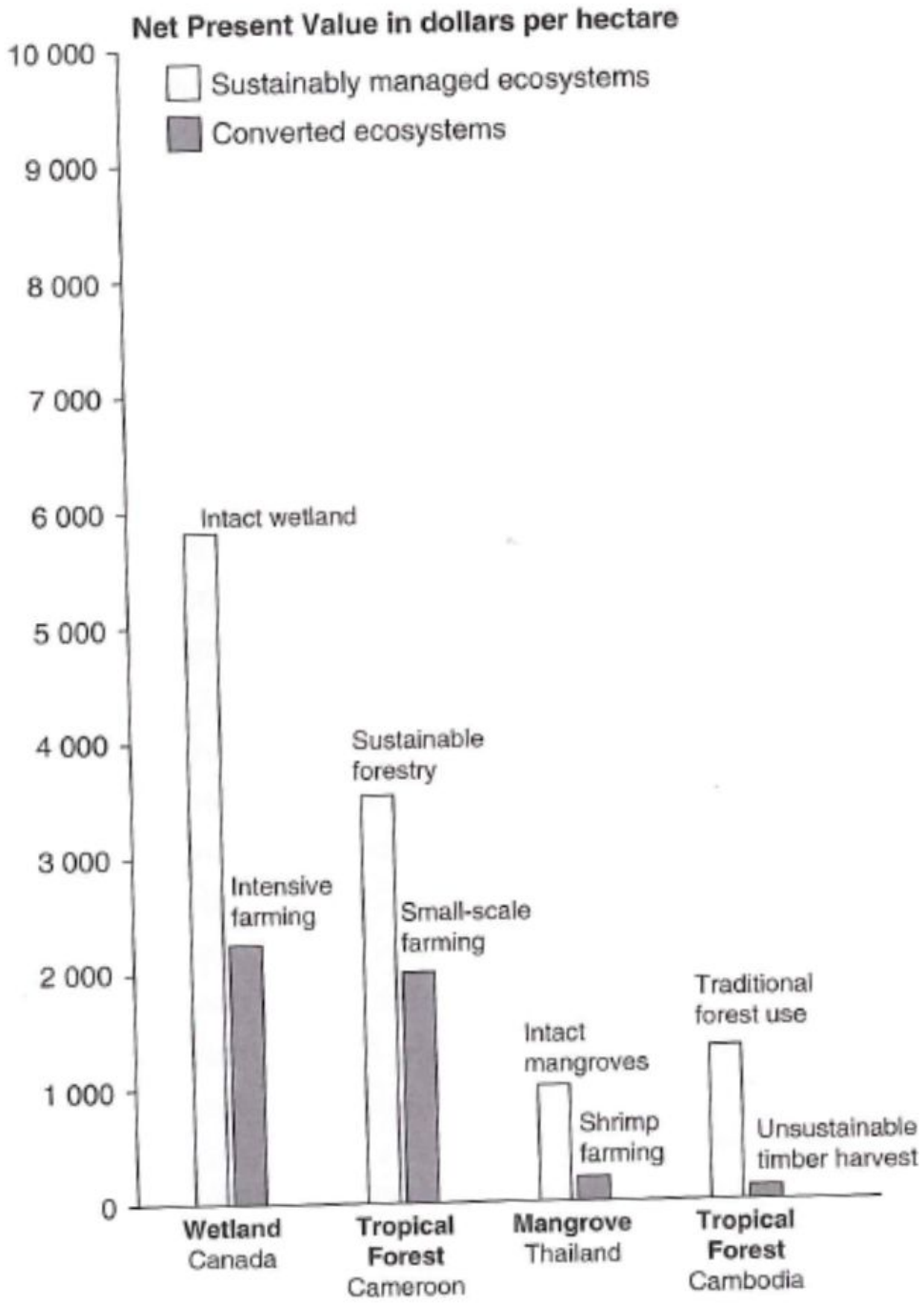
**Hidden costs:**

Valued: public benefits

Value: what they produce

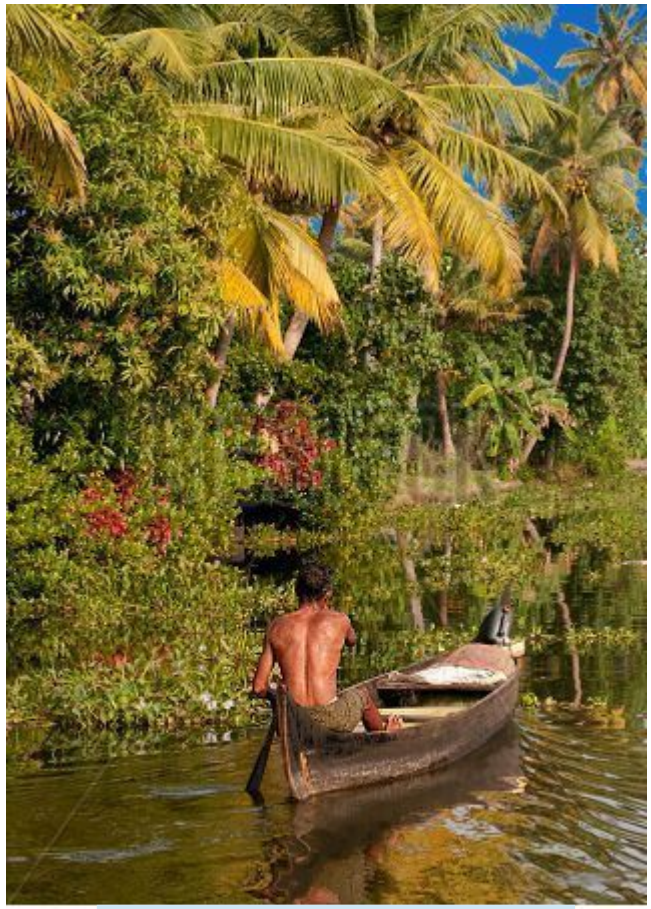


# What is the REAL value of what we produce??


Net Present Value in dollars per hectare
10 000
9 000
8 000
7 000
6 000
5 000
4 000
3 000
2 000
1 000
0
Sustainably managed ecosystems
Converted ecosystems
Intact wetland
Intensive farming
Sustainable forestry
Small-scale farming
Intact mangroves
Shrimp farming
Traditional forest use
Unsustainable timber harvest
Wetland Canada
Tropical Forest Cameroon
Mangrove Thailand
Tropical Forest Cambodia

# Summing up: Direct & Indirect valuation

*Example: Tropical wetlands*



**Use Values**

Indirect use values
- Flood control
- Soil fertility
- Pollution control
- Drinking water
- Transportation
- Ecotourism

Direct use values
- Fish & meat
- Fuelwood
- Timber, reeds
- Medicinal plants
- Edible wild plants
- Animal fodder

**Option values**

Future products
- Medicines
- Genetic resources
- Biological insights
- Food sources
- Building supplies
- Water supplies

**Existence value**

- Protection of biol. diversity
- Maintaining local culture
- Continuing ecol. & evol. processes

# Valuing nature

| Service | Rank |
|---|---|
| Gas regulation | |
| Climate regulation | |
| Water regulation | |
| Water supply | |
| Erosion control | |
| Nutrient cycling | |
| Waste treatment | |
| Pollination | |
| Food production (fish,game,fruit etc) | |
| Raw materials (timber etc) | |
| Recreation | |
| Cultural (spiritual, aesthetic etc) | |

# Valuing nature

| Service | Rank | Value/year (€) |
|---|---|---|
| Nutrient cycling | 1 | 17,075,000,000,000.00 |
| Cultural (spiritual, aesthetic etc) | 2 | 3,015,000,000,000.00 |
| Waste treatment | 3 | 2,277,000,000,000.00 |
| Water supply | 4 | 1,692,000,000,000.00 |
| Food production (fish,game,fruit etc) | 5 | 1,386,000,000,000.00 |
| Gas regulation | 6 | 1,341,000,000,000.00 |
| Water regulation | 7 | 1,115,000,000,000.00 |
| Recreation | 8 | 815,000,000,000.00 |
| Raw materials (timber etc) | 9 | 721,000,000,000.00 |
| Climate regulation | 10 | 684,000,000,000.00 |
| Erosion control | 11 | 576,000,000,000.00 |
| Pollination | 12 | 117,000,000,000.00 |

*From: Hambler, Clive. and Canney, Susan (2013) Conservation 2nd Ed.. Cambridge University Press.*

# Problems with economic valuing systems for biodiversity

# Problems with economic valuing systems for biodiversity

- Implicit acceptance of modern economic system
- Not all species or communities can be assigned an economic value
- Difficulty of assigning even option values
- What about species that are economically undesirable?
- Relies on 'perfect knowledge' to make decisions

# Further problems …

- As resources become scarce  more expensive!!
- What do we do if it becomes **<u>uneconomical</u>** to conserve biodiversity ?

# Further reading

* Primack, Richard B., and Katherine Ralls (1995) A primer of conservation biology 5th Ed. Sunderland, MA: Sinauer Associates. *Read chapter 3*.

* Hambler, Clive. and Canney, Susan (2013) Conservation 2nd Ed.. Cambridge University Press. *Read Chapter Economic methods pp. 317 – 330.*