Land and Forests

Dr. V.S. Ramachandran
Centre for Environmental Studies

What is a forest?

World view

How other countries define forests

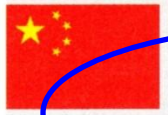
EUROPEAN UNION: Each member country has its own definition. The European Commission has defined forestland as having at least 20 per cent canopy closure (10 per cent in the Mediterranean forests) and a minimum area of 0.5 ha

RUSSIA: Forest includes lands covered by young stands of tree species with relative stocking 0.4 and more, and stands of other age groups with relative stocking 0.3 and more; harvested areas, burnt stands and other forest lands, which are in the process of natural regeneration.

BRAZIL: Forest is defined as an area of land greater than 1 ha, with more than 30 per cent canopy cover and a minimum tree height of five metres.

US: Forestland includes land at least 10 per cent of which is stocked by trees of any size, or land formerly having had such tree cover that will be naturally or artificially regenerated. Forest land includes transition zones such as areas between heavily forested and non-forested lands that are at least 10 per cent stocked with forest trees and forest areas adjacent to urban and built-up lands.

CANADA: Forestland are areas of land where tree canopies cover more than 10 per cent of the total area and the trees, when mature, can grow to a height of more than five metres. It does not include land that is predominantly urban or used for agricultural purposes.



CHINA: Forest means a land having minimum area 0.67 ha, minimum crown cover of 20 per cent and a minimum tree height of two metres.

What is a forest?

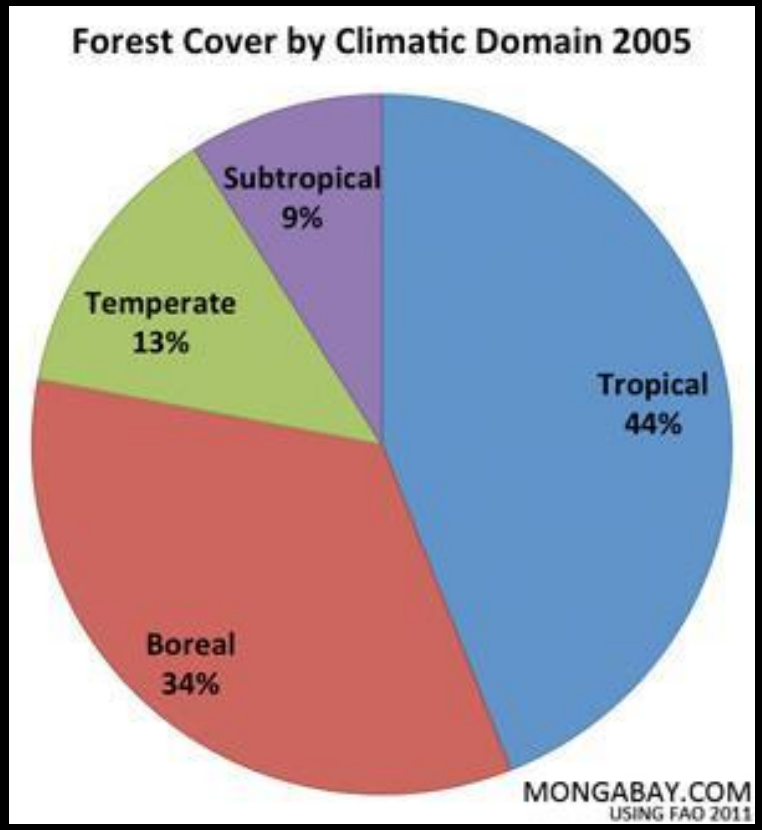
Same forest, different definitions

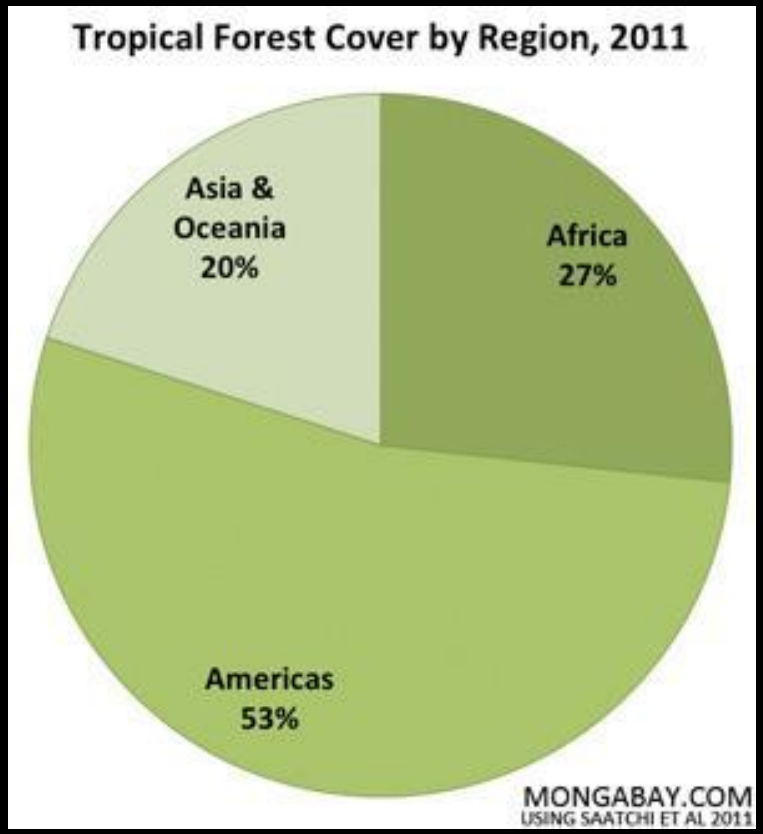
How forest laws and agencies define forests differs substantially

Forest laws/Agency	Definition
Indian Forest Act, 1927 and Forest Conservation Act, 1980	Do not have clear definitions for forest or forestland
Supreme Court order of 1996	Forest should be defined in the "dictionary sense" irrespective of ownership. Also accepted that any land recorded as forests in government records should remain forests
Forest Rights Act, 2006	Defines forestland as land of any description falling within any area and includes unclassified forests, undemarcated forests, existing or deemed forests, protected forests, reserved forests, sanctuaries and national parks
Forest Survey of India	Defines forest as an area of at least 1 ha with a canopy density of 10 per cent as forest; prime forests are classified as very dense and mid-dense with canopy densities of at least 70 per cent and 40 per cent respectively
India's forest definition for Kyoto protocol	A forest is a land area of at least 0.05 ha, with a minimum tree crown cover of 15 per cent, and tree height of at least 2 m

Chakravarthy, A. 2016. Lost in definition. *Down to Earth*, 25 (6): 16-18.

Forest Resources





Forest Resources

Tropical Forests

- Seen as a belt around the globe up to 23^0 on either side of the equator
- They grow in areas receiving annual rainfall >2000 mm or above & with a short dry period (4-5 months)
- Trees reach a height of 45-50

Forest Resources

Sub-tropical Forest

- Seen from 23^0 to 45^0 on either side of the equator
- Winters are relatively warm
- Frost or snow is rare

Forest Resources

Temperate Forest

- seen from 45^0 to 66^0 on either side of the equator
- Region experiences four season, with a well-defined winter
- This contains broad leaved evergreens, deciduous & coniferous plants

Forest Resources

Boreal forests

- Forested areas within the boreal zone

- Made up of cold-hardy trees
  - many of them coniferous (such as pine, spruce, larch & fir)
  - some deciduous (such as poplar & birch).

Forest Resources

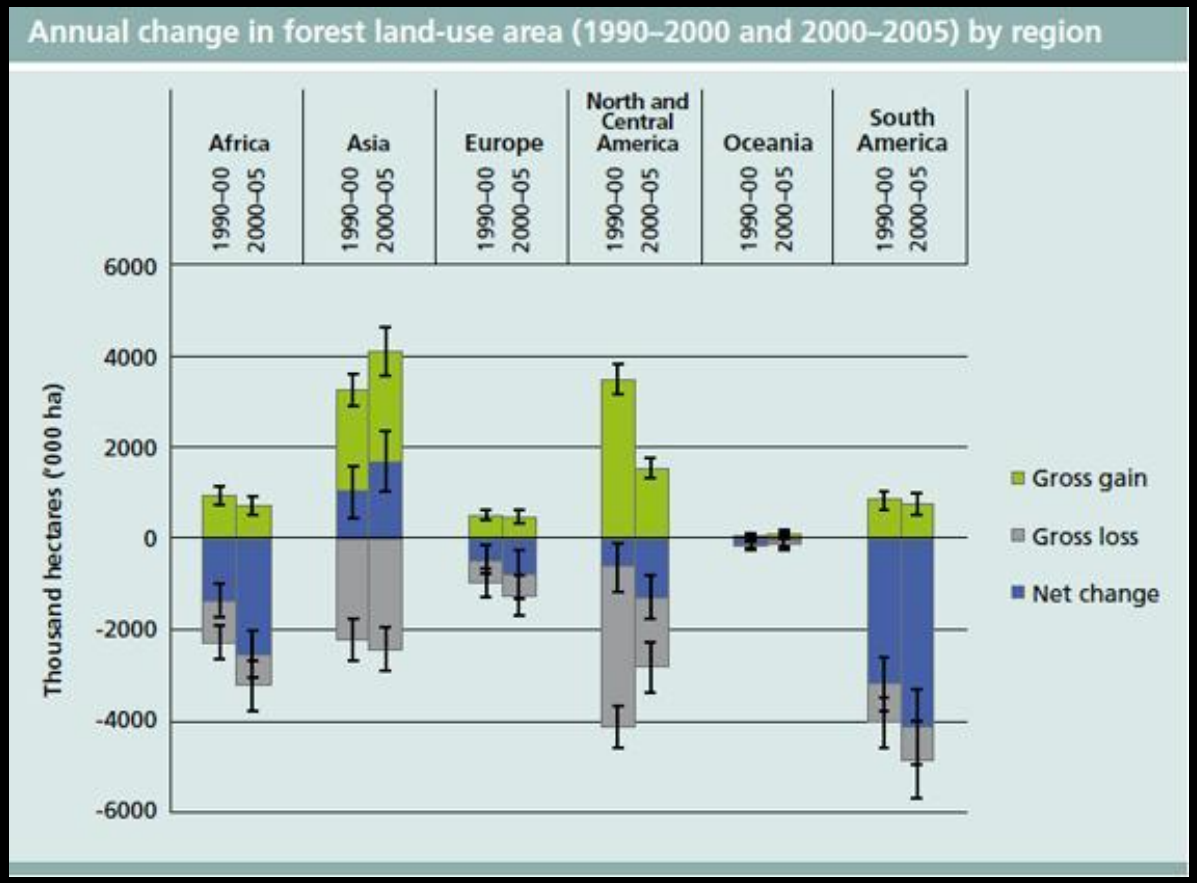
Boreal forests

- The ***boreal zone*** is the broad circumpolar vegetation zone of the high northern latitudes.
  - Boreal zone is more than just forest
  - It contains lakes, rivers & wetlands, as well as naturally treeless terrain such as alpine areas, heathlands in regions where the climate is influenced by the ocean, & grasslands in drier areas

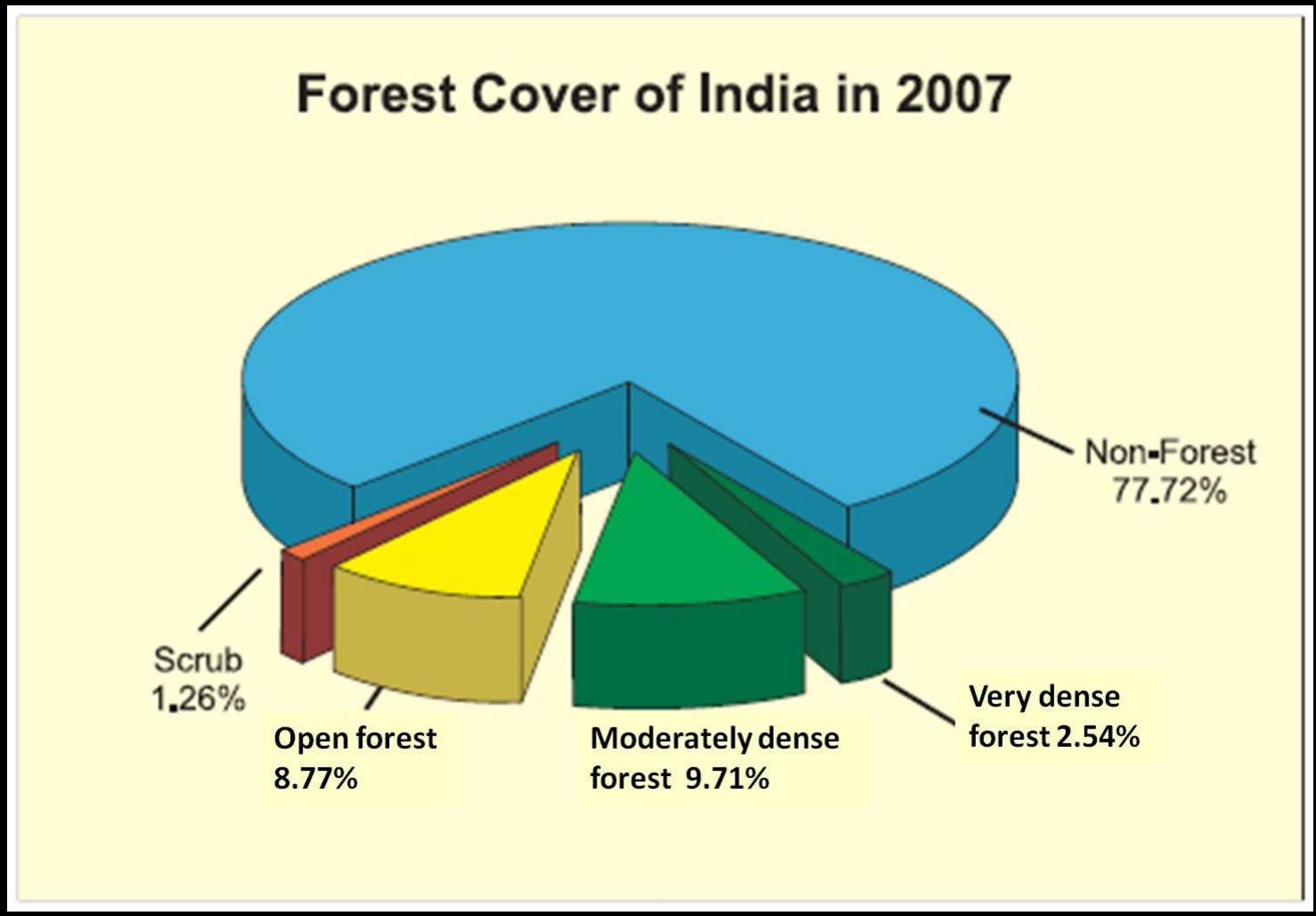
Status of Forest Resources

Status of Global Forests

Status	Forest cover (M ha)	% of forest cover	year	Source
Primary forest cover	1350	36	2010	FAO 2010
Secondary forest cover	2150	57	2010	FAO 2010
Planted forests	264	7	2010	FAO 2010



India's forest cover



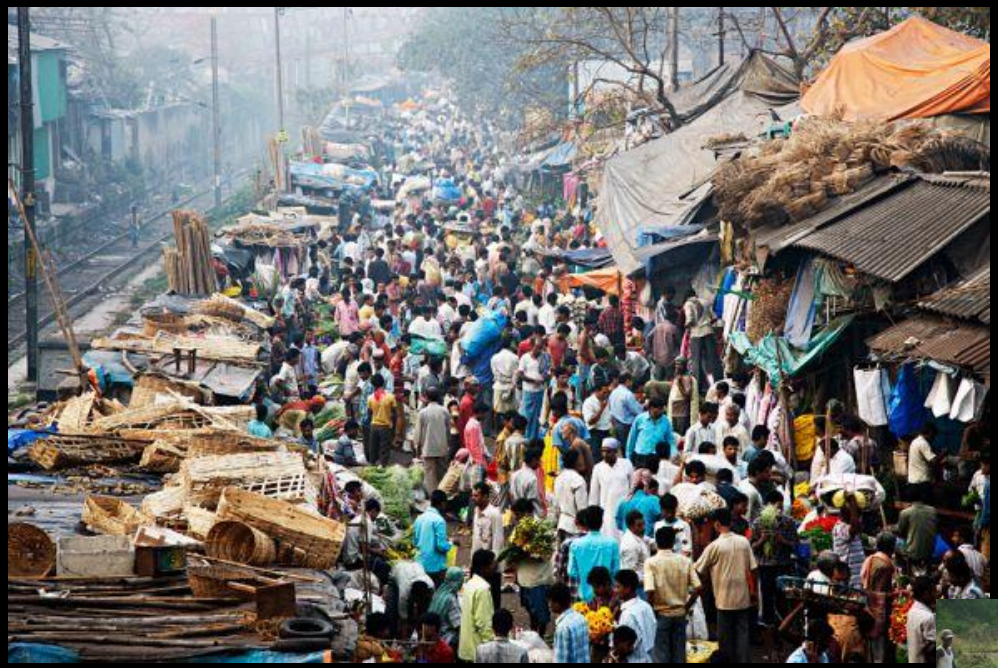
Role of forest/vegetation

- Helps in sequestration/trapping of CO_2
  - For one ton of wood produced 1.8 tons of CO_2 is removed & 1.3 tons of O_2 is released
- Reducing the intensity of rainfall & impact on soil
- Leaf litter & other organic materials on forest floor slow down surface runoff & Provides nutrients & soil carbon (humus) to the soil

Role of forest/vegetation

- Carbon-rich soil absorbs water like a sponge there by enhances retention & storage of water
  - More ground infiltration, better aquifer recharge, slow discharge to streams & better flow of water in rivers throughout the year
- Tropical rainforests produce about 30% of our planet's fresh water

Deforestation/Habitat Destruction: WHY?



Setting up of human establishments

Conversion to agricultural lands

Deforestation/Habitat Destruction: WHY?

Logging or cutting tree for timber needs

Firewood collection

Deforestation/Habitat Destruction: WHY?

Fires in forest – human induced

Charcoal making

Deforestation/Habitat Destruction: WHY?

Cattle grazing in forest

Deforestation/Habitat Destruction: WHY?

Establishment of cash crop plantation

Establishment of timber plantation

Deforestation/Habitat Destruction: WHY?

Establishment of ranches

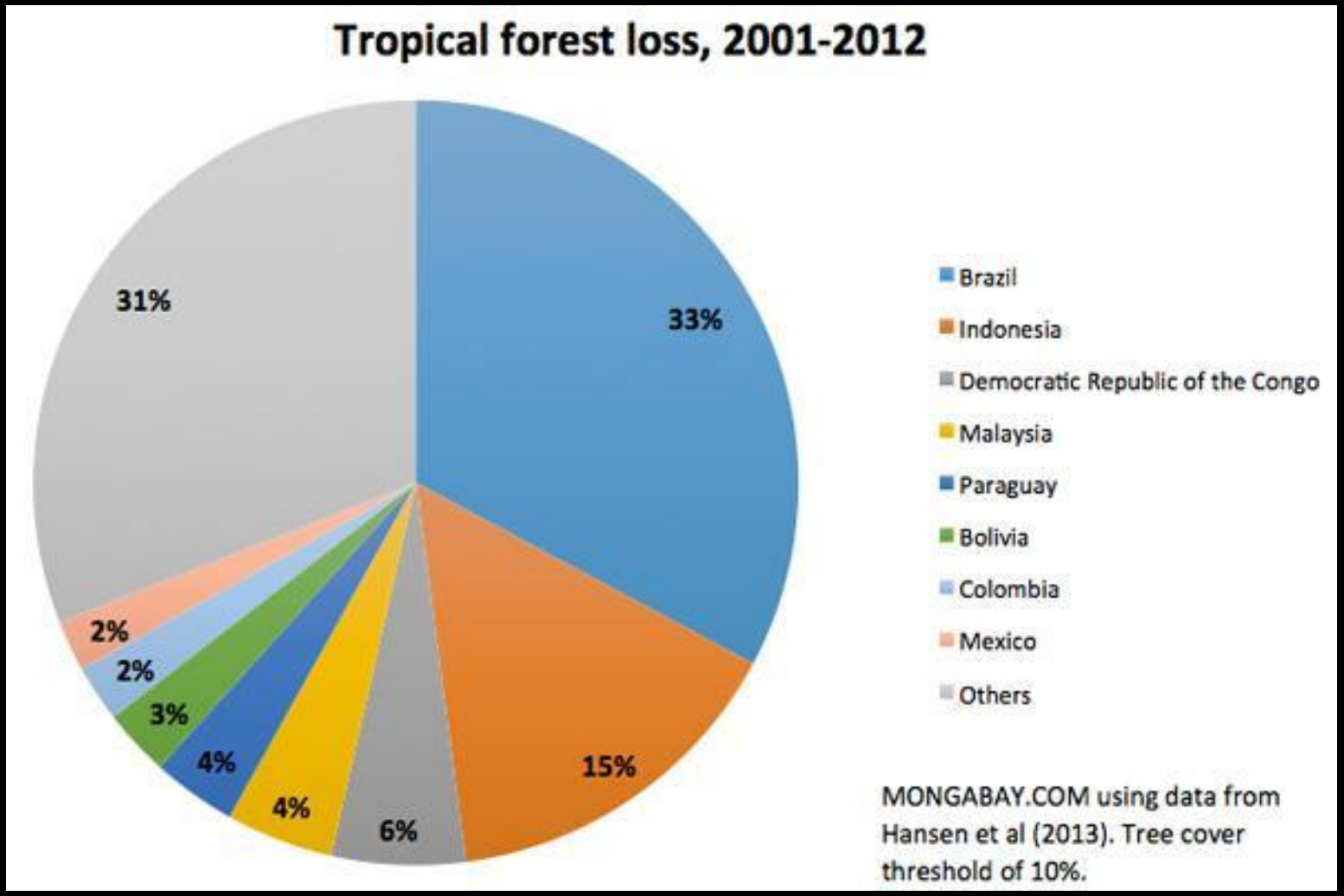
Building homes

Deforestation/Habitat Destruction

- Between 2000 & 2010 estimated deforestation was 13 mi ha per year
- Most deforestation taking place in tropical countries
- In 2010, forests covered about 31 % of world's total land area – about 4.033 mi ha

– corresponds to an average of 0.6 ha per capita

Deforestation/Habitat Destruction



Deforestation/Habitat Destruction: WHY?

- 48%: Subsistence farming
- 32%: Commercial agriculture
- 14%: Logging for timber & soft wood
- 5%: Fuel wood & Charcoal

UNFCC 2017

Aerial view of deforestation taking place in Indonesia, where forest is getting replaced with oil palm plantation

Status of forest

- Between 1990 & 2010
  - amount of forest land designated primarily for the conservation of biological diversity increased by 35%
  - These forests now account for 12% of the world's forests

Deforestation/Habitat Destruction: WHY?

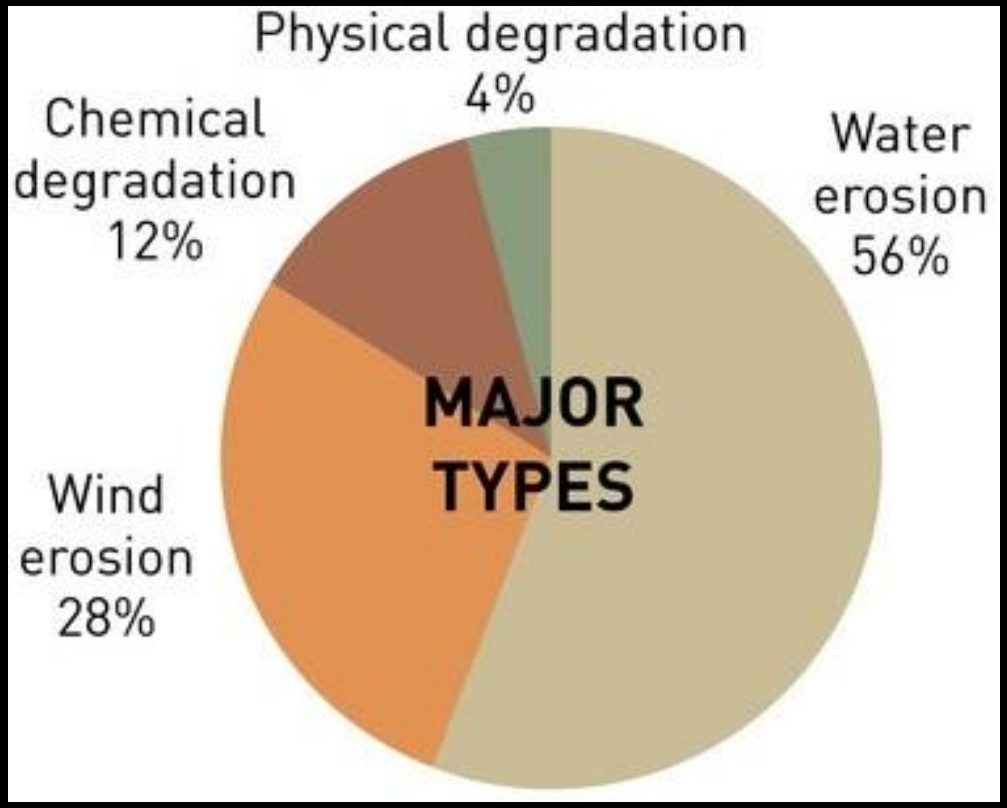
Impact of deforestation

- Loss of biodiversity
- Reduced sequestration of atmospheric CO_2
- Adverse soil erosion
- Disruption of H_2O cycle
- Most often deforested land degrade into wasteland
- Flood & drought
- Enhances impact of climate change

Land Degradation

- ✓ Land degradation is the reduction in capacity of the land to provide ecosystem goods & services, & assure its functions over a period of time
- ✓ Land degradation affects large areas & especially many people in dry land regions
- ✓ About 2000 million ha of soil, equivalent to 15% of the Earth's land area have been degraded through human activities

Land Degradation

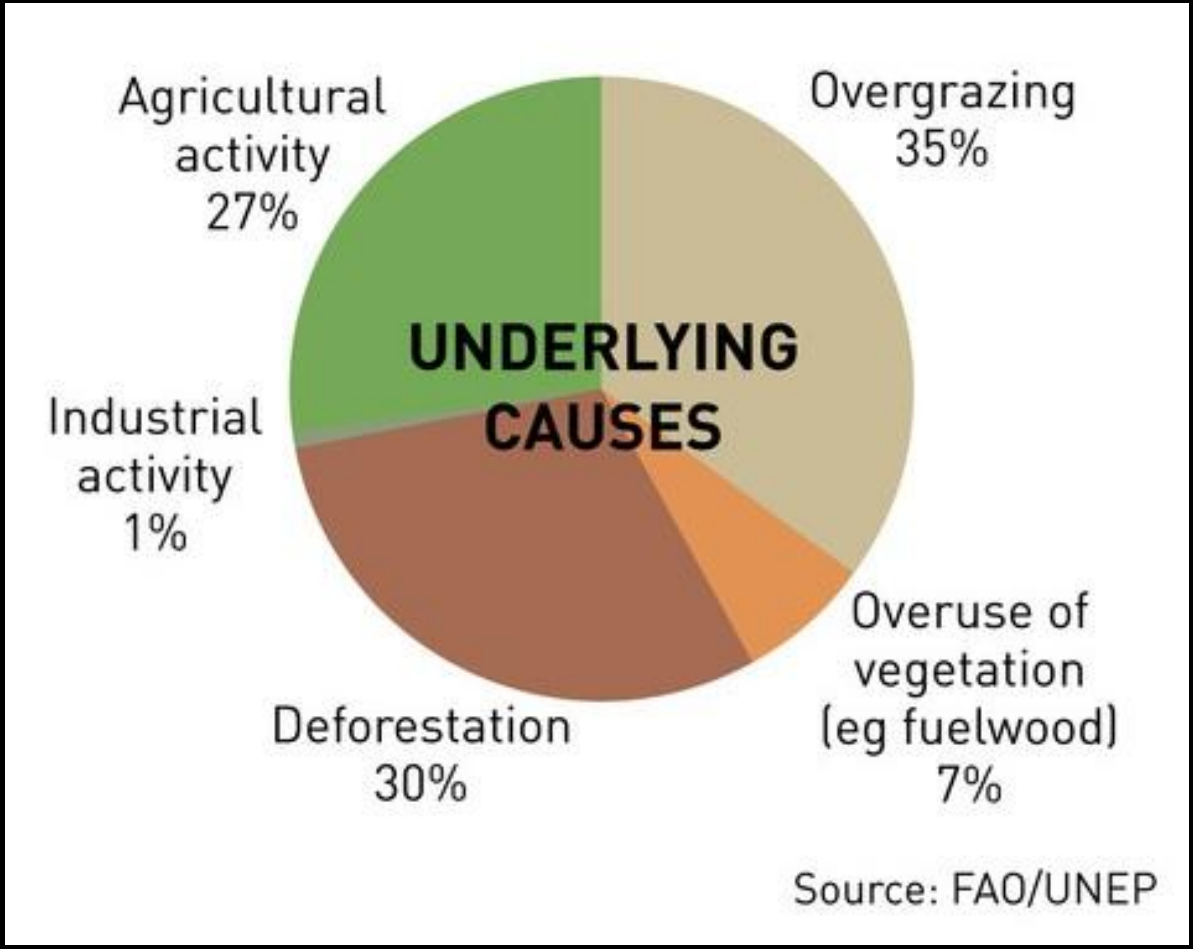


Land Degradation

Soil erosion is a major factor in land degradation & has severe effects on soil functions - such as

- Soil's ability to act as a buffer & filter for pollutants
- Its role in the hydrological & nitrogen cycle
- Its ability to provide habitat & support biodiversity

Land Degradation



Land Degradation

Agricultural activity leading to land degradation:

- Unsustainable agricultural land use
- Poor soil & water management
- Frequent use of heavy machinery
- Improper crop rotation

Natural disasters, including drought, floods & landslides

Land Degradation

- About 24% of global land area has been affected by land degradation
  - area is equivalent to the annual loss of about 1% of global land area, which could produce 20 million tons of grain each year
  - or 1%of global annual grain production

World Watch Institute, 2017.

Land Degradation

Areas undergoing degradation

- Cultivated land: 20%
- Forest: 30%
- Grass lands: 10%

- An estimated 1.5 billion people, or ¼ of the world's population, depend directly on land that is being degraded

FAO Newsroom. 2008

Deforestation & Land Degradation

Land Degradation

Areas undergoing degradation

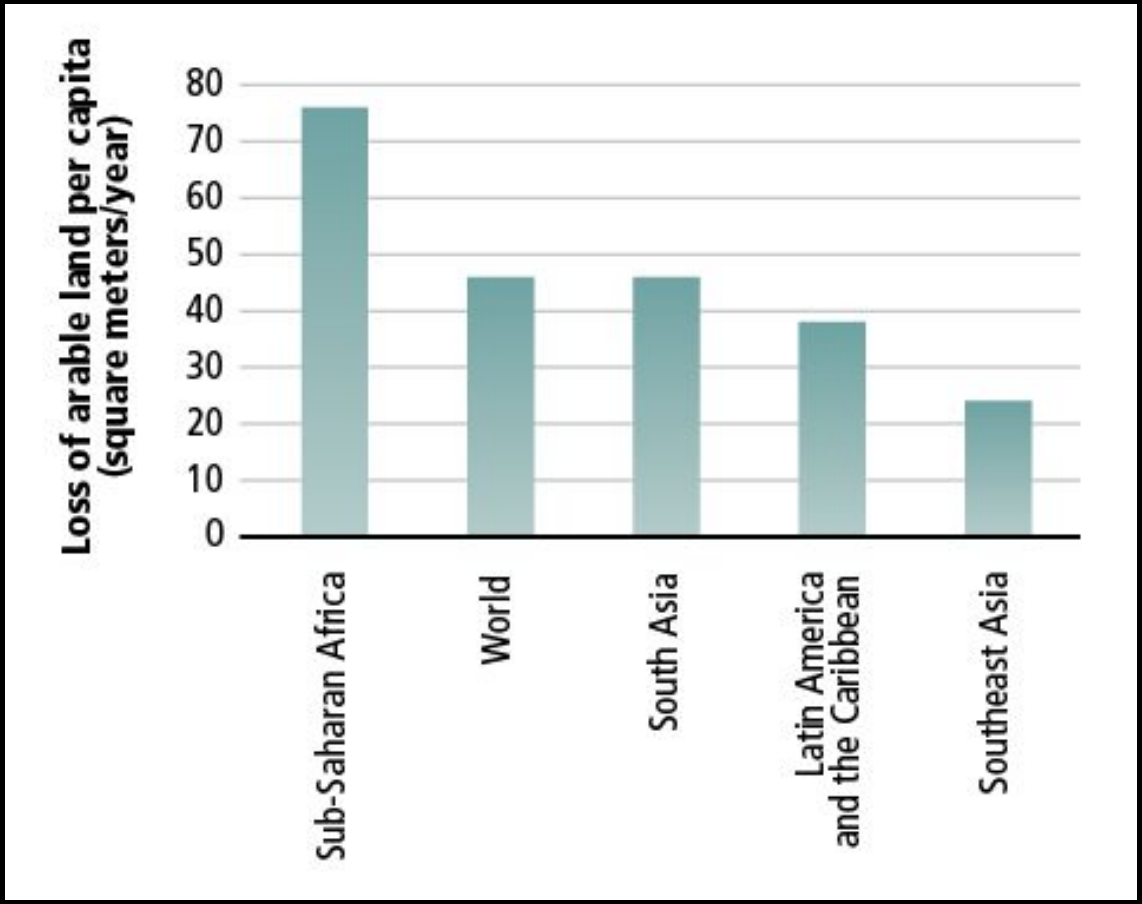
- Among the degrading land
  - 22% is very arid to dry sub-humid areas
  - 78% is in humid regions

- Degradation is being driven mainly by poor land management

FAO Newsroom. 2008

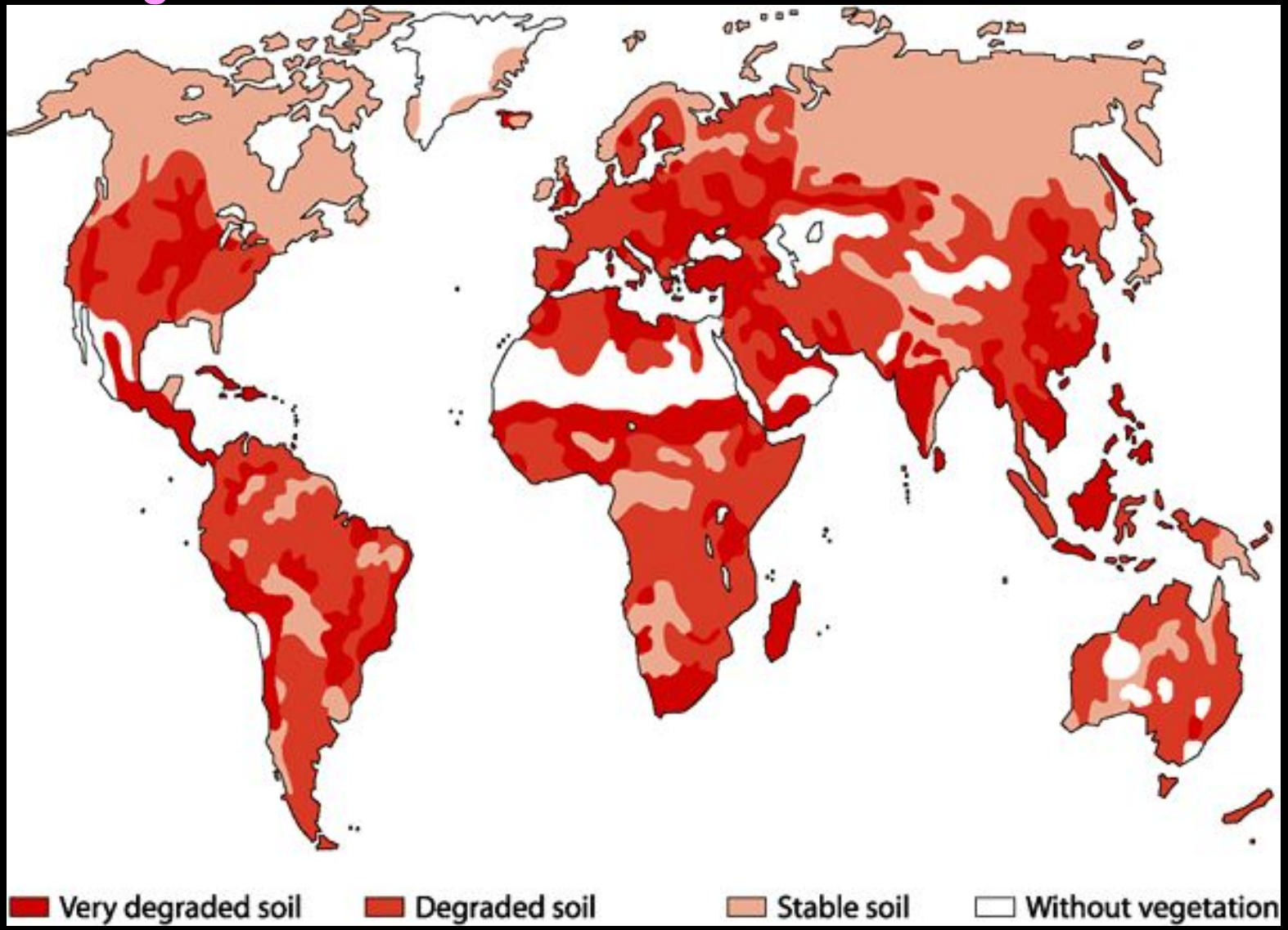
Deforestation & Land Degradation

Land Degradation



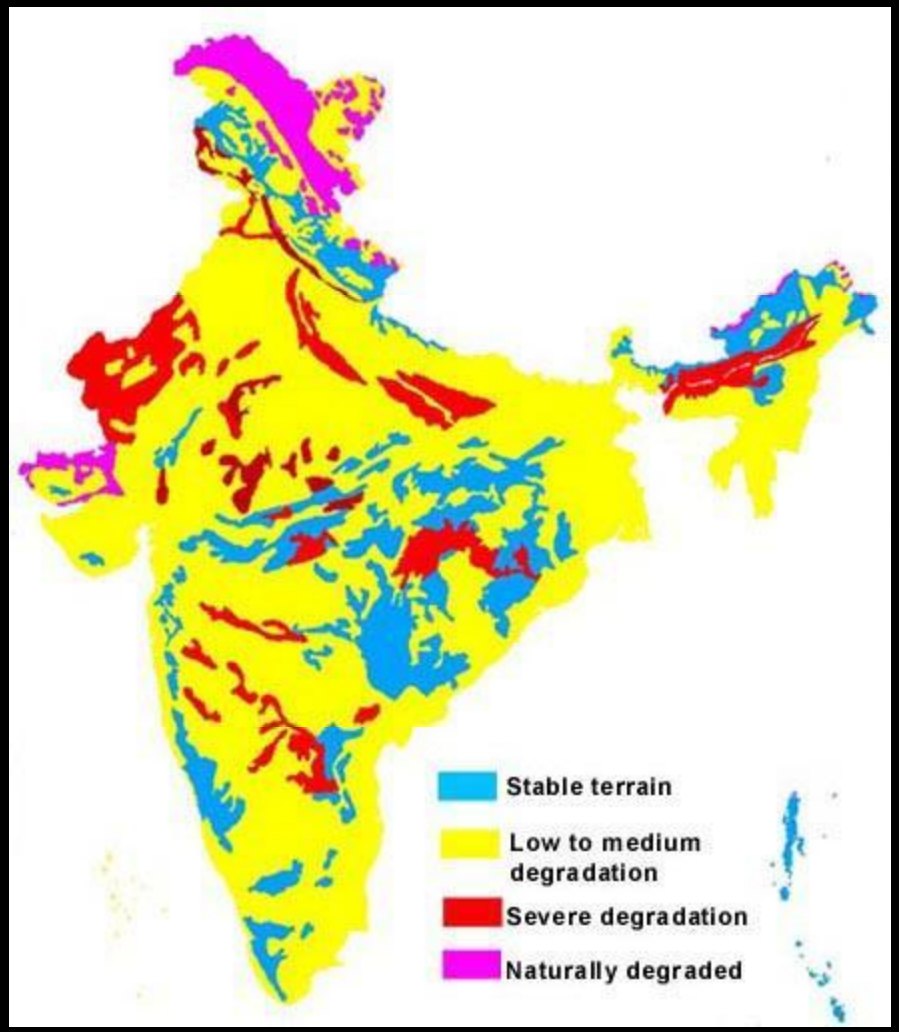
Deforestation & Land Degradation

Land Degradation



Deforestation & Land Degradation

Land Degradation



Land Degradation: IMPACTS!!

- Loss of biodiversity
- Salinization
- Loss of fertility/productivity

Land Degradation : IMPACTS!!

Airborne diseases

Waterborne diseases

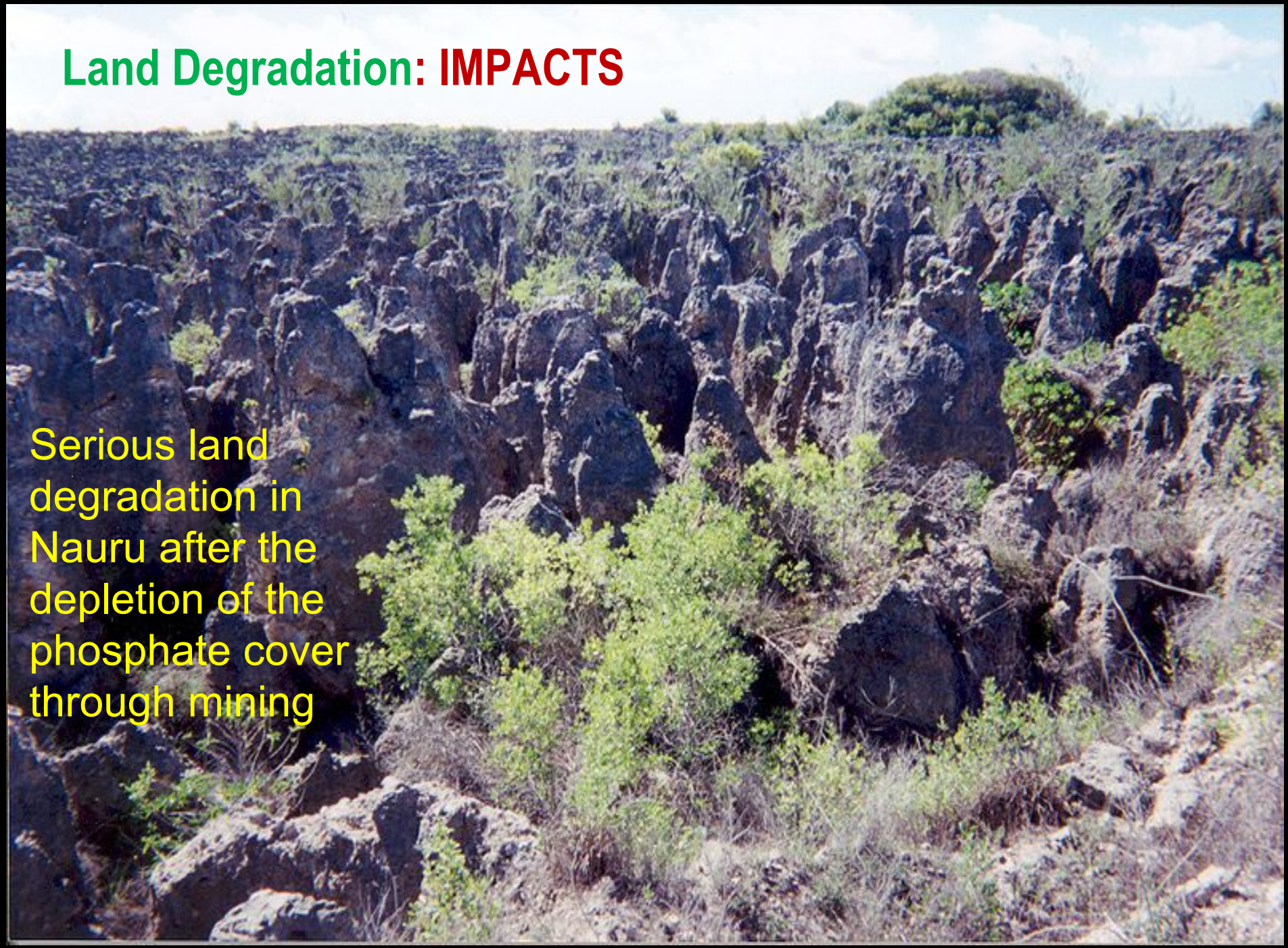
Foodborne diseases

Land Degradation : IMPACTS!!

Spread of communicable diseases

Forced migration of people

Land Degradation: IMPACTS



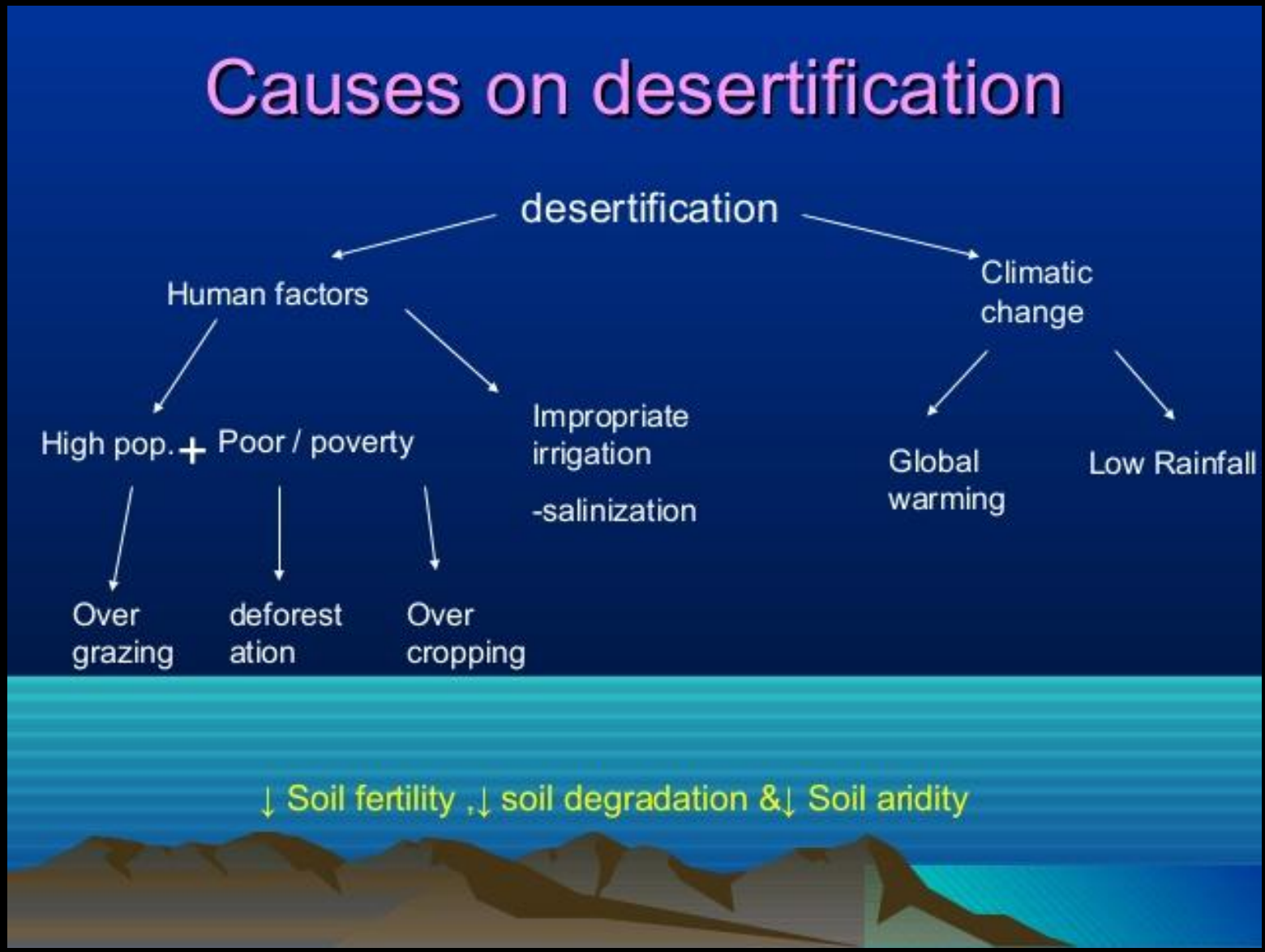
Serious land degradation in Nauru after the depletion of the phosphate cover through mining

Desertification

- Land degradation in arid, semi-arid (average annual rainfall less than 600 mm) & sub-humid areas is called desertification

- When land degradation happens in the world's drylands, it often creates desert-like conditions

Causes on desertification



Causes of desertification

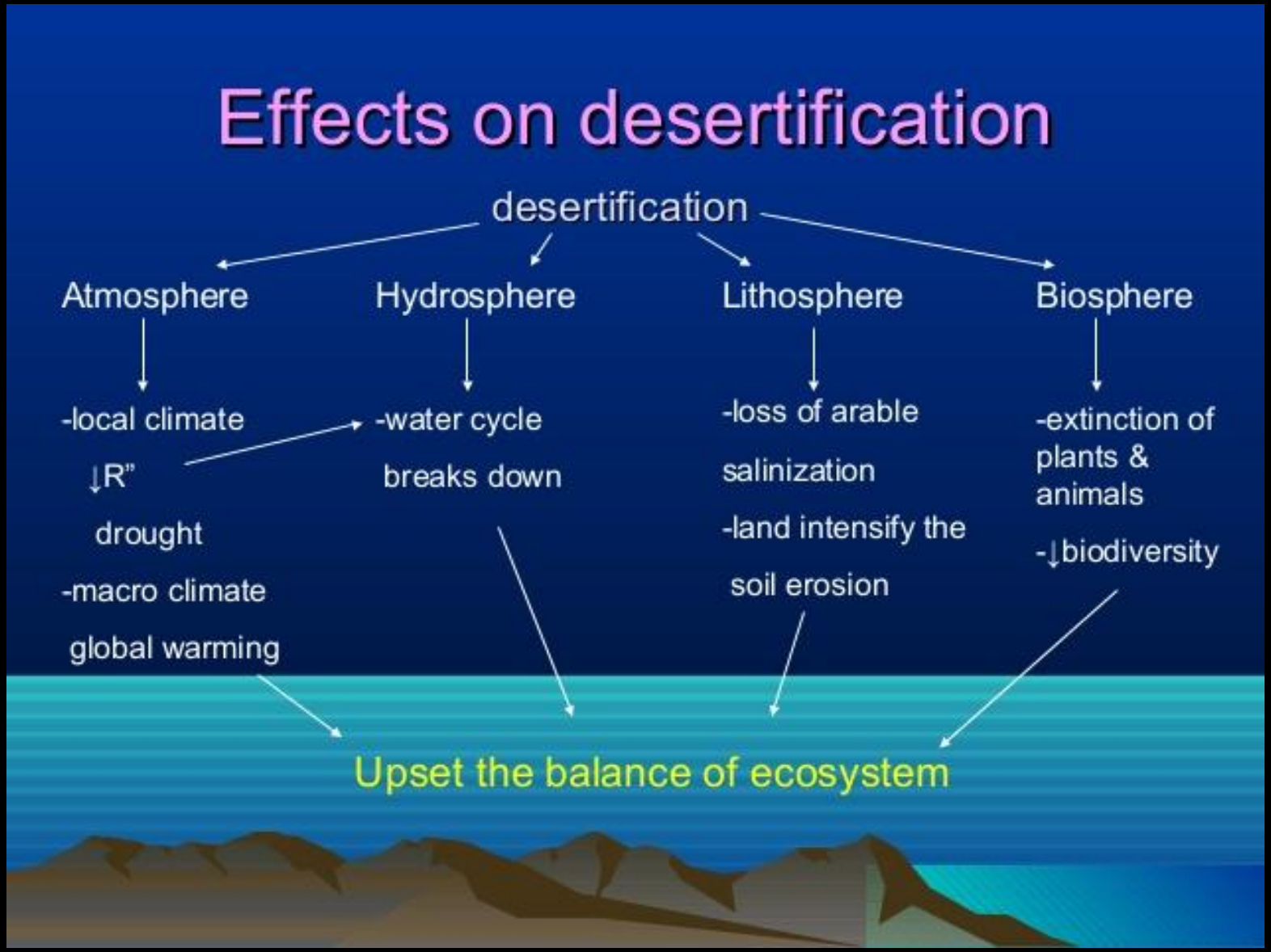
Cultivation on marginal lands

Marginal Land

- Arid and generally unhospitable land
- often has poor soil or other undesirable characteristics
- Thus has high risk of crop failure
- usually has little or no potential for profit
- This land is often located at the edge of deserts or other desolate areas

Read more: Marginal Land Definition | Investopedia
http://www.investopedia.com/terms/m/marginal-land.asp#ixzz4O4mu1QJi

Effects on desertification



Effects of desertification

- Reduction in ability of land to support life, affecting
  - wild species,
  - domestic animals
  - agricultural crops
  - people
- Reduction in plant cover leading to accelerated soil erosion by wind & water
  - South Africa losing approximately 300-400 million tonnes of topsoil every year

Effects of desertification

- As vegetation cover and soil layer are reduced,
  - rain drop impact & run-off increases
  - percolation decreases

How widespread is desertification?

- About 1/3rd of world's land surface is arid or semi-arid.
- Global warming will increase area of desert climates by 17% in the next century
- Worldwide, desertification is making approximately 12 mi ha useless for cultivation every year

Areas prone to desertification

- About ½ of southern Africa is semi-arid & thus at risk of desertification
- The areas which are known to have deteriorated this century are mainly on the edges of the southern Kalahari

How can desertification be halted or prevented?

- Reduce grazing pressure by reducing number of animals thus allowing plants to regrow
- Protecting the vegetative cover
  - that protect top soil from wind & water erosion
- Integrating land & water management to protect soils from degradation

How can desertification be halted or prevented?

- Turning to alternative livelihoods like greenhouse agriculture & tourism-related activities
- Creating economic opportunities in dry land urban centers & in areas outside of drylands

How can we restore or rehabilitate the ecosystem?

- Preventing soil erosion by
  - Sand fences, stone fences, terracing

- Making soil conditions favourable for plant growth by enriching with organic matter – mulching
  - Mulch (a layer of straw, leaves or sawdust covering the soil) reduces evaporation, suppresses weed growth, enriches soil as it rots, and prevents runoff & hence erosion

How can we restore or rehabilitate the ecosystem?

- Creating green wall/tree wall
  - Planting trees
  - Establishing seed banks - Reseeding in badly degraded areas
  - Reintroducing native species of the area

How can we restore or rehabilitate the ecosystem?

- Watershed management
  - Percolation tanks, contour bunding, check dams
  - Water harvesting using locally available/adapted techniques & storage
- Cooking Fuel: Planting trees for firewood