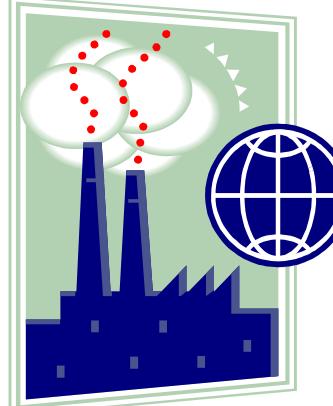
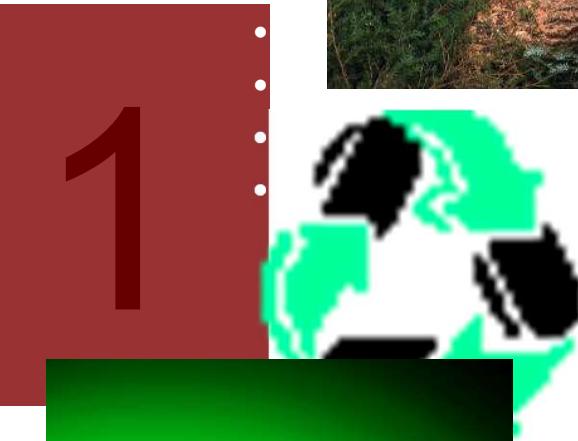


# Comprehend Environment and its issues

Class-2  
3<sup>rd</sup> August 2022

Dr . P. Rama Chandra Prasad  
Lab for Spatial Informatics

# Environmental Science



# Understanding Our Environment

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© Stocktrek/age fotostock

- The conditions on Earth are unique.
- Perfect for the existence of life as we know it.

The life sustaining ecosystems on which we all depend are unique in the universe, as far as we know.

# Introduction

- Environment
- Ecology
- Environmental Science / Environmental ecology

Capital: Solar, Earth, Environment

Carrying Capacity & variables

Sustainability and development

Resources: Renewable and Non renewable (Potentially renewable?)

Biodiversity – Genetic, species , ecological diversity

Environmental degradation

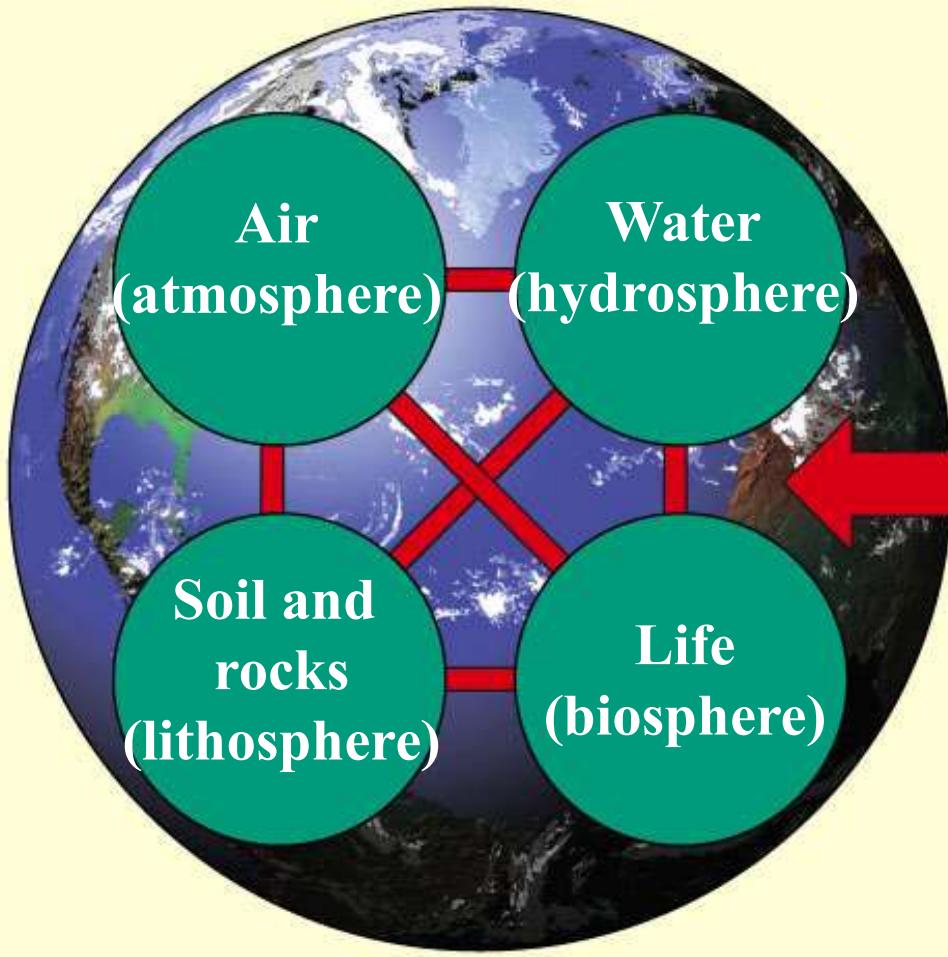
Environmental ethics



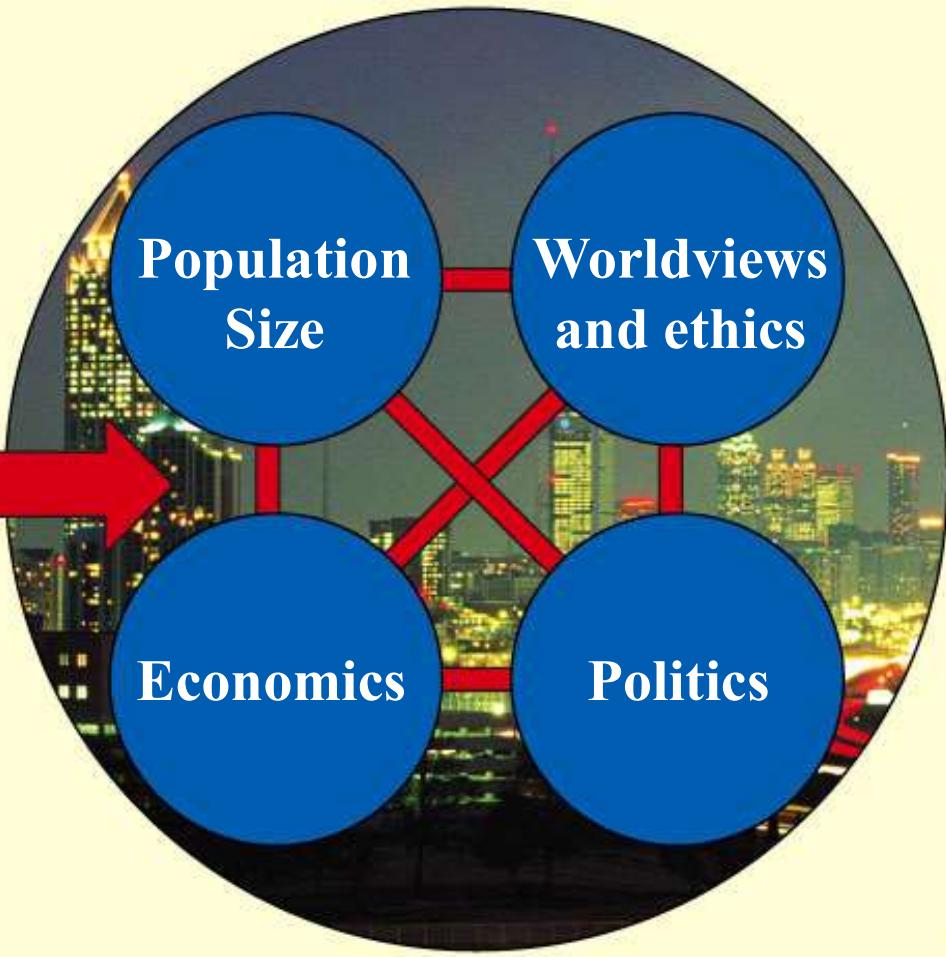
*Environmental science is not environmentalism*

# ENVIRONMENTAL SCIENCE

## Earth's Life-Support System

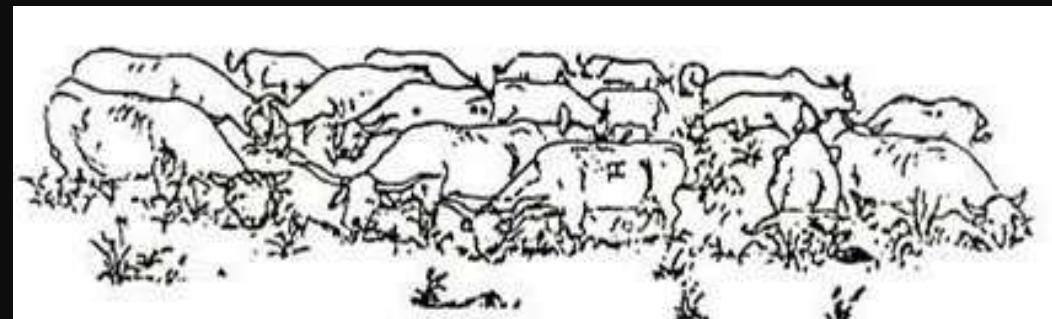


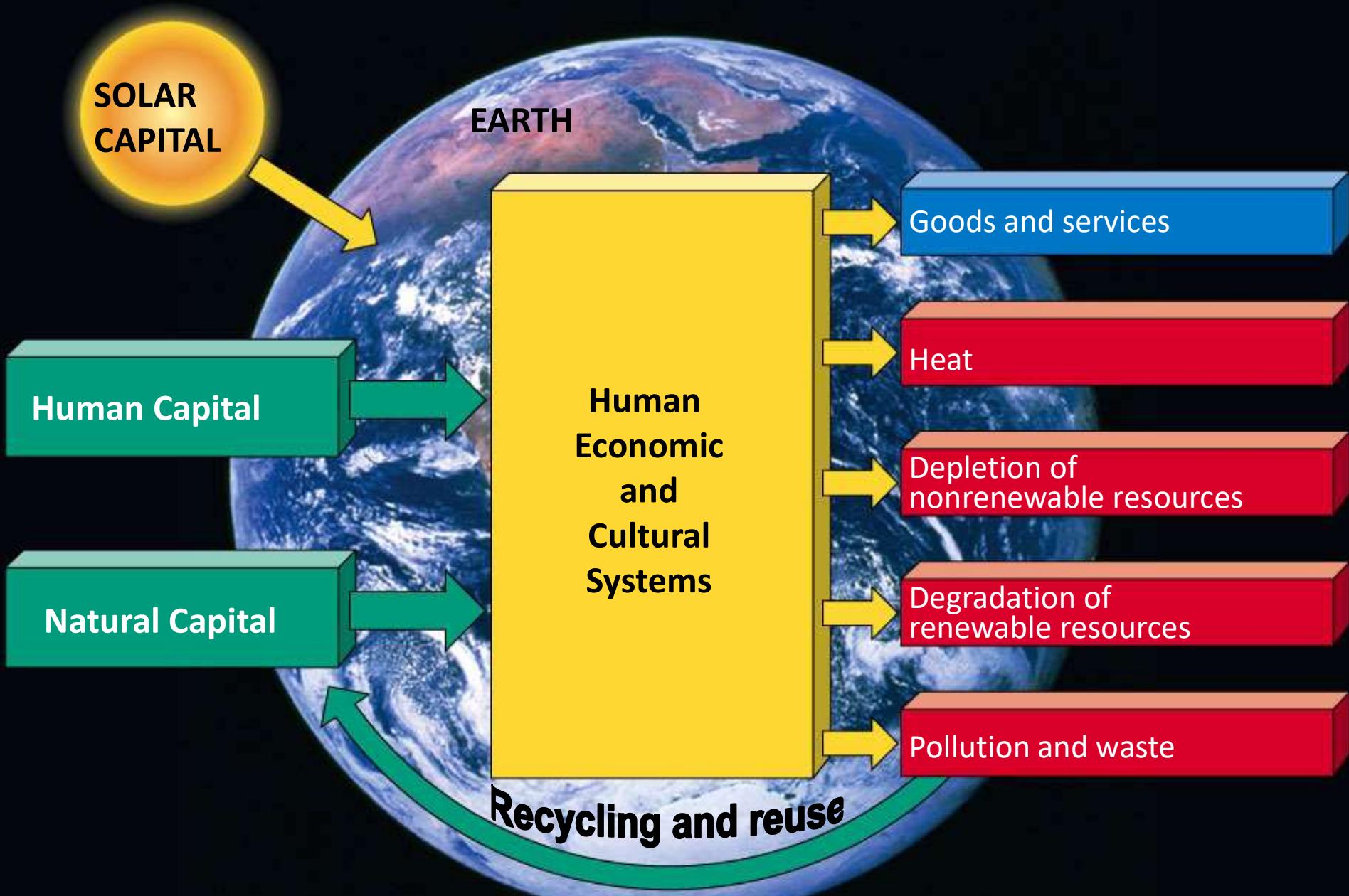
## Human Culturesphere



# The tragedy of the commons

- Garrett Hardin, 1968:
- In a “commons” open to all, unregulated use will deplete limited resources.





# Natural capital degradation

## Causes of Environmental Problems



Population growth



Unsustainable  
resource use



Poverty



Not including the  
environmental costs  
of economic goods  
and services in their  
market prices

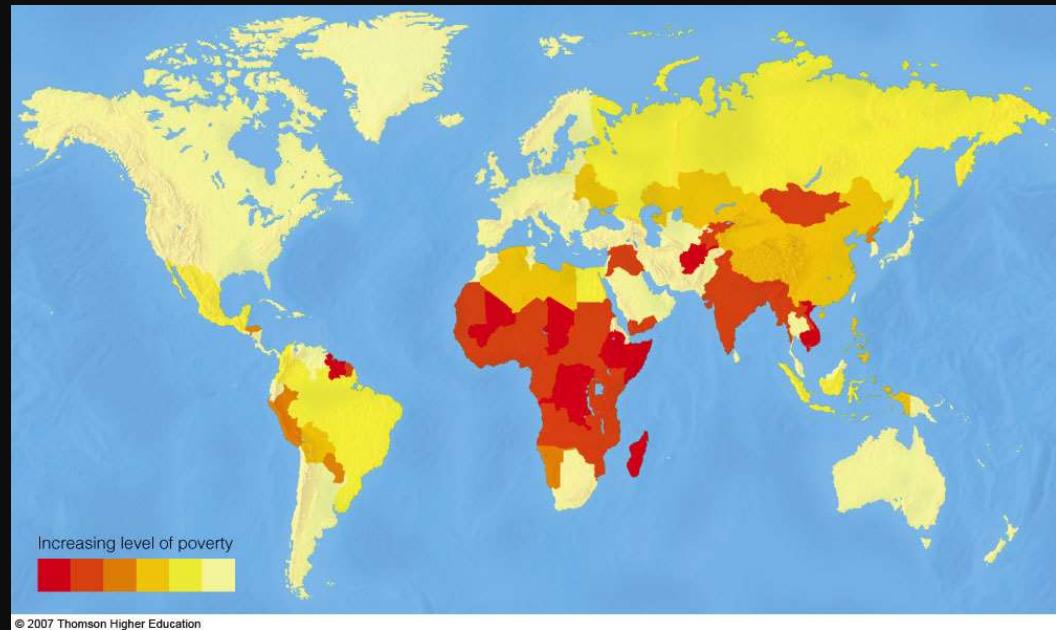
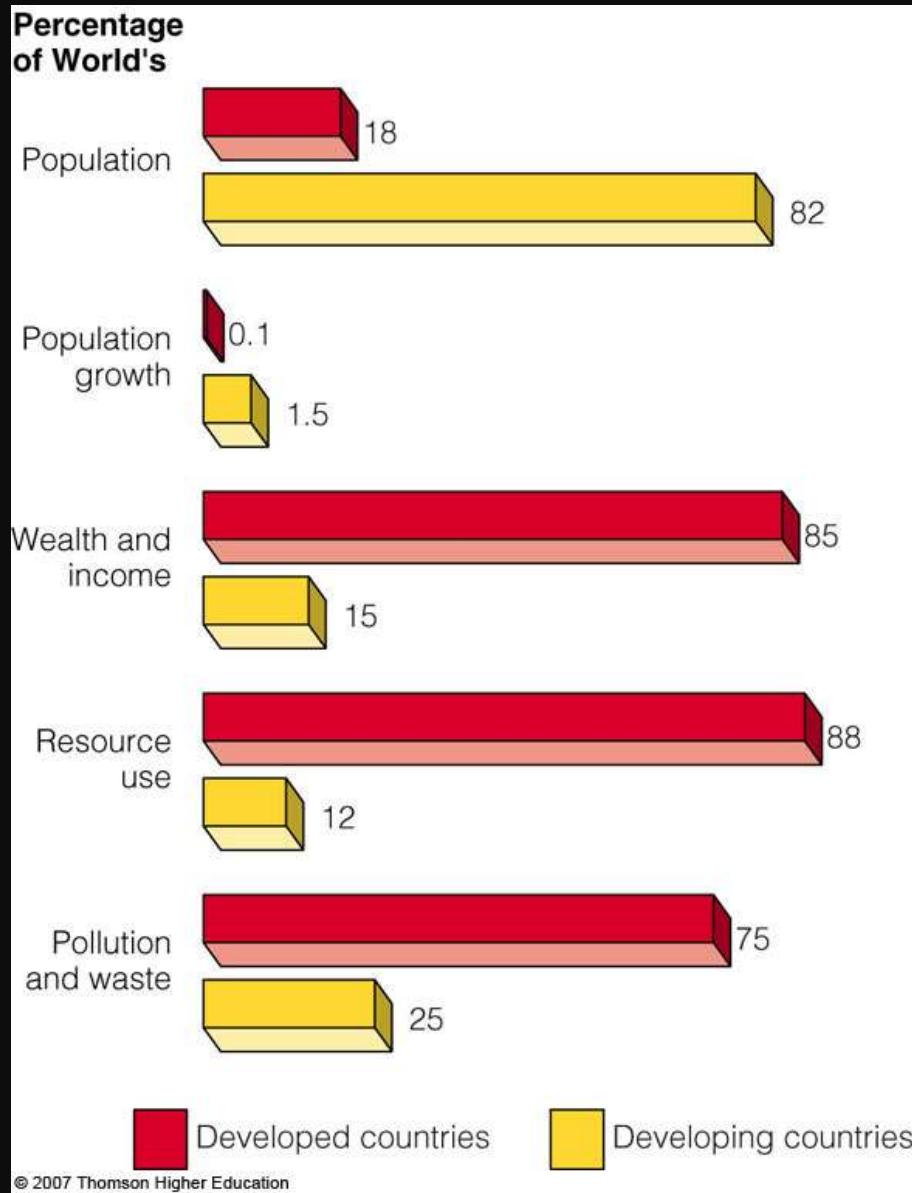


Trying to manage and  
simplify nature with too  
little knowledge about  
how it works

© 2007 Thomson Higher Education

- *The exponential increasing flow of material resources through the world's economic systems depletes, degrades and pollutes the environment.*

# Global Outlook



- Comparison of developed and developing countries.

## Developing Countries



X



X



=



Population (P)

X

Consumption  
per person  
(affluence, A)

X

Technological impact  
per unit of  
consumption (T)

Environmental  
= impact of population  
(I)



X



X



=



## Developed Countries

# Environmental science can help us avoid mistakes made by past civilizations



## *The lesson of Easter Island:*

- ~ 300 AD first inhabited, lush forests & other resources
- ~ 600 AD flourished, (Hundreds of the Statues, 10m, 100 tons)
- ~ 750 AD start to decline (overused the resources)
- 1722 AD in desolate condition in a barren landscape

*People annihilated their civilization by destroying their environment to deplete resources.*

*Denude forest(overuse of hauhau tree) → soil erosion → fast runoff → less fresh water /degrading arable land → lowering crop yield(bananas, sugarcane, sweet potatoes) → starvation/population decline → civilization collapse.*

- *Fall of the Mesopotamian Civilization (Wheat- based agrarian):*
  - prolonged irrigation system → degrade soil (salt too high) → not arable
  - decrease crop yields → food shortage → population decline (2,300 BC).

# *What is an “environmental problem”?*

- *The perception of what constitutes a problem varies between individuals and societies (place) and time*
- Ex.: *DDT, a pesticide*
  - *In developing countries: welcome because it kills malaria-carrying mosquitoes, lice and other insects.*
  - *In developed countries: not welcome, due to health risks (found to be a carcinogen a half century later)*

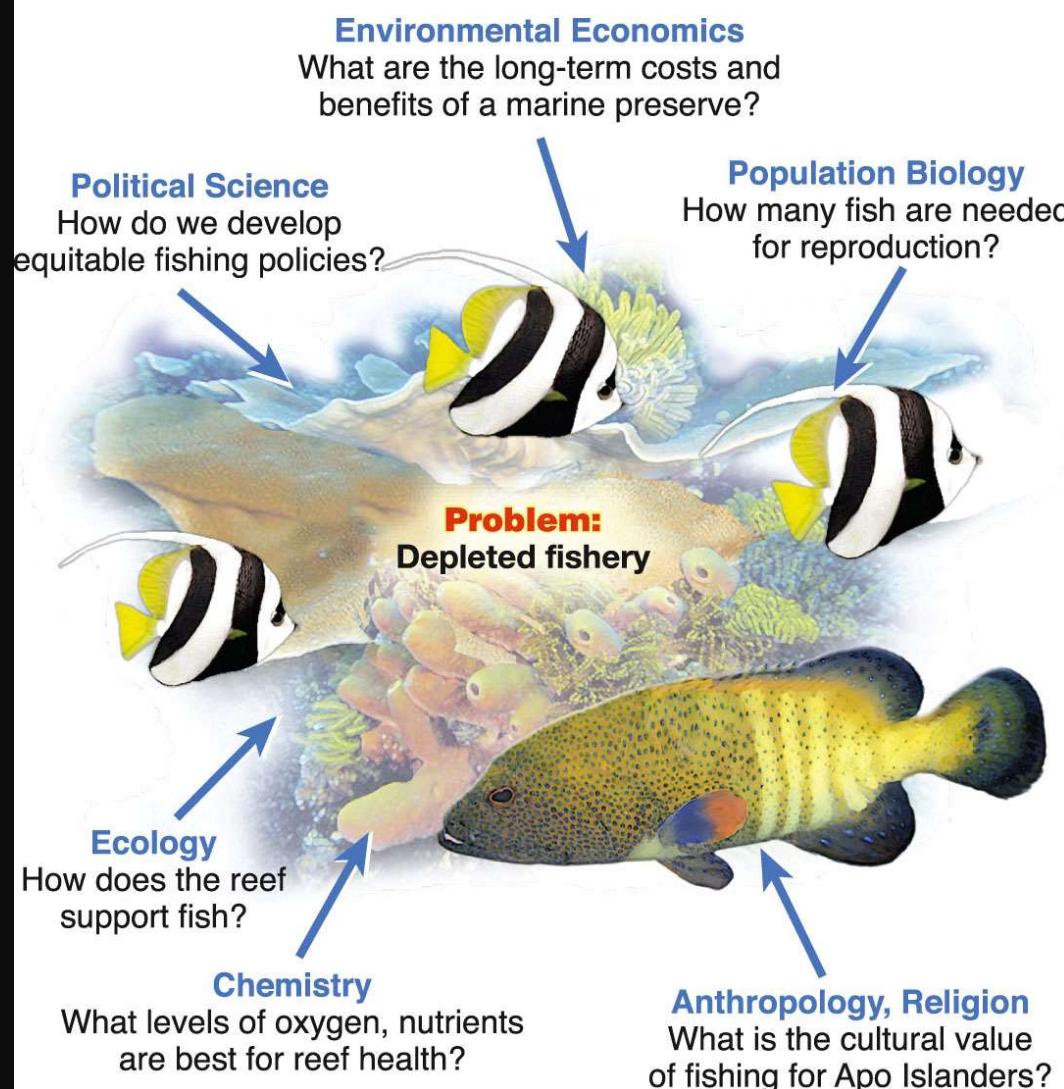


*Germany, 1945*

*Much popular pesticide:  
Sprayed almost everywhere  
In Summer time*

# What is environmental science?

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

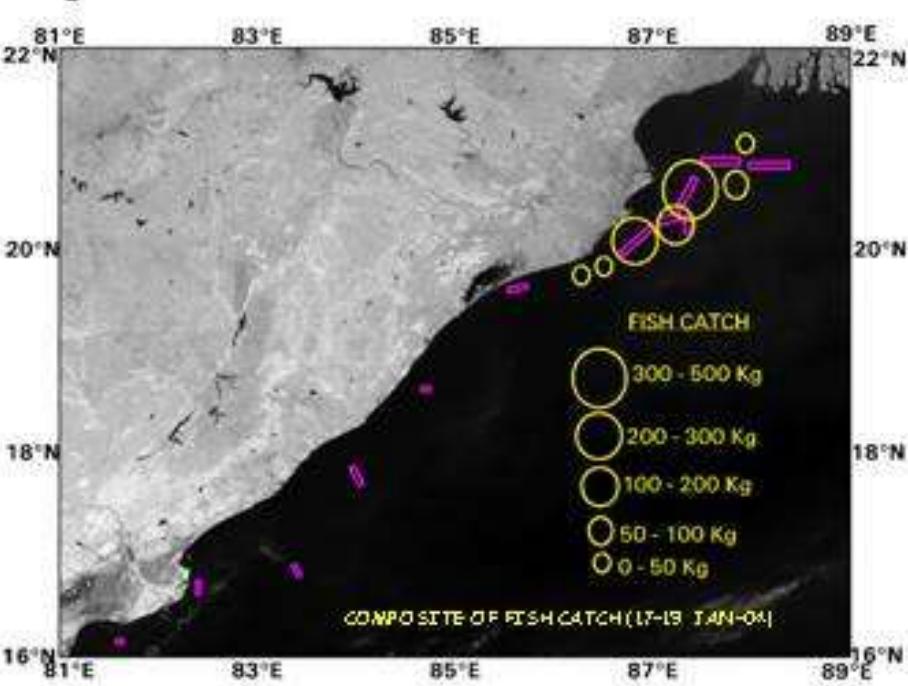
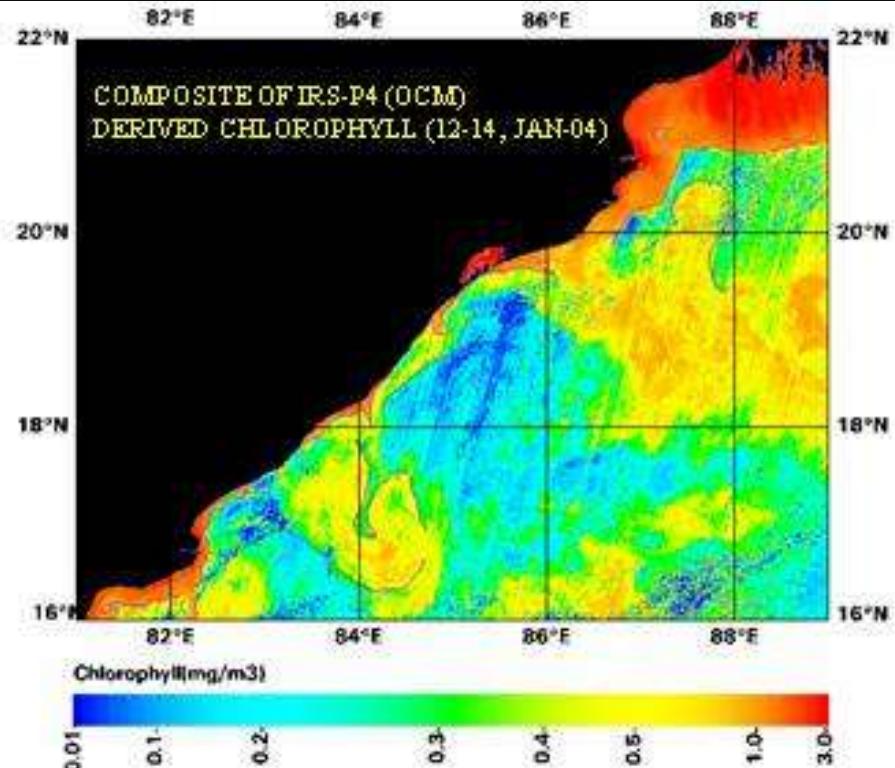
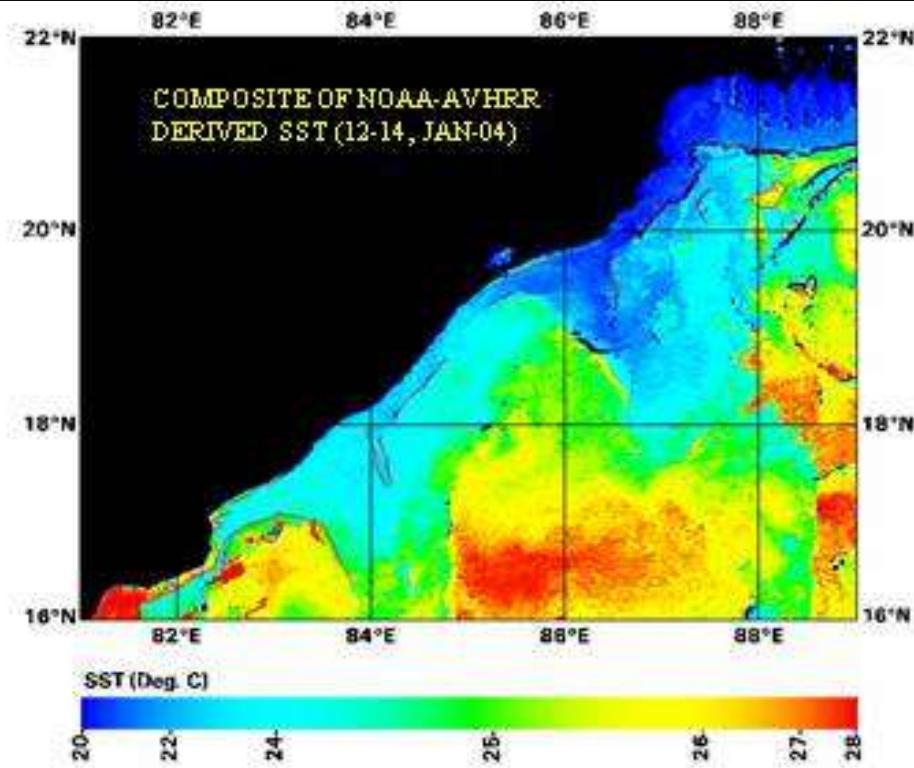


- *Environmental science is the systematic study of our environment and our place in it.*
- *Because environmental problems are complex, environmental science draws on many fields of knowledge.*

Blast Fishing???

Tourism

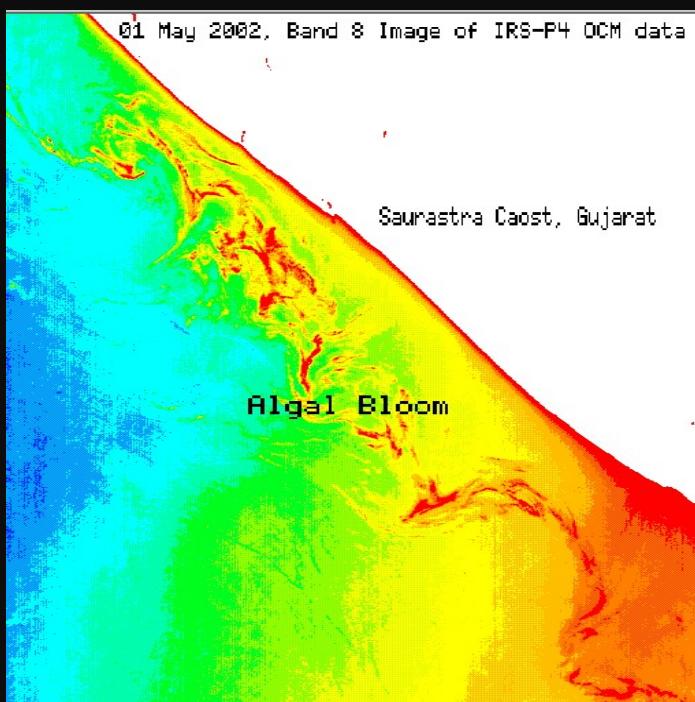
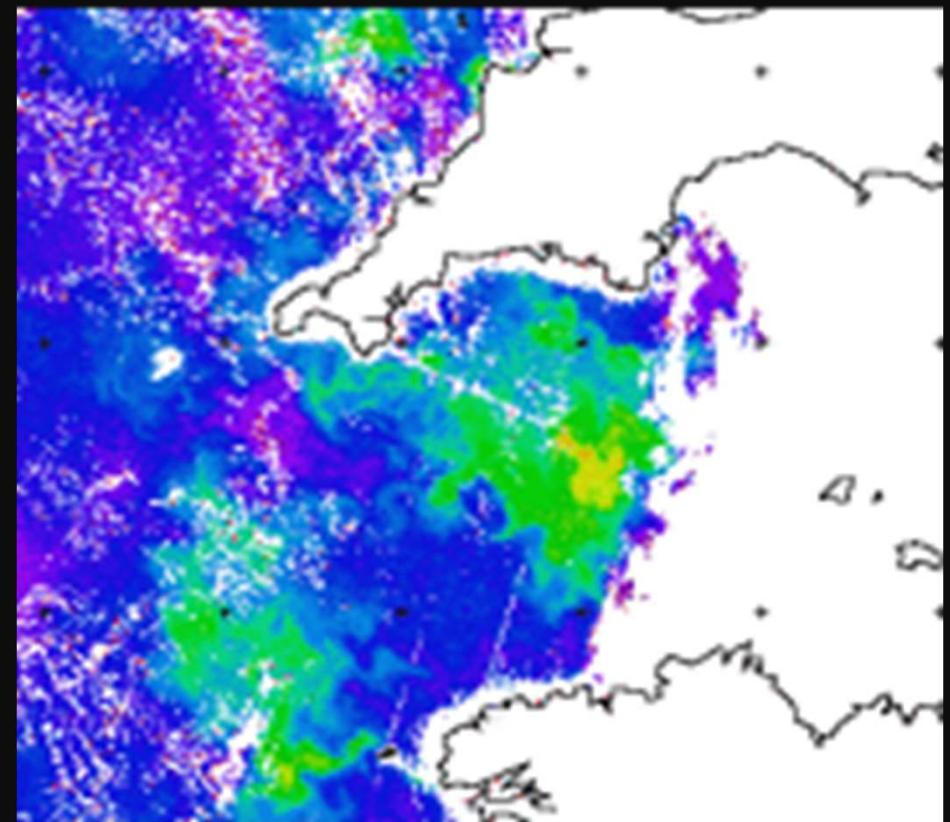
Information Technology



# Identification of HAB



Surface accumulations of cyanobacteria *Nodularia* in the Baltic Sea as detected by enhanced "true-color" MODIS imagery on July 30, 2003



*Trichodesmium*  
bloom  
observed on  
the Saurashtra  
coast, during  
the month of  
May.

HAB detection using a multivariate spectral classifier approach showing a (automatically identified) *Karen mikimotoi* bloom off the U.K. coastline. Areas of green, yellow and orange represent an estimate of its intensity. Areas of blue and purple are clear ocean.

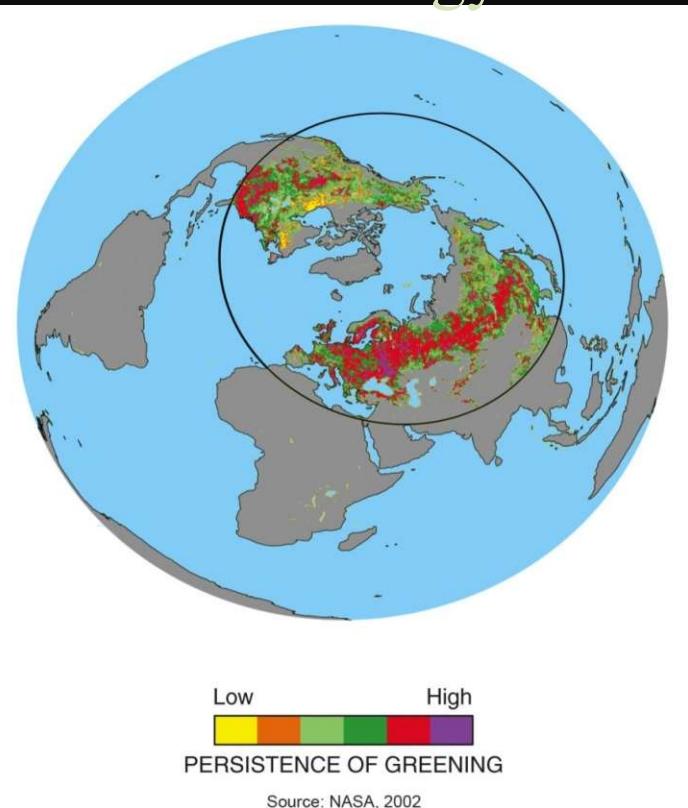
# Environmental Problems

Clean Water

Air Quality

Food Supplies

Energy resources



Marine resources

Biodiversity loss

Climate Change

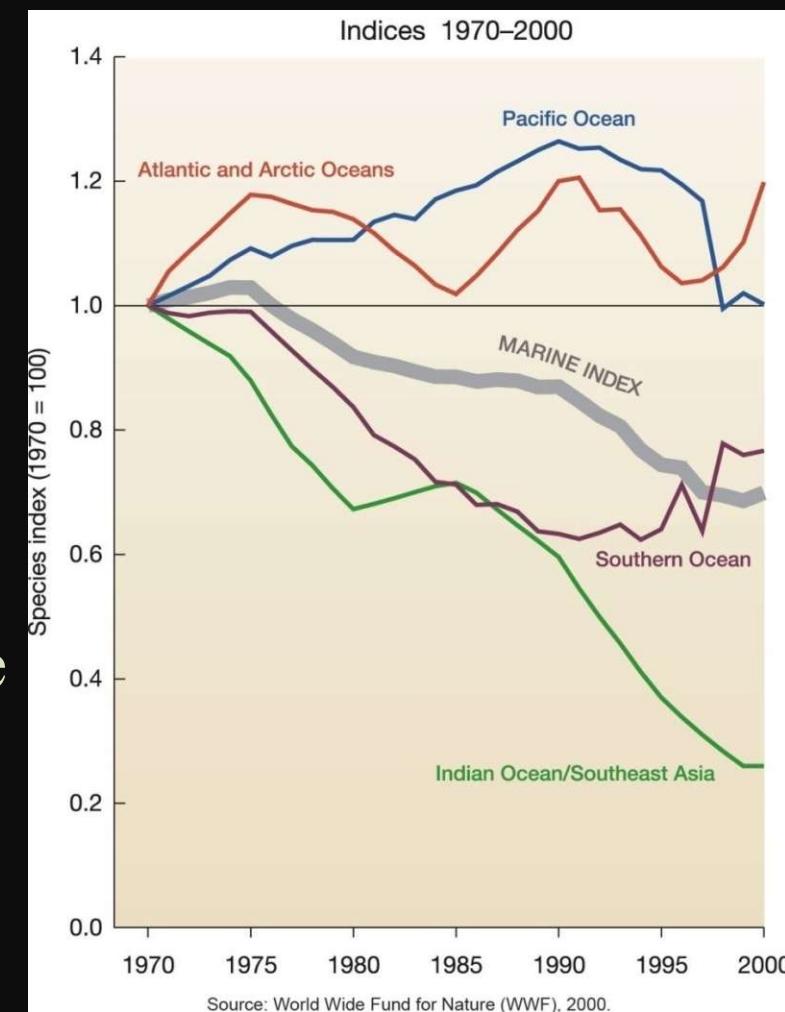
Opportunities

Health

Conservation of nature

Renewable energy

Population stabilization



Information

## Biodiversity Conservation

### *In situ*

Sacred groves and lakes

Biosphere Reserves

National parks, wildlife sanctuaries

Terrestrial

Marine

### *Ex situ*

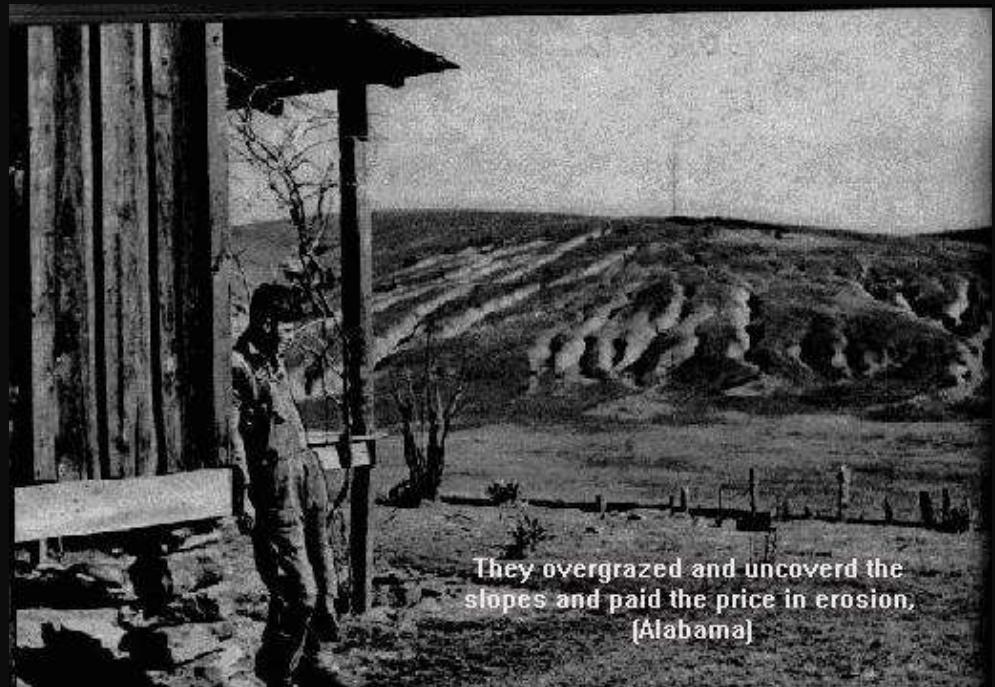
Sacred plant home garden

Seed Bank, Gene bank, Cryopreservation

Botanical garden, Zoological garden, Aquaria

# Food Supply Problems

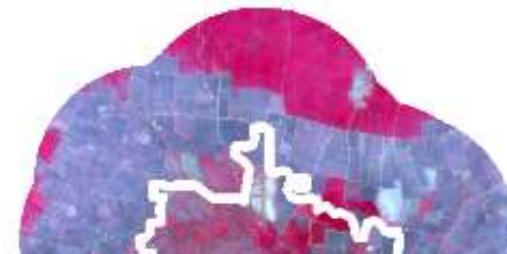
- *Overgrazing*
- *Farmland loss and degradation*
- *Wetlands loss and degradation*
- *Overfishing*
- *Coastal pollution*
- *Soil erosion*
- *Soil salinization*
- *Soil water logging*
- *Water shortages*
- *Groundwater depletion*
- *Loss of biodiversity*
- *Poor nutrition*



They overgrazed and uncovered the slopes and paid the price in erosion.  
[Alabama]

# KOLLERU LAKE

Kolleru (2016)



Year	Other Vegetation	Aquaculture	Visible Lake
1988	495.72	150.34	27.07
1996	402.19	243.91	14.09
2009	330.46	315.69	12.65
2016	369.73	266.78	0



Toposheet of 1955: 231.22 Sq.Km



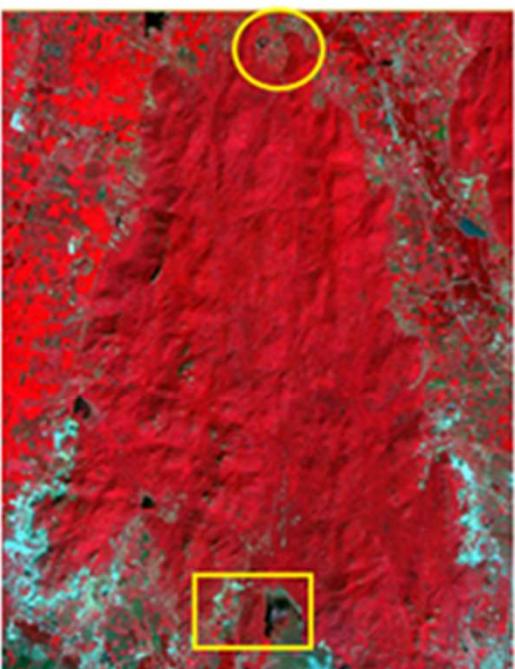
1990



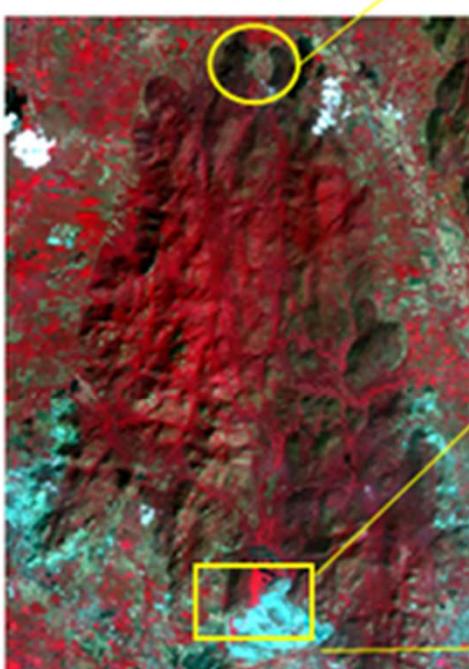
2000



Water body changed to agriculture



2009



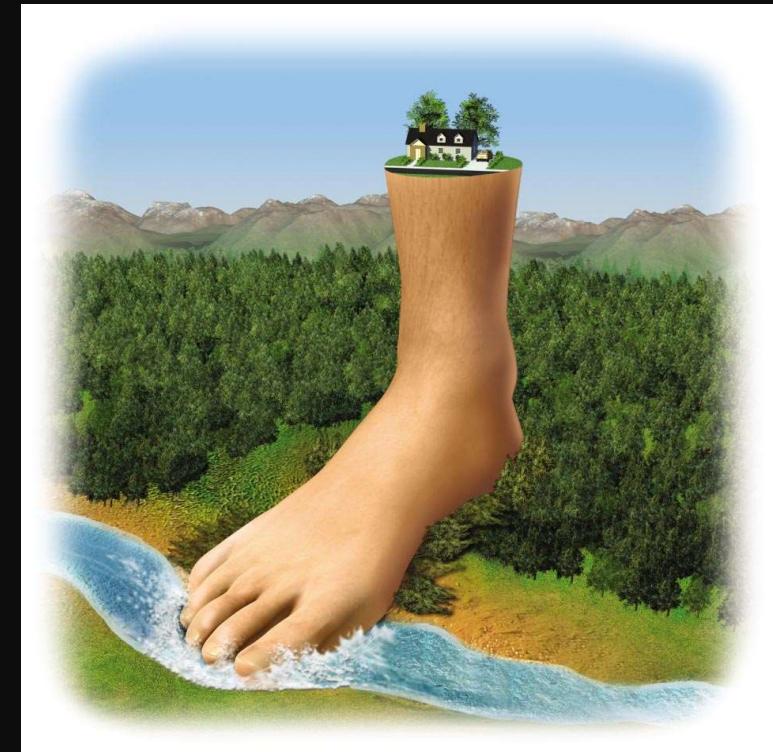
2015



Water body with vegetation and Ash pond

# The “ecological footprint”

- *The total area of land & water needed to produce the resource a person uses, plus the total amount of land and water area needed to dispose of its waste (ha).*  
~ *measure of resource and waste a person needed for his/her lifestyle.*
- *Higher in developed societies/nations*



*2.7 global ha -World Ave.  
(2019)*

$(1 \text{ ha} = 2.47 \text{ acre} = 108,000 \text{ ft}^2)$

*We are using 30% more (overshoot) of the planet's resources than are available on a sustainable basis!*

# The Ecological Footprint

## MEASURES

how fast we consume resources and generate waste



Energy



Settlement



Timber & Paper



Food & Fiber



Seafood

COMPARED TO

how fast nature can absorb our waste and generate new resources.



Carbon Footprint



Forest

Built-up land

Cropland & Pasture

Fisheries

Biocapacity is the capacity of a given biologically productive area to generate a supply of renewable resources and to absorb its wastes

World Biocapacity (EF at sustainable level): 1.63 global ha. This means there is a global deficit of 1.1 global hectares per person (Average world EF=2.7 gha)

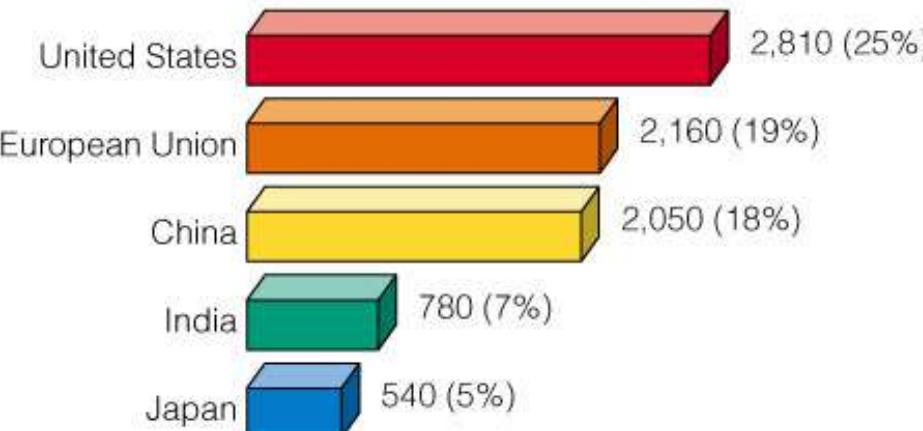
Ecological footprints and biocapacities vary greatly between countries.

A country's footprint and biocapacity depend on several factors including its geography, population size, and environmental policies

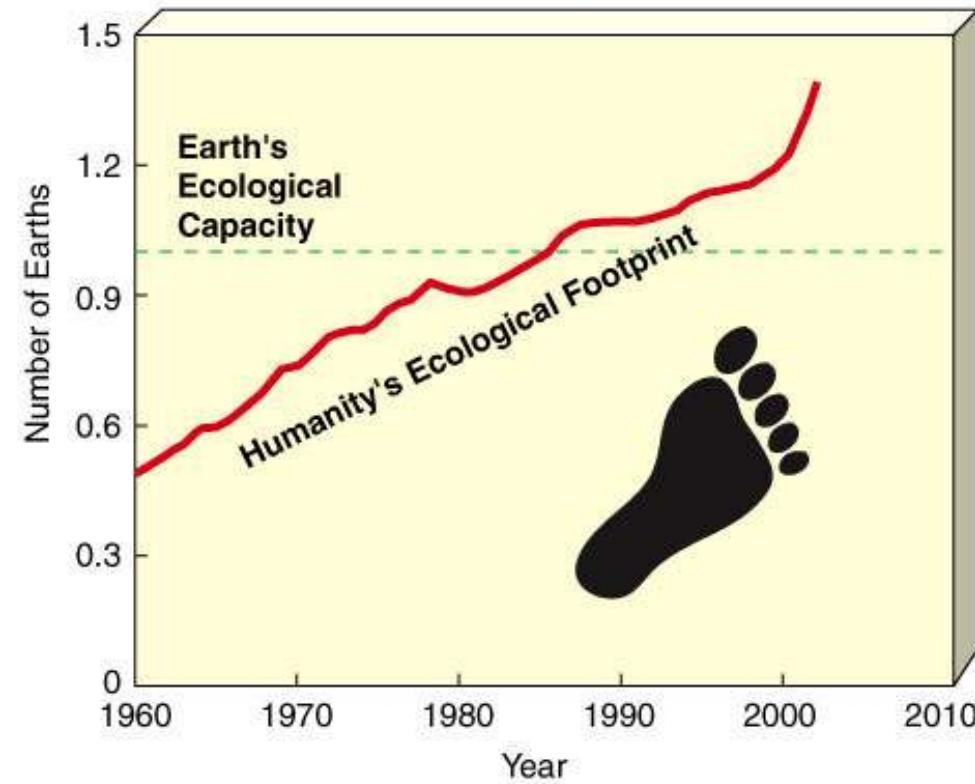
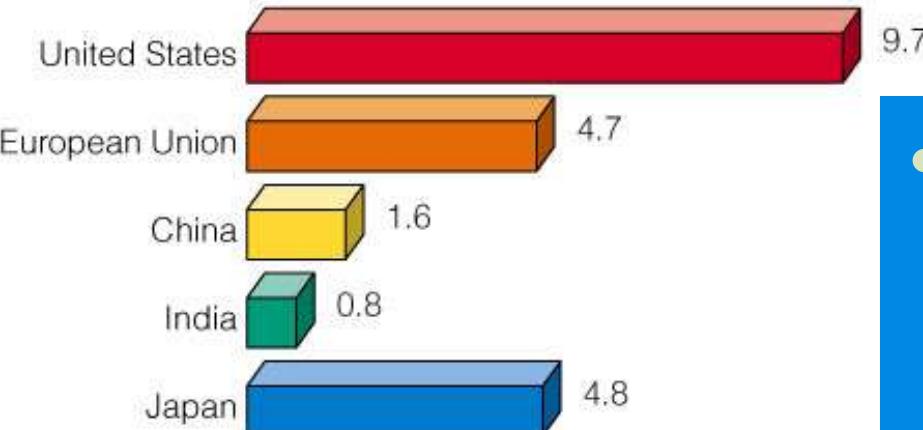
<https://worldpopulationreview.com/country-rankings/ecological-footprint-by-country>

# *Our Ecological Footprint*

Total Footprint (million hectares) and Share of Global Ecological Capacity (%)



Footprint Per Person  
(hectares per person)



- *Humanity's ecological footprint has exceeded earths ecological capacity.*

© 2007 Thomson Higher Education

You can calculate your own foot print at <https://www.footprintcalculator.org/signup>

# Earth Overshoot Day

*Previously known as Ecological Debt Day (EDD)*



*It is the date when humanity annual demand on nature exceeds what earth can regenerate over the entire year*

*In 2018, nature budget for the entire year has already been used up in the span of 8 months only*

*It means humanity is currently using nature 1.75 times faster than Earth ecosystems can regenerate*

*In 2019, Earth Overshoot Day is on July 29*

*This year overshoot falls two days earlier than last year*

$EOD = (\text{World Biocapacity} / \text{World Ecological Footprint})$

X 365



# EARTH OVERSHOOT DAY

THE DAY BY WHICH WE USE UP THE YEAR'S SUPPLY OF NATURAL RESOURCES!

In less than eight months, human consumption has been more than what the Earth can provide for the entire year. In economic terms, today we go into ecological deficit spending. This day is Earth Overshoot Day - and the date has been moving forward each year.

2018

01 AUGUST

152 DAY OVERDRAFT

2007

15 AUGUST

138 DAY

1997

30 SEPTEMBER

92 DAY

1987

24 OCTOBER

68 DAY

1977

01 NOVEMBER

60 DAY



1.7 EARTHS NEEDED

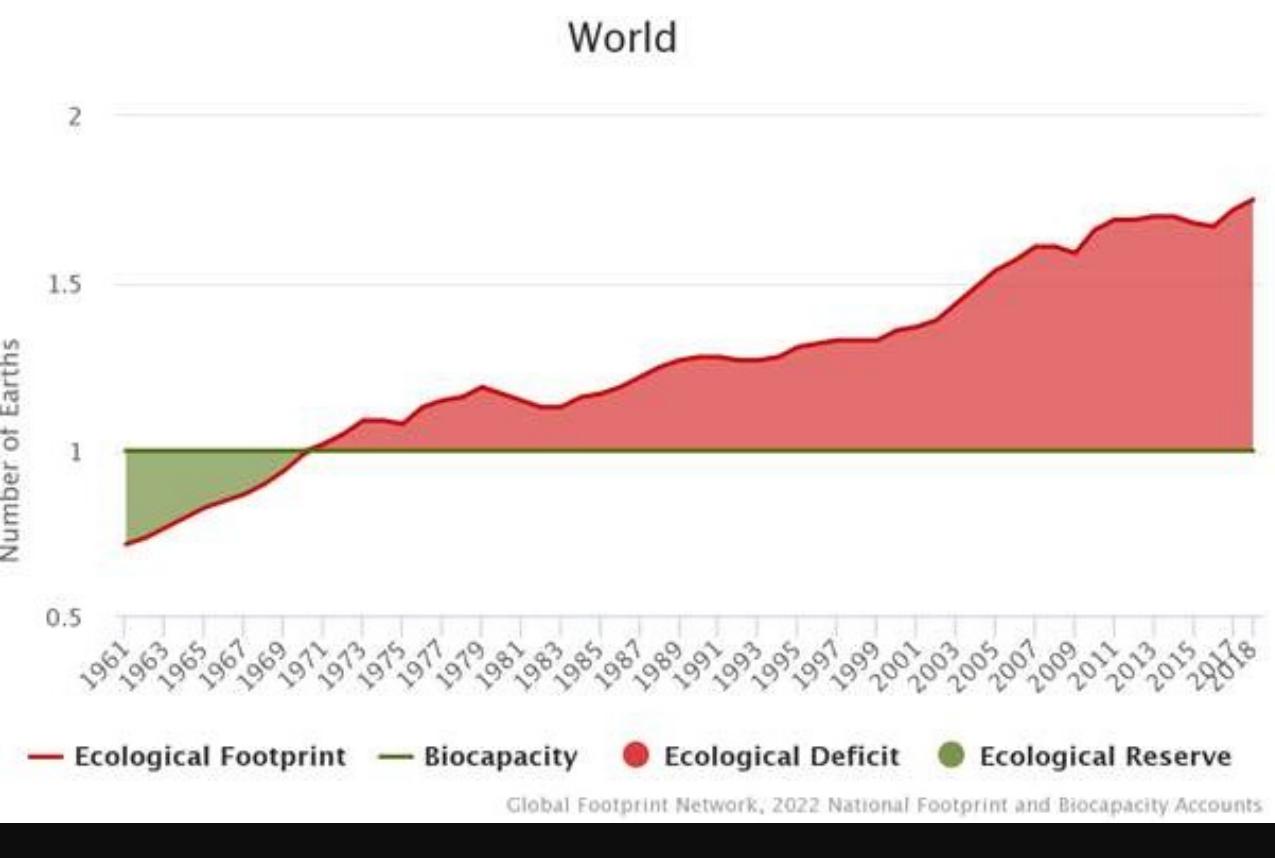
1 EARTH



LET'S PLEDGE TO MAKE THE RIGHT CONSUMPTION CHOICES FOR THE PLANET!

# How many Earths do we need

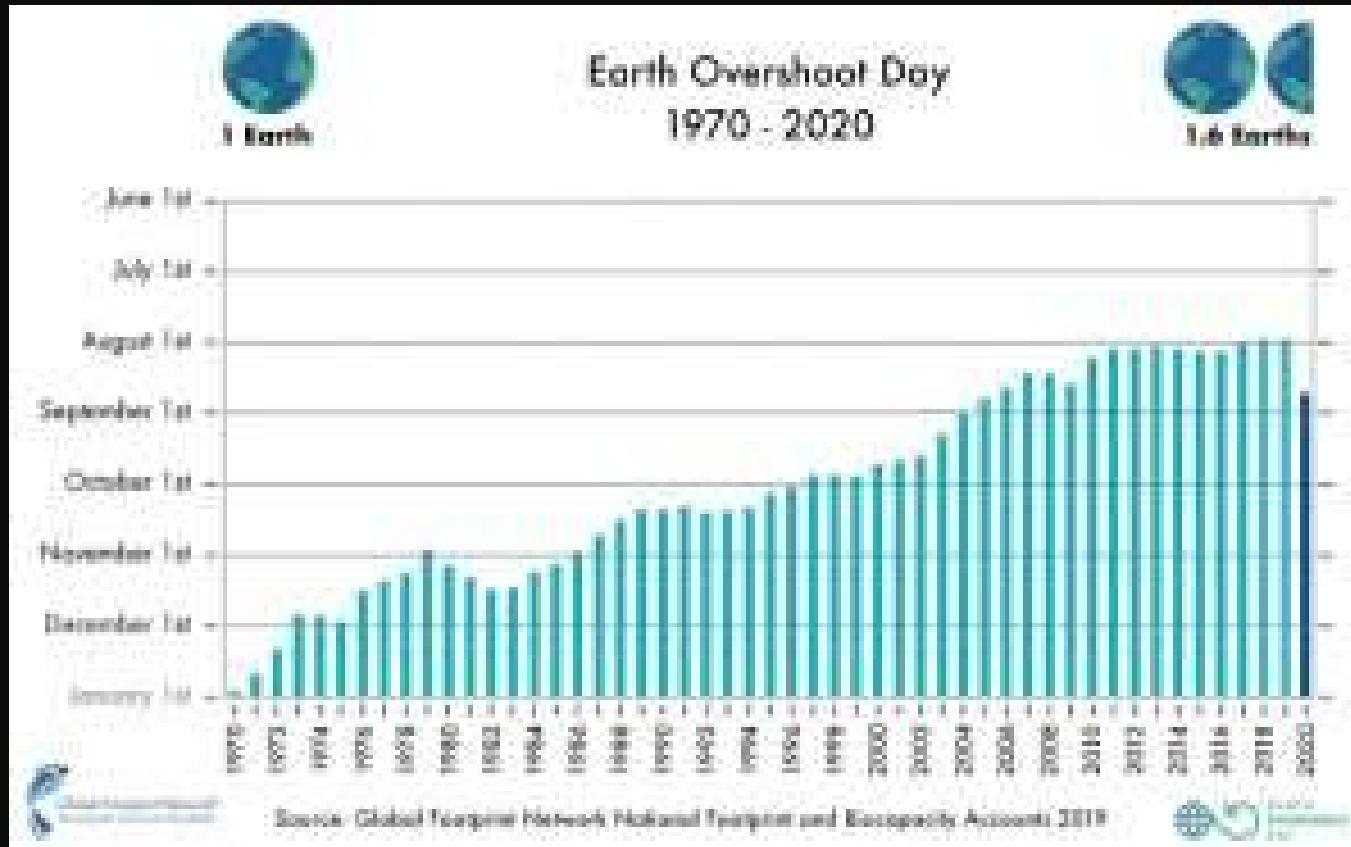
if the world's population lived like...



U.S.A.	5.0	5
Australia	4.1	4
South Korea	3.5	3
Russia	3.3	3
Germany	3.0	3
Switzerland	2.9	2
U.K.	2.9	2
France	2.8	2
Japan	2.8	2
Italy	2.6	2
Spain	2.3	2
China	2.2	2
Brazil	1.8	1
India	0.7	1
<b>World</b>	<b>1.7</b>	<b>2</b>

Source: Global Footprint Network National Footprint Accounts 2018

In 2020, Earth Overshoot Day is August 22,  
more than three weeks later than last year



**Earth Overshoot Day 2021 fell on July 29**

**Earth Overshoot Day 2022 fell on July 28**

**Earth Overshoot Day 2023 fell on August 2**

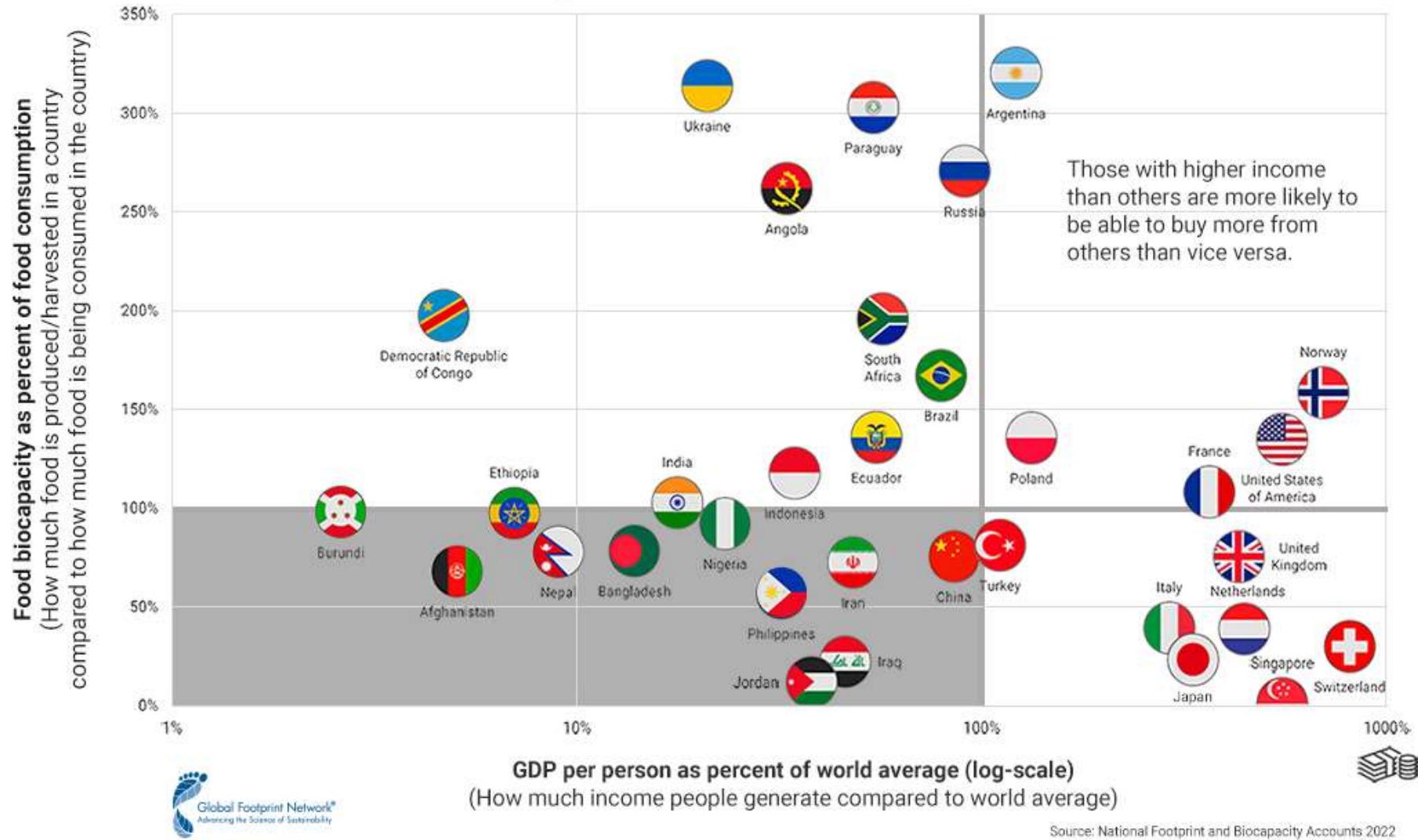
<https://www.overshootday.org/2021-calculation/>

<https://www.footprintnetwork.org/2020/06/05/press-release-june-2020-earth-overshoot-day/>



# Food security in a world of overshoot

**Food biocapacity as percent of food consumption**  
(How much food is produced/harvested in a country compared to how much food is being consumed in the country)

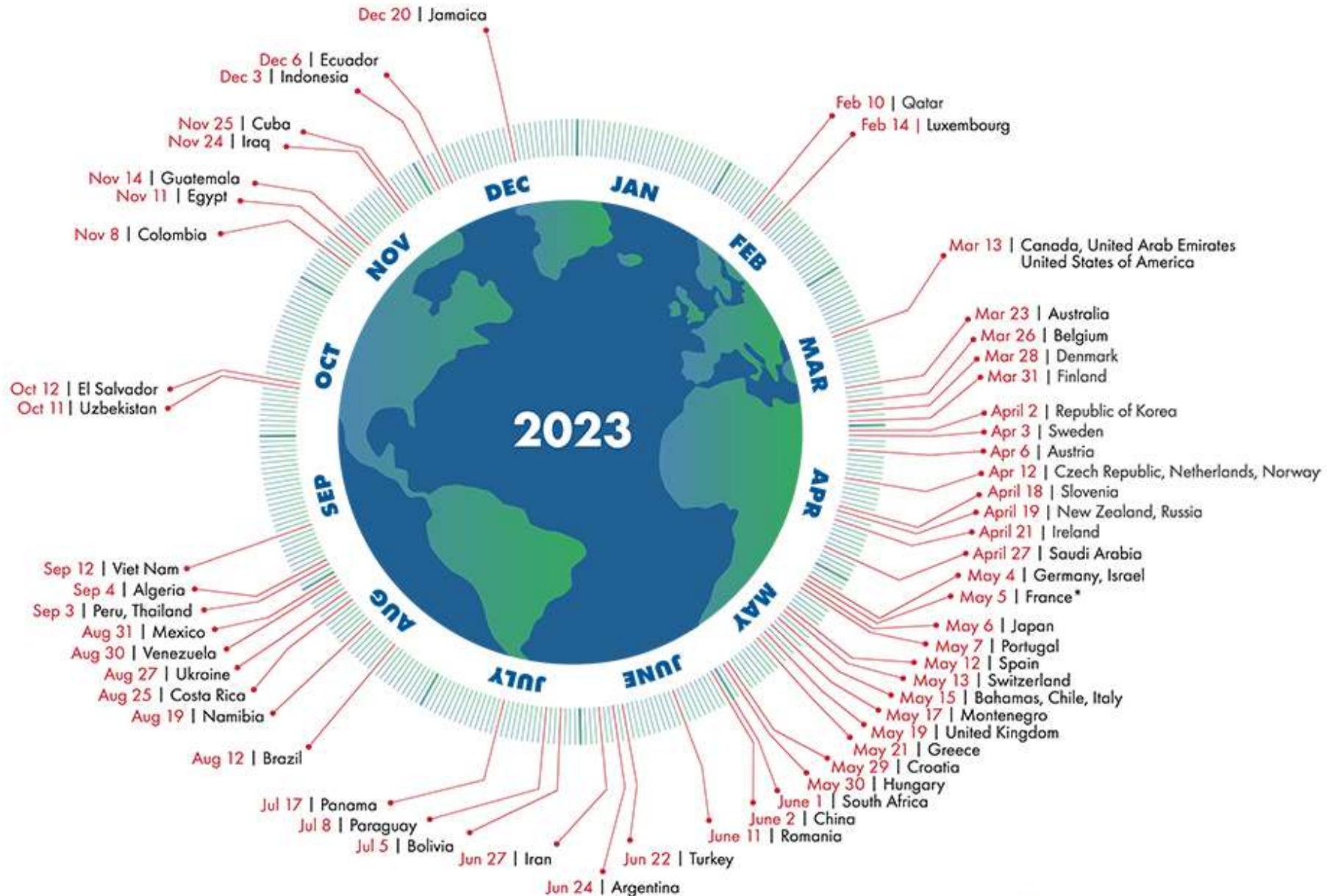


Source: National Footprint and Biocapacity Accounts 2022

Figure Countries' positions in terms of relative income and domestic food biocapacity. Countries in the bottom left quadrant generate less per person income than the world average, and consume more food than its agricultural biocapacity provides. For example, Nepal only produces 78% of the amount of food that it consumes. This risk is amplified by the country's financial disadvantage: its income per person is merely 9% of the world average. Countries with low income and lacking in food biocapacity are therefore particularly exposed to food insecurity.

# Country Overshoot Days 2023

When would Earth Overshoot Day land if the world's population lived like...



For a full list of countries, visit [overshootday.org/country-overshoot-days](https://overshootday.org/country-overshoot-days).

\*French Overshoot Day based on nowcasted data. See [overshootday.org/france](https://overshootday.org/france).

Source: National Footprint and Biocapacity Accounts, 2022 Edition  
[data.footprintnetwork.org](https://data.footprintnetwork.org)

# Human Dimensions of Environmental Science

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© The New Yorker Collection 1992. Lee Lorenz from cartoonbank.com. All Rights Reserved.

To get an average American through the day takes about 450 kg (nearly 1,000 lbs) of raw materials, including 18 kg (40 lbs) of fossil fuels, 13 kg (29 lbs) of other minerals, 12 kg (26 lbs) of farm products, 10 kg (22 lbs) of wood and paper, and 450 liters (119 gal) of water. Every year, Americans throw away some 160 million tons of garbage, including 50 million tons of paper, 67 billion cans and bottles, 25 billion styrofoam cups, 18 billion disposable diapers, and 2 billion disposable razors.

Sir, Earth is dying,  
what are we gonna do with  
the billions of dollars we have  
to survive..

Oh.. don't worry..  
We'll use those  
Billions of dollars  
For going to Mars..



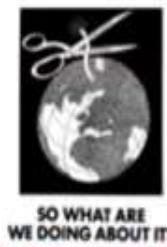
Blaming environmental problems on overpopulation scapegoats the world's poorest people, who are least responsible for carbon emissions. The richest fifth of the world's people consume 66 times more resources than the poorest fifth.

Are we heading towards such a future?





"The Malthusian motive: the will to control the population of the poor rather than the consumption of the rich; the desire to eliminate poverty by reducing the numbers of the poor rather than the inequalities of society. . .



.... If we claim that there are too many people on the earth, then why are we so sure that we are not the excess ones --we westerners who individually consume and pollute as much as 50 or more African or Indian peasants? In all my years in the field of population, I have never one single time heard a member of the population establishment say that there were too many upper-middle class white Anglo-Saxon Protestants in the world."

--Pierre Pradervand, Africa Report (1974)



## Time for them to die

How has it become so acceptable to wish catastrophe upon billions?

# "The Malthusian Motive"

V. Shreisha,  
2020102054



**Table 1.1 Quality-of-Life Indicators**

	Least-Developed Countries	Most-Developed Countries
GDP/Person <sup>1</sup>	(U.S.)\$329	(U.S.)\$30,589
Poverty Index <sup>2</sup>	78.1%	~0
Life Expectancy	43.6 years	76.5 years
Adult Literacy	58%	99%
Female Secondary Education	11%	95%
Total Fertility <sup>3</sup>	5.0	1.7
Infant Mortality <sup>4</sup>	97	5
Improved Sanitation	23%	100%
Improved Water	61%	100%
CO <sub>2</sub> /capita <sup>5</sup>	0.2 tons	13 tons

<sup>1</sup>Annual gross domestic product<sup>2</sup>Percent living on less than (U.S.)\$2/day<sup>3</sup>Average births/woman<sup>4</sup>Per 1,000 live births<sup>5</sup>Metric tons/yr/person**Source:** UNDP Human Development Index, 2006.

# Indigenous peoples are guardians of much of the world's biodiversity

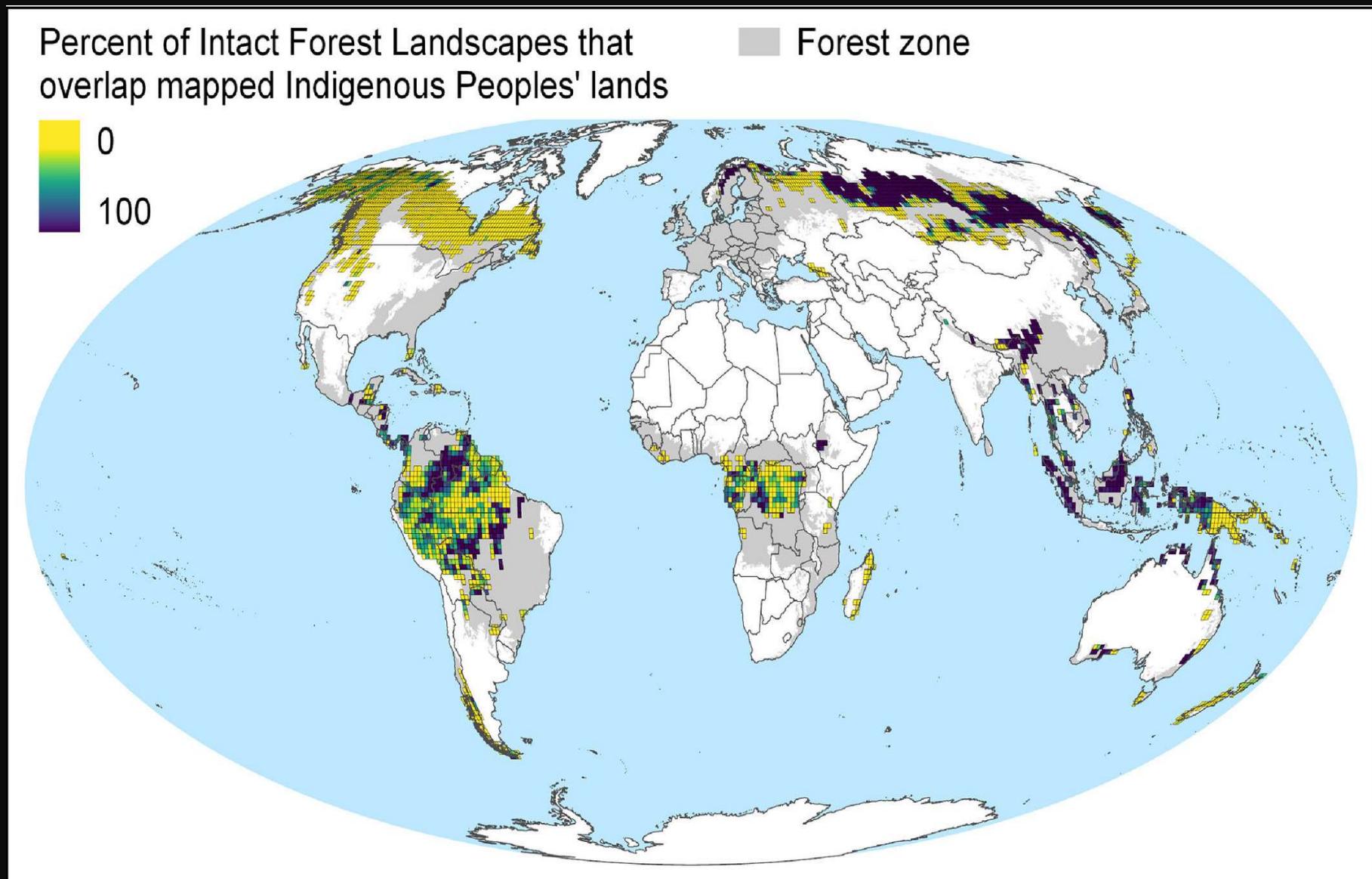
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© The McGraw-Hill Companies, Inc./Barry Barker, photographer

- *Often, the 500 million indigenous people who remain in traditional homelands still possess valuable ecological wisdom and remain the guardians of little-disturbed habitats*

# Importance of Indigenous Peoples' lands for the conservation of Intact Forest Landscapes



# **Conservation and Environmental Thought**

Pragmatic Resource Conservation

*(Utilitarian Conservation)*

Moral and Aesthetic Nature Preservation

*(Biocentric preservation)*

Modern Environmentalism

Global Environmental Citizenship