

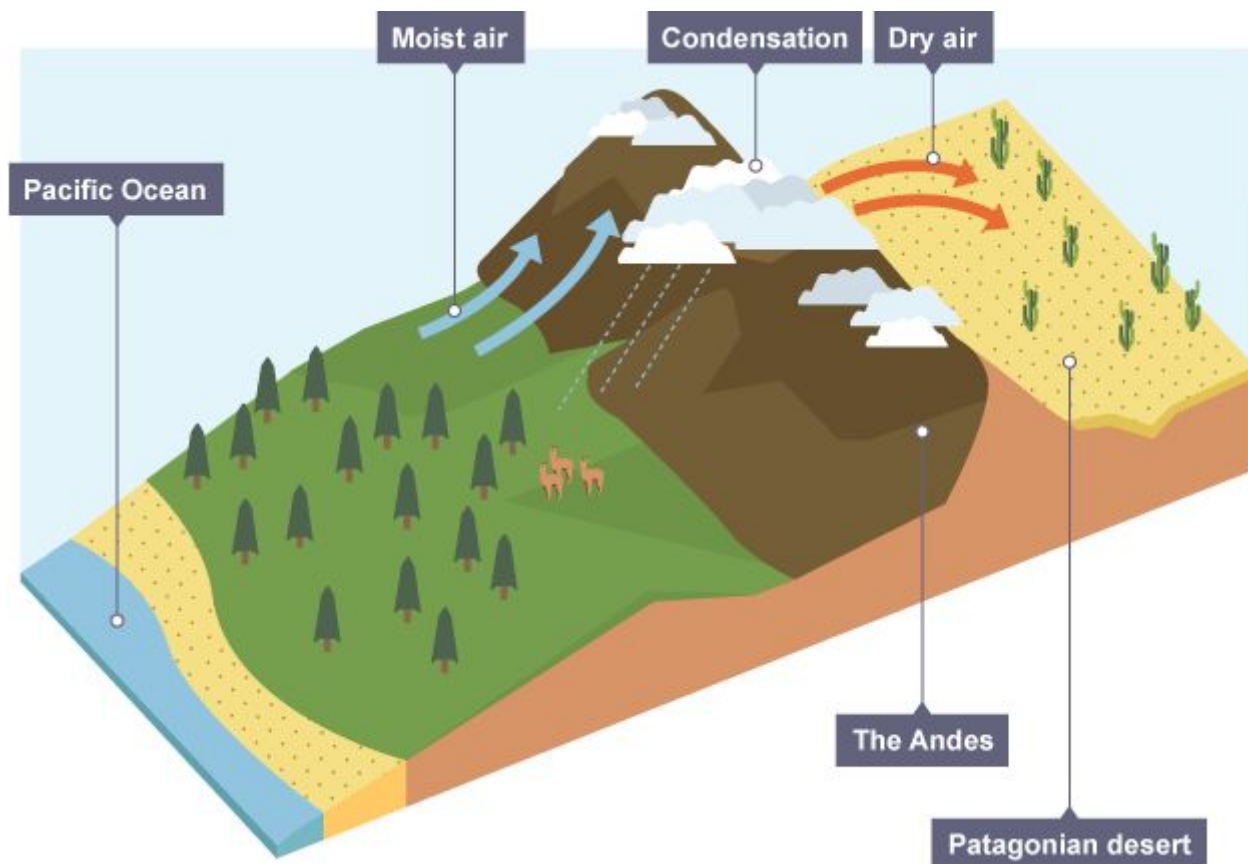
# **AQA Geography A-level**

## **3.1.2: Hot Desert Systems and Landscapes Essential Notes**

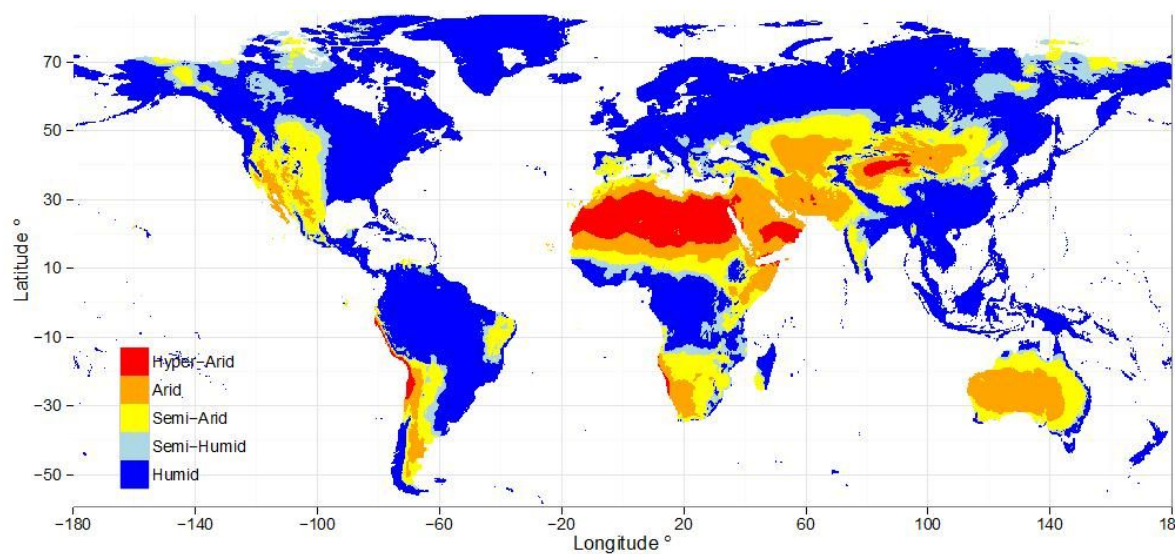


## Deserts as Natural Systems

Deserts form because of **air currents and circulation**. **Cold ocean currents** cool the air above, making it **dry**. When this air reaches the land, it causes **more evaporation than precipitation**, due to the lack of moisture, which results in the formation of a **desert**. Other **geological settings** that cause desert formations are: **extreme distance from oceans** and **cold ocean currents**.



A desert is thus a **landscape which receives very little precipitation**. These regions receive an average annual precipitation of less than **250mm**.



**Hot deserts** exist in rich and poor countries around the world. The **largest hot desert** in the world is the **Sahara desert in northern Africa** which covers over **9 million square kilometres**.

Hot deserts in rich areas, such as the **Mojave Desert in America**, are usually used for human activities such as **commercial farming, tourism and mining**. Hot deserts in poorer areas are usually used for **hunting, gathering and farming**.




**The Sahara Desert, North Africa**



**The Mojave Desert, Southwest USA**

## Systems and Processes

 Sources of **energy** in hot desert environments involve **isolation, winds and runoff**.

 **Geomorphological processes** include **weathering, mass movement, erosion, transportation and deposition**.

 **Weathering processes** include:

- **salt weathering**, where rocks **form fractures** due to high **efflorescent salt contents**,
- **exfoliation**, where the outer layer of rock **flakes off** over time,
- and **chemical weathering**, which is limited by the **lack of water**, the **amount of capillary action** and the **alkaline** nature of chemicals taken into rocks.

**Wind** has an important role in **erosion, transportation and deposition** of sediment. Wind erosion includes:

**Abrasion:** **Small particles** are **hurled** by the **wind** against **rock surfaces**, **smoothing** the rocks.

**Deflation:** Wind **blows away rock waste** and **lowers** the desert.

**Attrition:** Rock particles **rub against each other** and wear away.



A desert **sandstorm**.



## Water in the Desert

The **three main types of river** and **water sources** found in desert areas are:

- **Exogenous Rivers:** Sources **outside** the desert.
- **Endoreic Rivers:** Sources **near** the desert.
- **Ephemeral Rivers:** Sources that flow for only **part of the year**.

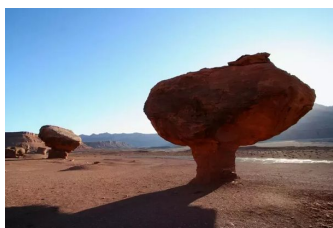
**Desert lakes** are generally **ephemeral** and are called **playas** (also known as **dry lakes**) which vary in size and are **very salty**.

The **episodic role of water** includes **sheet flooding** and channel **flash flooding**.

## Arid Landscapes

**Arid landscapes** are areas that have **a severely low availability of water**, to the extent where it **hinders or prevents** animal and plant life. **Aridity** is caused by **atmospheric processes** relating to **pressure, winds, relief and cold ocean currents**.

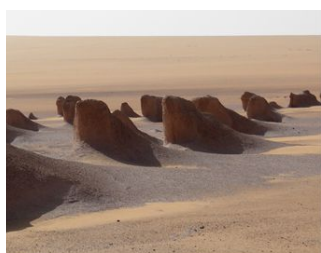
Desert **landforms** include:



**Rock Pedestals:** These are created by wind **abrasion processes** where the **base of rock** structures is cut away, leaving a wider top.



**Deflation Hollows:** **Depressions** are formed by **sand settling** after it has been carried over **long distances** by wind. These depressions collect rainwater.



**Yardangs:** These result from **sand grains** pushed by **persistent winds** to form **low ridges of sand** carved in **soft rock**.





## Desertification

Desertification is where **fertile land** becomes **dry**, **cracked** and **desert-like**, leaving soils **unproductive**.


'Desertification is potentially the most threatening ecosystem change impacting livelihoods of the poor... The basic materials for a good life for most dryland people have their origin in biological productivity'. (Adeel, 2005)




People in drylands solely depend on the **ecosystem** for their basic needs, using it to produce **crops, livestock, fuelwood and construction materials**. All of these rely upon the **plant productivity** which is often restrained by water availability.

Desertification affects **10-20%** of drylands, and it is estimated that **one billion people** are at risk from further desertification. **12 million hectares** of land is lost to desertification every year.

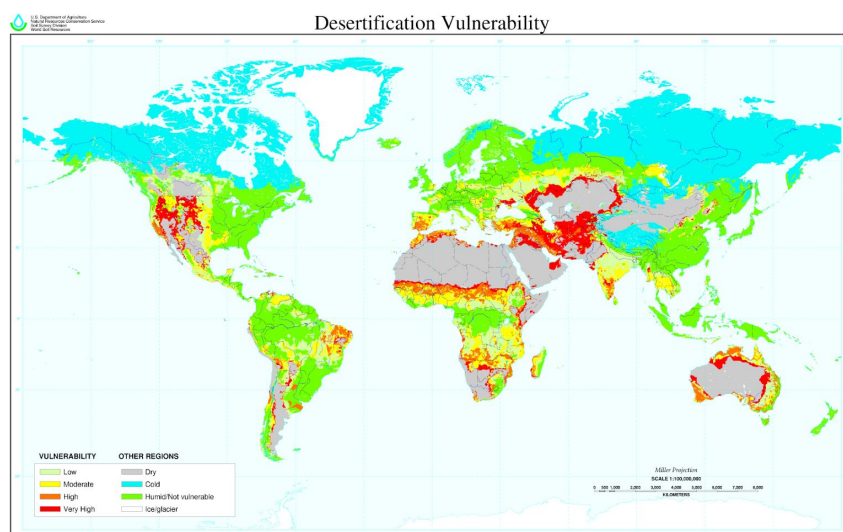
Common **causes** of desertification include:

**Climatic variations** - prolonged **high temperatures** with infrequent and **below average** rainfall prevents the growth of **vegetation**. 

**Human activities** - countries relying on **agriculture** can damage soils by **excess usage** or reducing fallow periods (**ploughing without sowing** so fertility is restored). This forces soils to **reduce organic matter**, limiting plant growth and increasing **erosion vulnerability**. 

Desertification is particularly acute in **Africa**, where in the future, areas suffering from '**slight**' desertification may become **severe**.

There is a **correlation between richer northern countries being invulnerable** whilst poorer **southern countries are highly vulnerable** to further desertification. The USA's Midwest is also extremely vulnerable.



## Impacts of Desertification

- Soils become **less stable** and are either **washed** or **blown** away which removes **nutrients**.
- Vegetation is then **damaged** as roots become **exposed**, killing many plant species.
- **Famine** can result as entitlements are lost through desertification.
- This can then endorse **food loss** as soils cannot grow food.
- Other effects include poor water quality, pollution, flooding and sand storms.

At a **local scale**, there is **reduced land productivity** and **socio-economic problems**. This then cause regional impacts such as a **reduction of food availability**, leading to food **insecurity**, **migration** and **limited development options**.

There is also **large scale ecosystem damage** whilst drylands remain **vulnerable** to climate change.

On a **global scale**, the cost of **land degradation** is ever increasing, currently at **US\$42 billion per year**, excluding hidden costs of more fertiliser use and loss of biodiversity/landscapes.

## Desertification and Food Insecurity - Case Studies

### Australia

This country has strong **global power** but is strained due to the **aridity** of land. Although **food insecurity** is currently a hidden battle, this may be brought to the forefront as **climatic variability** becomes more prominent in the future.



The Great Victoria Desert, Australia

In the **Murray- Darling basin**, human activity and drought conditions are causing a **reduction in basin size**. The Murray-Darling River holds **freshwater** and is primarily the source for **agriculture**.

Very few soils in Antarctica are naturally suited for agriculture, having high **salt** stores, low **nutrients** or being shallow. Only **6% of land is arable without irrigation**.

**Livestock** is the most **extensive** use of **agricultural land** but desertification is reducing the life expectancy of animals due to **strained water resources**, an increase in pests, and an inability to **adapt to changing climatic conditions**.

The Salvation Army's 2015 economic social impact survey found **10% of Australians said they could not afford to buy enough food**, with this proportion on the rise.



Governments have implemented **security protocols**, creating policies which encourage **self-reliant** approaches to manage climatic variability and protect agriculture. For instance, in Queensland, they have introduced **satellite monitoring** of rangeland condition which will hopefully be extending throughout the continent so land can be regulated.

## East Asia

The **Gobi Desert** is located in **Northern China and Southern Mongolia**.



The Gobi Desert



As food **cannot be grown in many parts of the region**, it is causing **localised food insecurity** for those who cannot cope otherwise. However, for the parts of the desert within China, there is **limited food insecurity** as the government provide assistance with **crop growth and conservation**.

- Population of **57,200 people**
- **Social changes** involve increased **out migration** and **changes in employment structure**, decreasing the number of **farmers** and thus **food** availability.
- **Government** is the key player in the Chinese region of the desert as they **control markets** and introduce the settled farming of specific crops.
- In the **Mongolian** region of the Gobi desert (southern part of the country), there is **no government encouragement** towards rain-fed intensive farming, compared with China.
- Herders are moving away from traditional role, causing a **large flow of out-migration**, as more women go to university whilst men work in the **mines** (Mongolia is rich in gold, copper and tin).
- Out-migration has **weakened community networks**, which have been a **fundamental safety-nets** in managing disasters such as **desertification**. Herders are forced to **migrate into the city** where they rely on cheap (Chinese) imported food. This is **unsustainable**.
- The Gobi Desert is **expanding** because of **desertification in southern China**, overtaking 3600km<sup>2</sup> of grassland per year. **Expansion** also occurs because of **deforestation**, **overgrazing** and **depletion of water resources**. **Dust storms** additionally **cause further damage** to the agricultural economy.
- China has created some solutions, such as the 'Green Wall of China', creating a ring of newly planted forests to **stabilise soil**, retain moisture and **prevent desertification**.

