



Hot deserts

LO: understand that hot deserts have a range of distinctive characteristics.

Key words – location, interdependence, adaptation and biodiversity.

Use the following link – online textbook -

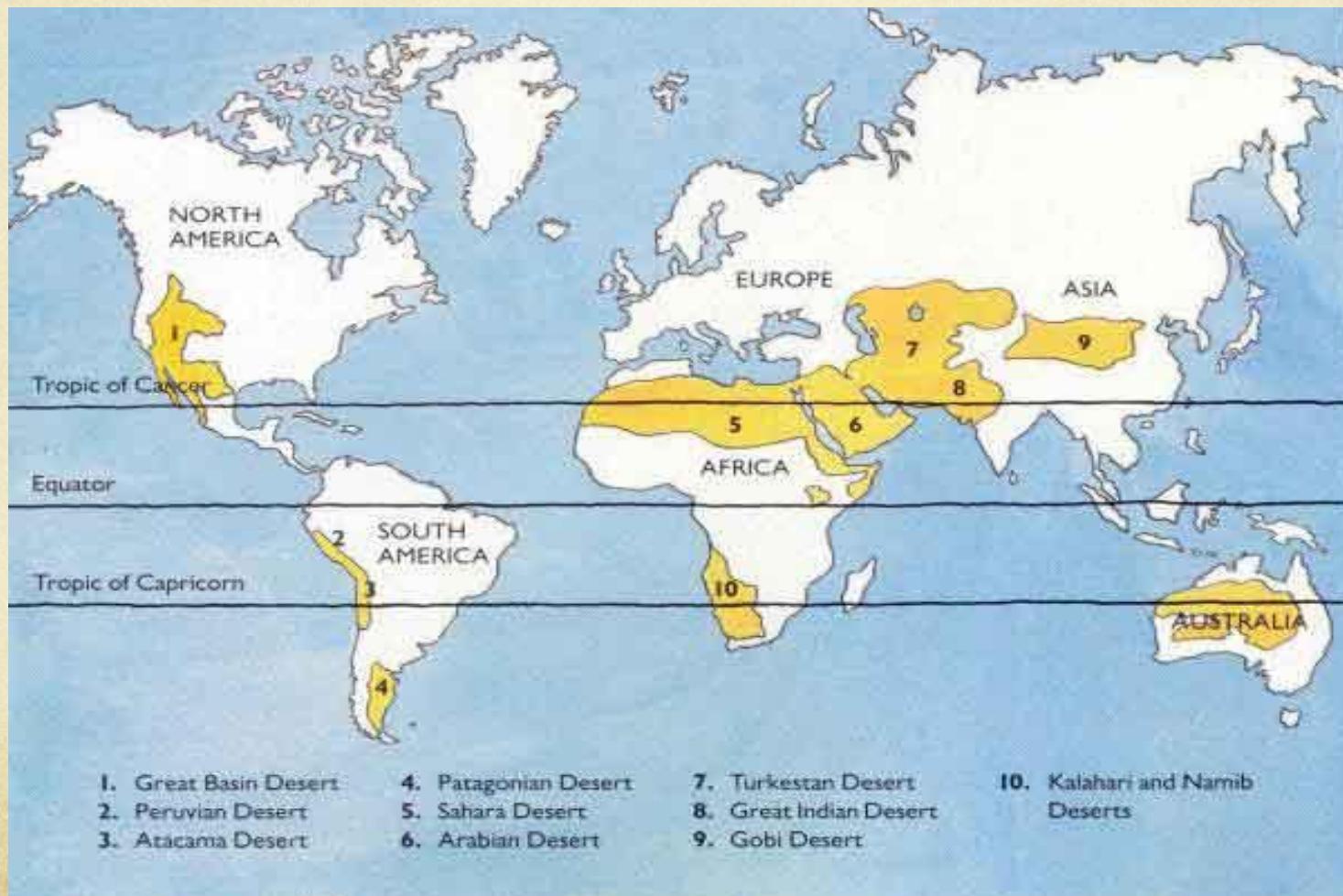
<https://books.google.co.uk/books?id=j-bRCwAAQBAJ&pg=PT227&lpg=PT227&dq=USA+western+desert+region+development+opportunities&source=bl&ots=UdCpaOWefX&sig=egSEWjA8HeUmo2ks3zLibuelH3M&hl=en&sa=X&ved=oahUKEwiutsaV887UAhVqIcAKHZf6CycQ6AEIKDAB#v=onepage&q=USA%20western%20desert%20region%20development%20opportunities&f=false>

You might have to copy and paste the above link



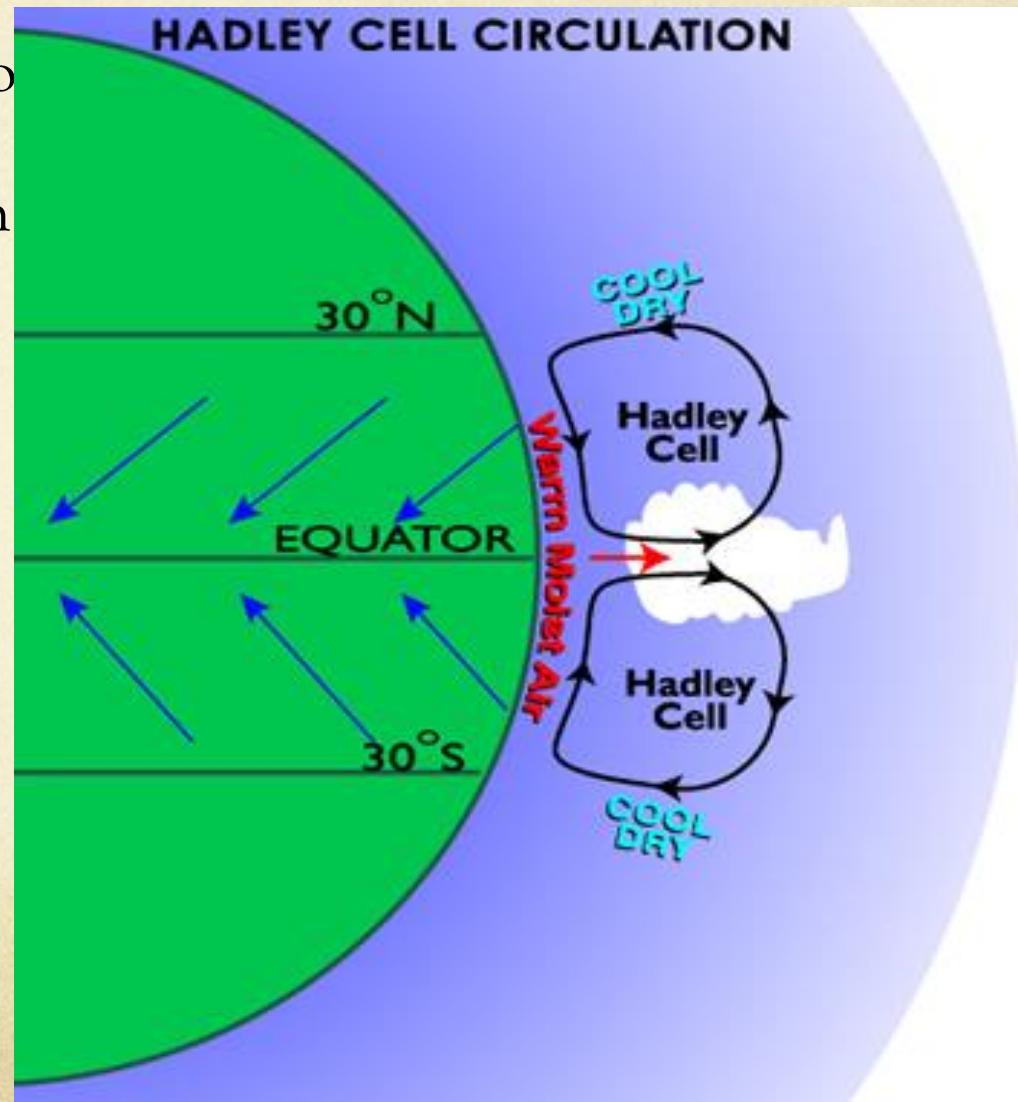
Location

Using the map describe the global location of hot deserts.



What causes the desert?

The Hadley Cell (diagram to the left) illustrates how hot deserts are formed – explain this process using geographic terminology.

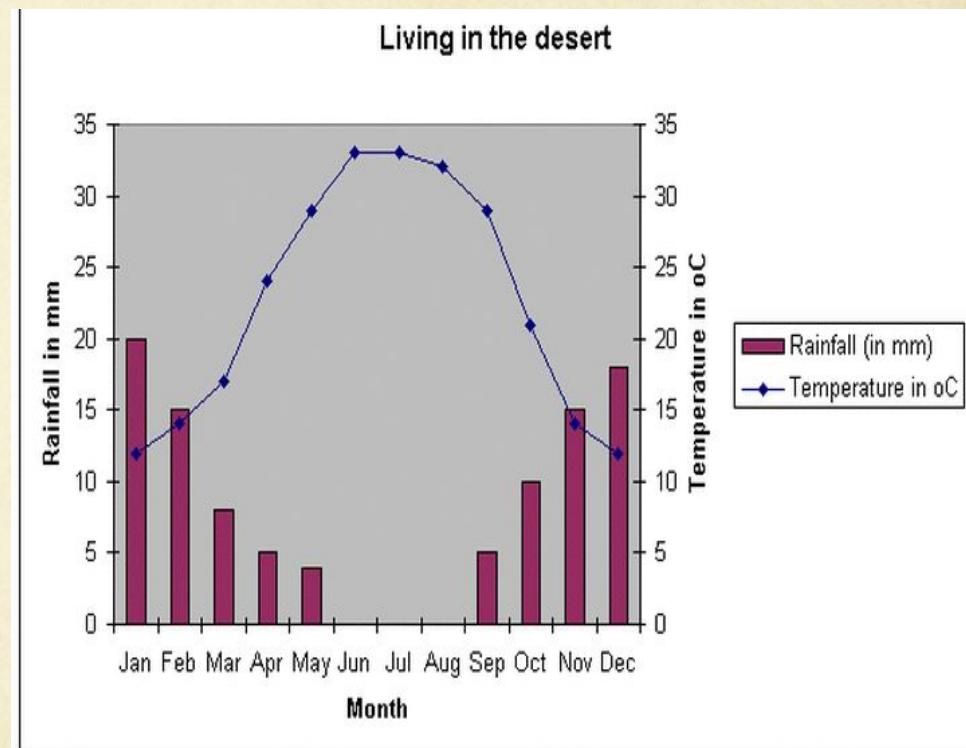


Hot desert climate

The climate graph to the left highlights the typical climate of a hot desert environment.

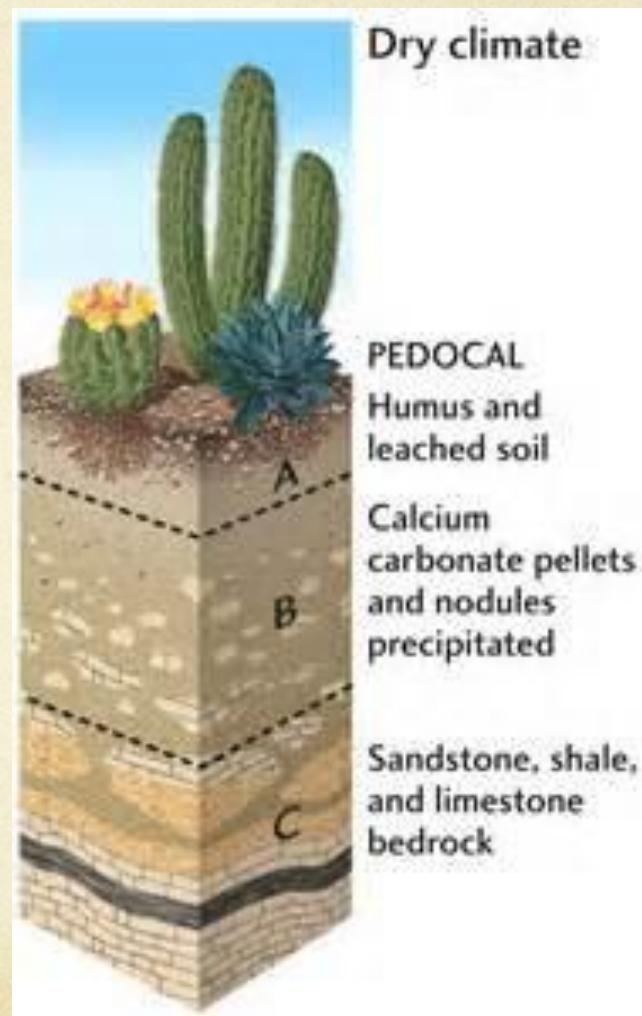
Using the graph provide the following data:

- * Hottest and coldest months
- * The temperature range
- * Wettest and driest months
- * Annual rainfall

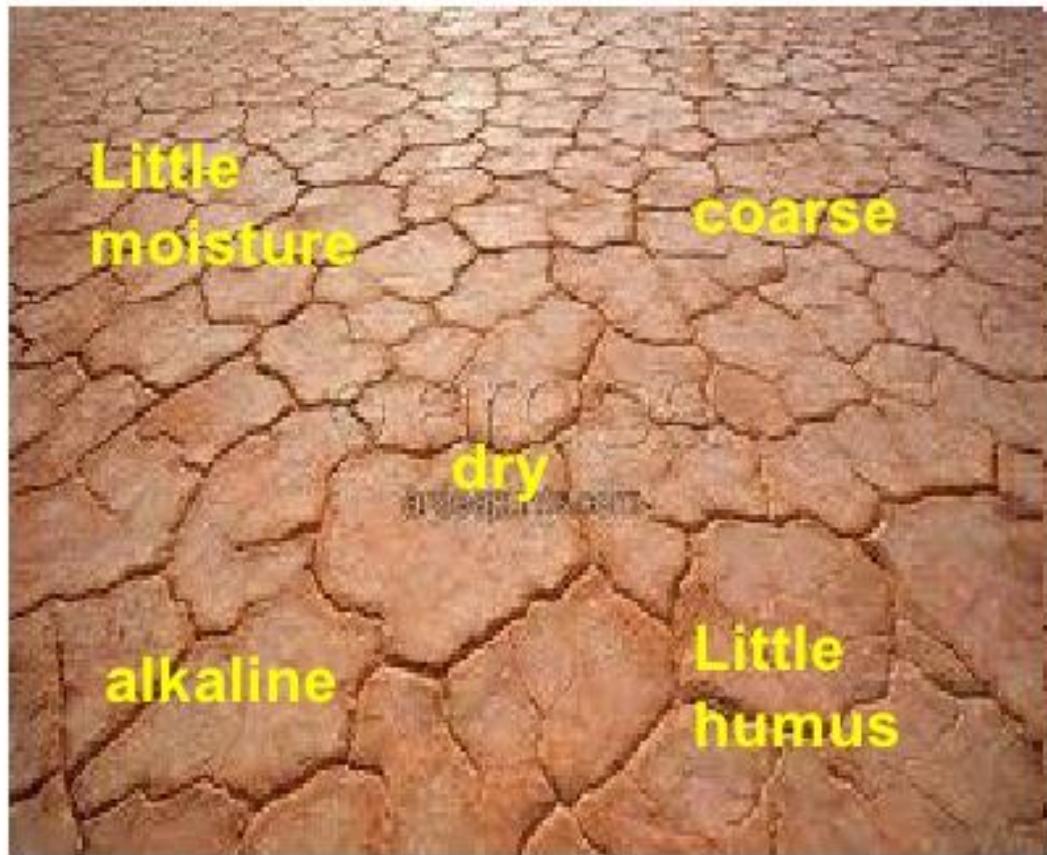
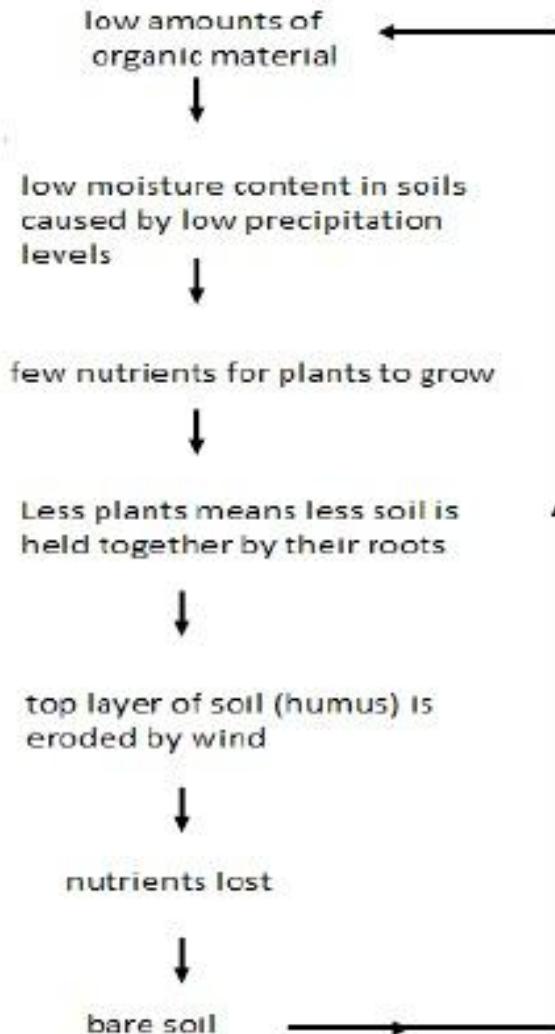


Soil type - Pedocal

Pedocal - it is a class of soil which forms in semi-arid and arid regions. Has low soil organic matter with only a thin topsoil (A horizon).



Soil



Occasionally when a lot of rainfall occurs in a short space of time very little of the water is infiltrated into the soil as it is very hard and dry. Therefore there is high surface runoff.

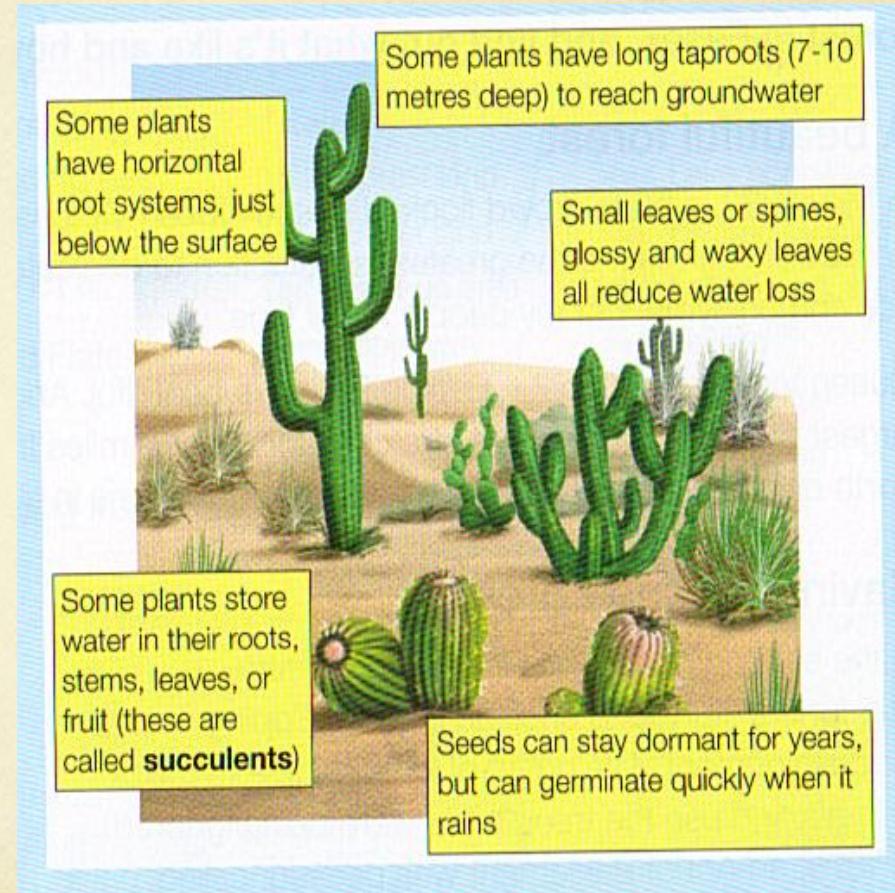
Biodiversity – plant adaptation

How have plants adapted to the hot desert environment. Use the image to the left and the textbook (pg 84).

Key terms – dry conditions, high temperatures, short periods of rainfall.

Watch the following YouTube video and **take notes**:

<https://www.youtube.com/watch?v=T1bpYeuVKpI>



Biodiversity – animal adaptation

Using the diagrams below and the textbook (pg 85) explain how animals have adapted to this harsh environment.

Animal adaptations- Fennec fox

Adaptation

burrowing and nocturnal lifestyle



Function

Cooler temperatures at night mean less water loss while carrying out activities.

large ears (about 15cm)

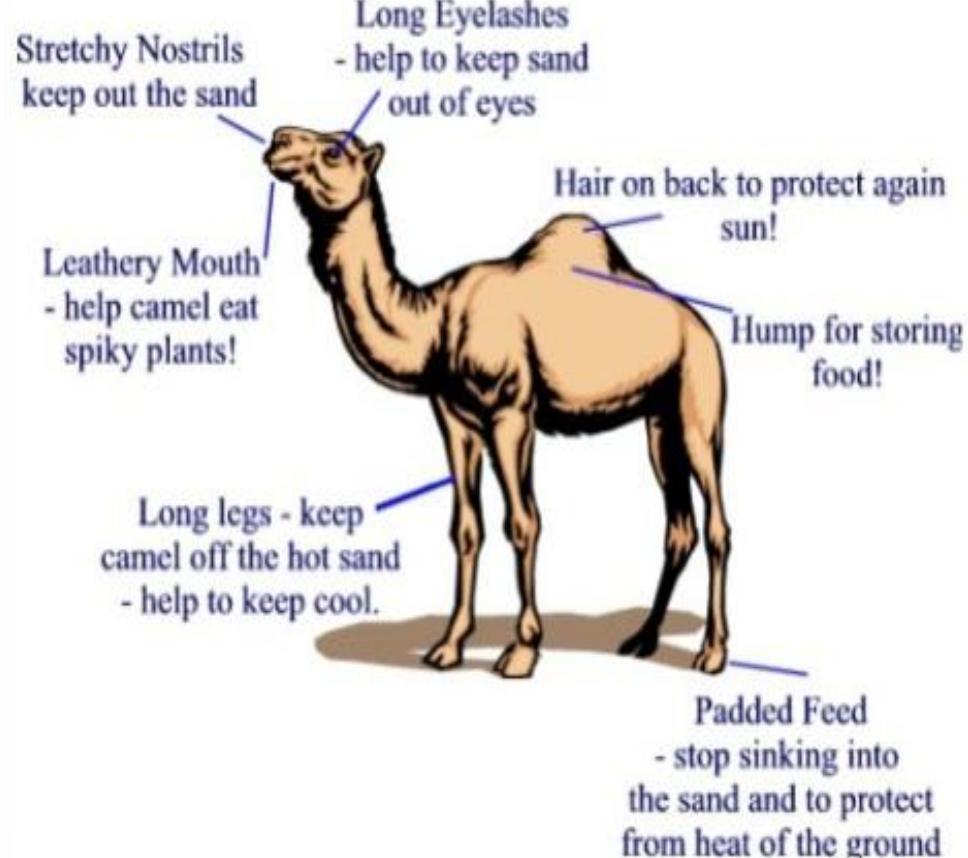


help dissipate excess body heat on hot days in the desert.

Thick, sandy fur



helps insulate them from the cold desert nights but also reflects heat, As well as providing excellent camouflage.



Interdependence that exists in the hot desert environment

- Links between the different parts of the food web – biotic and abiotic.
- The role of vegetation in stabilising sandy soils – plants stop the soils from being blown away by the wind (desertification).
- Increasing unsustainable use in the deserts – threatens the interdependence.
- Fragility of deserts affects the biodiversity.



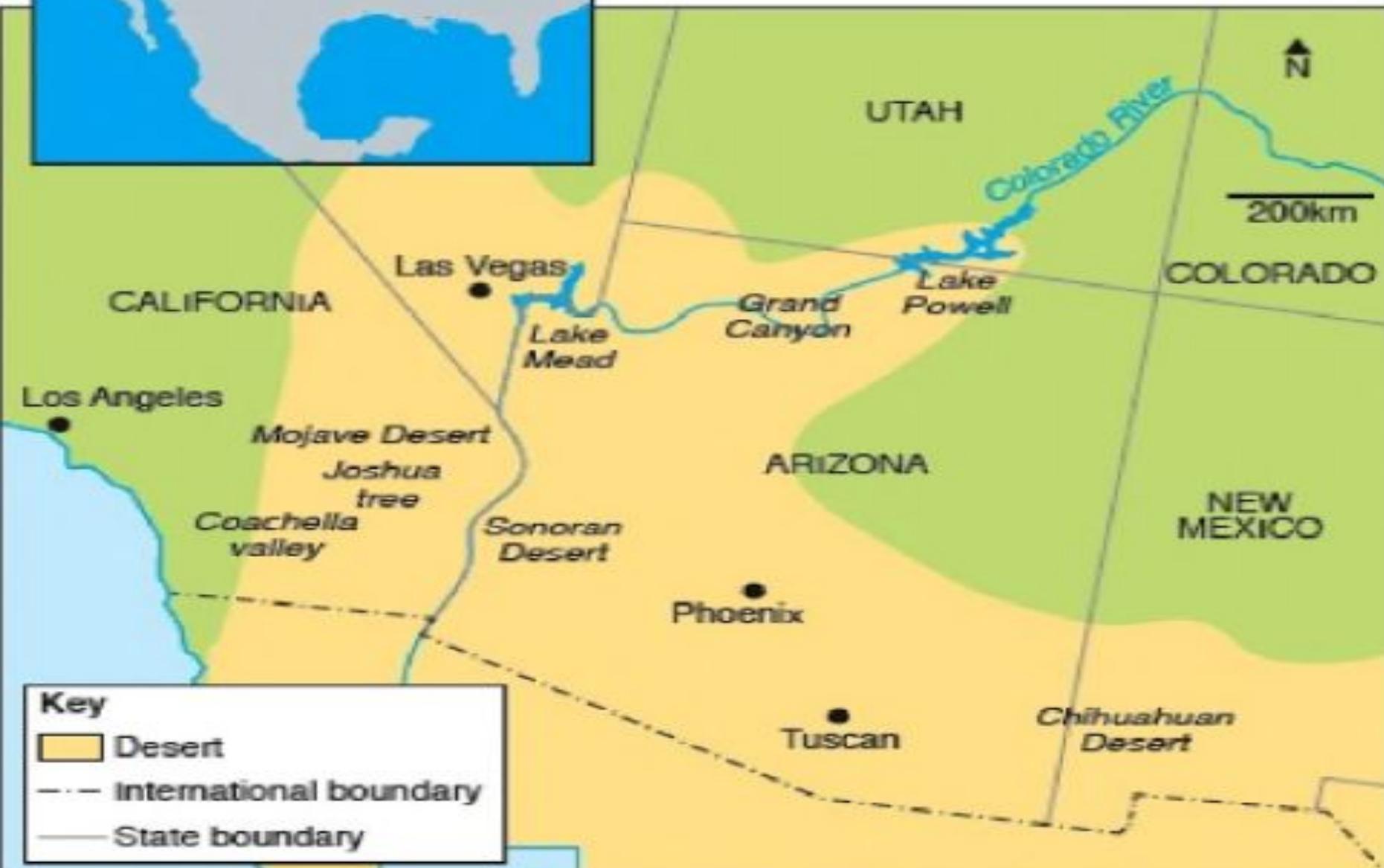
Development opportunities in the Western Desert Location



Using the maps and the textbook (pg 86) describe the location of the Western desert in the USA.
In your answer you will need to include the names of the different desert which make up this region and the states they are located within.



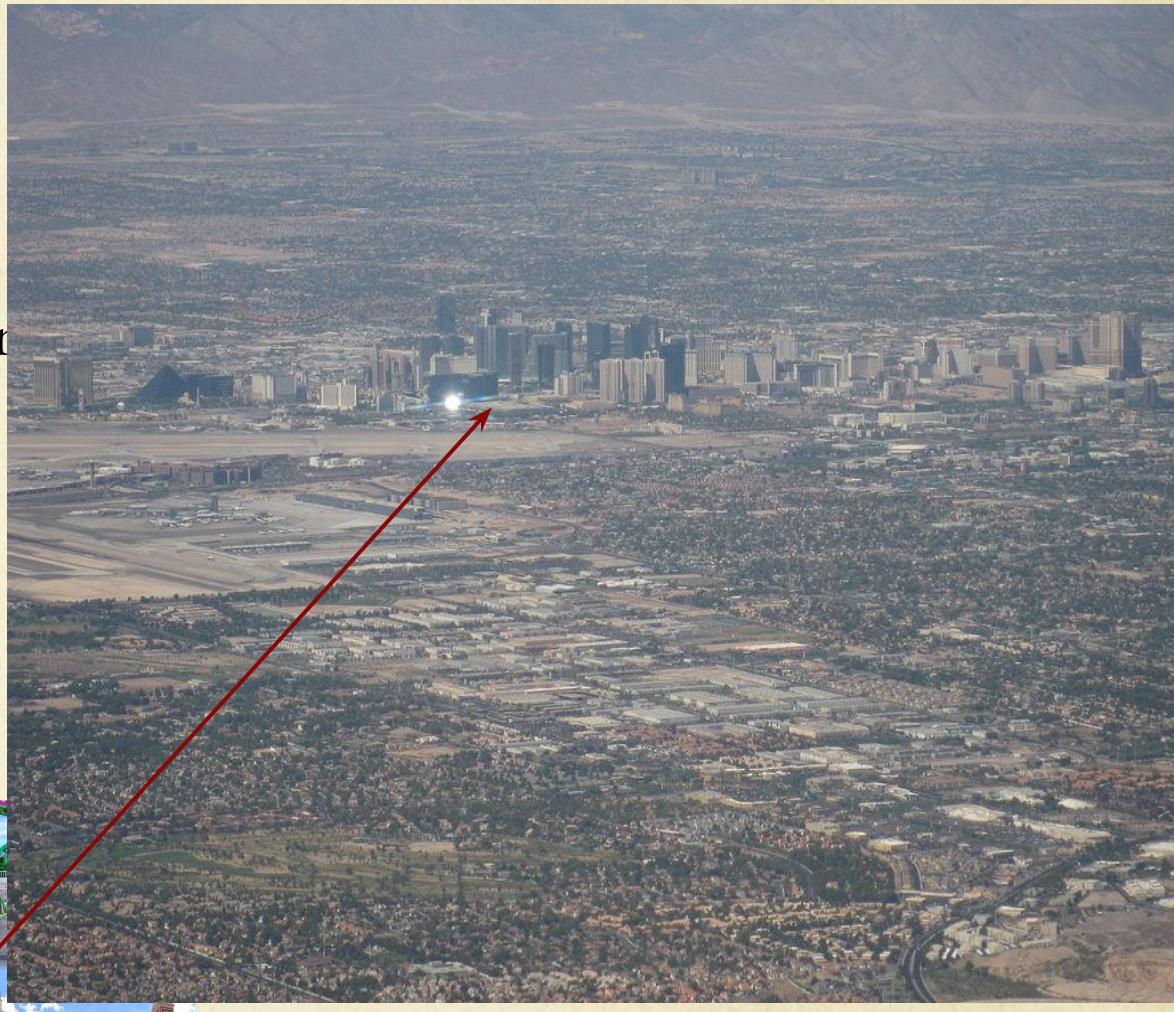
The next slide contains another map of the desert region



Western Desert's development opportunities

Discuss each of the bullet points

- Farming
- Mineral extraction
- Energy
- Tourism

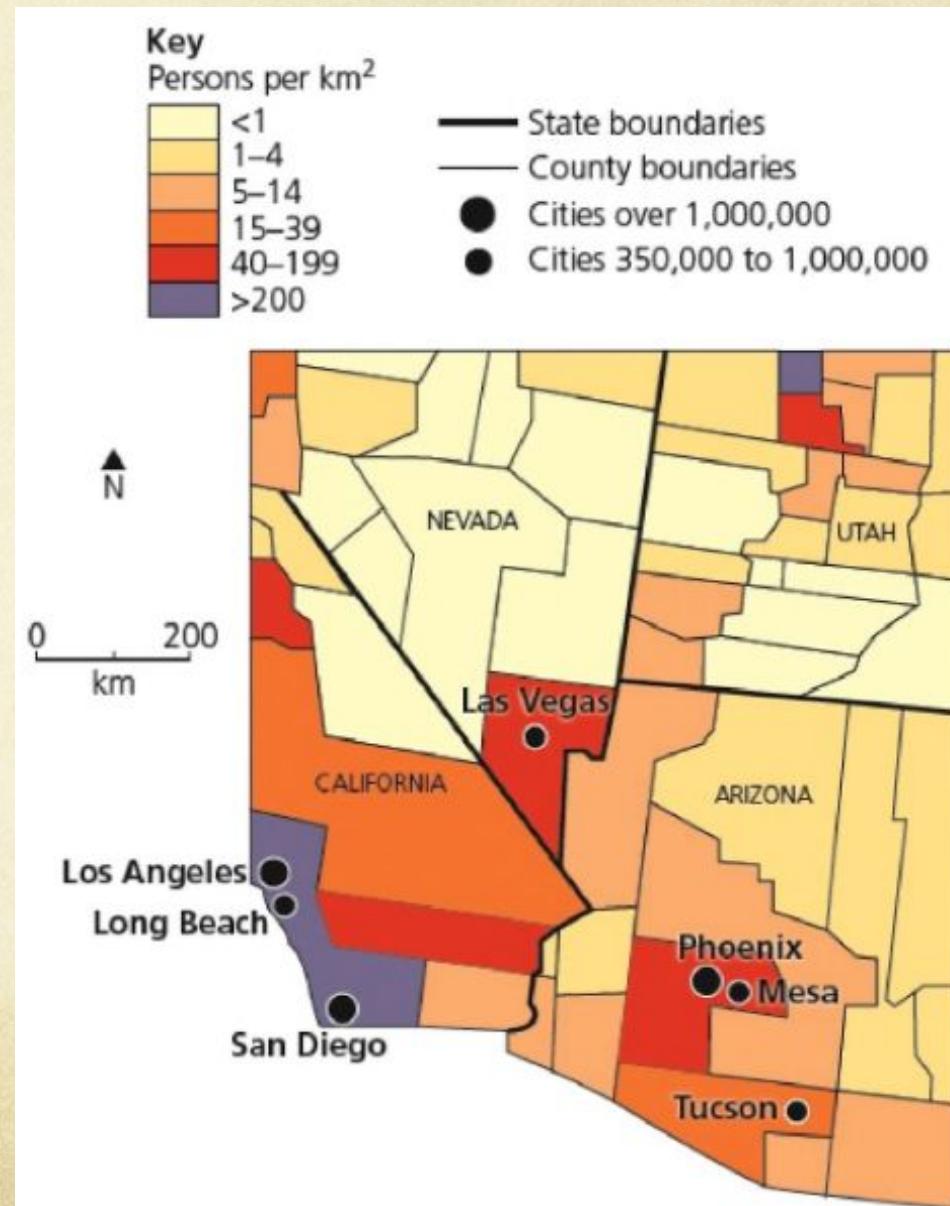


Las Vegas – built in the desert – attracts 37 million tourists a year.

Population distribution

Describe population distribution in the Western Desert (refer to the map).

Using the textbook (pg88) explain why this uneven development has occurred?



Development challenges in the Western Desert

Adapting to the hot desert environment has been a challenge to settlers this is due to the high temperatures (50°C) in the Mojave Desert's Death Valley – this is the survival limit of the plants an the absence of people reflects the low carrying capacity of the land.

Accessibility – this area lacks surfaced roads due to the low population densities 1 person per square km. The extreme temperatures make this a dangerous place to travel. However – improvements have been made:

(a) Railway moved in (1900s) – the choice of sites for situation has influenced the growth of future key settlements.

(b) Better roads were laid in the 1900s.

How have people adapted to the climate – before air conditioning and improved water supplies houses needed: flat roofs, small to reduce sunlight keeps temps down, whitewashed walls.



The Western Desert – water crisis

The following webpage provides detailed information regarding the Colorado River - <http://www.bbc.co.uk/education/guides/zcrrr82/revision>

Watch the following YouTube clips part 1 and 2 -
<https://www.youtube.com/watch?v=BEIRbFJTZdI> &
<https://www.youtube.com/watch?v=JAHHu6tbtow>

Use the following four slides to assess the water crisis in this sensitive environment.



The Colorado River

The Colorado River is located in South-West USA and North-West Mexico. It is over 2,300km and has its source in the Rocky Mountains and its mouth in the Gulf of California. Its drainage basin covers an area of 640,000km². The Colorado River and its tributaries pass through the US states of; Wyoming, Nevada, Utah, California, Arizona, Colorado and New Mexico.

The climate across the river basin is very varied, in the Rockies temperatures can fall to -50 degrees Celsius and experience precipitation in excess of 1000mm, whereas some areas in the Mojave Desert can experience temperatures of nearly 50 degrees Celsius and precipitation as low as 15mm.

About 12.7 million people live within the drainage basin of the Colorado River, although some people outside the drainage basin (especially in California) use water from the Colorado River. In total it is estimated that about 40 million rely on the river for domestic, agricultural, industrial and energy needs.

To cope with the massive demand, the Colorado River has become one of the most managed river's in the world. The river has over 29 major dams built along its and hundreds of miles of artificial canals. The Hoover Dam was one of the first major dams built along the river (and certainly the most famous), it was completed in 1936 and created Lake Mead - this is still the US's

Colorado River Aqueduct (CRA): This is 389km of tunnels, pipes and canals taking water from the Colorado River to California. The water is taken from the Parker Dam and is pumped up over the Rockies ending up at Los Angeles. Work on the project began in 1933 and water was first pumped in 1939. On average 1.5km³ of water is pumped through the aqueduct each year.

Central Arizona Project (CAP): This is 541km diversion canal. The canal was designed to provide water for irrigation of 405,000 hectares (1.85 trillion litres a year) and for domestic use in cities like Phoenix and Tucson. Construction of the project began in 1973 and it was completed in 1993. The canal starts at Lake Havasu and eventually finishes at Tucson. The scheme cost about \$4 billion to build.

California State Water Project (SWP): The project aimed to provide water for 23 million people and 6.6 million MWh of electricity to people living in Southern California. The project began in the 1950's.

Environmental & management strategies

It is impossible to manage a river so much and not create some **environmental problems**. Problems include:

The Colorado River used to carry about 90 million tonnes of sediment (alluvium) a year down to its mouth. However, the majority of this now gets trapped behind dams, damaging the delta and wetland ecosystem at the river's mouth.

Salinity in the lower Colorado has increased changing the ecosystem.

The number of fish shrimps and sea mammals have all reduced around the mouth of the river.

Evaporation rates have increased behind the river's many dams. About 15% of water is evaporated.

The deep water in the reservoirs behind the dams has reduced the temperature of the river in many areas.

In an attempt to reduce environmental damage while allowing continued economic and population growth, a number of **management strategies** have been implemented and/or suggested, including:

Reduced leakage: It is estimated that 25% of all water is currently lost through leaking pipes and canals.

Recycling Water: Using more grey water in domestic homes.

Sewage Treatment: Recycling industrial and domestic waste more efficiently.

Domestic Conservation: Improving education and introducing things like half flush toilets.

Drip Irrigation: Use more efficient irrigation techniques.

Changing Crops: Growing crops or varieties that need less water.

Metering and Pricing: Increasing the price of water and metering its use.

Cloud seeding: Using chemicals to create artificial rain has been talked about.

Desalination: With the Pacific Ocean on California's door step the technology of desalination could be improved.

Groundwater: Increase extraction of groundwater supplies.

Impacts on particular groups:

Californian farmers

There are conflicting views about the Colorado river because the dam can be used for water irrigation in large quantities however building a dam will cause flooding in surrounding areas, this could be bad for farmers because then crops will die. As well as that the water in dam appears to be running out so it won't be long before all the water is gone and they need to think of another way of getting water for irrigation.

Native Americans

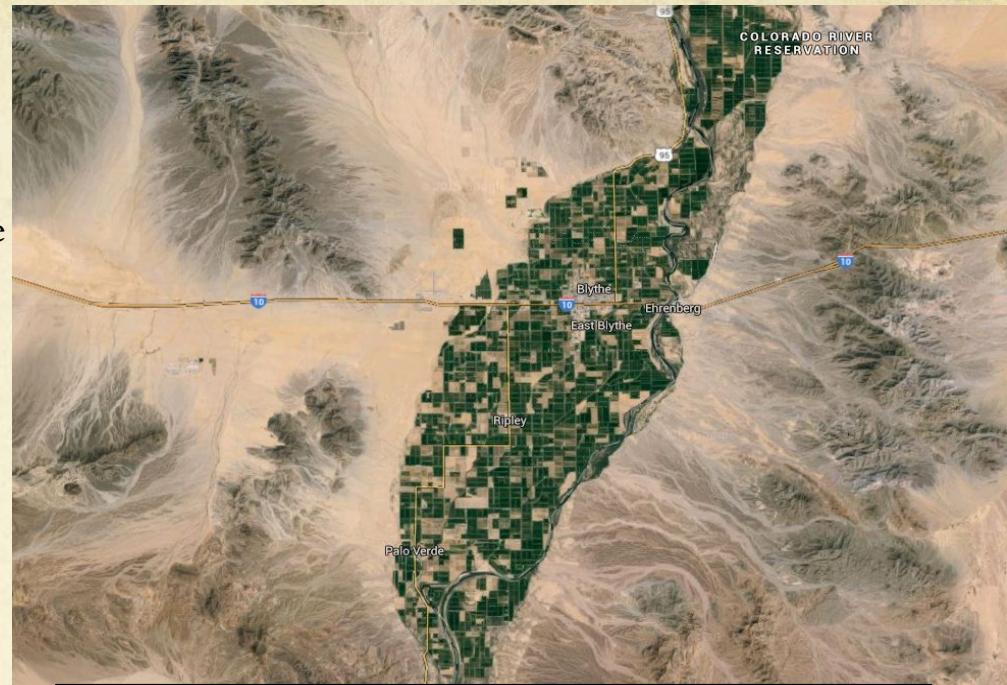
Their home may be destroyed in the making of this dam and it would also ruin the view because you are putting up a man-made dam that looks obtrusive. However, the advantage of the dam is that it can regulate enough water all year around for people living in these areas that would otherwise find it difficult to obtain water.

Californian urban dwellers

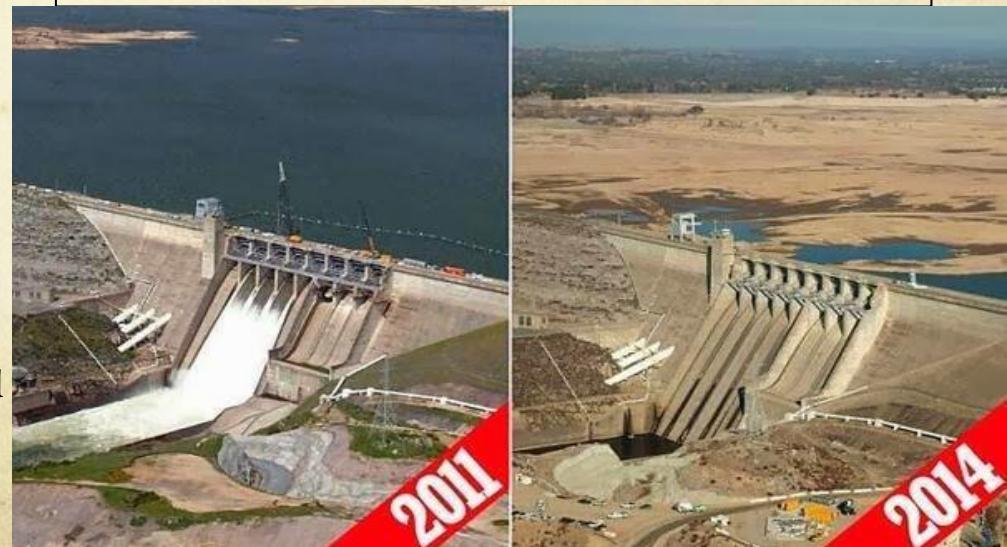
It provides enough water for their golf courses and gardens. That could help with urbanisation the dam can also produce hydroelectric power. The problem is that droughts could occur and because the water is running out they need to find an alternative method of getting water.

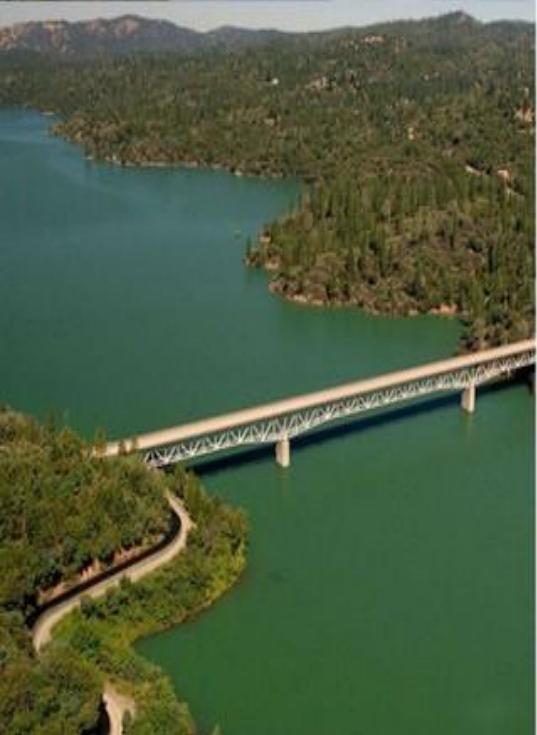
Mexican farmers

The dam will provide water for farming as well as domestic use. It could however cause floods that could ruin all the plants and crop. The water can also be difficult to distribute or maybe they won't get as much as they need compared to other groups of people.



Irrigating the desert – causing problems





Desert fringes and desertification

<https://books.google.co.uk/books?id=j-bRCwAAQBAJ&pg=PT244&lpg=PT244&dq=desert+fringes+and+desertification&source=bl&ots=UdCpbNUdbS&sig=U-SOe7oq4PgpTDrGriLewv78PVc&hl=en&sa=X&ved=oahUKEwiCq5K6utHUAhXpj8AKHVliAEsQ6AEITzAK#v=onepage&q=desert%20fringes%20and%20desertification&f=false>

Desertification is –

- (a) the processes by which an area becomes a desert.
- (b) the rapid depletion of plant life and the loss of topsoil at boundaries and in semiarid regions, usually caused by a combination of drought and the overexploitation of grasses and other vegetation by people.



What are the causes:

Overtcultivation: the land is continually used for crops and does not have time to recover eventually all the nutrients are depleted (taken out) and the ground eventually turns to dust.

Overgrazing: In some areas animals have eaten all the vegetation leaving bare soil.

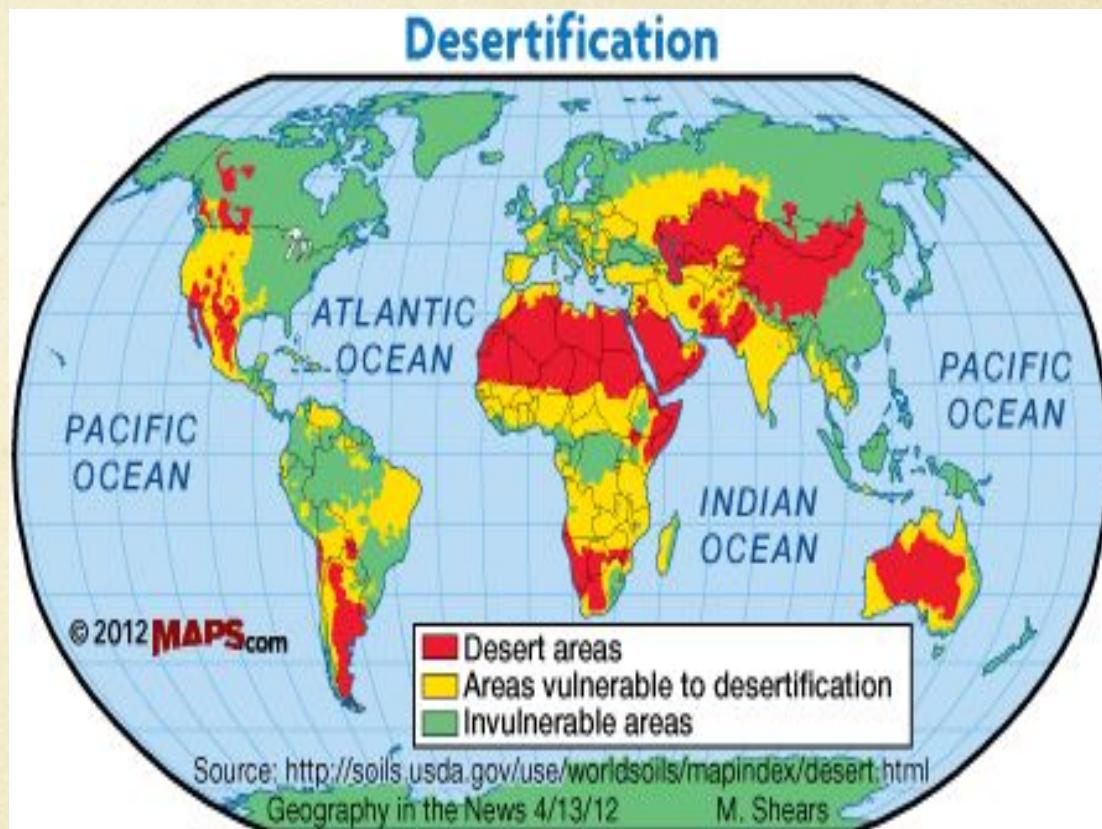
Deforestation: Cutting down trees leaves soil open to erosion by wind and rain.

Climate Change: Decrease in rainfall and rise in temperatures causes vegetation to die

What are the links between desertification and natural climate change? (pages 92-93)

Watch the following YouTube clips –

- (a) <https://www.youtube.com/watch?v=tDWS6AzEkEo>
- (b) <https://www.youtube.com/watch?v=c-MYQYKQXhI>
- (c) <https://www.youtube.com/watch?v=aUC8xYIJR-Q>
- (d) <https://www.youtube.com/watch?v=tYGo6X94kEU>



Sahel region, Africa

Case study BBC -

http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/drought_rev3.shtml



Human causes

Cause	Explanation	Solution
Deforestation	The removal of trees for firewood and for the expansion of urban areas has led to the soil being left exposed to the wind and rain as there is less interception by the leaves. The nutrients in the soil then get washed or leached away leaving soil infertile.	Afforestation – The replanting of trees greening the Sahel Zone and Burkina Faso. A green wall helps the soil regenerate, protects it from soil erosion and people can use the gum to sell to make a sustainable future.
Over cultivation and poor farming methods	Over use of land to grow crops each year without allowing the nutrients in the ground to return leaves the soil of poor quality where nothing can grow. This leads to regular crop failure. Poor farming methods like ploughing also makes soil poor.	Educate the farmers on their farming methods so they use the land in a productive way and protect it. Allow the soil time to regenerate using crop rotation to use different areas every two years. Don't plough the land or use poor equipment.
Overgrazing due to farmers becoming less nomadic (stay in one place now!)	Farmers rely on the water and land around them more. This means that farmers don't regularly move to new fertile areas. Cultures are lost and the desert spreads quickly. In some cases 3 miles each year.	Control the land use and provide alternative work to take pressure off the land. Plant acacia trees for use as fodder so the animals don't strip the ground of vegetation.
Over use of Fertilisers	This leads to the need for more food at greater expense to the economy and the land. Urbanisation and the need for more homes put's pressure on the land.	Use Genetically Modified Crops as these are drought resistant and can produce more food from less land. This will mean food supplies are consistent and safe.
Lack of irrigation	This causes crops to die and poor farming methods to be used. The soil becomes compacted and of poor quality.	Build Terraces on the land to help conserve water and reduce the amount of runoff. This will also reduce the nutrients lost through leaching.
Poverty/Civil War	Lack of farming investment and lack of money leads to people using any available land and overusing it. War also means people stay in the same areas, water gets polluted, overused and land gets destroyed.	Build bunds or stone lines across fields to trap moisture and reduce the top soil loss through erosion.

Physical causes

Cause	Explanation	Solution
Climate change and drought	A change in global climate has caused more droughts than normal. This damages animal's habitats and the soil in many areas. This also leads to famine in the long term as crops die. Disease is prevalent due to poor water quality.	Irrigation schemes or dams to store water for use on farmers' fields. Provide each area with the ability to collect water from a well or using play pumps.
Variations in seasonal rainfall and high evapotranspiration rates	Rainfall only occurs in one part of the year leading to water stress in the other parts of the year. Crops grown are limited due to high evapotranspiration rates	Storing water during the rainy season to reduce water stress. Plant more drought tolerant crops.
High pressure systems	Strong high pressure systems in North Africa prevent warm, wet air moving towards.	None

Tackling desertification (read page 96-97)

A number of solutions have been suggested to solve the problem of soil degradation and desertification including:

A giant shelter break (the Green Wall) – see article to the right

Population control

Finding alternatives to firewood e.g. solar cookers

Improved farming techniques e.g. reduced grazing numbers

- **Great Green Wall to stop Sahel desertification**

The wall envisioned by 11 African countries on the southern border of the Sahara, and their international partners, is aimed at limiting the desertification of the Sahel zone

The Sahel zone is the transition between the Sahara in the north and the African savannas in the south, and includes parts of Burkina Faso, Chad, Djibouti, Eritrea, Ethiopia, Mali, Mauritania, Niger, Nigeria, Senegal and Sudan.

