
Biodiversity

Which do you like better?

A

B

Which do you like better?

A

B

What do you think biodiversity means?

Biodiversity

What does "Bio" mean?

Bio = Life

Biodiversity

What does "Diversity" mean?

Diversity = Variety

Biodiversity is the variety of life on Earth and the essential interdependence of all living things

- **Scientists have identified more than 2 million species. Tens of millions -- remain unknown**

- **The tremendous variety of life on Earth is made possible by complex interactions among all living things including microscopic species like algae and mites.**

Types of biodiversity

- Alfa biodiversity
- Beta biodiversity
- Gama biodiversity

- Alfa biodiversity: Biodiversity of a small area.
- Beta biodiversity: A gradient of biodiversity between two or more areas or habitats.
- Gama biodiversity: Biodiversity of total biosphere of whole area.

Variety of biodiversity can be seen on four levels

- Genetic diversity
- Species diversity
- Ecosystem diversity
- Functional diversity

Biodiversity

Species

Ecosystem

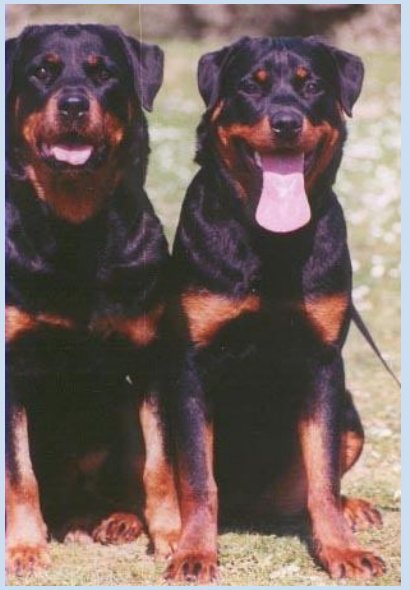
Genetic

There are 3 components of biodiversity

1. **<u>Diversity of genes</u>**
   Chihuahuas, beagles, and rottweilers are all dogs—but they're not the same because their genes are different.

Chihuahua

Beagle



Rottweilers

2. Diversity of species

For example, monkeys, dragonflies, and meadow beauties are all different species.

Saki Monkey

Golden Skimmer

Meadow Beauty

3. Variety of ecosystems

Prairies, Ponds, and tropical rain forests are all ecosystems. Each one is different, with its own set of species living in it.

Paines Prairie

Hoh Rain Forest

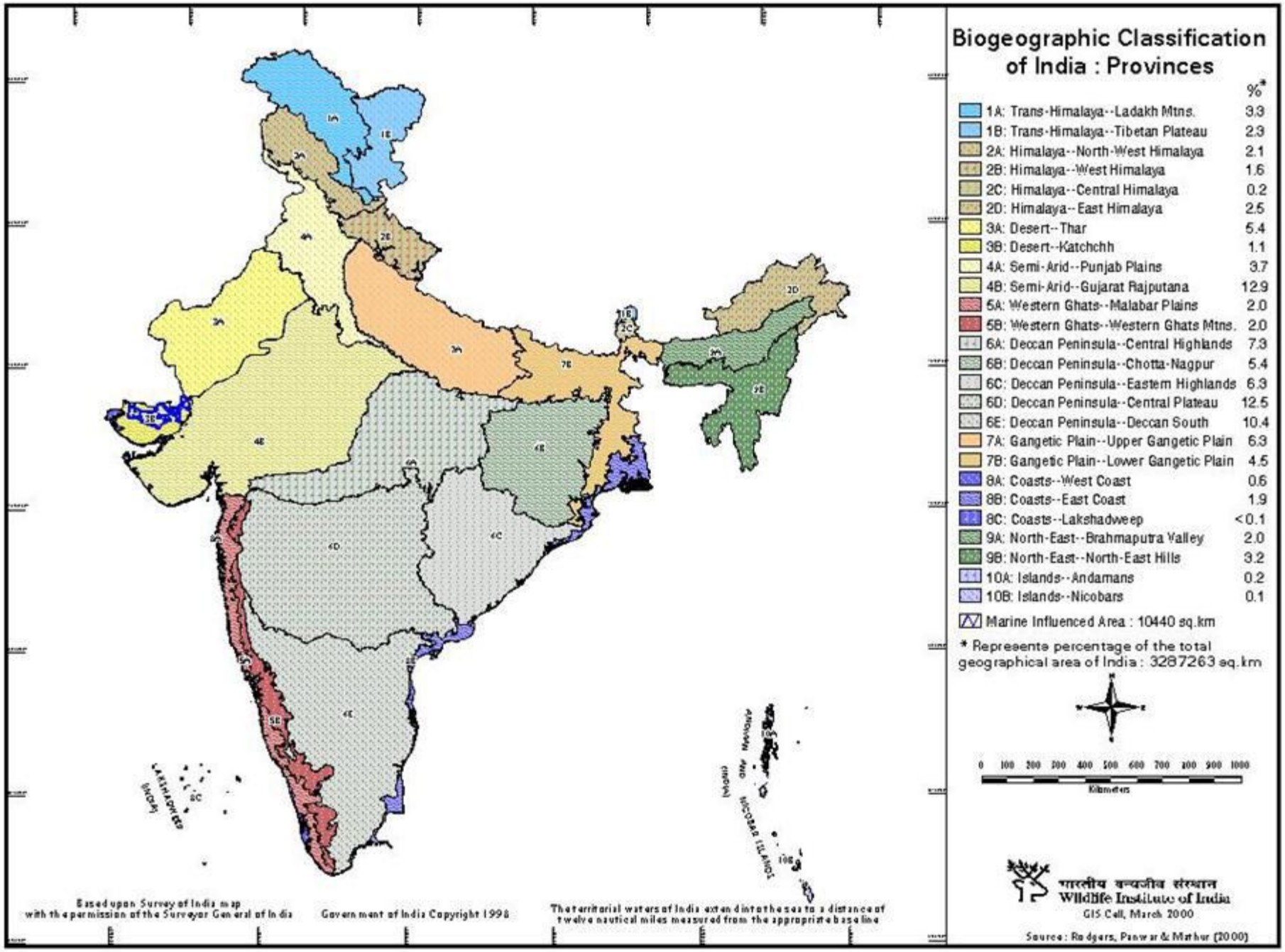
Florida Sand hill Pond

4. Functional diversity

- Biological and chemical processes of functions such as energy flow and matter cycling needed for the survival of species and biological communities

Biogeographic classification of India

1. The cold mountainous snow covered Trans Himalayan region of Ladakh.
2. The Himalayan ranges and valleys of Kashmir, Himachal Pradesh, Uttarakhand, Assam and other North Eastern States.
3. The Terai, the lowland where the Himalayan rivers flow into the plains.
4. The Gangetic and Bhramaputra plains.
5. The Thar Desert of Rajasthan.
6. The semi arid grassland region of the Deccan plateau Gujarat, Maharashtra, Andra Pradesh, Karnataka and Tamil Nadu.
7. The Northeast States of India,
8. The Western Ghats in Maharashtra, Karnataka and Kerala.
9. The Andaman and Nicobar Islands.
10. The long western and eastern coastal belt with sandy beaches, forests and mangroves.


Biogeographic Classification of India : Provinces
%*
1A: Trans-Himalaya--Ladakh Mtns. 3.3
1B: Trans-Himalaya--Tibetan Plateau 2.3
2A: Himalaya--North-West Himalaya 2.1
2B: Himalaya--West Himalaya 1.6
2C: Himalaya--Central Himalaya 0.2
2D: Himalaya--East Himalaya 2.5
3A: Desert--Thar 5.4
3B: Desert--Katchchh 1.1
4A: Semi-Arid--Punjab Plains 3.7
4B: Semi-Arid--Gujarat Rajputana 12.9
5A: Western Ghats--Malabar Plains 2.0
5B: Western Ghats--Western Ghats Mtns. 2.0
6A: Deccan Peninsula--Central Highlands 7.3
6B: Deccan Peninsula--Chotta-Nagpur 5.4
6C: Deccan Peninsula--Eastern Highlands 6.3
6D: Deccan Peninsula--Central Plateau 12.5
6E: Deccan Peninsula--Deccan South 10.4
7A: Gangetic Plain--Upper Gangetic Plain 6.3
7B: Gangetic Plain--Lower Gangetic Plain 4.5
8A: Coasts--West Coast 0.6
8B: Coasts--East Coast 1.9
8C: Coasts--Lakshadweep <0.1
9A: North-East--Brahmaputra Valley 2.0
9B: North-East--North-East Hills 3.2
10A: Islands--Andamans 0.2
10B: Islands--Nicobars 0.1
Marine Influenced Area : 10440 sq.km
* Repreeente percentage of the total geographical area of India : 3287263 sq.km
0 100 200 300 400 500 600 700 800 900 1000
Kilometers
भारतीय वन्यजीव संस्थान
Wildlife Institute of India
GIS Cell, March 2000
Source : Rodgers, Panwar & Mathur (2000)
Based upon Survey of India map with the permission of the Surveyor General of India
Government of India Copyright 1998
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate baseline

Why is Biodiversity Important?

Value of biodiversity

- Consumptive value
- Productive value
- Social value
- Ethical value (destruction of nature)
- Aesthetic value (beauty of nature)
- Option value

Categorizing Economic Values

Direct Use Value(Goods)	***Indirect Use Value (Services)***	***Non-Use Values***	
Food, medicine, building material, fiber, fuel	Atmospheric and climate regulation, pollination, nutrient recycling	1. Potential (or Option) Value	Future value either as a good or service
	Cultural, Spiritual and Aesthetic	2. Existence Value	Value of knowing something exists
		3. Bequest Value (future generation)	Value of knowing that something will be there for future generations

Direct Use Value: Goods

Source: © AMNH-CBC

- Food
- Building Materials
- Fuel
- Paper Products
- Fiber (clothing, textiles)
- Industrial products (waxes, rubber, oils)
- Medicine

Food

- Today, most people rely on ~20 types of plants, and only 3 to 4 are staple crops.
- Diversity is critical for developing new strains and breeds, i.e. that suit a particular environment or are resistant to pests or disease and as a source of new crops

Source: © AMNH-CBC

Building Materials, Paper Products, and Fuel

Source: © AMNH-CBC

Fiber

Source: USDA Cotton Program

Source: USDA Photo b Ken Hammond

Industrial Products

Originating plant or animal	**Product/End use**
Cork oak (*Quercus suber)*	Cork
PARē RUBBER TREE (*HEVEA BRASILIENSIS*)	Rubber
Lac insect (*Laccifer spp.*)	shellac
CARNAUBA PALM (*COPERNICIA CERIFERA*)	**CARNAUBA WAX**
Wax plant (*Euphorbia antisyphilitica)*	candelilla wax
Jojoba plant (*Simmondsia chinensis)*	jojoba oil
Cochineal insect (*Dactylopius coccus*)	**CARMINE DYE***

Medicine

Source: © AMNH-CBC

- About 80% of the people in developing countries use plants as a primary source of medicine.
- 57% of the 150 most-prescribed drugs have their origins in biodiversity

Traditional Medicine: Basis of Many Drugs

Drug	**Source**	**Use**
Barbaloin, aloe-emodin	**Aloe** (*Aloe spp.*)	antibacterial, skin conditions, purgative
Atropine	**Belladonna** (*Atopa belladonna*)	Relaxant, sedative
Codeine	**Opium poppy** (*Papaver somniferum*)	Painkiller
Colchicine	**Autumn crocus** (*Colchicum autumnale*)	Anticancer agent
Digitoxin	**Common foxglove** (*Digitalis purpurea*)	Cardiac stimulant
Ephedrine, Pseudoephedrine	**Joint fir** (*Ephedra sinica*)	Asthma, emphysema, bronchiodilator, hay fever
L-Dopa	Velvet bean *(Mucuna deeringiana*)	Parkinson's disease
Menthol	**Mint** (Menta spcs.)	Nasal congestion
Morphine	**Opium poppy** (*Papaver somniferum*)	Painkiller
Quinine	**Yellow cinchona** (*Cinchona ledgeriana*)	Malaria
Reserpine	**Indian snakeroot** (*Rauvolfia serpentina*)	Hypertension
Scopolamine	**Thornapple** (*Datura metel*)	Sedative
Taxol	Pacific Yew (*Taxus brevifolia*)	Anticancer
Vinblastine, vincristine	Rosy periwinkle (Catharanthus roseus)	Leukemia

Indirect Use Values: Services

- Regulating global processes, such as atmosphere and climate
- Soil and water conservation
- Nutrient cycling
- Pollination and seed dispersal
- Control of agricultural pests
- Genetic library
- Inspiration and information
- Scientific and educational
- Tourism and recreation
- Cultural, spiritual, and aesthetic
- Community Resilience/spirit
- Strategic

Source: © AMNH-CBC

Global Processes: Atmospheric Regulation

- Photosynthetic biodiversity created an oxygenated atmosphere, and also has the potential to moderate the rising amounts of atmospheric carbon dioxide linked to global climate change

Source: Frey © AMNH-CBC

Global Processes: Climate Regulation

- Forests and other vegetation modify climate: by affecting sun reflectance, water vapor release, wind patterns and moisture loss. Forests help maintain a humid environment, for example, half of all rainfall in Amazon basin is produced locally from forest-atmosphere cycle

Source: Bain © AMNH-CBC

Soil and Water Conservation

Example: Coastal wetlands and mangroves

- Filters excess nutrients and traps sediments that would otherwise impact neighboring marine and aquatic areas

Other services:

- Minimizes damage from waves and floods
- Serves as a nursery for juvenile commercial fish
- Provides habitat for many birds, fish, and shellfish

Source: Ersts © AMNH-CBC

Nutrient Cycling

- Biodiversity is critical to nutrient cycling and soil renewal
- Decomposers such as algae, fungi, and bacteria

Source: Snyder © AMNH-CBC

Pollination and Seed Dispersal

- Many flowering plants depend on animals for pollination to produce food.
- 30% of human crops depend on free services of pollinators; replacement value estimated billions of dollars/year in US alone

Source: Spector© AMNH-CBC

Source of Inspiration or Information

- Biomimicry
- Applied Biology
- Medical Models
- Education and Scientific Research

Source: Brumbaugh © AMNH-CBC

Medical Models

Source: New Jersey Fish and Wildlife

Hibernating bears may improve the treatment of:

- trauma patients
- kidney disease
- osteoporosis

Spiritual and Cultural Values

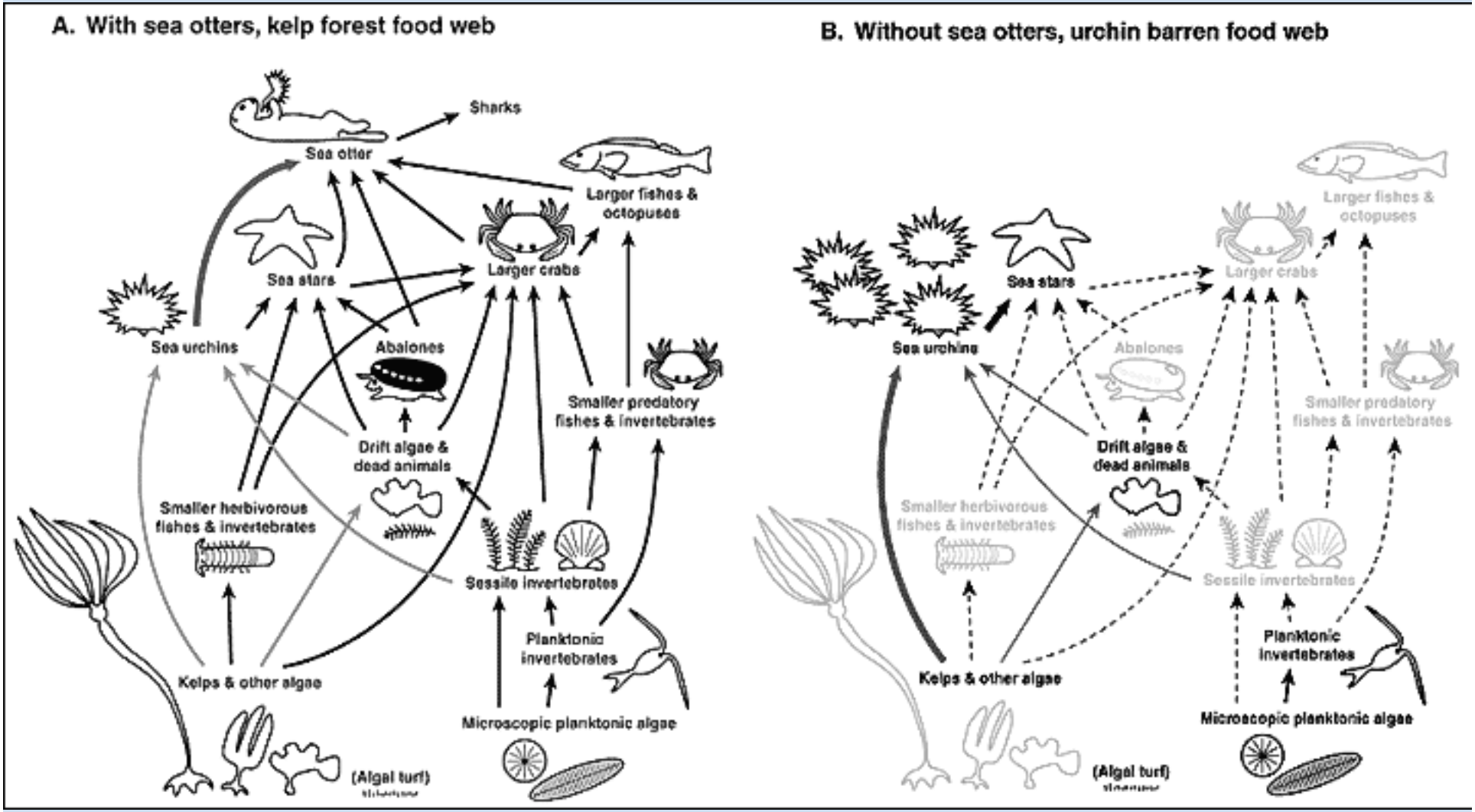
- The survival of natural areas and species are important to different cultures around the world.
- Thousands of cultural groups in the world, each have distinct traditions and knowledge for relating to natural world

Source: Projecto Gato Andino Bolivia, Villalba & Bernal, 1998

Aesthetic Value

Source: Brumbaugh © AMNH-CBC

Forest Food Webs



Source: Brumbaugh © AMNH-CBC

http://research.amnh.org/biodiversity/crisis/index.htm

Non-Use or Passive Values

- Existence value
- Bequest value (will be for future generations)
- Potential or Option value (for future work/generation)

End….

Thank you….