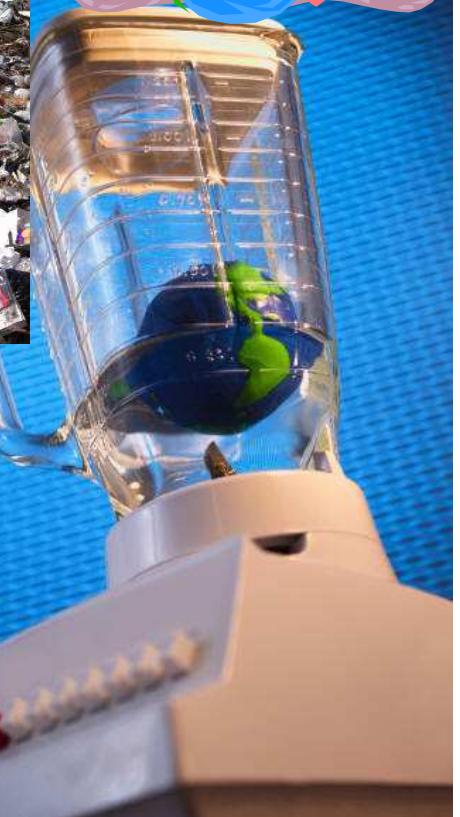
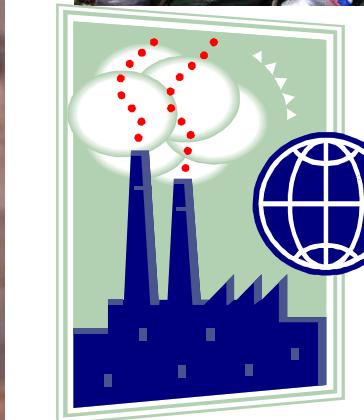
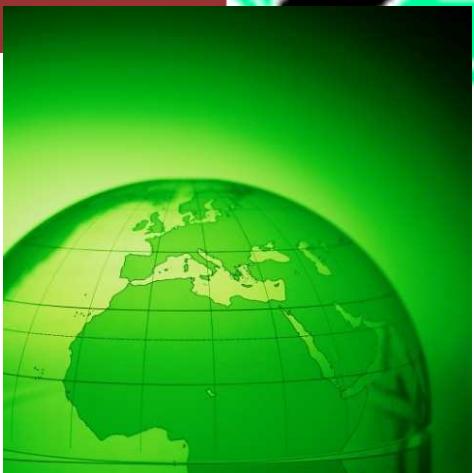
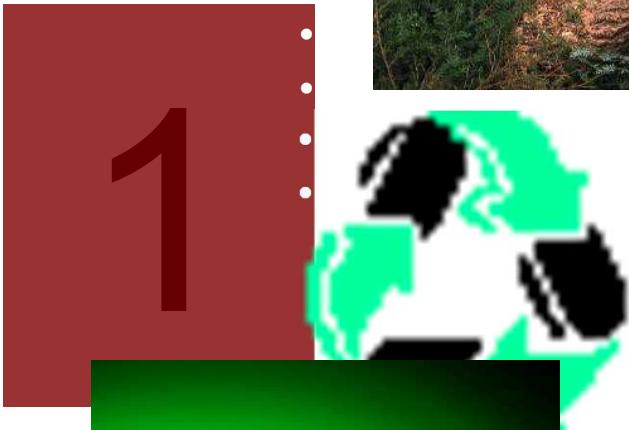


Comprehend Environment and its issues

Class-2
5th August 2025

Dr . P. Rama Chandra Prasad
Lab for Spatial Informatics

Environmental Science



Understanding Our Environment

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- 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

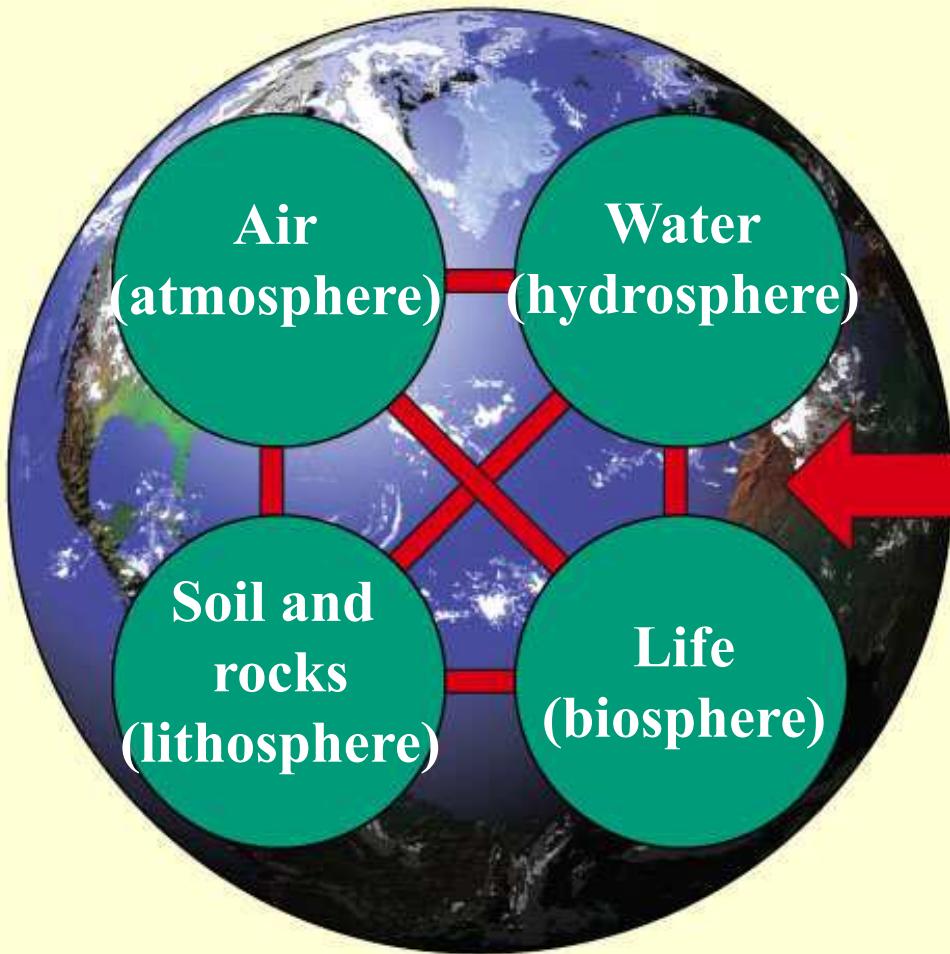
Environmental ethics



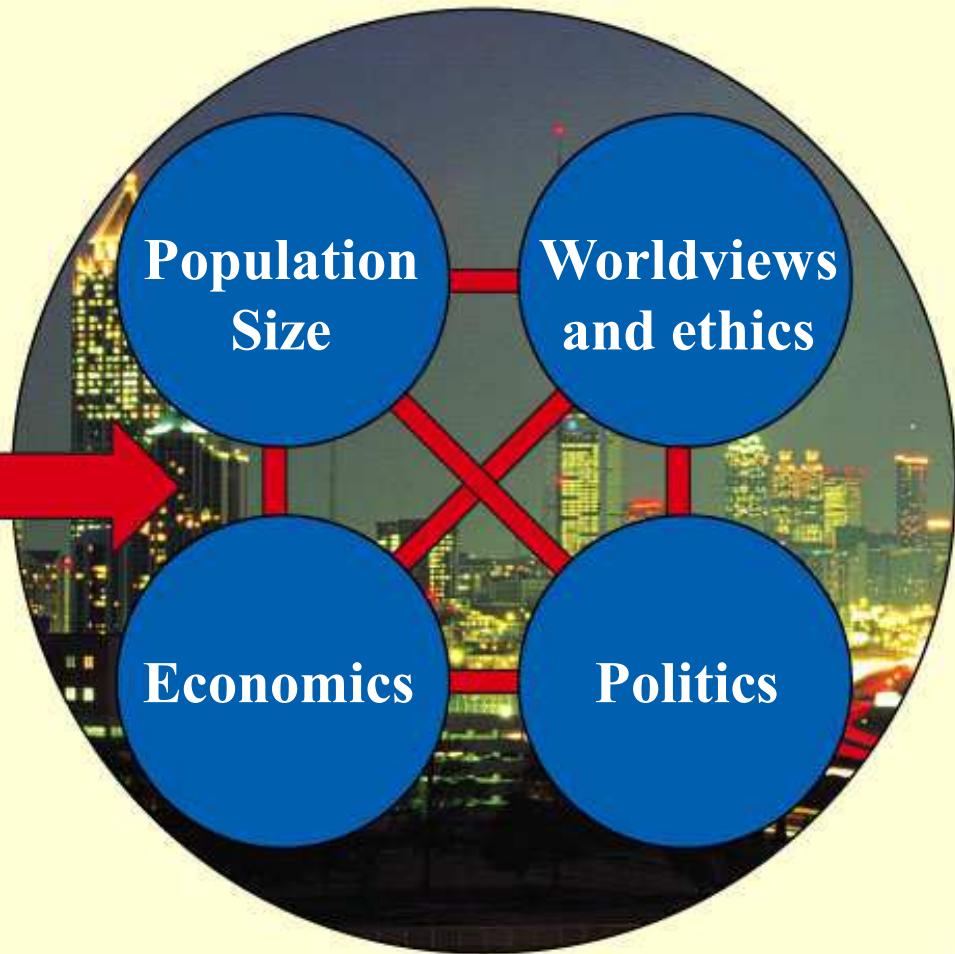
Environmental science is not environmentalism

ENVIRONMENTAL SCIENCE

Earth's Life-Support System

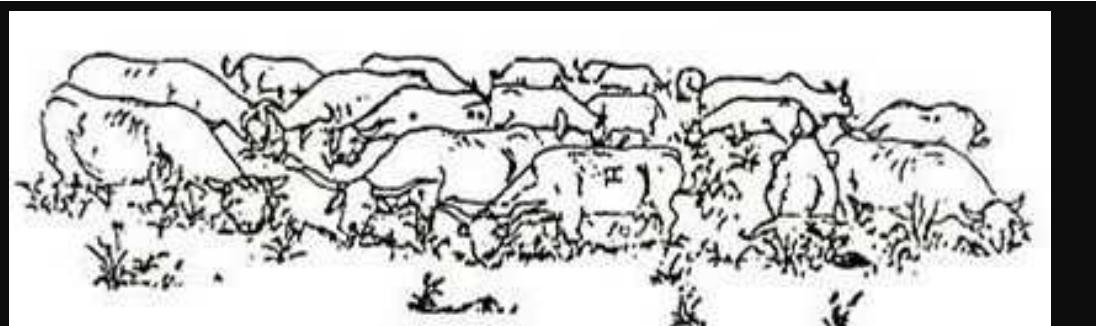


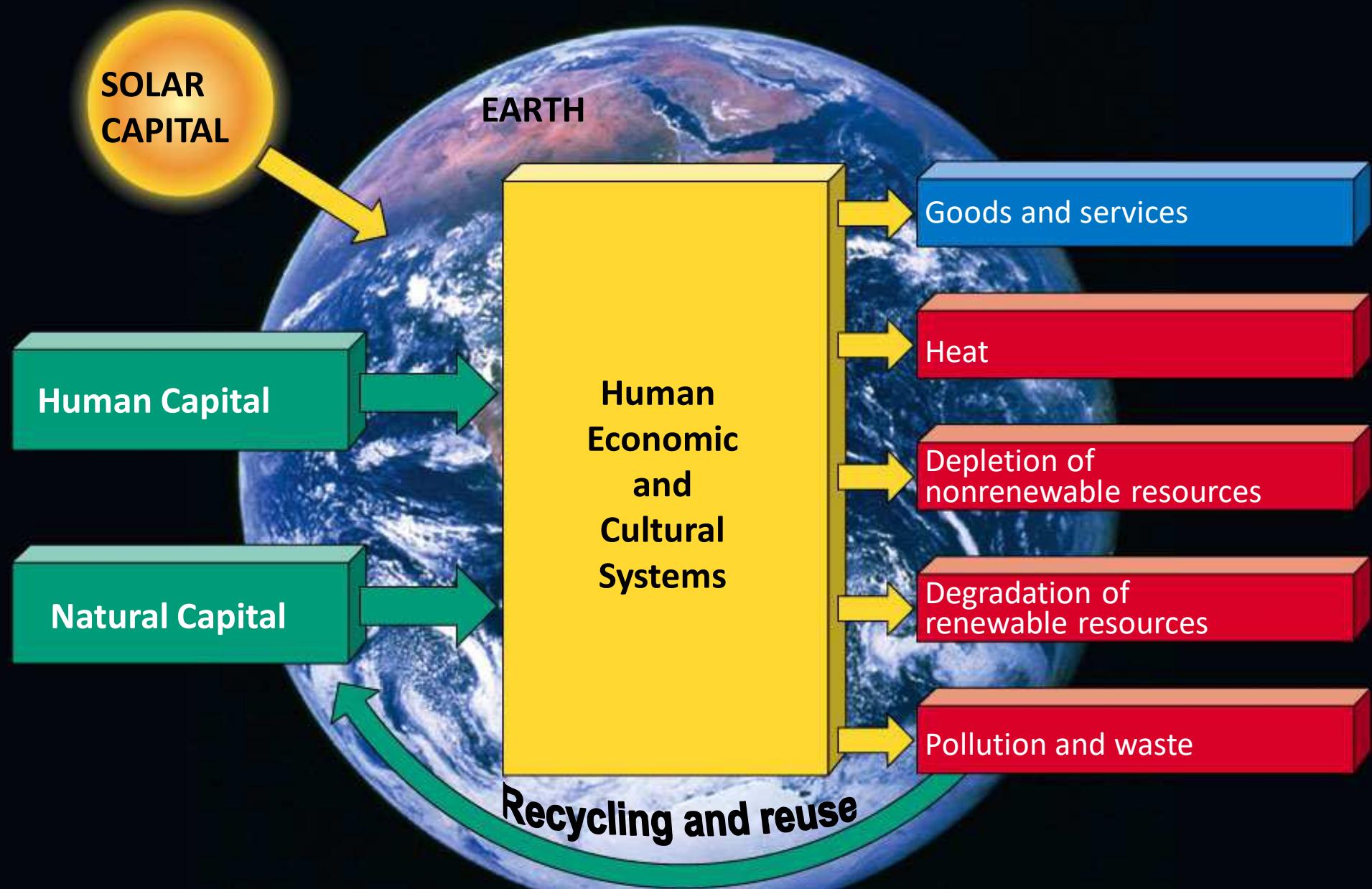
Human Culturesphere



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

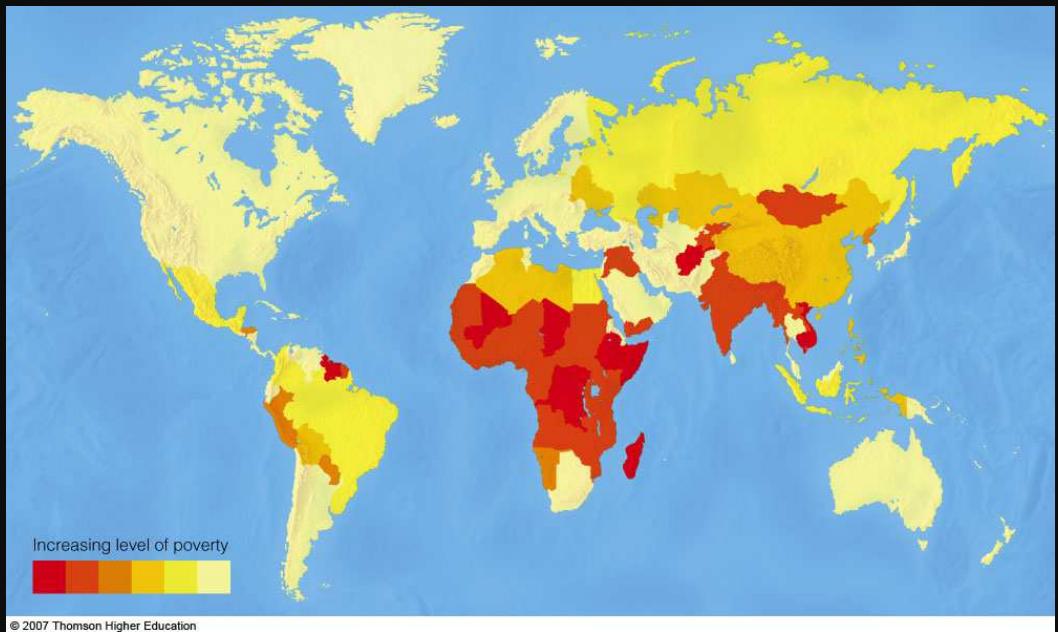
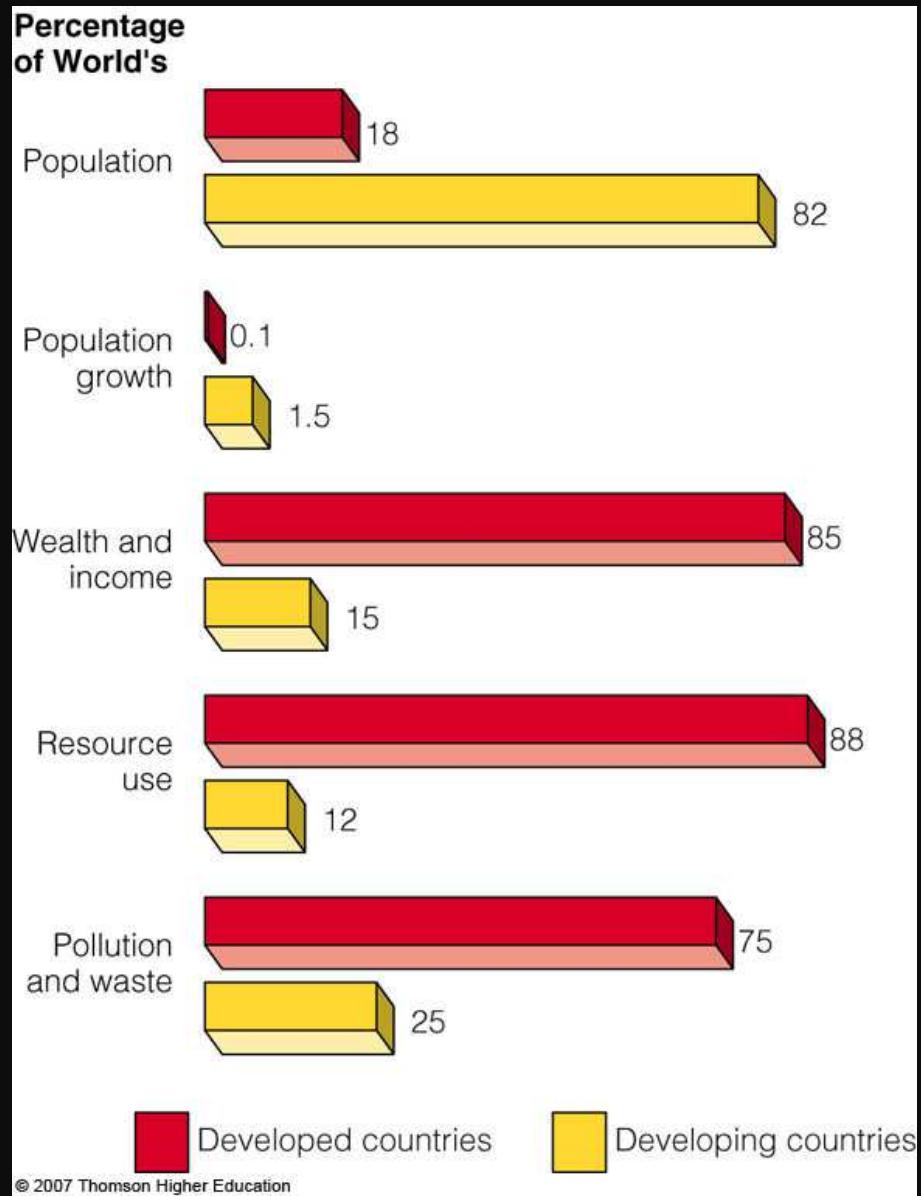
The graphic features five circular icons on a blue background, each representing a cause of environmental problems:

- Population growth**: An image of a diverse crowd of people.
- Unsustainable resource use**: An image of a pickup truck.
- Poverty**: An image of a person sitting on a concrete ledge.
- Not including the environmental costs of economic goods and services in their market prices**: An image of a forested hillside.
- Trying to manage and simplify nature with too little knowledge about how it works**: An image of a person working in a field of tall, yellow plants.

© 2007 Thomson Higher Education

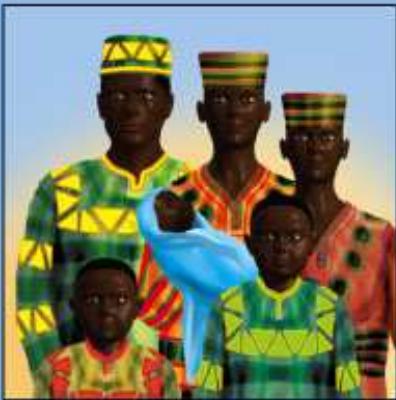
- *The exponential increasing flow of material resources through the world's economic systems depletes, degrades and pollutes the environment.*

Global Outlook



- Comparison of developed and developing countries.

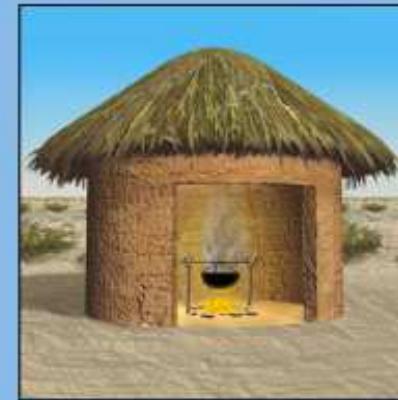
Developing Countries



X



X



=



Population (P)

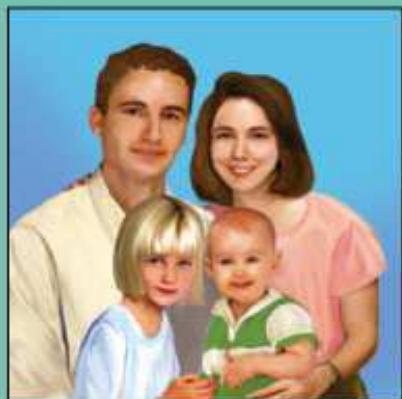
X

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)*

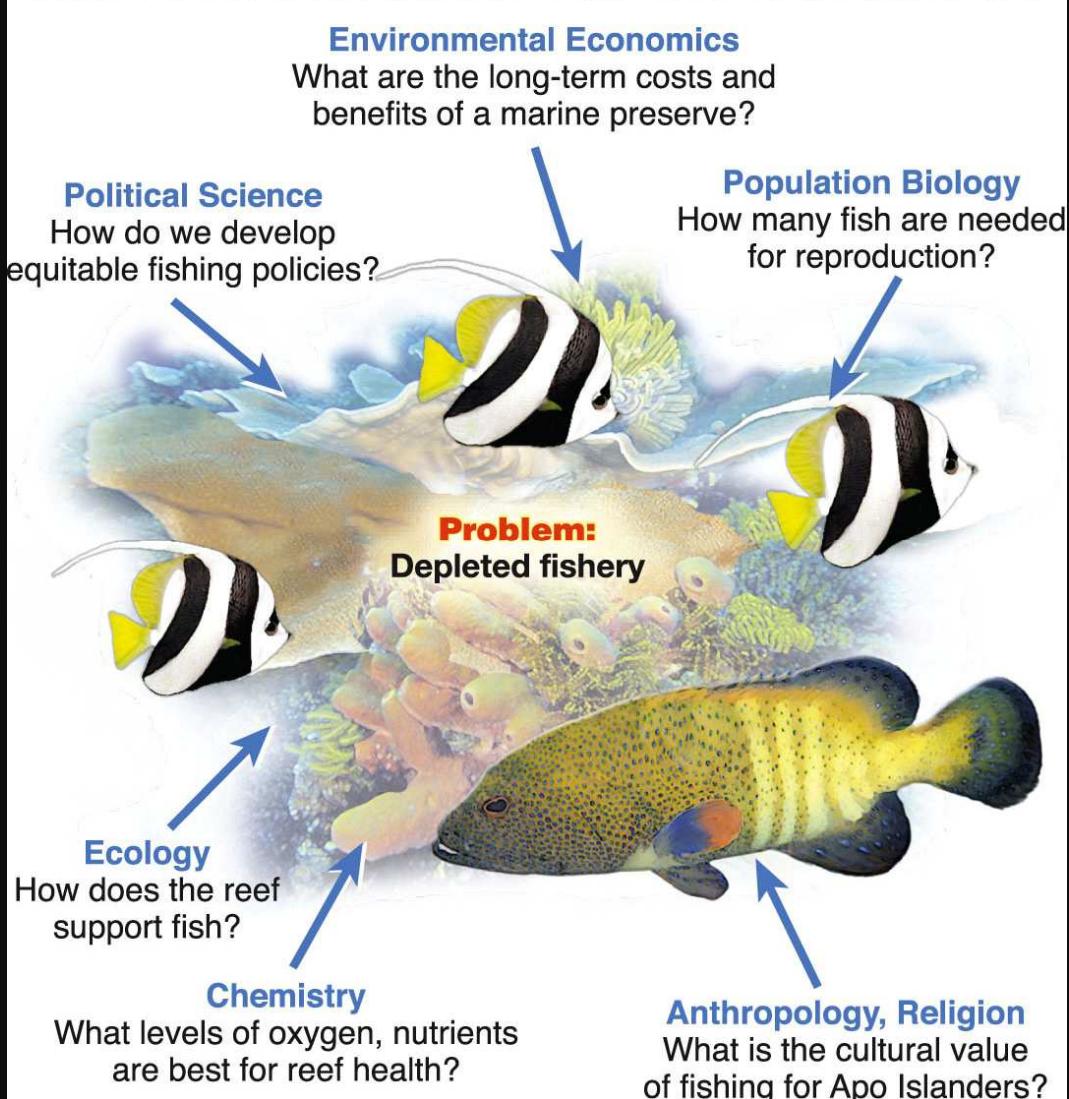


Germany, 1945

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

What is environmental science?

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- *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???

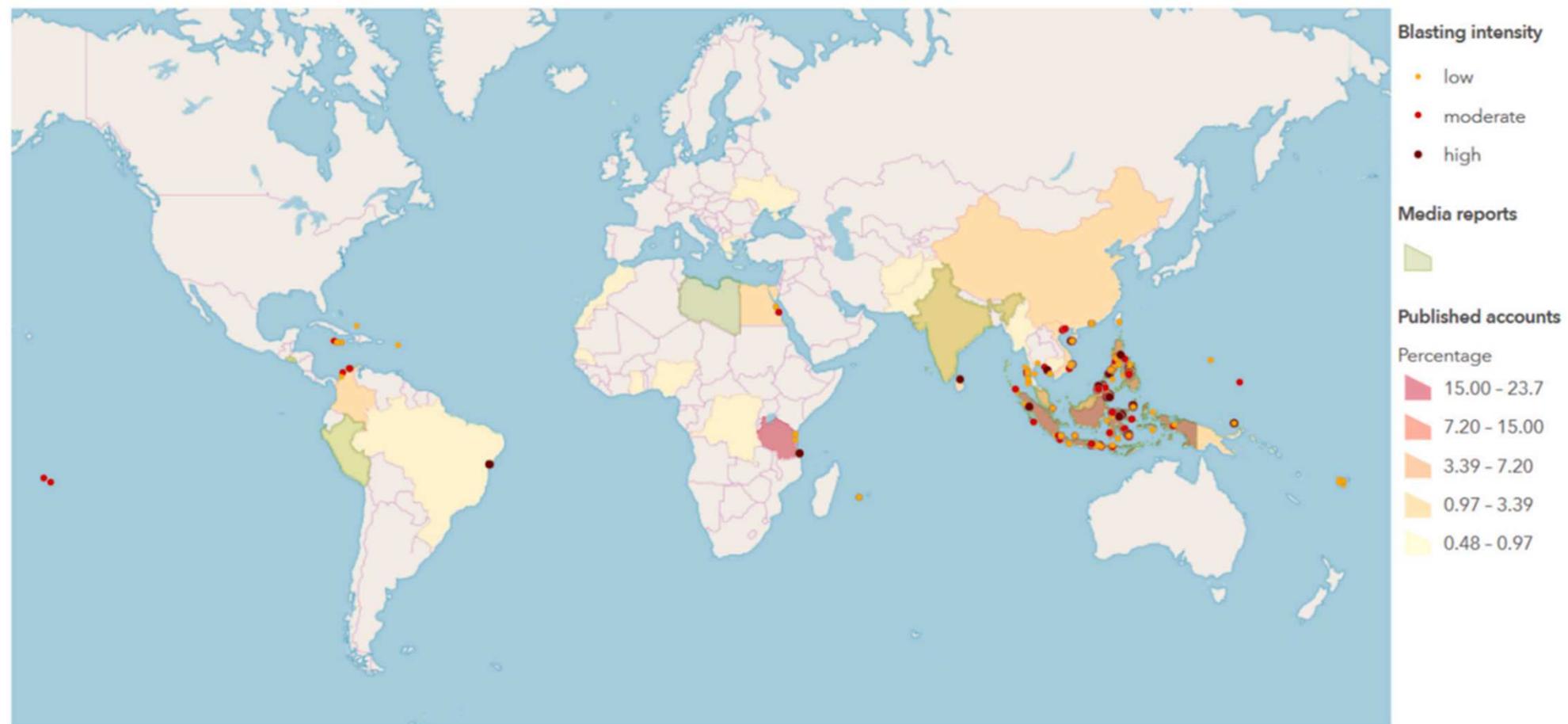
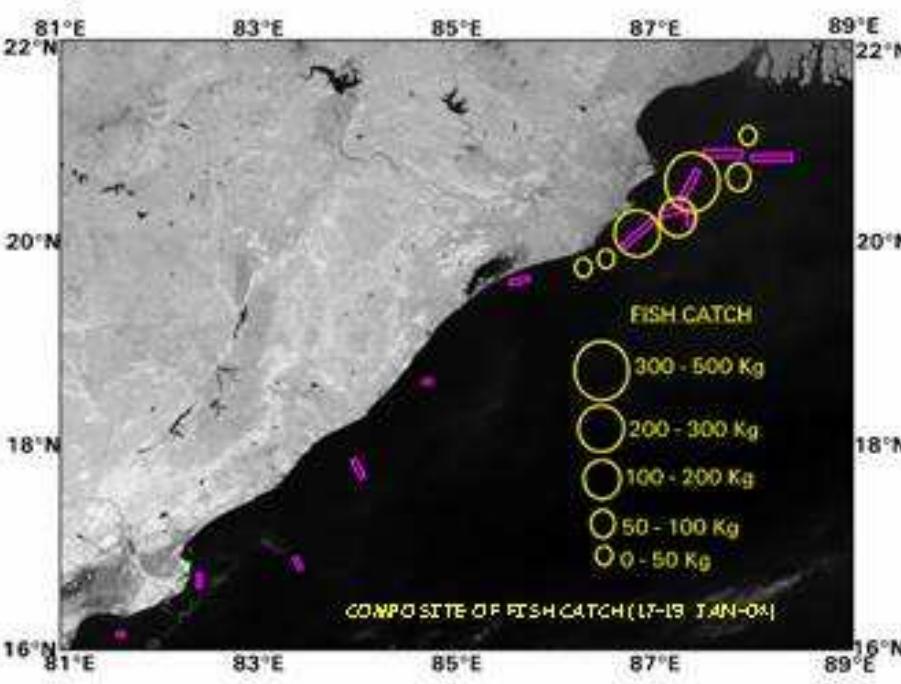
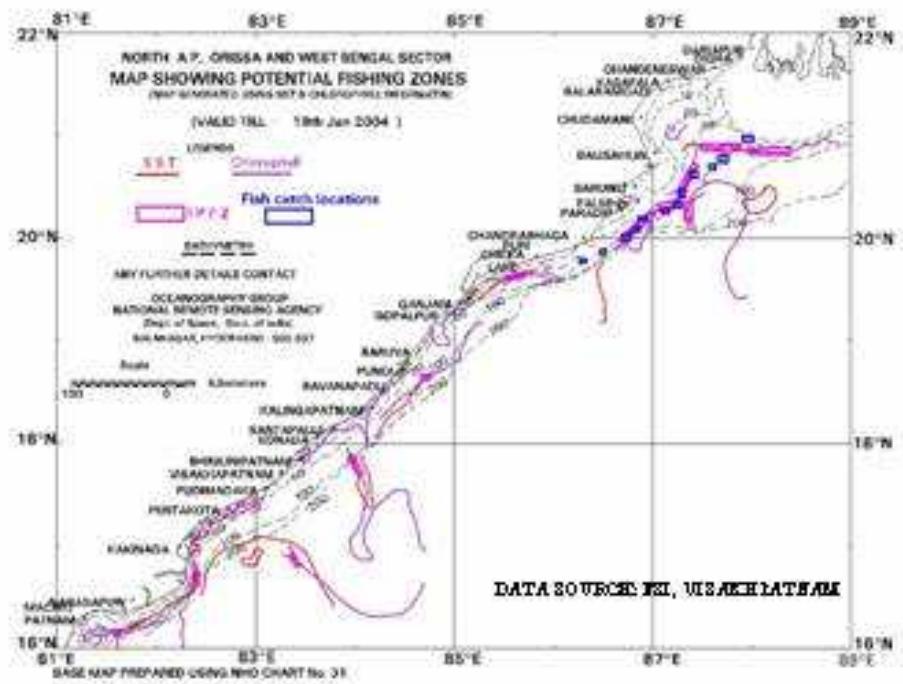
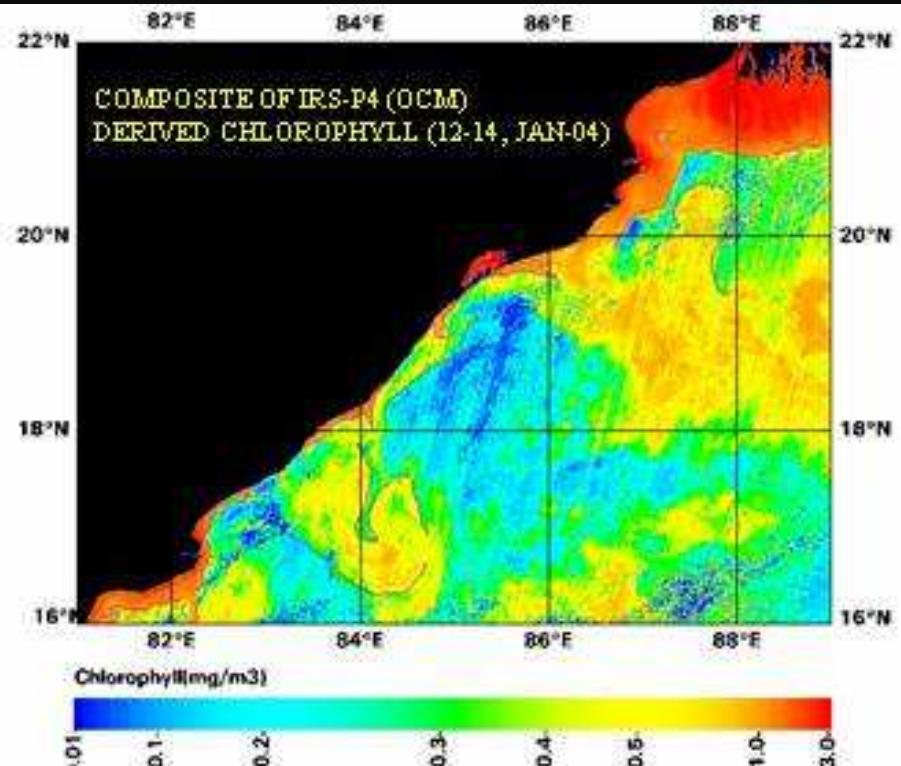
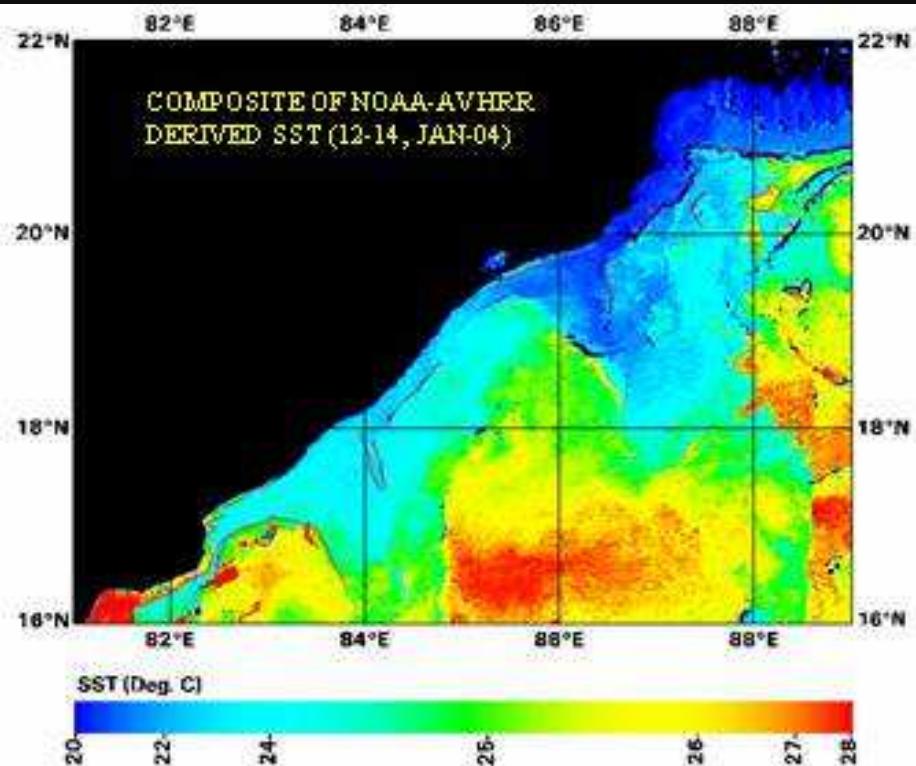


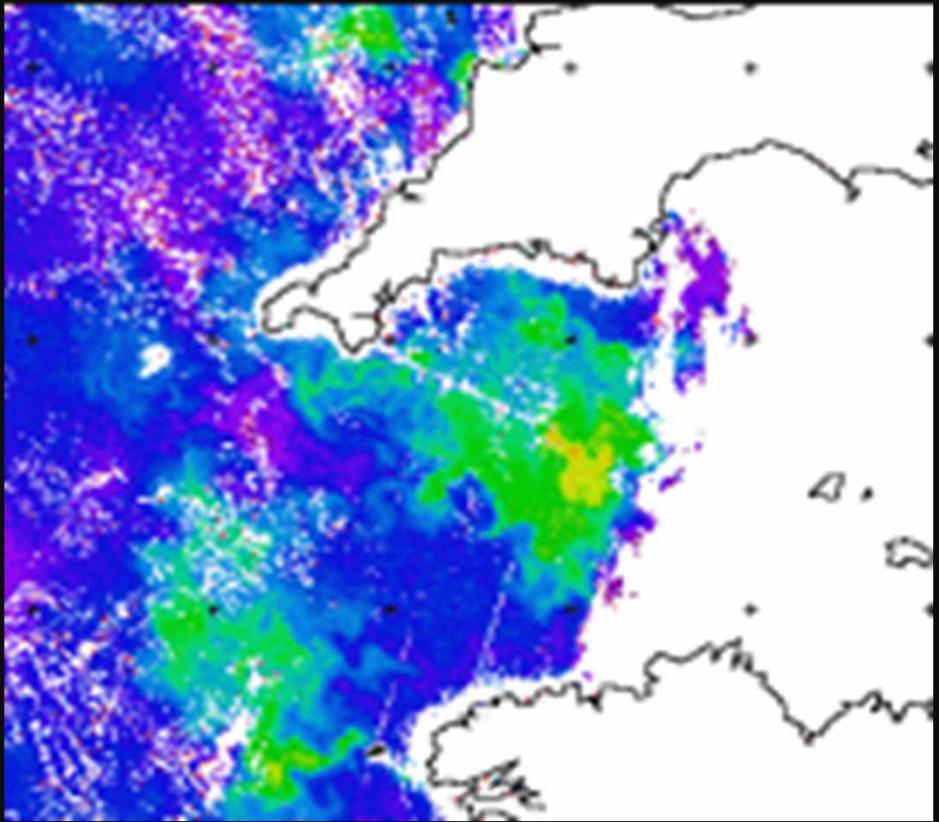
Fig. 2. Literature search results showing blast fishing intensity from 1997 to 2018, media reports of blasting, and the percentage of published articles with empirical evidence of blast fishing. Blast fishing intensity data obtained from [Reef Check \(2018\)](#) and used with permission.



Identification of HAB

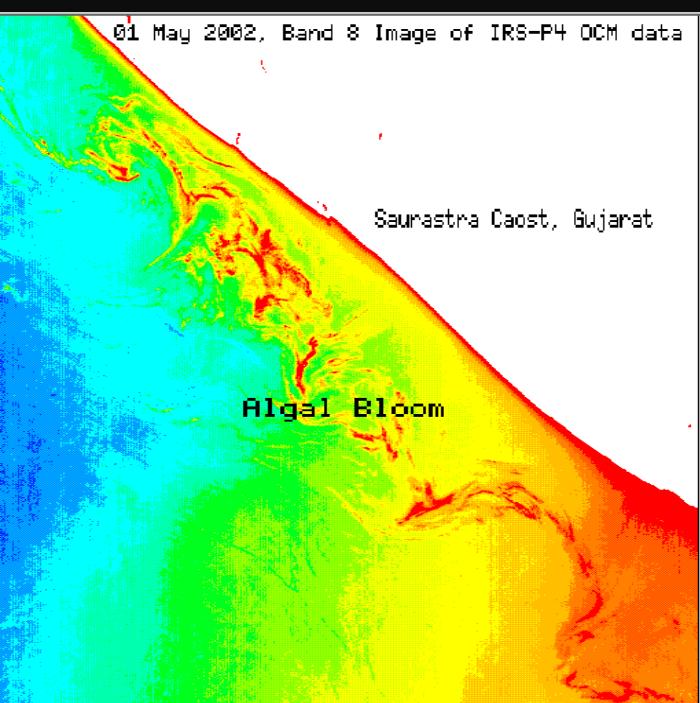


Surface accumulations of cyanobacteria *Nodularia* in the Baltic Sea as detected by enhanced "true-color" MODIS imagery on July 30, 2003



*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.*

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



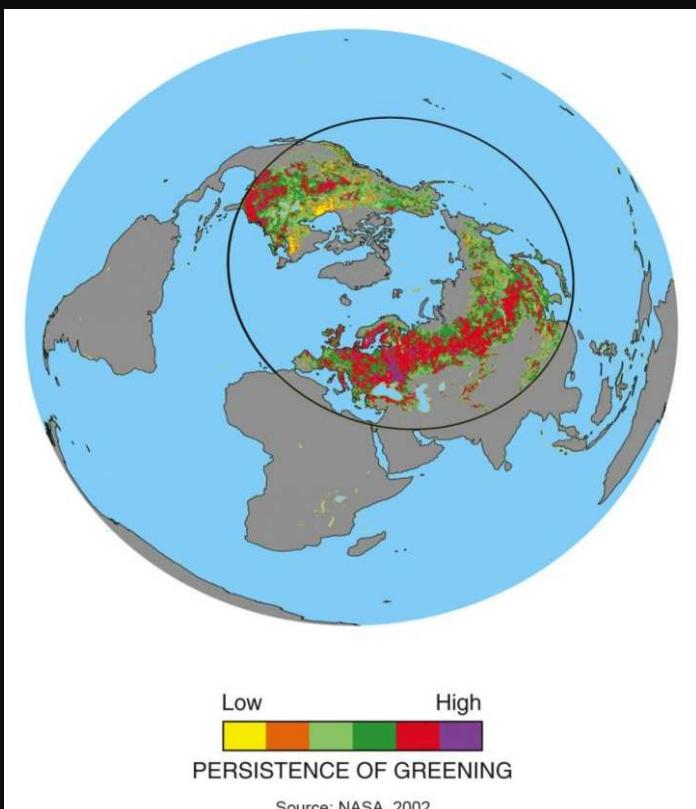
Environmental Problems

Clean Water

Air Quality

Food Supplies

Energy resources



Marine resources

Biodiversity loss

Climate Change

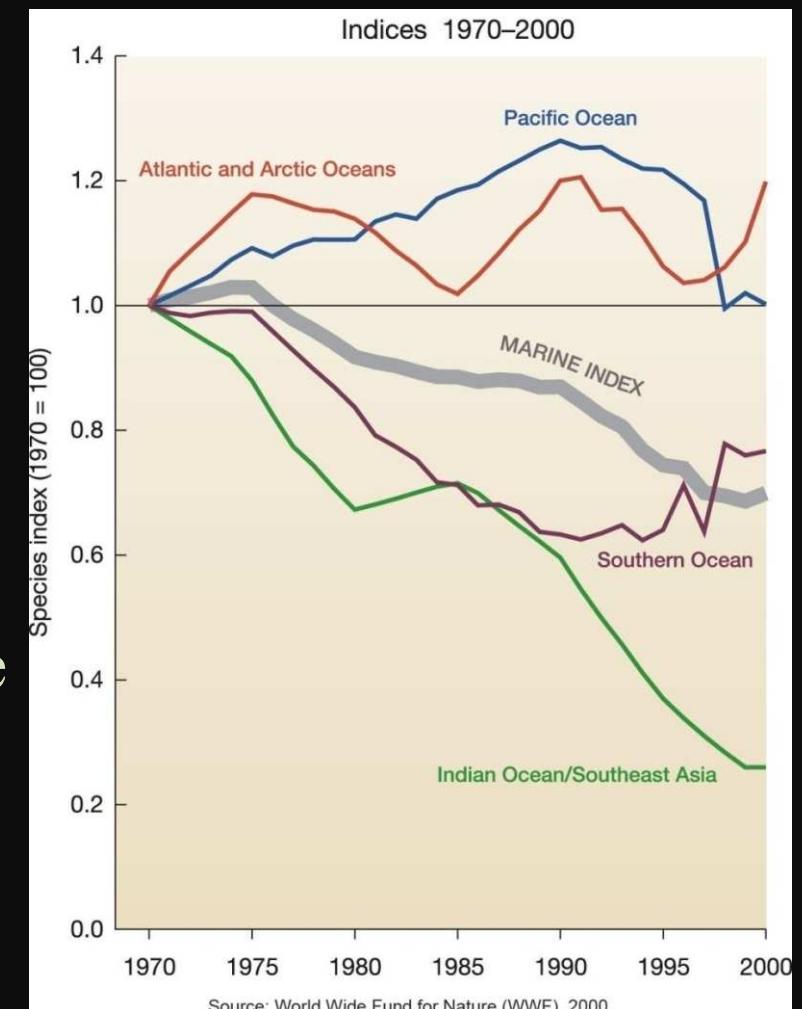
Opportunities

Health

Conservation of nature

Renewable energy

Population stabilization



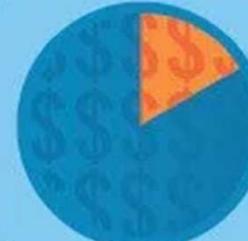
Information

FISH FEEL PAIN



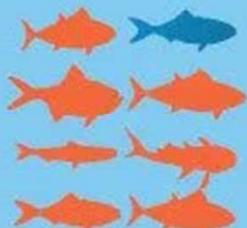
2050

IS THE YEAR SOME
EXPERTS SAY
WORLD FISHERIES
MAY COLLAPSE



\$50B

IS LOST EVERY YEAR
FROM MISMANAGED
FISHERIES



57%

OF THE WORLD'S FISH
STOCKS ARE ALREADY
FULLY EXPLOITED



90%

OF PREDATORY FISH:
TUNA, SHARKS,
SWORDFISH, COD
& HALIBUT ARE GONE!



300,000

WHALES AND DOLPHINS
ARE KILLED EACH YEAR
VIA BY-CATCH



LESS THAN 2%

OF THE WORLD'S
OCEANS ARE
PROTECTED

are projecting we will face a
barren ocean by 2048.



compassionate farming
education initiative

Biodiversity Conservation

In situ

Sacred groves and lakes

Biosphere Reserves

National parks, wildlife sanctuaries

Terrestrial

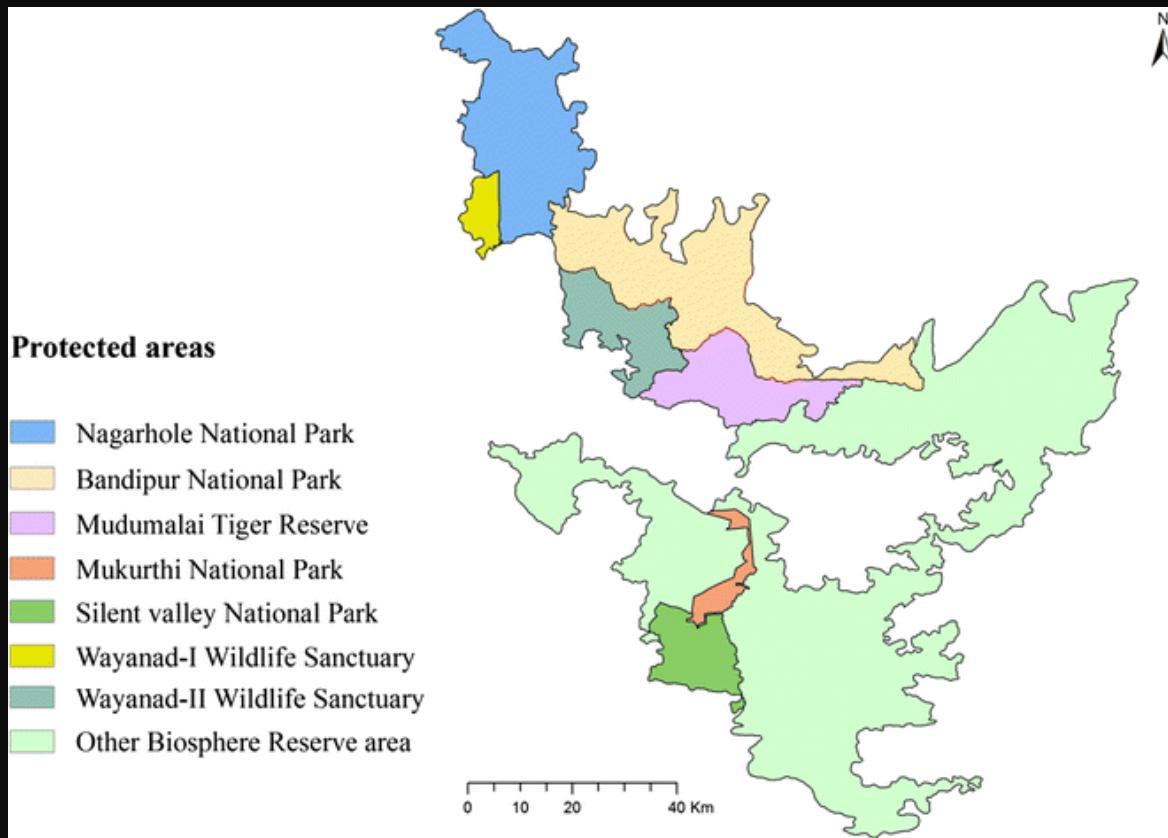
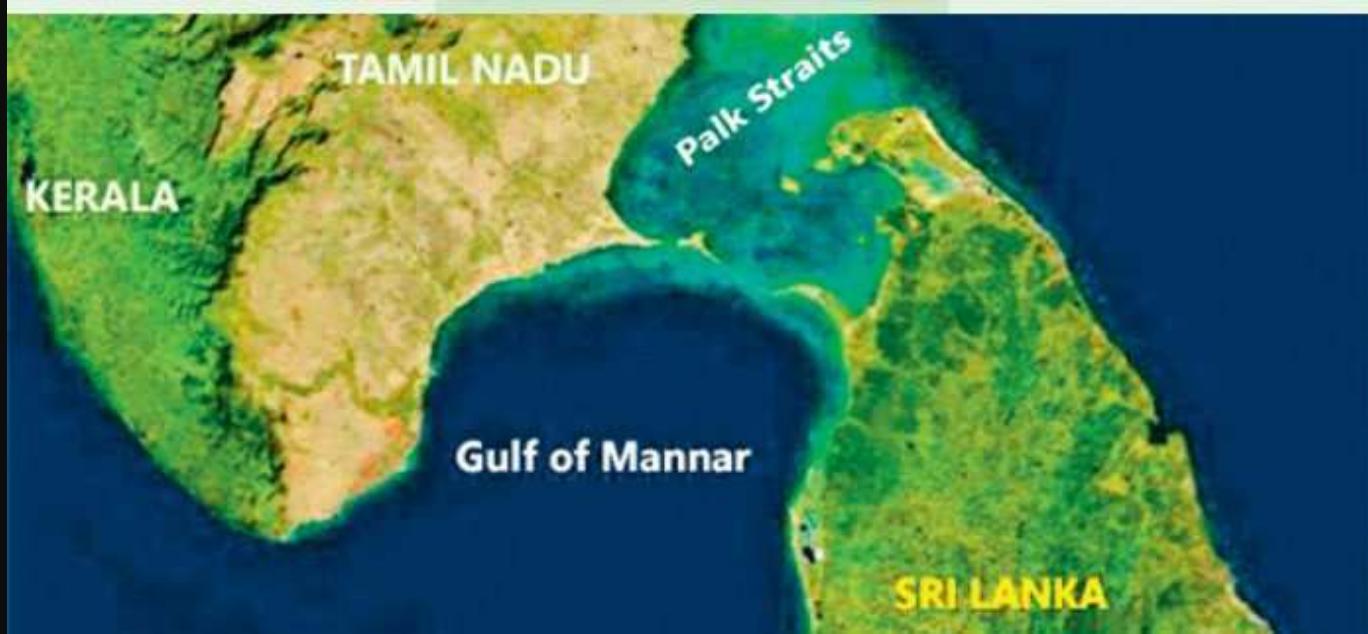
Marine

Ex situ

Sacred plant home garden

Seed Bank, Gene bank,
Cryopreservation

Botanical garden,
Zoological garden,
Aquaria



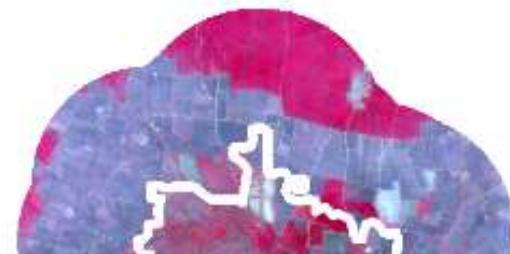
Food Supply Problems

- *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*



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



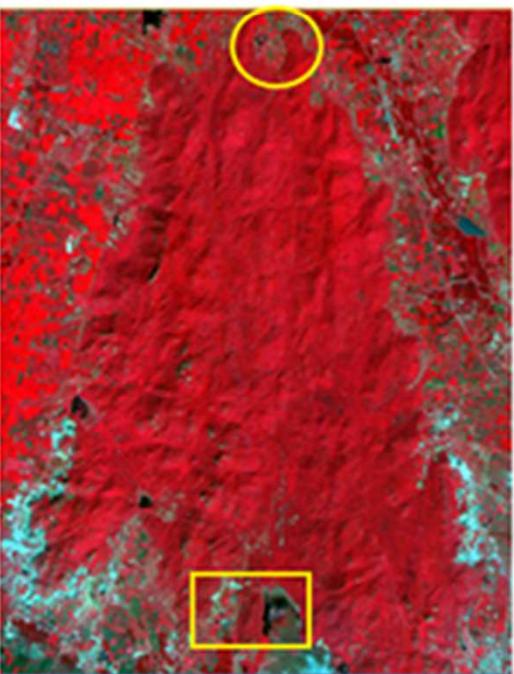
1990



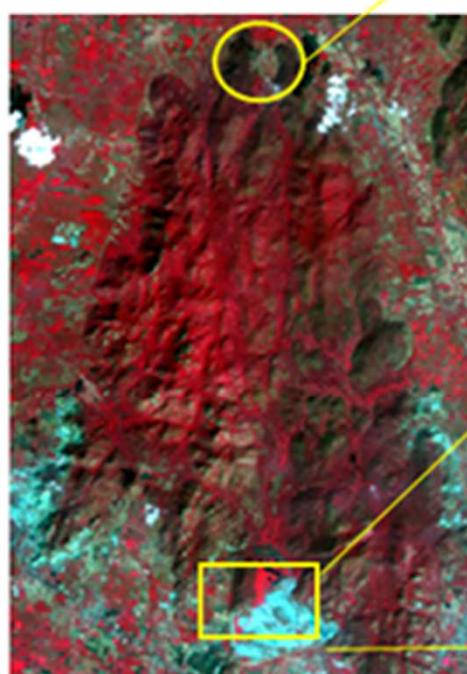
2000



Water body changed to agriculture



2009



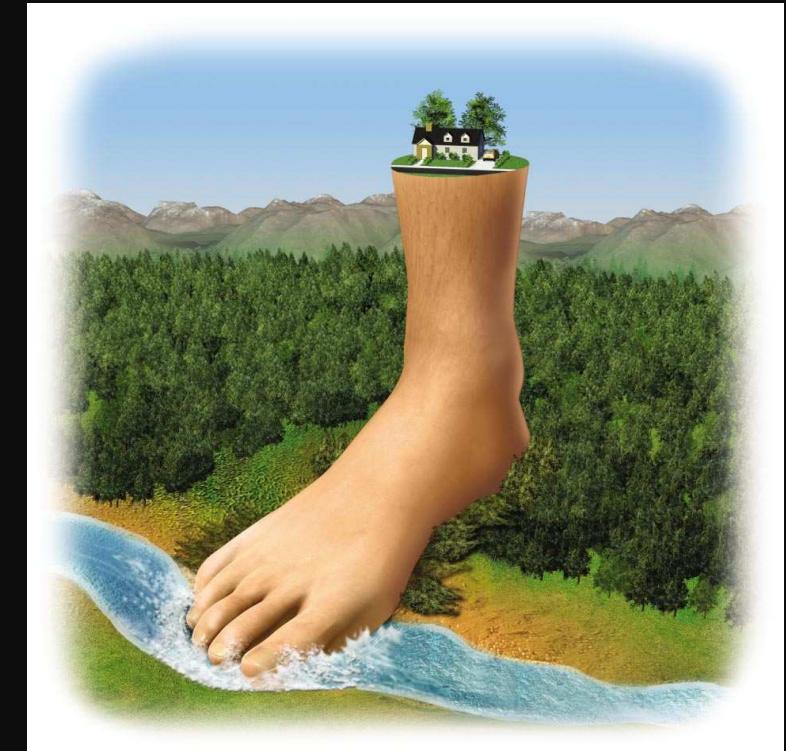
2015



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*



2.75 global ha per person-World Ave. (2023)

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

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



Carbon Footprint



Forest

Cropland & Pasture

Fisheries

COMPARED TO

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



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 label): 1.5 global ha.
This means there is a global deficit of 1.25 global hectares per person (Average world EF=2.75 gha)

.

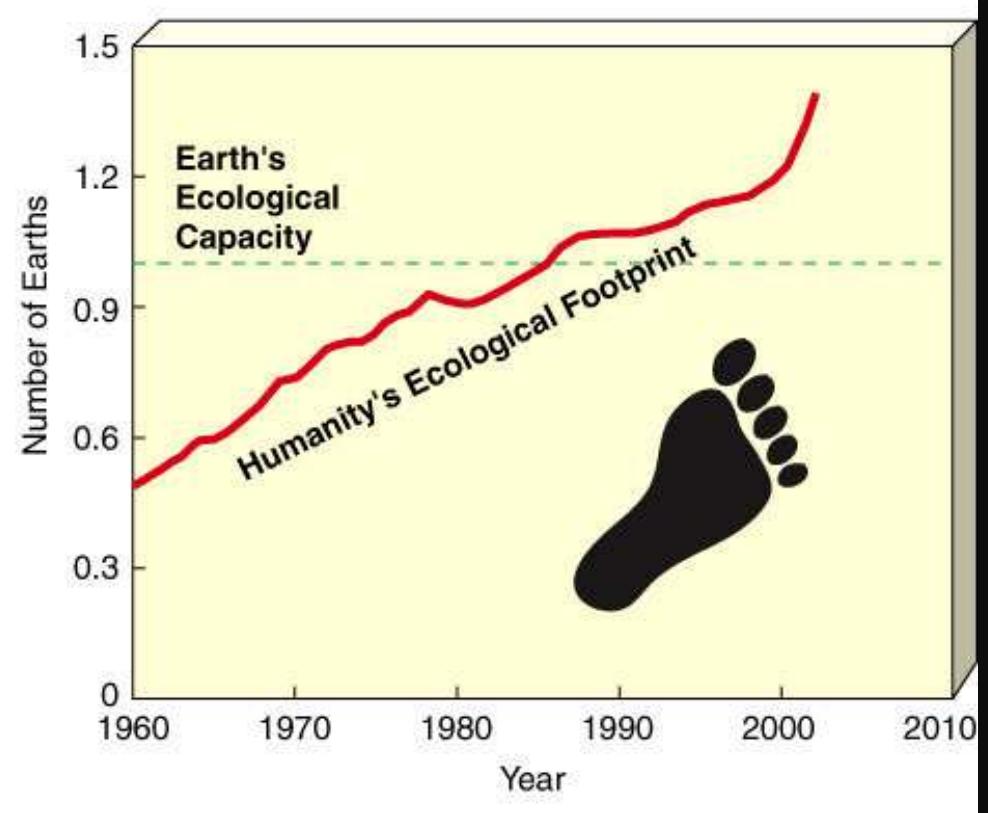
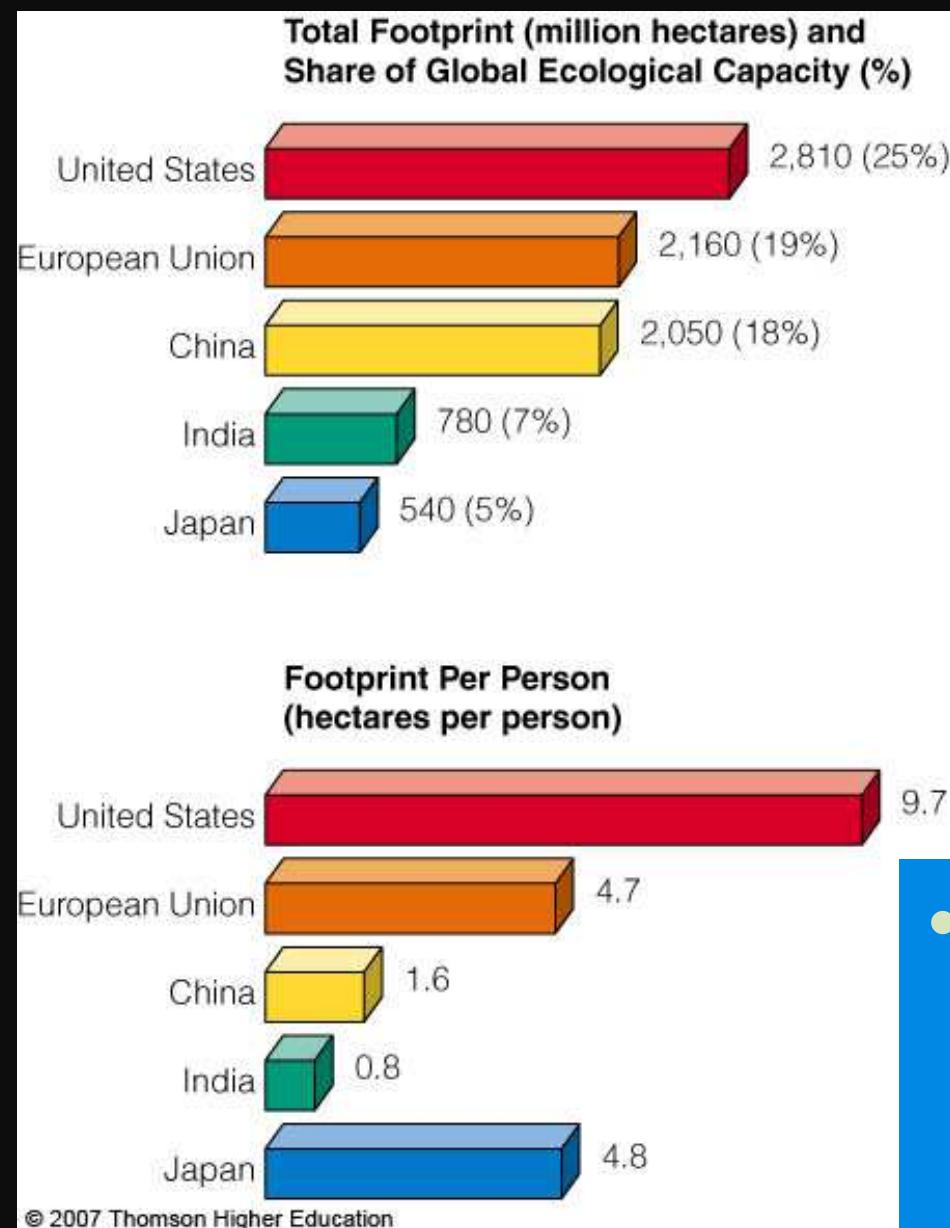
Ecological footprints and biocapacities vary greatly between countries. A country's footprint and biocapacity depend on several factors including its geography, population size, and environmental policies

Ecological Reserve" or "Biocapacity Reserve

Ecological Deficit or Biocapacity Deficit

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

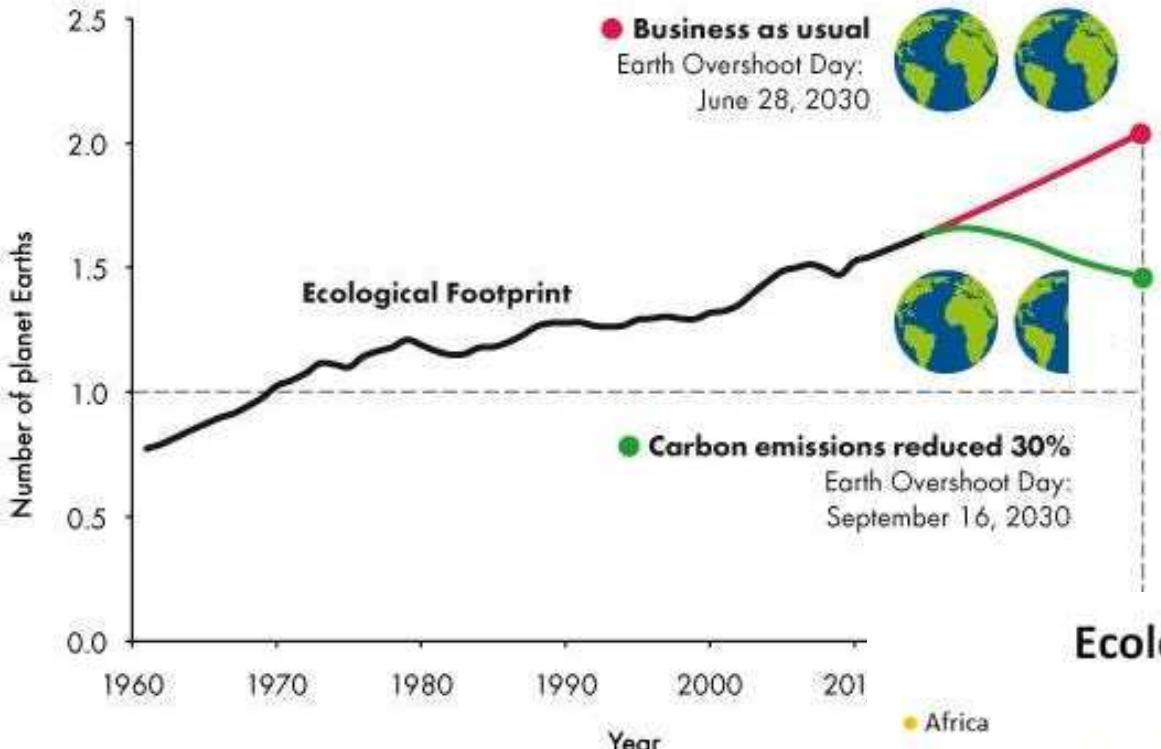
Our Ecological Footprint



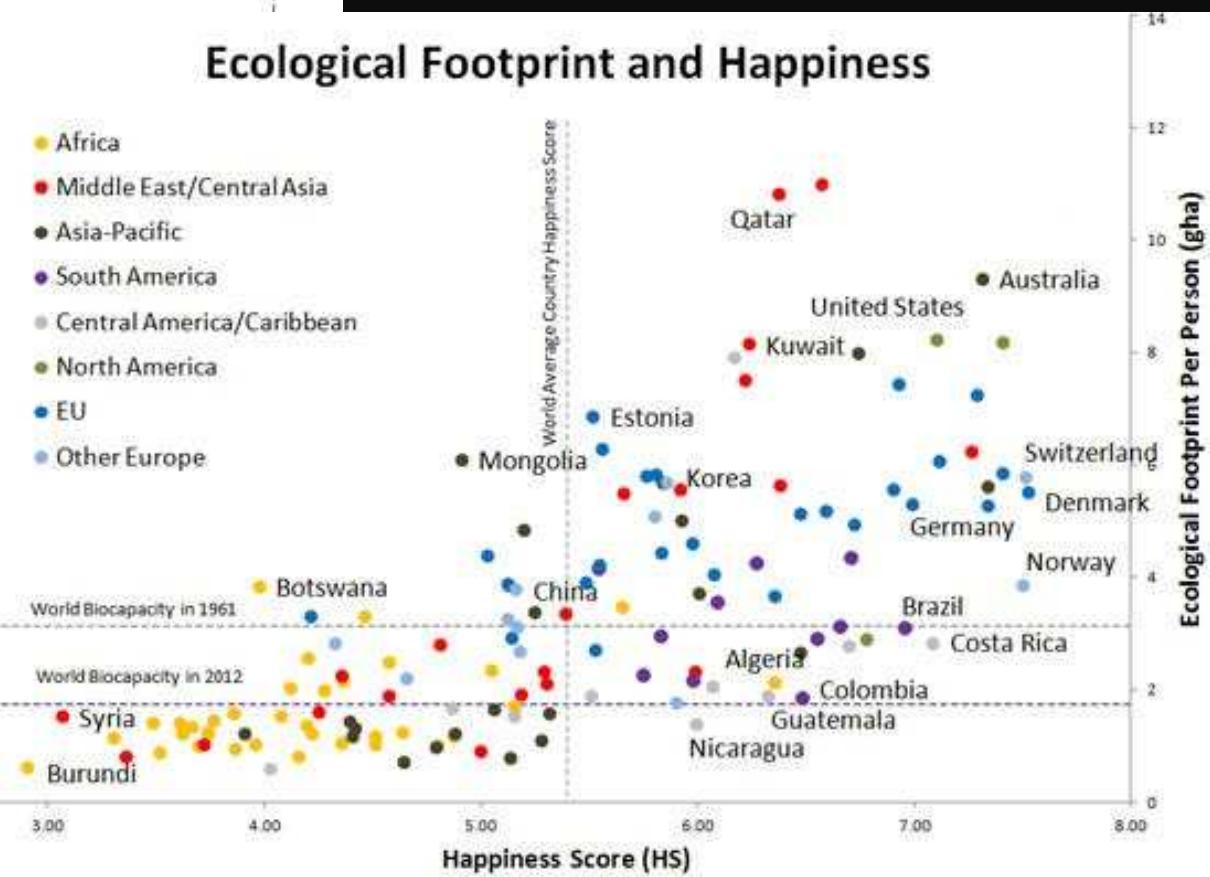
- *Humanity's ecological footprint has exceeded earth's ecological capacity.*

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

How many Earths does it take to support humanity?



Ecological Footprint and Happiness



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

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



EARTH OVERSHOOT DAY

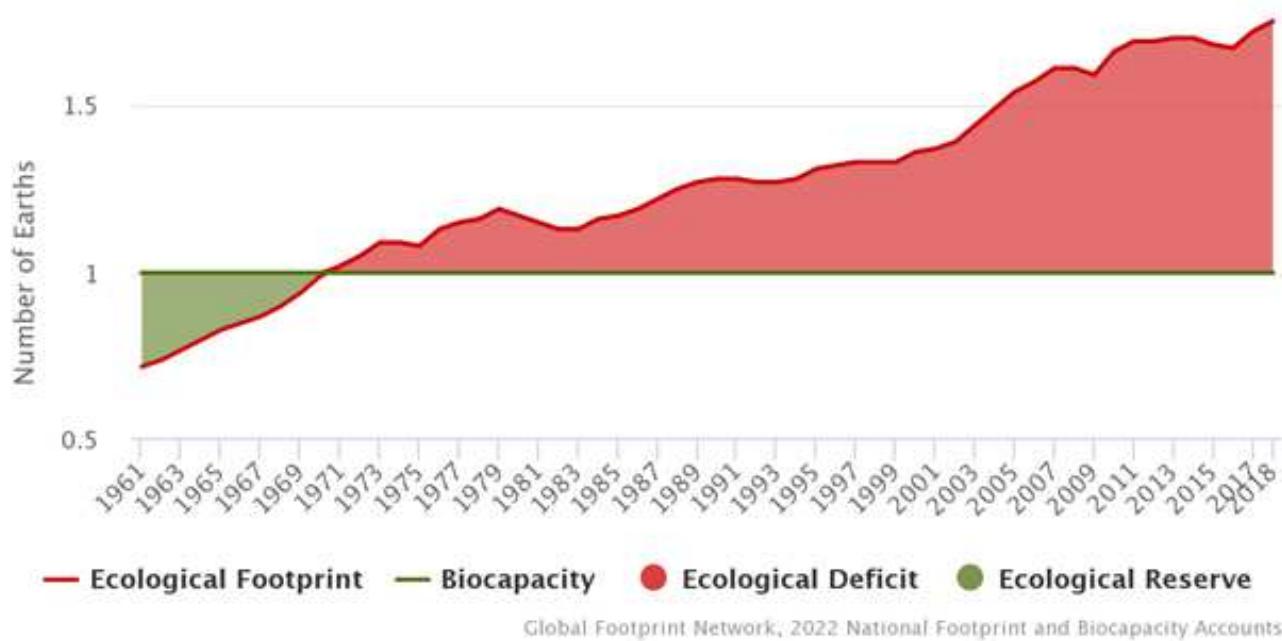
THE DAY BY WHICH WE USE UP THE YEAR'S SUPPLY OF NATURAL RESOURCES!

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.



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

World



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

Earth Overshoot Day 2024 fell on August 1

Earth Overshoot Day 2025 fell on July 24

How many Earths do we need

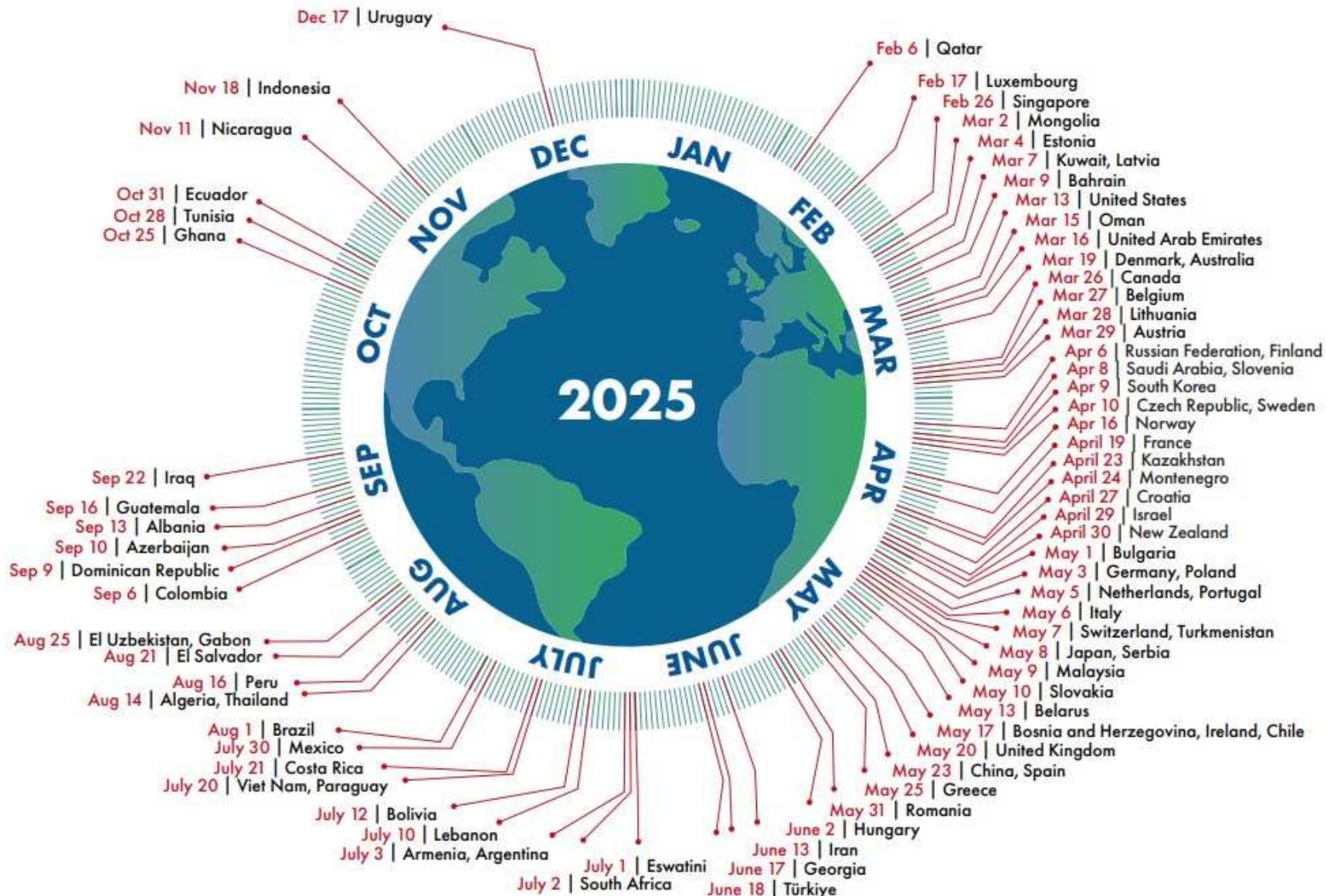
if the world's population lived like...

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
World	1.7	1

Source: Global Footprint Network National Footprint Accounts 2018

Country Overshoot Days 2025

When Earth Overshoot Day would land if all the people around the world lived like...



For more information, visit:
<https://overshootday.org/newsroom/country-overshoot-days/>

Source: National Footprint and Biocapacity Accounts, preliminary 2025 Edition
York University, FoDaFo, Global Footprint Network, data.footprintnetwork.org



Global Footprint Network
Advancing the Science of Sustainability



Food security in a world of overshoot

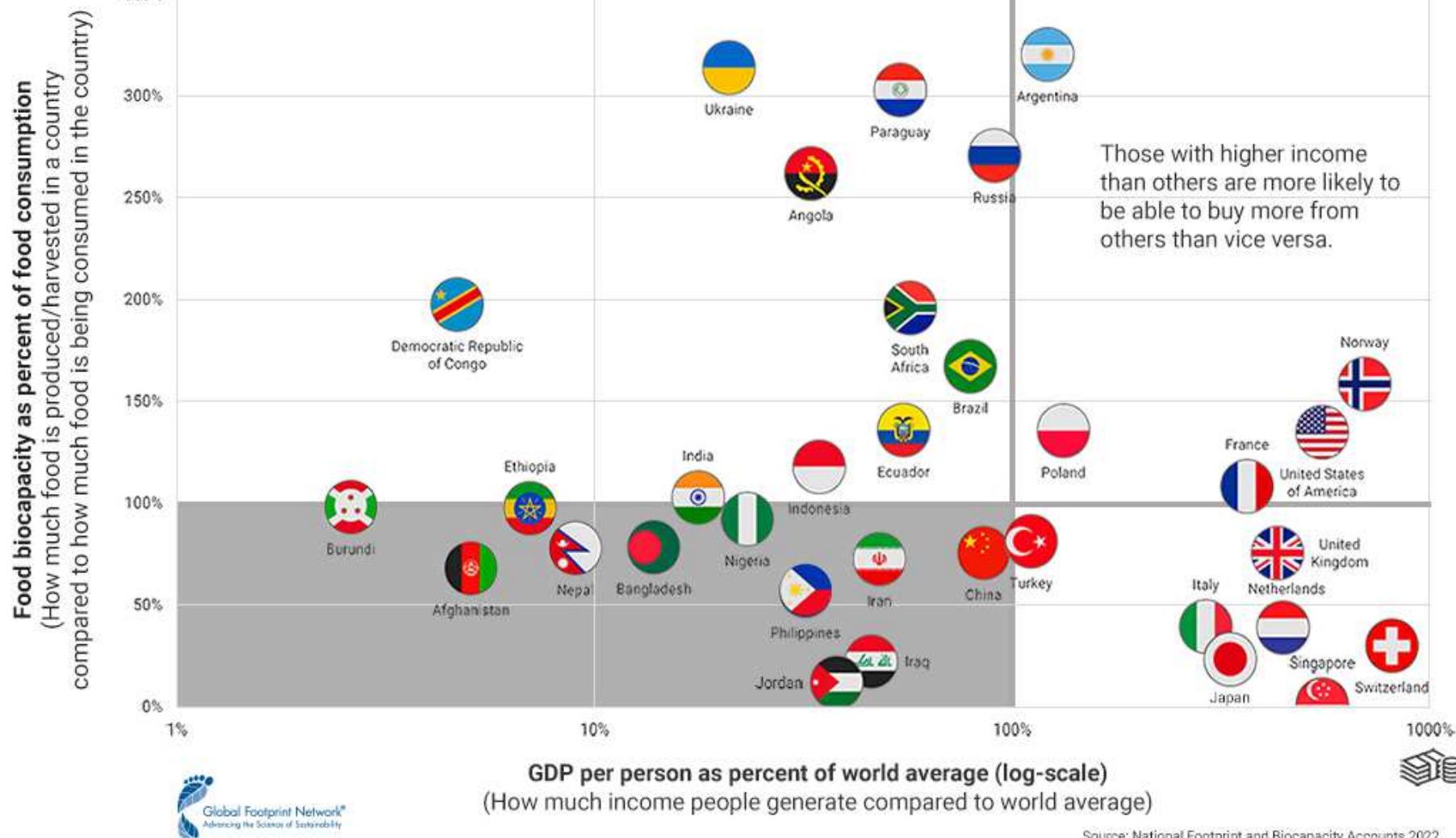


Figure Countries' positions in terms of relative income and domestic food biocapacity. Countries in the bottom left quadrant generate less per person income than the world average, and consume more food than its agricultural biocapacity provides. For example, Nepal only produces 78% of the amount of 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.

Human Dimensions of Environmental Science

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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)

The Malthusian Motive"

V. Shriisha,
2020/02054



Table 1.1 Quality-of-Life Indicators

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

¹Annual gross domestic product²Percent living on less than (U.S.)\$2/day³Average births/woman⁴Per 1,000 live births⁵Metric tons/yr/person**Source:** UNDP Human Development Index, 2006.

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

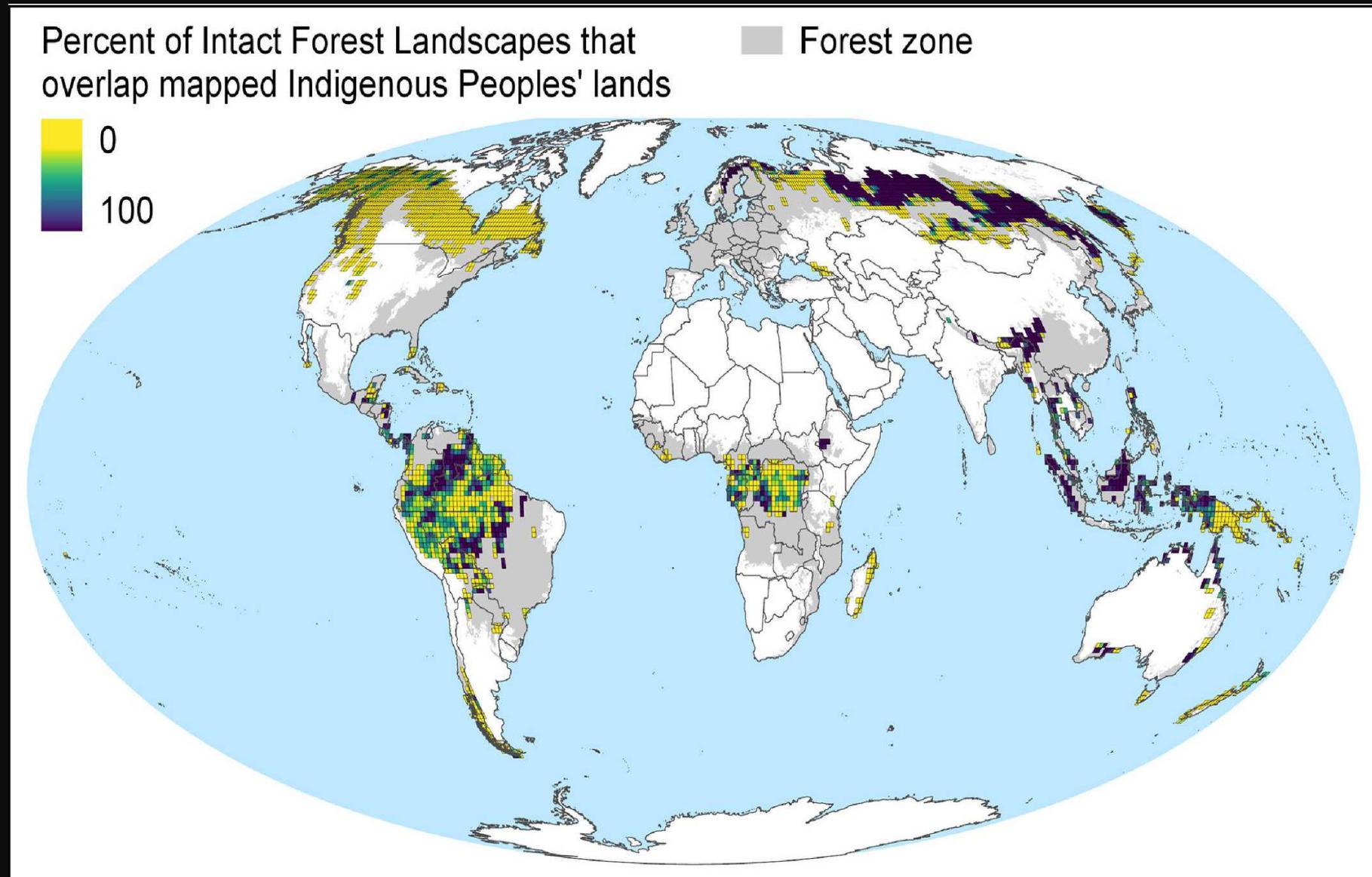
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- *Often, the 500 million indigenous people who remain in traditional homelands still possess valuable ecological wisdom and remain the guardians of little-disturbed habitats*

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