Desert Soil
- High mineral content, low organic content
- Can’t retain water due to lack of humus
- Shallow, sandy, grey, gravelly soils
- Intense evaporation can draw salts to the surface, in a process called salinisation

Case study of a Hot Desert—Thar Desert
- NW India + Pakistan
- Area of 200,000km²
- Mostly in state of Rajasthan
- Most densely populated desert in the world 83 people per km²

Animal Adaptations
- Nocturnal + Burrowing to avoid High day time temperatures e.g. Scorpions, + Long eared Jerboa.
- Camels: fat stored in hump allow camel to survive long periods without food & water, and wide flat feet to cope with moving sand & double eyelashes to help keep out sand in sand storms
- Eat prey with high water content e.g. Road Runners
- Waterproof skin to prevent water loss + moving sideways to minimise contact with hot sand e.g. Peringueys Adder.

Plant Adaptation:
- All 3 cacti have thick fleshy stems to store as much water as possible when it comes available
  - Saguaro Cactus—tap roots up to 20m long to reach water levels deep beneath surface & a large lateral root network close to surface to absorb as much rainfall as possible before it evaporates. Waxy & waterproof to further reduce water loss.
  - Old man Cactus—white hairs reflect heat
  - Prickly Pear—prickly spines to reduce water loss during photosynthesis and deter predators, waxy & waterproof like Saguaro
- Yellow daisy—Seeds lie dormant for very long time & only germinate after heavy rain. Whole life cycle very short

Development opportunities in Thar

1 Mineral Extraction
- Valuable reserves of Gypsum used for making plaster and cement
- Feldspar—used for Ceramics
- Phospherite for Fertiliser
- Koalin to whiten paper
- Limestone at Jaisalmer for steel industry + construction.

2 Energy
- 175 Billion tons of Lignite Coal, exploited in the 2015 Thar Coal Project. Created 200 technical jobs and 1600 menial jobs and average wage in area has increased from 6000 Rupees to 35000. Company is also building new schools in area.
- Jaisalmer Wind park constructed in 2001
- Bhaleri solar power plant is used in water treatment.

3 Farming
- Mostly subsistence, goats, sheep, vegetables and fruit trees.
- Some commercial farming in irrigated areas e.g. near Indira Gandhi Canal (built 1958) for wheat and cotton, sesame, maize and mustard.

4 Tourism
- Beautiful dune landscapes used for weddings, 10 of 1000’s visit area from Pakistan.
- Jeep dune safari’s and Camel rides near Jaisalmer.
- Annual desert festival each winter.
- All this gives local job opportunities as guides, providing food and accommodation.
Challenges to development in the Thar desert

1. Extreme Temperatures
   - Working in the heat of the day can be draining for farmers = low productivity
   - Livestock such as cattle and goats need shade to protect them from the intense sun
   - The low annual rainfall, high temperatures and strong winds in the desert leads to high rates of evaporation making crop production difficult

2. Water Supply and demand
   - Water can be sourced from natural ponds (Tobas), man-made ponds (Johads) or underground aquifers. However the water quality in wells can be poor.
   - Population growth and development has led to an increase in water demand, yet it is very scarce, which could result in migration into other sensitive areas.

3. Accessibility
   - Many areas are only accessible by camel and any public transport may be overloaded
   - Very limited road networks exist because the are is so barren.
   - The high temperatures can cause tarmac to melt and the strong winds blow sand over the road making them difficult to navigate.

Causes of desertification: it is the degradation of marginal land as it becomes drier and less productive. The areas can also be called semi arid (nearly dry), and are found on the edges of deserts. These areas are estimated to cover around 30% of the world and are classed as fragile environments.

1. Climate Change: Either naturally or due to human climate change the worlds average annual rainfall has decreased in the last 50 yrs.
2. Population Change: 50 Million people live in the Sahel area, an area prone to desertification. Population growth due to natural increase in LICs, as well as migration into refugee camps either due to civil wars or harsh conditions, leads to stress on the land as more food and wood is needed (see pt 3 & 4)
3. Fuel wood removal: Increasing populations in marginal lands require increase in wood for fuel and building. Removing wood exposes soil to sun which dries & loosens the soil. Winds blow away the top soil. Half the worlds top soil has been removed in the last 150yrs
4. Overgrazing, Over-cultivation and soil erosion: Increase in population means there is a greater demand for food. Too many animals in one area leads to over grazing, e.g. by herds of goats, this exposes the soil to erosion and removes any roots which could have held the top soil. Overcultivation (same crop in same area year on year), can reduces soil fertility as the soil is not given time to recover between crops. Crops die, leaving soil exposed etc

Physical impacts of Desertification
- Loss of top soil & vegetation diversity
- Salinisation (drawing salts to the surface through evaporation) making the soil infertile

Human impacts of Desertification
- Lack of food and water
- Increases migration. As areas become unsustainable people are forced into other marginal areas (leading to further pressure on land).

Management strategies of desertification

1. Water + Soil Management
   - Building low stone walls to stop water running down slopes
   - Bunds (Magic stones e.g. in Burkino Faso), lines of stones built 0.5-1.5m high along the contours of slopes. Any rain washing downslope will get trapped. This has increased crops up to 50% and reduced desertification.
2. Tree planting in Thar
   - Planting Prosopis cineraria trees provides foliage for animals to eat. Provides firewood and strong wood for building. Provides shade for animals and moist growing conditions for plants. Roots stabilise dunes.
3. Alternative Technology
   - Alternative technology involves using methods and materials suitable to the country’s level of development e.g Magic stones, solar power cooking reduces need for fuel wood.

Solutions to the Challenges in Thar

- The Prosopis cineraria tree is suited to grow in the desert and can provide shade and fodder for animals
- Moving sandune sand can be stabilised by growing blocks of trees to create shelter belts along side roads.
- The 650km Indira Gandhi Canal was constructed in 1958 to provide drinking water and irrigation to allow commercial growing of cotton and wheat around Jaisalmer