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Dry Lands

- Desertification occurs on Dry-lands.

Dry Lands- T*errestrial regions where the production of crops, forage, wood and other ecosystem services are limited by water.*

Or

all lands where the climate is classified as dry sub humid, semiarid, arid or hyper-arid. This classification is based on Aridity Index values

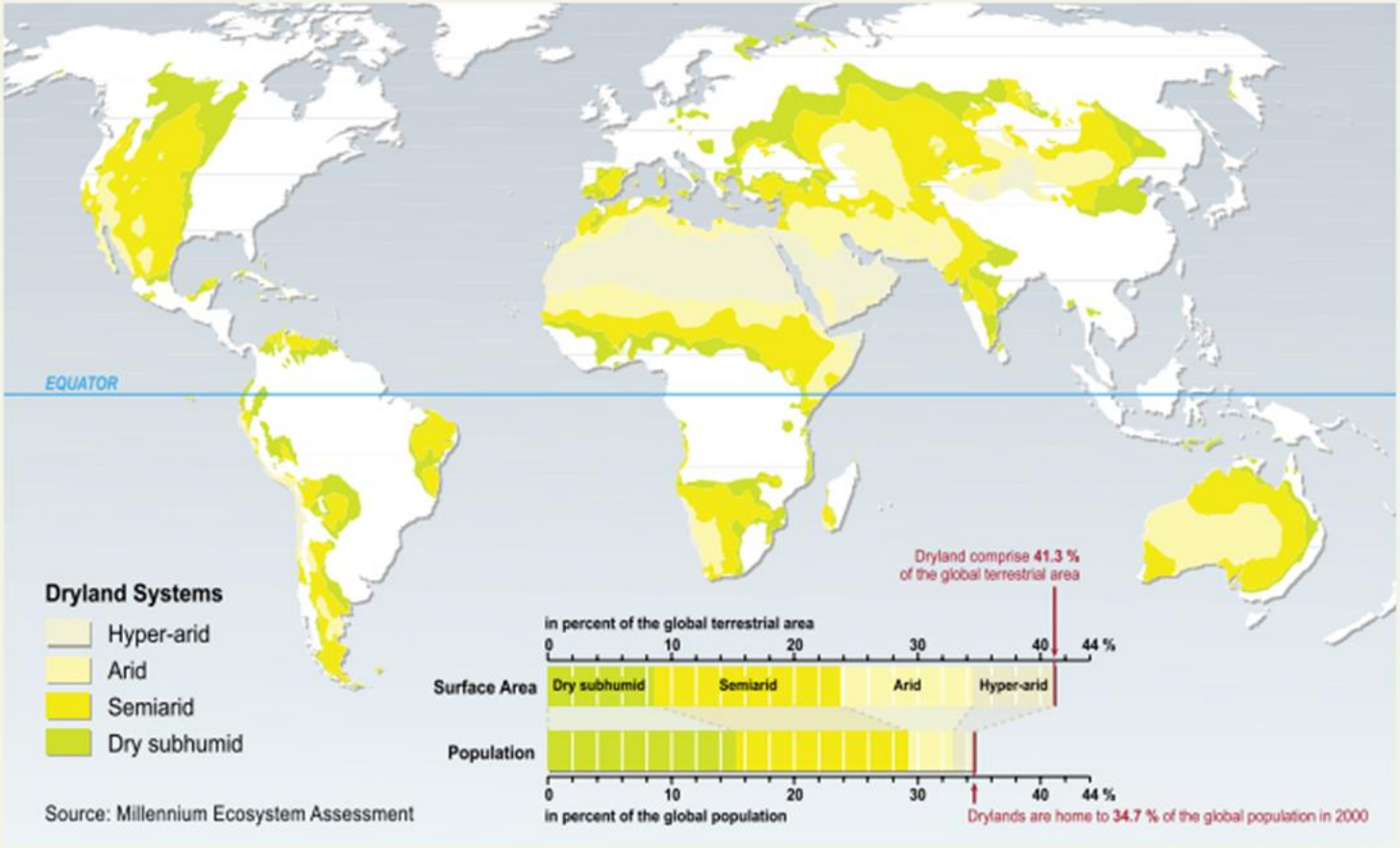
- Dry lands cover 40% of the earth's surface
- Vulnerable more than 1 billion people who are dependent on these lands for survival.
- Around 80% of the productive land in the arid and semi-arid regions of the world is estimated to be converting into deserts and around 600 million people are threatened by desertification (UNEP).

Dry lands in the world



Dryland Systems in the world

Drylands include all terrestrial regions where the production of crops, forage, wood and other ecosystem services are limited by water. Formally, the definition encompasses all lands where the climate is classified as dry subhumid, semiarid, arid or hyper-arid. This classification is based on Aridity Index values†.



† The long-term mean of the ratio of an area's mean annual precipitation to its mean annual potential evapotranspiration is the Aridity Index (AI).

Notes: The map is based on data from UNEP Geo Data Portal (http://geodata.grid.unep.ch/). Global area based on Digital Chart of the World data (147,573,196.6 square km); Data presented in the graph are from the MA core database for the year 2000.

Desertification

- "Land degradation in arid, semiarid and dry sub humid areas resulting from various factors, including climatic variations and human activities." (*U.N. Convention to Combat Desertification)*
- "the intensification or extension of desert conditions leading to reduced biological productivity, with consequent reduction in plant biomass, in the lands carrying capacity for livestock, crop yields and human wellbeing *(World Map of Desertification, UNCOD 1977)*

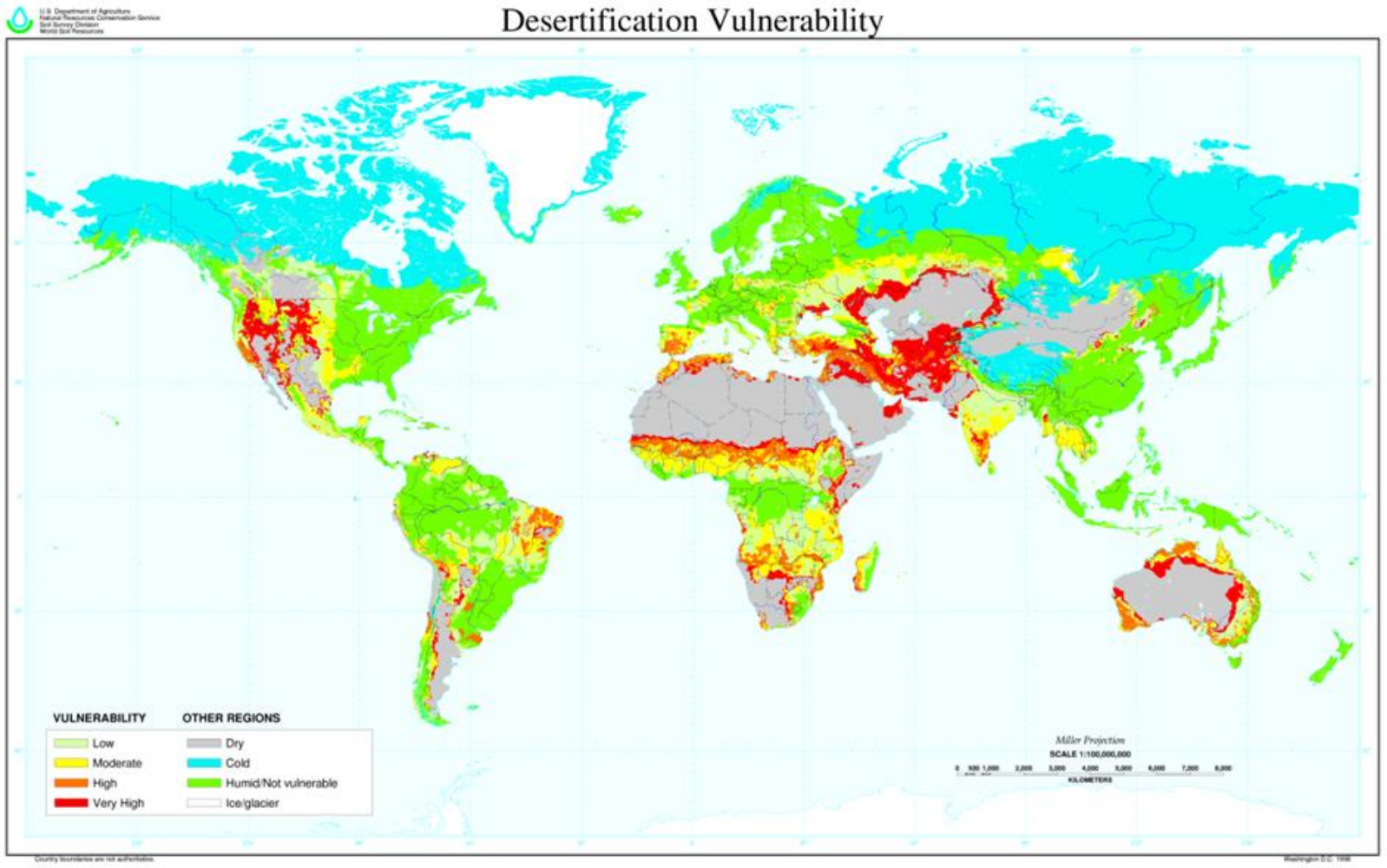
Land degradation - *Reduction or loss of the biological or economic productivity of drylands. Which a relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife*

Arid: *Lacking moisture, especially having insufficient rainfall to support trees or woody plants*

Facts of Desertification

- Desertification is a significant global ecological and environmental problem
- It's the process of **severe environmental degradation that occurs due to water balance of nature in an ecosystem is disturbed.**
- Disappearance or permanent degradation of the vegetation can occur
- Globally around 2 billion acres of land have become deserts in the past 50 years
- Environmental impacts at the global and regional scale;affected areas may located thousands of kilometers away from the deserted areas
- The current rate of desertification is around 15 million acres per year, the worst being in sub-saharan Africa than desert in Rajasthan
- 10-20% of dry lands are already severely degraded and 70% of soil degradation due to human-induced reasons

Desertification Vulnerability



Natural Resource Conservation Service

Deserts

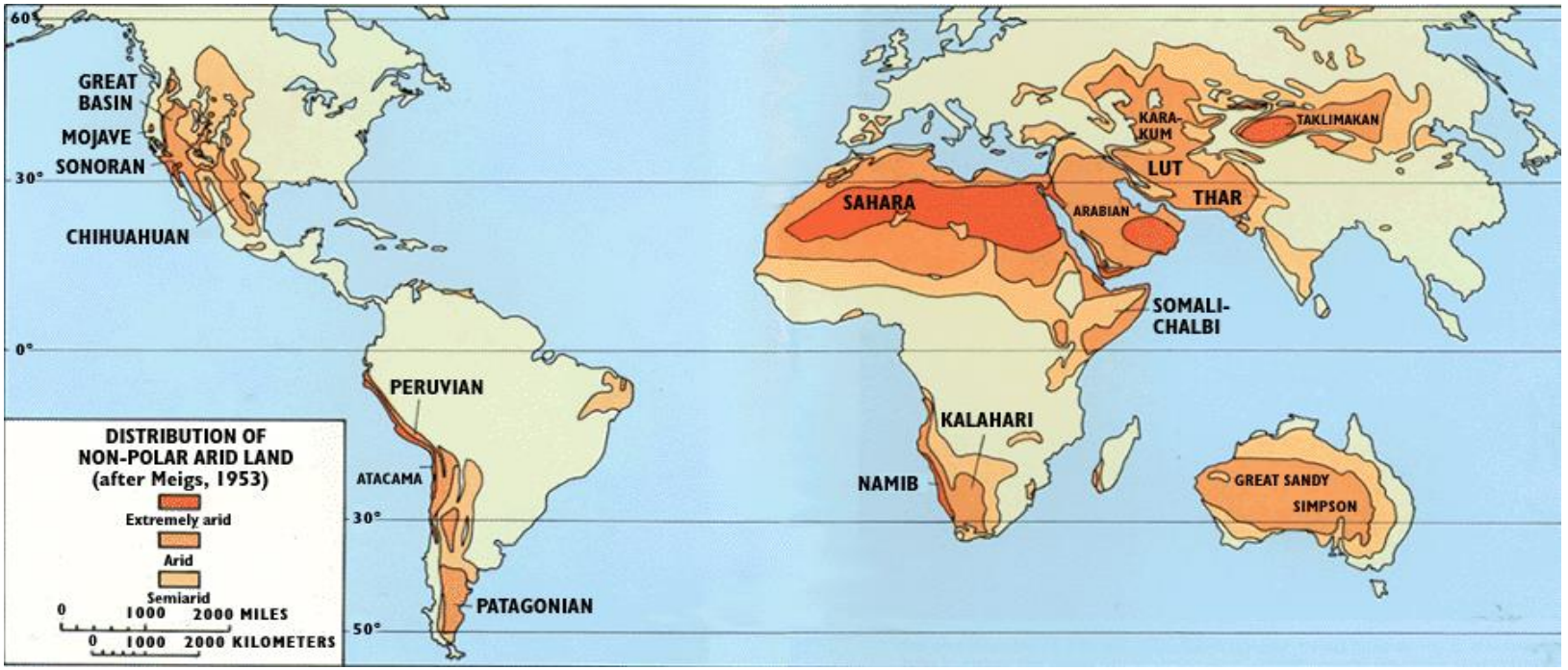
A large, dry, barren region, usually having sandy or rocky soil and little or no vegetation.

Water lost due to evaporation and transpiration in a desert exceeds the amount of precipitation; most deserts average less than 25 cm (9.75 inches) of precipitation each year



Deserts in the World

Approximately one-third of the Earth's land surface is desert, arid land with meager rainfall that supports only sparse vegetation and a limited population of people and animals.



Famous Deserts around the world



Namib Desert- South Affrica/Nambia



Black Rock Desert- AZ,USA



Atacama- Peru, Argintina



Sahara –North Africa



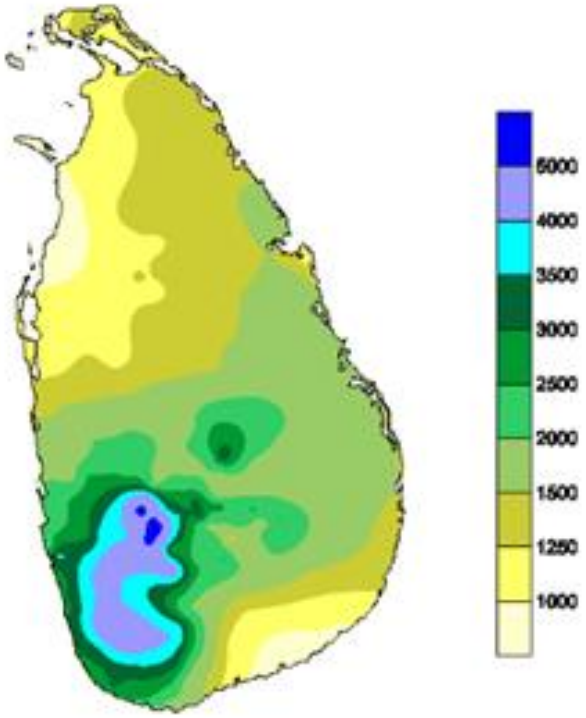
Gobi -China & Mongolia



Thar – India/ Pakistan

Sri Lankan Context

- No experience on desertification characters prominently yet.
- But, light characters are appearing in certain districts .
- As a country Sri Lanka has developed a National Adaptation Plan for Climate Change identifying strategic actions at national level.



Categories of Desertification

***Light Desertification*: Very slight damage occurs in vegetation cover and soil. This damage does not affect the biological capacity of the environment and can be neglected.**

***Moderate Desertification*: A medium degree of damage of vegetation cover occurs and formation of small sand dunes and salinization of the soil which reduces production by 10-25%.**

Severe Desertification: Increasing of the erosion activity which affects the vegetation cover and reduces production up to 50%.

***Very severe desertification*: Composition of active naked great sand dunes occurs and formation of many grooves and valleys and the salinization of the soil which leads to soil degradation.**

It is the most serious type of desertification.

Socio-Economic impact of Desertification

- Poor human well-being and high poverty in dryland populations

  Poor human well-being-political marginalization and the slow growth of health and education, infrastructure, facilities, and services
- Reduction in crop and animal production
- Livestock deaths and rise in the prices of food.
- Ground water levels had fallen, leaving dry wells,
- People migrate as a consequence of drought and desertification to urban areas or to other rural areas
- Dust storms is widely considered to be a cause of ill health (fever, coughing, and sore eyes)
- Often socially and politically marginalized due to their remoteness

Causes of Desertification

- Unsustainable land use patterns
- Global Climatic Variations
- Human-induced reasons-misuse of resources such as water, land and vegetation





Unsustainable Land use patterns

Overgrazing

- Too many animals grazing on the land.
- Animals eat all the vegetation.
- Vegetation fails to grow.
- Soil is exposed to rain and wind.
- Soil is washed or blown away.





Unsustainable Land use patterns

Over cultivation

- Many crops being grown on the land year after year.
- No rotation of crops.
- Crops take all the nutrients from the soil.
- The soil becomes infertile and nothing can grow.
- Because there are no crops to protect the soil the soil is again easily eroded by the wind and rain.





Unsustainable Land use patterns

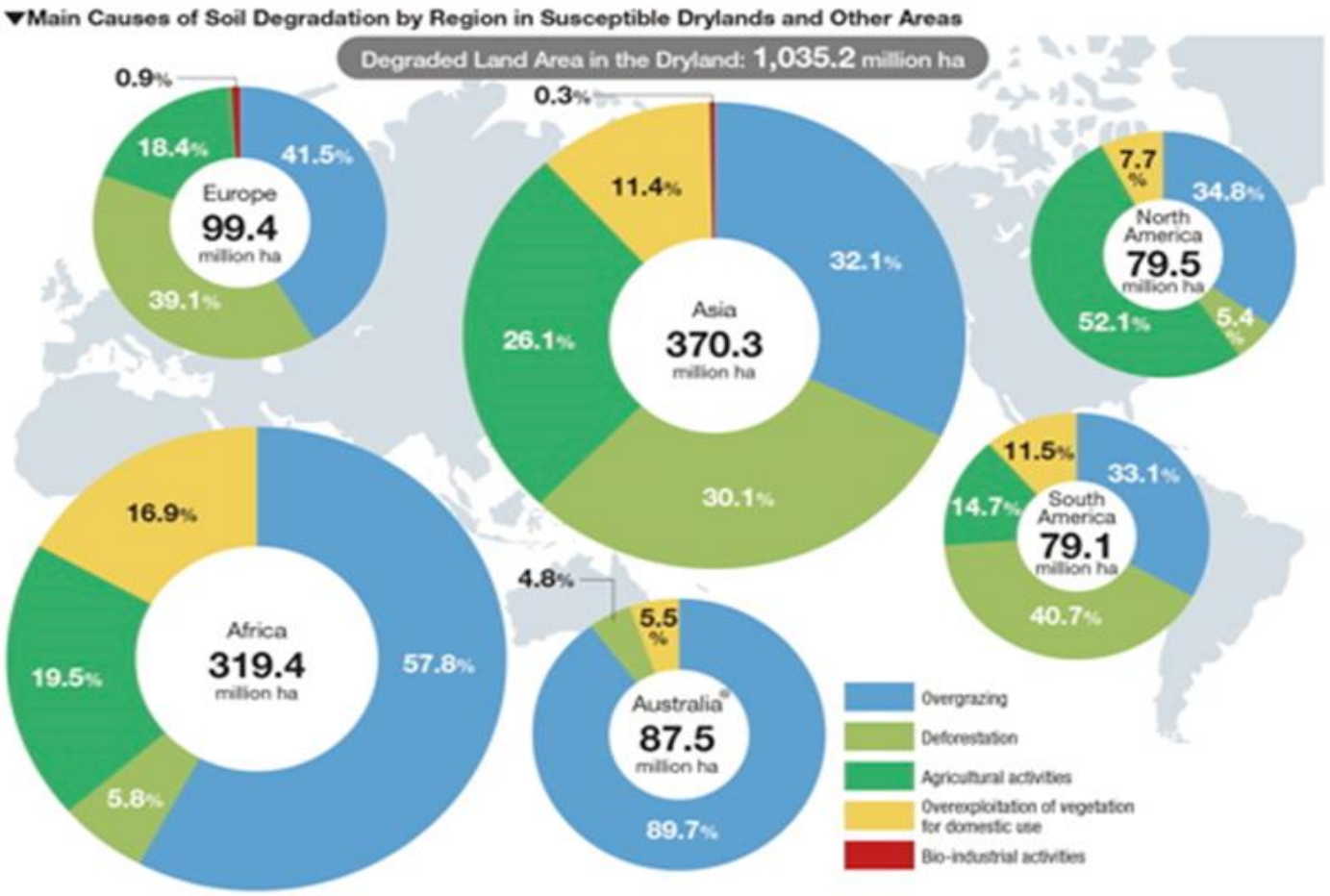
Deforestation/Removal Of Natural Vegetation

- There are few trees in the desert and their roots hold the soil together.
- When the trees are removed for firewood or to build shelter the roots die and the soil becomes loose.
- Yet again this means the soil can be easily blown or washed away.
- Because of lack of vegetation cover rain could not be motivated
- Deep water attraction





Dryland Soil Degradation by continents



Ecosystem and Human wellbeing- Desertification Synthesis

Globalization Impact on Desertification

- Globalization reinforce the driving forces of desertification
- Trade liberalization, macroeconomic reforms, focus on raising production for exports, enlarged markets
- Therefore, more drylands are under go more human induce activities
- Increases the rate of desertification in global scale





Climatic Factors Associate with Desertification

- Temperature
- Precipitation
- Evaporation
- Wind
- Changes of ecosystem equilibrium







Climate Change

- Considerably, no Global long-term trend in rainfall change in arid to sub arid area over the period of instrumental records (since last 150 years) not been changed much
- There has been an increase of 0·5°C in global temperature over the past 100 years.





Climatic Conditions

Droughts

- long period without rainfall.
- Severe impact on economic, social and health states
- Causes crops to die
- Lack of food
- May have to move to find food





Reasons of Climatic Variation

- **Urbanization**
- **Atmospheric pollution by CO2 and other GHG gases** (SO_2, NO_2, CH_4) and CFC.
- **Uneven thermal Increases**

  It increasing with latitudes above 40° N and S. The increase is only slight or non-existent in subtropical and inter-tropical latitudes where most arid and semi-arid lands lie.
- **Global Circulation changes/ Wind Patterns**

Case Study – Atacama Desert

- One of the major desert
- Unexpectedly bloom after decades due to climatic changes and el-nino condition



Human-induced Reasons

- **Population growth**

  Demands higher amounts of natural resources and expands more and more over the landscape

- **Agricultural technologies**

  Improper irrigation methods used in arid areas, such as canal irrigation, lead to a buildup of salt in the soil and make it difficult for crops and other plants to grow.

  Use poor quality crops with low economic value

- **Unsustainable policies**

- **Scarcity, Poverty and Political instability**

  country need to solve the crisis at the moment and do not think about sustainable cultivation strategies

Case Studies – African Sahel

- The Sahel is a semi-arid to arid area of scrubland and desert laying across Ethiopia, Eritrea, Northern Nigeria and Somalia.
- Desertification in is progressing at a higher rate affecting 2,500 hectares each year.
- After 25 years of great drought, assessing progress and moving towards new agendas and approaches



Reasons for desertification in the Sahel

- **Population increases**

  Overgrazing of the land to meet higher food requirement

  The increased energy requirements have lead to deforestation as more firewood has been needed.

- **Environmentally unsound policies**

  Do not forbid or actively encourage activities-desertification.

- **Lack of education in agricultural policies and techniques**

  Lead to stripping the land of minerals and humus which has not been replaced.

- **Poor irrigation practices**

  Raise salinity, and sometimes dry the rivers that feed large lakes: Aral Sea and Lake Chad have shrunk dramatically

- **Environmental or physical factors**

  Long periods of drought and short periods of torrential rain experienced by the Sahel region, and some climatic change

Desertification Impact on Ecosystem

- Ecosystems sustain only in balanced environment. It can cope with challenges and adapt, but beyond a certain tipping point they collapse.
- Dryland land degradation causes loss of habitats of many species

  (loss of vegetation, soil organic matter, and soil stability, Temperature)
- Major threat to biodiversity – loss of species richness
- Some countries have developed Biodiversity Action Plans to counter desertification effects







Policy Framework

United Nations Convention to Combat Desertification(UNCCD).

- The only internationally legally mandatory framework to address the problem of desertification and to Combat desertification .

  "to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability"

- Addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found. (Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa).
- link environment and development → sustainable land management
- Improve living conditions of people in drylands, maintain and restore land and soil productivity

Policy Framework- UNCCD Cont..

- Mitigate → national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements
- Associate with direct recommendation of the Rio Conference's Agenda 21, was adopted in Paris -1994 and entered into force in December 1996. 195 countries are already included.
- The dynamics of land, climate and biodiversity are connected through *the Convention on Biological Diversity (CBD)* and *the United Nations Framework Convention on Climate Change (UNFCCC)*
- 10-Year Strategy of the UNCCD (2008-2018) was adopted in 2007
- Bottom-up approach, encourage participation of local people in combating desertification and land degradation.
- Good Governance and Sustainable Development
- International Year of Deserts and Desertification- 2006

Prevention of Desertification

- **Integrated land and water management are the key methods of prevention**
  - Protect soils from erosion
  - Salinization
  - Controls on soil degradation – agricultural techniques
- **water management practices**
  - use of traditional water-harvesting techniques
  - Efficient water storage
  - Introducing diverse soil
- **Management strategies**
  - Create pressures on prohibited human activities
  - Maintain carrying capacity of ecosystems
  - Diverse species composition
- Prevention requires a change in governments and peoples attitudes

Mitigation of Desertification

- **Reforestation**

  Natural or intentional restocking of existing forests and woodlands that have been depleted

- Reforestation can be used to improve the quality of human life by soaking up pollution and dust from the air, rebuild natural habitats and ecosystems, mitigate global warming since forests facilitate Carbon-sequestration of atmospheric carbon dioxide, and harvest for resources.







Mitigation of Desertification

- **Fixation of soil**
- Often done through the use of shelter belts, woodlots and windbreaks.
- Windbreaks are made from trees and bushes and are used to reduce soil erosion and evapotranspiration.
- Enriching of the soil and restoration of its fertility is often done by plants. The Leguminous plants which extract nitrogen from the air and fixes it in the soil, and food crops/trees as grains, barley, beans and dates are the most important.
- Sand fences can also be used to control drifting of soil and sand erosion



Shelter belts



Sand Fence

Mitigation of Desertification

Contour trenching

an agricultural technique that can be easily applied in arid subareas to allow for water and soil conservation and to increase agricultural production.

•This involves the digging of 150m long, 1m deep trenches in the soil. The trenches are made parallel to the height lines of the landscape, preventing the water from flowing within the trenches and causing erosion. Stone walls are placed around the trenches to prevent the trenches from closing up again.







Mitigation of Desertification

- **Farmer-managed Natural Regeneration**
- produced successful results for desert reclamation.
- Its a simple and low-cost method has enabled farmers to regenerate some 30,000 square kilometers. The process involves enabling native sprouting tree growth through selective pruning of shrub shoots.
- The residue from pruned trees can be used to provide mulching for fields thus increasing soil water retention and reducing evaporation.



Mitigation of Desertification

- **Managed Grazing**
- Restore grasslands by using fences with many small paddocks and moving herds from one paddock to another after a day or two in order to mimick natural grazers and allowing the grass to grow optimally.





Mitigation of Desertification

- **Contour stone bunds**
- Trap organic material such as leaves, whilst allowing water to trickle through.
- This distributes water evenly over fields when it rains, and the trapped organic material can be raked across the fields, eventually turning to humus and so improving the quality of the soil.





Mitigation of Desertification

- **Perméable rock dams (digues filtrantes)**
- The structures are typically long, low dams of loose stone constructed in gullies and across valleys.
- It lack a spillway, the dams force flood water to spread over their length, which strongly reduces its erosive force.
- Also force water to infiltrate: this results in large quantities of sediment being deposited, often filling up gullies within two years – which in turn creates favorable conditions for growing crops where nothing could be grown before.





Case Study - Great Green Wall

- The Great Green Wall is a project developed by the African Union to face desertification in South Sahara.
- It is the largest environmental transformation in Africa and the Green belt of trees expands out 7,775km long and 15km thick.
- The trees' shade and bulk help offer crops relief from the overwhelming heat and gusting winds.
- Spans out across 11 countries of Africa.





Desertification in the Future determine by

When CO_2 and other GHG are increasing,

Phenomena 1:

- Global Potential Evapo-transpiration (PET) increase
- Mean annual precipitation to PET would then decrease
- Less/no changes in rainfall took place in arid and semi-arid lands.
- Therefore, **Aridity will increase**

Phenomena 2:

- Increase photosynthesis by plants and therefore primary productivity increases
- It would also increase water-use efficiency via the reduction of stomatal conductance.
- Therefor, **higher productivity and more efficient water use**.

- **The net balance of these two opposite consequences or to which phenomenon would prevail over other will determine the elevation of desertification in future**.
  (Le Houérou et el, 1996)

Conclusion

- Desertification occurs on all continents except Antarctica
- Takes place worldwide in drylands, and effects locally, nationally, regionally, and globally.
- Affects the livelihoods of millions of people, including a large proportion of poor in drylands.
- Drylands occupy 41% of earth's land area
- Drylands include all terrestrial regions where water scarcity limits the production of crops, forage, wood, and other ecosystem provisioning services.
- Some 10–20% of drylands are already degraded
- 1–6% of the dryland people live in decertified areas, larger number is under threat from further desertification.
- If not carefully manage desertification and degradation of ecosystem services in drylands, it will threaten future generations
- Therefore, desertification one of the greatest environmental challenges today and is a major obstacle to meeting basic human needs in drylands.

Thank You!