

# **BIODIVERSITY AND BIOLOGICAL INVASIONS**

# What Is Biological Diversity?

- **the variety of life-forms, commonly expressed as the number of species or the number of genetic types in an area.**

# Why Do People Value Biodiversity?

- **There are nine primary reasons: utilitarian; public-service; ecological; moral; theological; aesthetic; recreational; spiritual; and creative.**

Biological diversity involves the following concepts:

**GENETIC DIVERSITY:** the total number of genetic characteristics of a specific species, subspecies, or group of species. The total number of genes.

**SPECIES DIVERSITY** : Total number of species in a given area.

Species diversity has three qualities:

species richness—the total number of species;

species evenness—the relative abundance of species; and

species dominance—the most abundant species.

- Extinct creatures eg T. rex
- Creatures who breed asexually eg bacteria
- Creatures who can't be tested ethically eg Man x Chimp

**HABITAT DIVERSITY:** the different kinds of habitats  
in a given unit area.

Within an ecosystem there can be many

**HABITATS**



# Importance of Biodiversity:

- **Maintains soil quality:** healthy bacteria, algae, fungi, mites, millipedes and worms help cycle nutrients
- **Maintains air quality:** plants purify the air and filter harmful particles out of the air
- **Maintains water quality:** variety of vegetation reduces erosion and purifies water by removing (using or absorbing) nutrients and pollution

- **Pest control:** most crop pests can be controlled by other organisms for a longer period of time – helpful because many pests become resistant to synthetic pesticides
- **Pollination and crop production:** More than 1/3 of world's crops rely on healthy pollinators
- **(Potential) Medicines:** many current and possible future medications found in areas with high biodiversity

# Threats over Biodiversity

- Habitat destruction/fragmentation
- **Invasive species**
- Population growth
- Pollution
- Overconsumption

# INVASIONS AND INVASIVE SPECIES

## What are invasive species?

- Non-native species
- Have a negative impact on their new surroundings
- Cause economic, environment harm and harm to human health
- Invasive=most aggressive species

- They displace native species and disrupt important ecosystem processes
  - Plants, mammals, fish, birds, insects and disease cause organisms

**Alien species**-Implies introduction to a particular ecosystem,  
is considered as a threat

**Introduced species**-Implies introduction but not a threat

**Exotic Species**-Implies species from another part of the world

# Characteristics of Invasive Species

- Widespread in Native Range
- History of Invasiveness Elsewhere
- Adapted in Wide Range of Environments and Soils
- Rapid Growth and Maturity
- Produces Many Offspring
- Rapid Colonizer
- Efficient Dispersal Mechanisms
- Broad Diet
- Aggressive Behavior
- *Close Association with Humans*
- Small in Size



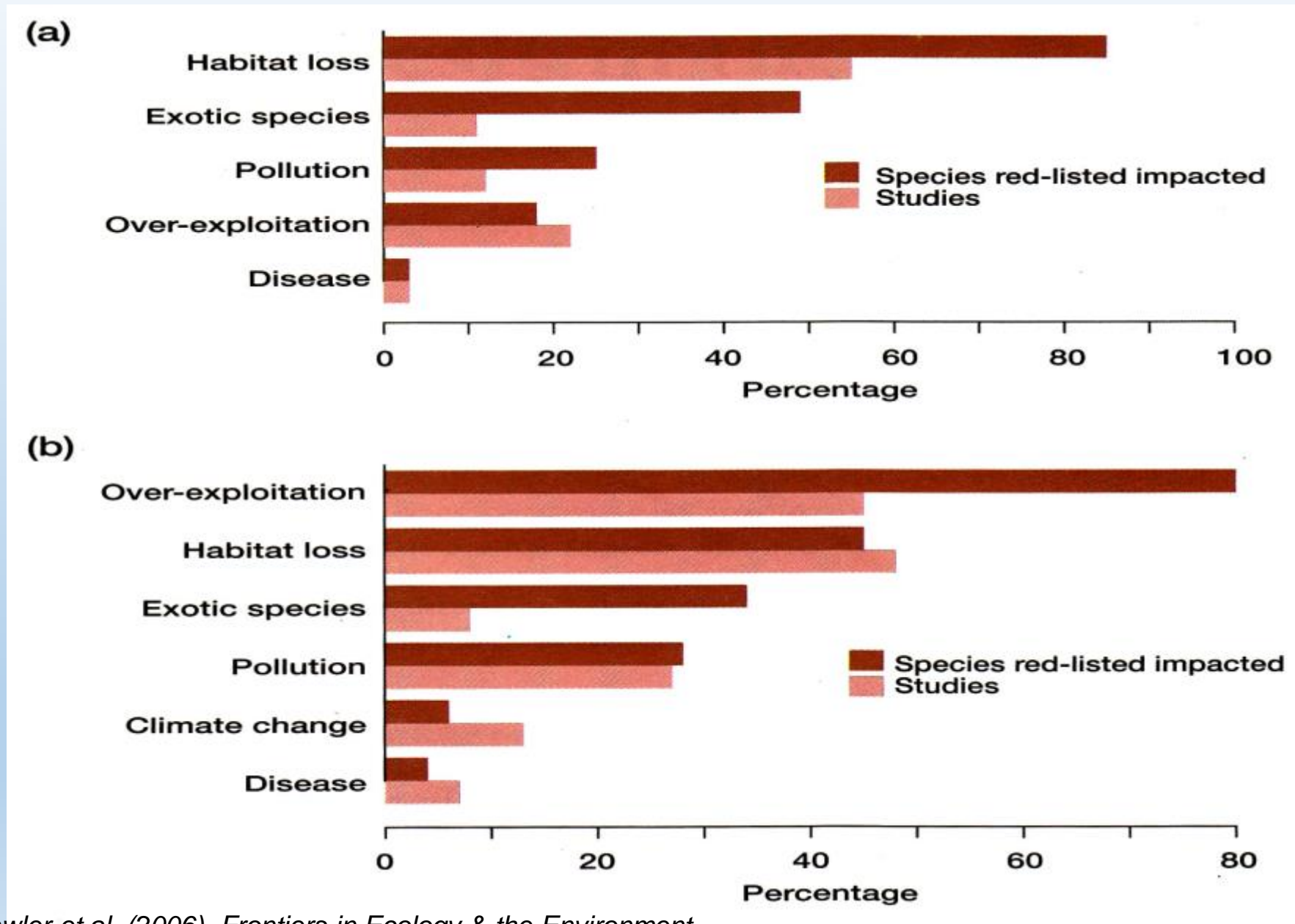
## What are the impacts of invasive species?

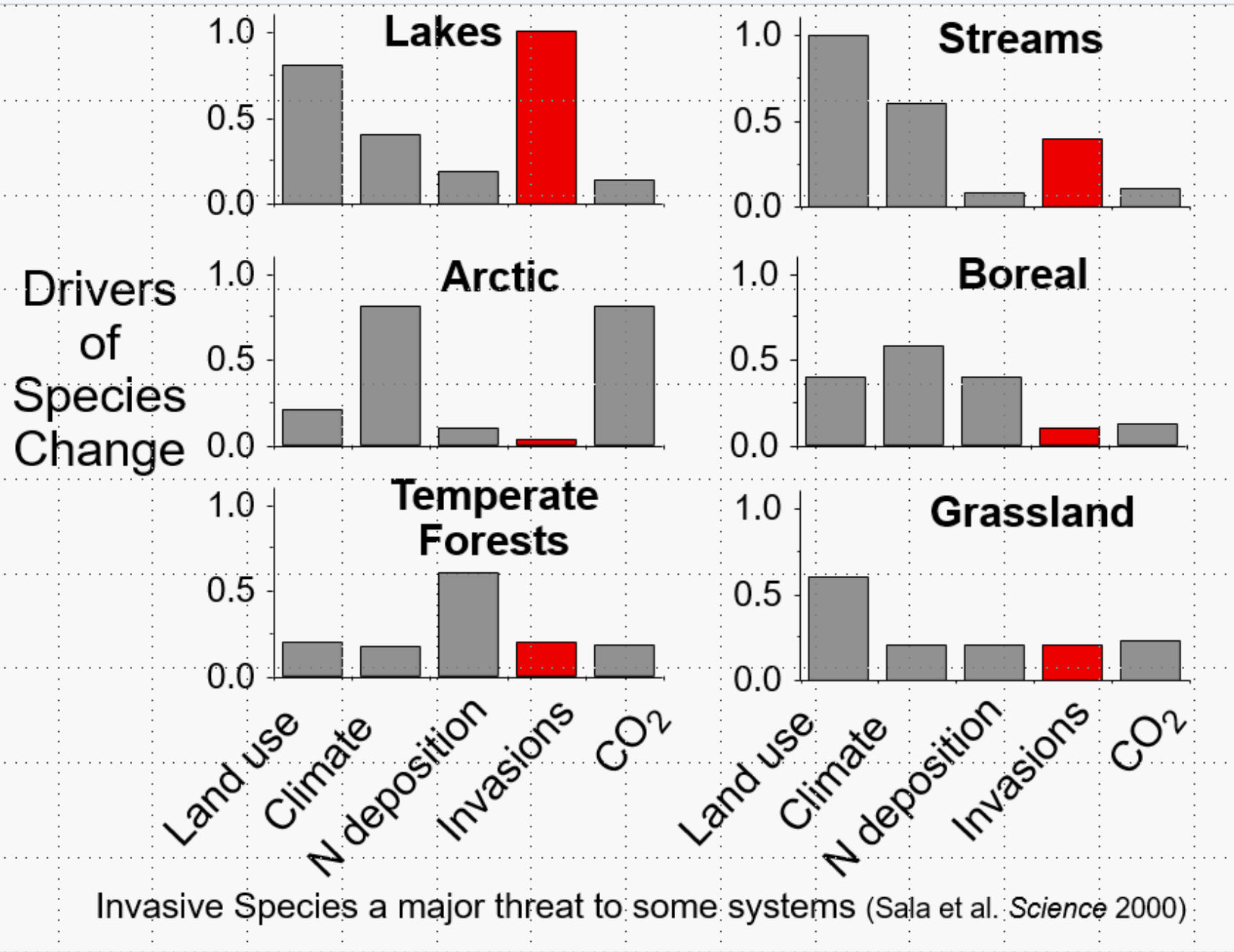
- Environmental impact
- Economic impact
- Health impacts

## Environmental impacts

- Extinction of local species or threaten endangered species
- Irreparable changes of ecosystems (changes in disturbance regimes, alterations of water regimes, erosion, sedimentation, changes in soil chemistry)
- Killing or crowding out of native species
- Completely changing how ecosystems function (disrupt trophic level relationships, compete with natives for resources, space, light)
- Cause Habitat Loss
- Hybridize with natives

# Causes of Global Species Endangerment





## **Economic impacts**

Direct costs: Controlling the spread of invasive species

Indirect costs: Relate to the ecosystem services

- Lost agricultural productivity
- Lost forest productivity
- Lost recreational opportunity

- USA: \$150 Billion
- India: US\$117 Billion
- South Africa: US\$17.5 Billion
- United Kingdom: US\$12 Billion
- Australia: AUS\$10 Billion
- New Zealand: US\$10 Billion
- Africa (Aquatic Weed Control): \$US60 Million

## **Health impacts**

- Invasive species spread disease
- Food security and water depletion

- **Diseases**

- 1999 - West Nile Virus - USA
  - 9,862 People Infected
  - 264 People Died
- 2003 SARS in China
- \$17 Billion Tourism Losses

- **Stings - Allergic Reactions**

- Imported Red Fire Ant
- Africanized Honey Bee



# Human, Plant and Animal Diseases

- Cholera spread (e.g. Peru from India)
- West Nile Virus (spread by birds and mosquitoes)
- Dutch Elm disease (fungus arrived with beetles from Europe)
- Chronic Wasting Disease (affects cattle in Alberta)
- Infectious Salmon Anemia (came to farmed salmon in N.B. from Europe)
- SARS and HIV in humans

Dogwood (Cornus-kızılcık) anthracnose: wilt and death caused by *Discula destructiva* (fungus)

Dutch elm disease (beetle transmitted fungus

*Ophiostoma ulmi*, that kills American elm)

What we can do to prevent enterence of invasive species to our surroundings or the areas that we visit?

# Characteristics of Invaded Habitats

- Ecological similarities between origin and receiving ecosystems
- Lack of co-evolved predators and parasites
- Level of Development and Disturbance
- Secondary pathways and vectors for further spread
- Isolated Communities with High % Endemic Species

# Spread of Plants and Animals – *Who's Using Who?*

- Reversion of Cultivars to Wild Forms
  - Olives
  - Granny Smith Apple

# Process of Invasion

- Primary Introduction
- Growth- Reproduction- Establishment
- Secondary Spread
  - Vehicles, Trains, Trailers, Animals

How do invasive species enter?

# Intentional Introductions

- Agricultural Crops
- Forestry Species
- Erosion Control
- Aid Trade
- Ornamental Plants
- Germplasm
- Mammals as Food Source on Islands
- Biocontrol Agents
- Fishery Releases
- Pets Released in Wild
- Aquaculture Escapes
- Smugglings



# Unintentional Introductions

- Adaptations for Spread
  - Plants – seeds with prickles, seed sails, floating seeds
  - Animals – dog tick
- Stowaways
  - Khapra Beetle (pest of grains and seeds)
- Hitchhikers
  - Snails
- Contaminants (Co-mingled)
  - Weed Seed in Crop Seed

- Hitchhikers on Nursery Plants
- Hitchhikers on Cut Flowers
- Soil Pests
- Planes, Trains, Vehicles, Equipment
- Mail
- Ballast Soil and Water
- Hull Fouling Organisms
- Marine Debris

# Pathways of Unintentional Spread

## Transportation of people or products

- Ships
- Planes
- Trains
- Vehicles – Trucks

## People

- Beggar-lice on Trousers, stick o tyres

# Ballast Water in Ships

- Ships loaded with cargo called are stable and do not need ballast water
- Ships without cargo carry ballast water to increase stability
- Probably the single biggest source of invasive species globally (when combined with hull fouling species)

# Example: Melaleuca in the Florida Everglades

- Florida Everglades
  - River of Grass, Tree Islands
  - 80 Miles wide, 1/3 M Deep
- 1906 – Introduced from AUS
- 1936 - Aerial Seeding with Melaleuca
- 1970s – Rapid Spread throughout the Glades
- 1990s – 200,000 ha Infested

## How to identify invasive species:

- Invasive species take over an entire area and eliminate biodiversity
- They can grow out of control
- They chase out our native species
- The result is monoculture
- They have no natural predator

# Methods of Predicting Invasiveness

- Criteria for Invasive Alien Species Prevention Program
  - Know About Invasive Alien Species Worldwide
    - GISP:
      - <http://www.gisp.org/>
    - Global Invasive Species Database:
      - <http://www.issg.org/database/welcome/>
  - Know Which Ones Pose a Threat to Your Country

# Çıldır Gölü'nde istilacı midye alarmı

ABD'ye yılda 5 milyar dolarlık zarar veren istilacı tür 'zebra' midye Çıldır Gölü'nde ortaya çıktı. Nereden ve nasıl geldiği bilinmeyen zebra midyeler, buldukları her şeyi yiyip tüketiyorlar.

09:47 - 26 Kasım 2019

Haberler | Gündem



Denizden 1959 metre yükseklikteki, Kars ile Ardahan arasında bulunan Çıldır Gölü, zebra midyelerin tehdidi altında... Doğruiyol köyünde oturan, geçimini balıkçılık yaparak sağlayan Atanur Dursun, Çıldır Gölü'nde su seviyesinin yaklaşık 12 metre çekildiğini söyledi.

## “HER ŞEYİ YİYİP TÜKETİYORLAR”

Dursun, “Nereden ve nasıl geldiği bilinmeyen zebra midyeler, buldukları her şeyi yiyip, tüketiyorlar. Çıldır Gölü'nün kendisine ait tatlı su midyesi var. Bu midyelerin içini bile yemiş kurutmuşlar. Bir midyenin üstünde binlercesi var. Daha önce hiç böyle bir şeyle karşılaşmamıştık. Yetkililer biran evvel buna bir çözüm yolu bulmalı” diye konuştu.

Van Yüzüncü Yıl Üniversitesi Su Ürünleri Fakültesi Öğretim Üyesi Dr. Mustafa Akkuş, zebra midyenin diğer akarsulara taşınmasına ve Van Gölü'ndeki inci kefallerinin üreme habitatlarını tamamen yok olmasına dikkat çekti.

“İstilacı ve yağmacı olan zebra midyenin taşınması çok kolay. Su dışında nemli ortamda günlerce hayatta kalabiliyor. Akarsularda, kumların, taşların üzerinde büyük koloniler oluşturuyor. Ortamdaki planktonları süzüyor. Bir zebra midye, günde bir litre suyu süzme kapasitesine sahip. Son iki yıldır Çıldır Gölü'nde görülmeye başlayan zebra midyelerin, Keban ve Atatürk Barajı'nda olduğu biliniyor.” (DHA)



<https://www.youtube.com/watch?v=KYIJdhw8NcA>

<https://www.youtube.com/watch?v=w9JgAXgiqLQ>

<https://www.youtube.com/watch?v=gN0wq21DYIc>

<https://www.youtube.com/watch?v=rJDVg35qPNs&t=100s>