Inside this booklet are detailed notes about all our case-studies. You should now use them for making your own revision cards for each case study. You should aim at LEARNING at least 3 place names and 5 facts and figures for each place. Make sure you can also describe what is happening or the changes in each example.

Remember to look at past papers on Frog to see what questions are asked.

Good luck and best wishes from Mrs England and Mr Hunt
# GCSE Geography 2015 Case Studies

You should aim to give accurate facts and figures and precise ‘place detail’ on these case studies to reach Level 3.

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>An example of:</th>
<th>Notes done</th>
<th>Learnt</th>
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</thead>
<tbody>
<tr>
<td><strong>Theme 1: Rivers and Coasts</strong></td>
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</tbody>
</table>
| 1 | **Dawlish Warren:**  
Langstone Rock = erosion  
The spit at Dawlish Warren = deposition  
Protection methods at DW | A rapidly eroding coastline,  
Landforms created by erosion  
Landforms created by transportation & deposition  
Coastal management and controversy over management | | |
| 2 | **The river Exe** | Landforms created by a river  
Flood management in MEDC | | |
| 3 | **Flooding in Bangladesh** | Causes of & flood management in LEDC | | |
| **Theme 2: Population & Settlement** | | | | |
| 4 | **Chinese One Child Policy** | Strategies to influence natural population change within a country | | |
| 5 | **Ageing Population** | Japan | | |
| 6 | **Mexico-USA** | International migration – causes, consequences and management | | |
| 7 | **Rural urban migration to Jakarta, Indonesia** | Migration within one country  
Causes, consequences & management of urbanisation | | |
| 8 | **Village of Woodbury and growth of Cranbrook** | Causes, consequences & management of counter-urbanisation | | |
| 9 | **Exeter & Bristol** | Urban change, social, economic & environmental planning & the sustainability of urban change | | |
| 10 | **Bristol (Cribb’s Causeway & Cabot Circus)** | How retail service provision changes over time | | |
| **Theme 3: Tectonic & Climatic Hazards** | | | | |
| 11 | **Mount Merapi, Indonesia (JPE)** | A volcanic eruption in a LEDC | | |
| 12 | **Tohoku earthquake & tsunami in Japan** | An earthquake in a MEDC | | |
| 13 | **Cyclones in Bangladesh** | A tropical storm in a LEDC | | |
| 14 | **Drought in Australia** | Drought in a MEDC | | |
| **Theme 4: Economic Development (Examined in SDME)** | | | | |
| 15 | **Cribb’s Causeway and Cabot Circus in Bristol Junction 27 M5?** | The location of economic activity in MEDC | | |
| 16 | **Practical Action in Bangladesh or Medic Malawi** | A Development Project in LEDC | | |
1. Coasts and Rivers

**Dawlish Warren** – is a seaside resort located on the south coast of Devon, at the mouth of the river Exe. It is south of Exeter and between the towns of Dawlish and Exmouth.

1. Land-uses at Dawlish Warren

- **Seaside resort** – mainstay of local economy with its **multiplier effects**. Tourist accommodation tends to be **budget holidays**, ranging from tents and caravan sites to several holiday parks. Attracts over **800,000** extra people in the summer, particularly from West Midlands and South Wales, **(20,000 per day)**. Tourists can also enjoy the family fun and entertainment facilities behind the beach.

- **1.5 mile of sandy beach** – **Blue Flag for 16th year** = good quality for bathing water and beach facilities

- **Golf course** – 18 holes

- **Nature Reserve** - 500 acres - became a National Nature Reserve in 2000. Also a Site of Special Scientific Interest (SSSI) due to over 600 species of flowering plants including the rare **Warren Crocus**. Important as a resting place for over **23,000** migrating wildfowl and wading birds including the avocet.

- http://www.dawlishwarren.info/

2. Features / landforms created by the **PROCESS of erosion** = Langstone Rock

South westerly winds have a long fetch but it is the easterly winds which do the most damage as they head straight onto the beach. Langstone Rock is located between Dawlish and Dawlish Warren. It was formerly joined to the mainland but was cut off by Brunel’s railway.

**Key words to use:**

- This is a resistant **headland** made of **breccia** (mixture of sandstone and sharp pebbles left by a flash flood)

- **Hydraulic action & abrasion** important

- The process of **undercutting** leads to a **wave cut notch & wave cut platform** on north side, only visible at low tide.

- **Joints** = lines of weakness are attacked by erosion

- **Caves and an arch** – note: the blow hole on this diagram is no longer visible and there are no stacks visible here.

- The top of the headland is also vulnerable to **biological & freeze–thaw weathering**; this may cause arch to collapse in future.

The **beach at Dawlish** is also vulnerable to erosion by destructive waves. February 5th 2014 saw destruction of railway. Repairs cost **£35 million**. The closure of the railway cost South West **£1.2 billion in lost sales and bills** (BBC). http://www.dawlishbeach.com/wp/
3. The processes of transportation and deposition at Dawlish Warren

1. As the fetch and prevailing winds are from the south-west, material will be moved eastwards along the coast past Dawlish by longshore drift.
2. After Langstone Rock (X) the direction of the original coastline changes as we enter the Exe Estuary. Larger material (shingle) was deposited in water sheltered by the headland (B).
3. Further deposition of finer material (sand) enabled the spit to build up slowly to sea-level (C) and to extend its length (D).
4. Occasionally, the wind changes its direction (e.g. comes from the east). This in turn causes the waves to alter their direction (e.g. approach from the south east). During this time some material at the end of the spit may be pushed inland to form a curved end (E). When the wind returns to its usual direction, the spit resumes its growth eastwards (F).
5. The spit became permanent when sand was blown up the beach, by the prevailing wind, to form sand-dunes (now part of the Nature Reserve). (Before WW2, there were chalets on the end of the spit – G)
6. Salt marsh has developed in the sheltered water behind the spit towards Starcross.
7. The spit is unable to grow across the estuary towards Exmouth as the current of the river Exe carries material out to sea leading to sandbanks parallel to the shore at Exmouth (Pole Sands), attracting kite surfers. (If there was no river, the spit may grow across the bay to form a bar).
8. Unfortunately, the stone groyne built at Langstone Rock to protect Dawlish and the railway, is preventing new material moving east so the spit at Dawlish Warren is vulnerable to erosion. (Human intervention)

http://www.geographyhwc.org.uk/Video/Coasts/spitformation.pq.wmv
https://www.youtube.com/watch?v=OiAs1VCsXs (dunes)

Can you locate the following places from the explanation on the aerial photograph above of Dawlish Warren?

Dawlish Langstone Rock Exmouth (see image below) Starcross

source:
https://www.flickr.com/photos/environment- agency/14796494133/in/album-72157643205851084/
4. Management of Dawlish Warren

Why should we protect the Warren? Or should we let 'Managed Realignment' happen?

- Coastal erosion of the spit will increase flood risk to Dawlish Warren village as well as other locations (e.g. Lympstone, Starcross, Topsham and Exeter) further up the estuary.
- Sea level rise due to climate change could affect 150,000 people who live close to the Exe Estuary.
- The Warren is a nature reserve and provides a unique habitat for a range of coastal species.
- It is a popular tourist destination and is home to a number of small businesses and residential properties.
- The beach is getting narrower due to erosion, so tourists are moving towards the nature reserve.
- Exmouth is a popular seaside town on the other side of the estuary from Dawlish Warren. In recent years, as a result of coastal erosion, sand has been lost from some parts of the beach resulting in a loss of amenity for beach users.
- The First Great Western mainline railway runs parallel to the coast, linking the Cornwall, Plymouth and South Devon to the rest of the country.

How have we protected Dawlish Warren in the past?

<table>
<thead>
<tr>
<th>Defence scheme</th>
<th>Date built</th>
<th>Approximate Cost (2000 Pounds)</th>
<th>Linked +/− acres</th>
<th>What is it protecting?</th>
<th>Net VAAR of property 2000</th>
<th>Cost Benefit = Cost of preventative of defence for 100 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Rip &amp; Rock Armour</td>
<td>1973</td>
<td>£444,000</td>
<td>40</td>
<td>Amusement complex</td>
<td>£2.0m</td>
<td>2,250,000 (950,000/27) =</td>
</tr>
<tr>
<td>2 Wave-return sea wall</td>
<td>1852, 1895</td>
<td>£1.4m</td>
<td>400</td>
<td>Amusement complex</td>
<td>£2.4m</td>
<td>2,250,000</td>
</tr>
<tr>
<td>3 Gabions</td>
<td>1863-6</td>
<td>£4.4m</td>
<td>20</td>
<td>Warren &amp; Nature Reserve</td>
<td></td>
<td>2,250,000</td>
</tr>
<tr>
<td>4 Breakwater</td>
<td>1862</td>
<td>£627,215</td>
<td>350</td>
<td>Beach house</td>
<td>£905,800</td>
<td></td>
</tr>
<tr>
<td>5 Sand Stabilisation and beach nourishment</td>
<td>n/a</td>
<td>£300,000</td>
<td>10</td>
<td>Nature Reserve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Gabions</td>
<td>1970</td>
<td>£600,000</td>
<td>15</td>
<td>Nature Reserve and golf course</td>
<td>£800,000</td>
<td></td>
</tr>
</tbody>
</table>

Credit: Credit Andy Schindler www.outdoorlearningforschools.co.uk
What is happening at Dawlish Warren now?


Look particularly at the Environmental Agency’s display boards on the flickr photo link.

1. Proposals for Dawlish Warren and Exmouth were shared with the public at exhibitions held in June 2014. *Helps to foster inclusion = socially sustainable*

2. The Environment Agency and its partner **Teignbridge District Council** are to:
   - add extra sand to the beach at Dawlish Warren, a process known as beach re-charge. Sand will be dredged from Pole Sands.
   - maintain the seawall and revetment at the base of Dawlish Warren sand spit, near to the tourist facilities and village *(=economically sustainable)*
   - repair, replace and possibly extend the wooden groynes along the beach
   - build a new flood defence near the visitor centre to reduce the risk of tidal flooding to Dawlish Warren village
   - remove the gabions (rock filled wire baskets) as these are harming the Special Area of Conservation (SAC) at the dunes. *(= environmentally sustainable).*

3. The cost of this scheme was estimated at **£14 million** but protects businesses and railway worth **£158 million** so the cost benefit ratio is positive! They received £8 million and work has started by 2015.
Flooding on River Exe - When & where?

October 1960 = devastating floods along Exe.
Half the annual average of rain fell (380mm), saturating the ground.
700 cumecs flowed into Exeter, flooding parts of Exwick, St Thomas and Alphington.
No deaths but 2500 homes affected. (Exe brings thick red slime from Exmoor sandstone).
December 1960 – 5 weeks later = second flood – 1200 homes.

Response = Hard Engineering = cost £8 million, opened in 1977, copes with 700 cumecs

1. Three flood relief channels were built –
   - Cowley
   - Exwick Spillway (near St David’s Station)
   - Trews Weir

2. Radial gates – When the river Exe reaches 180 cumecs, water begins to flood the 2 chambers holding the floats. As the floats rise, the radial gate is lowered on a pivot, diverting the excess water into the Exwick relief channel.

3. Levees / Embankments to raise the banks, and therefore capacity, of the channel. Seen by Exe bridges.

2014+ More sustainable options
Although these defences have worked well, from 2012-2014, floods caused the closure of the First Great Western main railway line for over 4 weeks resulting in great disruption for the southwest.
Environment Agency consulted residents about improvements:
   - Deepening of the Trew's flood relief channel by 1metre and lowering the side spill weir.
   - At the end of the relief channel, a weir has been removed and this means that this area will now be wetter at high tides helping birds.
   - The scheme will cost around £30 million and is expected to be completed by 2017.
   - Peat bog restoration on Exmoor over 2000 hectares. Extra water held in bogs = 104 Olympic pools.
RIVER Floods in Bangladesh

Physical causes of the floods

• 80% of Bangladesh consists of a huge flood plain and delta (largest delta on earth).
• 25% of the total area is less than 1 metre above sea level, 75% less than 10 metres above sea level.
• 10% of the land area is made up of lakes and rivers
• Snowmelt from the Himalayas takes place in late spring & summer
• Bangladesh experiences heavy monsoon rains, especially over the highlands. Dhaka receives over 2000mm.
• Tropical storms (Cyclones) bring heavy rains and coastal flooding
• The main cause was the above average & long period of heavy rain which caused all 3 rivers (Ganges, Meghna & Brahmaputra) to have their peak flow at the same time!!!

Human causes of the floods

• Deforestation (particularly on Himalayas) may be partly to blame, stripping the land bare of the vital top soil which slows and drains water. This causes soil erosion which reduces the ability of the land to absorb water.
• Irrigation for farming is a factor, because this causes river channels to silt up, reducing their capacity to hold flood waters. According to some experts, irrigation interferes with river drainage into the sea.
• Climate experts also believe global warming is partly to blame, by increasing monsoon rainfall and speeding up the melting of Himalayan snows.
• Urbanisation - in built-up areas, such as Dhaka, with a lot of concrete roads and houses, there are fewer places for water to go and less soil for water to drain into. Planners in cities prone to flooding have to develop ways of channelling water to cope with potential floods. This can mean more water in the rivers.

Effects of RIVER flooding in Bangladesh

<table>
<thead>
<tr>
<th>Date</th>
<th>Area flooded</th>
<th>Deaths</th>
<th>Homeless</th>
<th>Short term effects</th>
<th>Long term effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>57%</td>
<td>1300+</td>
<td>25 million+</td>
<td>Serious shortage of drinking water &amp; dry food.</td>
<td>100,000 in Dhaka alone suffered from diarrhoea</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Diseases spread such as bronchitis, cholera &amp; diarrhoea.</td>
<td>Airport, roads and railways flooded</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Left fields of rotting crops, wrecked roads and bridges and destroyed villages</td>
<td>$7bn damage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 million tonnes of rice lost</td>
<td>But there can be positives - the flood waters:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1/2 million cattle and poultry lost.</td>
<td>• Replenish groundwater reserves</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cost the country almost $1 bn.</td>
<td>• Provide nutrient rich sediment for farming</td>
</tr>
<tr>
<td>2004</td>
<td>60% (40% of Dhaka)</td>
<td>800</td>
<td>20 million</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 million tonnes of rice lost</td>
<td>• Provide fish</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1/2 million cattle and poultry lost.</td>
<td>• Reduce the need for artificial fertilisers</td>
</tr>
</tbody>
</table>
How is flooding managed in Bangladesh?

Bangladesh is an LEDC and therefore does not have money to implement large schemes.

It is always going to be threatened with flooding, so the focus is on reducing the impact.

- The Flood Action Plan (FAP) is funded by the World Bank. It funds projects to monitor flood levels and construct flood banks/artificial levees.
- More sustainable ways of reducing the impact of flooding
  - building coastal flood shelters on stilts,
  - education about early-warning systems
  - Tube wells (the top is above the usual flood height).
- Non-governmental Organisations (NGOs) such as Practical Action and Christian Aid encourage new techniques to help farmers adapt. These include farming pumpkins on the sand banks, fish farms and keeping ‘super ducks’!

Bangladesh is unfortunate!

“Its people are those who are least responsible for the rise of global warming, yet they experience the worst of its escalating effects”.

2. Population and Settlement

China = a country which has MANAGED its natural population change

- Are some countries overpopulated?
- What are the causes of overpopulation?
- What are the effects of overpopulation on people and the environment?
- Are some strategies for population management more sustainable than others?

In the late 1970s, the Chinese government introduced a number of measures to reduce the country’s birth rate and slow the population growth rate. The most important of the new measures was a one-child policy, which decreed that couples in China could only have one child.

- In 1950 the rate of population change in China was 1.9 per cent each year. (A growth rate of only 3 per cent will cause the population of a country to double in less than 24 years!)
- The Chinese government under Mao Zedong had encouraged people to have a lot of children to increase the country’s workforce. But by the 1970s the government realised that current rates of population growth would soon become unsustainable.

The one-child policy

The one-child policy, established in 1979, meant that each couple was allowed just one child. Benefits included increased access to education for all, plus childcare and healthcare offered to families that followed this rule. ‘Granny Police’ and snoopers at work helped to enforce the policy.

Problems with enforcing the policy:

- Those who had more than one child didn’t receive these benefits and were fined.
- The policy was keenly resisted in rural areas, where it was traditional to have large families.
- In urban areas, the policy has been enforced strictly but remote rural areas have been harder to control.
- Many people claim that some women, who became pregnant after they had already had a child, were forced to have an abortion and many women were forcibly sterilised. There appears to be evidence to back up these claims.
Impact of the policy

- The birth rate in China has fallen since 1979, and the rate of population growth is now 0.7 per cent.
- There have been negative impacts too - due to a traditional preference for boys, large numbers of female babies have ended up homeless or in orphanages, and in some cases killed. In 2000, it was reported that 90 per cent of foetuses aborted in China were female.
- As a result, the gender balance of the Chinese population has become distorted. Today it is thought that men outnumber women by more than 60 million.
- On average there are 130 men for every 100 women. In some areas this can be 169:100.

Long-term implications

China’s one-child policy has been somewhat relaxed in recent years. Couples can now apply to have a second child if their first child is a girl or if both parents are themselves only-children.

While China’s population is now rising more slowly, it still has a very large total population (1.3 billion in 2008) and China faces new problems, including:

- the falling birth rate - leading to a rise in the relative number of elderly people, some forecasts say dependents will be 1/3 of the population.
- fewer people of working age to support the growing number of elderly dependants - in the future China will have an ageing population.
- Children will have to support the elderly as there is no state pension
Japan Aging Population

Changes in the Population Pyramids of Japan- showing an ageing population

Causes:

- High standard of living led to highest life expectancy in world
- Birth rates 10/000 in 1990s
- Low fertility – average less than 2 children per woman
- Small families due to limited living space
- Concern to raise healthy children
- High costs of child care and education
- Late marriage and many young people are opting to remain single, women rebelling against traditional roles and boys not wanting the responsibilities…. (Remember Anime girlfriends…)

Effects:

- High elderly dependency ratio – by 2025, 27% will be spent on social healthcare, putting strain on pension system. (1970 =6%)
- Less spent on schools
- Shortage of younger workers – more women may work and elderly may need to retire later

Solutions:

The Government has introduced incentives, such as

- free childcare,
- increase in child benefits and
- 6-month maternity leave
- Improvements to work-life balance so more time to procreate.....
- 2010 “Child Care and Family Care Leave Law” gives fathers 8 weeks paternity leave and aims to increase the time fathers spend with family and reduce working hours for all.

Source: Statistics Bureau, MIC; Ministry of Health, Labour and Welfare.
International Migration - Mexico to the USA

What is the situation?

- There is a 2000km border between USA and Mexico.
- Between 1990 & 2010, 7.5 million Mexicans arrived in USA, many unauthorised.
- Illegal migration is a huge problem for USA and Mexico
- US Border Patrol guard the border and try to prevent illegal immigrants
- Deportations in 2013 were over 1000 per day, 65% were Mexicans.

Why do people migrate?

In the past (1980-90s) there were huge contrasts between conditions in Mexico & USA, e.g. adult literacy was 55% in Mexico & 99% in USA.

- GNP was $3750 compared to $24,750 in USA.
- Jobs in USA were available to Mexicans, particularly in farming and the service sector.

However, since 2012, immigration is slowing down because:

- The Great Recession in USA means fewer jobs available.
- Conditions improved in Mexico – adult literacy is now 93% and GNP $15,600
- Border patrols are more aggressive to ensure people enter legally.

What are the impacts on the USA?

- Illegal migration costs the USA millions of dollars for border patrols and prisons
- Mexicans are seen as a drain on the USA economy - annually $20 billion is sent back to Mexico.
- Migrant workers keep wages low which affects Americans although farmers are now suffering as sources of cheap labour lessen.
- Problems may occur in cities due cultural and racial issues
- The incidents of TB has been increasing greatly due to the increased migration
- Three states have high Mexican populations (Texas, California and Illinois although Mexicans now spreading into other states).
  - Mexican migrants benefit the US economy by working for low wages
  - Mexican culture has enriched the US border states with food, language and music
  - President Obama has tried to ‘bring people out of the shadows’ and regularise those there illegally, as long as they pay tax.

What are the impacts on Mexico?

- The Mexican countryside has a shortage of economically active people
- 10% of people born in Mexico live elsewhere, mainly USA.
- Many men emigrate leaving a majority of women who have trouble finding marriage partners
- Young people tend to migrate leaving the old and the very young
- Legal and illegal immigrants together send some $20 billion a year back to Mexico (Remittances are the 2nd highest source of foreign currency, tourism = 1st).
- Some villagers have come to rely on this money but migrants will send less as they stay in USA.
**Rural-urban migration to Jakarta** (push-pull factors similar to Mexico/USA)

1950 - 15% of Indonesia lived in cities  
1990 - It took 40 years for this number to double to 30%,  
2010 - So it has only taken 60 years to triple to 44%

Remember the population of Indonesia is around 250 million (4\(^{th}\) largest in the world).

The primary reasons for rural–urban migration are related to the lack of well-paying jobs in the countryside and the dream of opportunities for education and work in the city.

**Impact on Jakarta:**
- Jakarta is predicted to reach **12 million by 2020**. Now largest MEGACITY in Southeast Asia.  
- Population densities in Jakarta have reached 14,400 people per km\(^2\)  
- City services such as water & schools can’t keep up with the rate of migration.  
- Infrastructure is under stress, particularly roads - traffic congestion costs Jakarta $1.4 bn /per annum.  
- Inequalities are increasing in cities and Kampungs (shanty towns) are increasing, 1:4 live in poverty.  
- Land prices are rising with globalisation and many slums are forcibly cleared for new developments, increasing densities elsewhere.  
- High unemployment (2012 6%) as many new migrants do not have the education or qualifications for urban jobs.  
- Unemployment can lead to crime.

**Impact on rural areas:**
- It is the young and capable who move (many say due to hard manual work and unreliability of harvest)  
- This leaves elderly people to farm (80% of farmers are 45+)  
- A food crisis may develop as those remaining are often less educated and farm in traditional manner.

**Solutions:**
- New towns around Jakarta to spread load  
- Toll roads  
- **Basic Education Program (BEP)** – the Australian government has invested in rural education  
  - Between 2005 and 2010 Australia funded the construction of **2074** junior secondary schools across 20 of Indonesia’s provinces  
  - This has included more than 1500 public schools and 500 Islamic schools.  
  - This has created around **330,000** new junior secondary school places for 13-15 year olds.  
  - Australia gave **A$387.6million** to Indonesia for this project. (A$200 million loan. A$187.6 million grants.)  
  - Existing schools have also been improved. The focus has been particularly in rural areas as students in Jakarta have more chance of finishing secondary school.
Transmigration in Indonesia (Internal Migration – Movement within a country)

Transmigration i.e. the movement of people from the densely populated core to the outlying islands, was first started one hundred years ago, in colonial times, by the Dutch authorities and has continued throughout the century. Its main aims have been:

- to encourage a more balanced distribution of population within the country.
- to reduce population pressure in the core by moving people to the peripheral islands.
- to improve living standards for the migrants Between 1900 and the country’s independence in 1949 over half a million people were moved. Despite various governments since then setting quite high targets only a further two million people have been moved.

The scheme offers:

- free transport to the new area.
- free land allocation of two hectares.
- free housing in the new area.
- free equipment, fertilisers etc. and enough food to keep the family going until the first harvest.

There have been several issues associated with transmigration:

- It is very costly and over £200 million has been loaned by the World Bank so far to help with the scheme. Many people feel that its limited success does not justify this spending. Its impact on Indonesia’s population problems has been minimal. In the 1980s, Java’s population increased by 18% in spite of out-movements. In 1995 the country’s population was growing by 3.2 million per year! This is more than the entire number of people who had moved out from the core in the whole of the transmigration movement. Also, up to 20% of the migrants have since returned home because of problems in the new areas.
- Many people are alarmed at the effects on the environment. Over 120 million hectares of Tropical Rainforest have been felled to create land for the new settlers. Soil erosion and soil exhaustion also occurred once the delicate balance of the Tropical Rainforest ecosystem has been disturbed.
- There have been conflicts between the immigrants and the local residents because:
  (i) Traditional farmers are worried that the incomers will take over their area and destroy their way of life. They also complain that the new settlers are given more financial help than they receive.
  (ii) Local shifting cultivators have had to move as their land is being used by the newcomers.

However, transmigration has brought some advantages:

- Improved infrastructure on the peripheral islands, e.g. better roads, more schools and health facilities, although in many areas they are still not adequate for the numbers of people who actually live there.
- People from the core who had no land or jobs now have a future in their new homes.
- Some spontaneous migration to the outer islands has been stimulated.
COUNTERURBANISATION - Causes and Consequences  (= Urban to Rural Migration)

Since the 1960s there has been a continuing trend of urban to rural migration in MEDCs, with people leaving cities and moving into countryside areas, this process is known as counterurbanisation.

(i) Causes
Why are more people moving from urban areas into the countryside? (This is the reverse trend of what is happening in many LEDCs where rapid rural-urban migration has been taking place since the 1950s/60s!).

Push Factors (reasons for the movement away from cities)
- higher rates of congestion and pollution in cities
- high land values making it harder for people to find affordable housing (£350,000 would only buy a 2 bedroom flat in London)
- higher crime rates

Pull Factors (reasons for movements to the countryside)
- perceived better quality of life
- believed to be a safer, quieter and more pleasant environment for children to grow up in
- less pollution and more open space
- lower land-values and more affordable housing
- more businesses locating on greenfield sites to make the most of room for expansion and the more pleasant environment. (Use the MET OFFICE here as a prime example!!!).
- Improvements in transports and technology have led to the increase in counterurbanisation as it has become easier for people to commute to work or indeed work remotely from home, using internet / fax / e-mail technology.

(ii) Consequences
- Lots more new houses required = added onto towns such as Exmouth, Tiverton & Crediton
- New community at Cranbrook near Exeter Airport. Permission was given in January 2011 for the first 1100 new houses in this 'eco-town'.
- Suburbanised villages = many villages (e.g. Woodbury or Exminster) which have seen an increase in population have become more suburbanised in character =lost some of their rural characteristics as new housing developments have been built and, in some instances, business units have developed.
- Village shops and local services often suffer as these settlements often become "dormitory villages", where a large proportion of the population commute to work leaving a small daytime population.
- Many commuters use large supermarkets on the edge of towns and the lower demand for villages shops and services has forced many to close.
- There are also social impacts, as once tight-knit communities begin to lose community spirit as more and more people move in.

A case study - e.g. Woodbury near Exeter
- experienced the gentrification of existing housing, including several barn conversions
- infrequent bus service as many households have one or two cars – hurts non-drivers
- need for more low cost housing for young people (average house in Woodbury = £358,000)
- ✓ local facilities - kept Post Office & village shop & primary school due to additional numbers, gained new village hall.
- ✓ possible increase in newcomers not participating in village life
Bristol can be used for changes in retailing (Economic Development – tertiary industry) and urban land-use changes (Settlement)!

1998 = “Welcome to The Mall at Cribb’s Causeway where shopping is a joy”.
- 135 top name stores,
- Anchor stores = Marks & Spencer & John Lewis
- 7,000 free parking spaces,
- consistent late night opening
- Cinemas and restaurants on site
- easy access from M4 & M5
- 4.6 million people in its catchment area
- Now 13th in UK in sales volume

BUT 2000+ = Doughnut Effect on Bristol City Centre ...
- Increasing movement of retail from the C.B.D. (Central Business District) to the outskirts (rural-urban fringe) of the cities.
- Obviously, car ownership has fueled this process
- The added attraction of an out-of-town site for retail is costs of development are lower on Greenfield sites.

SO 2008 = Cabot Circus opened
- 120 shops, food outlets and cinema
- Cost £500 million
- Near Bristol Temple Meads mainline railway station (env. sustainable)
- Linked to 3 Park & Rides, parking for 2500 cars
- Anchors = House of Fraser and Harvey Nichols in Quakers Friars area
- Designed sustainably from start – achieved BREAAM Excellence award.
  ✓ Glass roof used for rainwater harvesting
  ✓ Natural ventilation
  ✓ Recycling of food waste
  ✓ Local people involved
  ✓ Art works enhance area
- Next to Broadmead shopping Centre which was redeveloped as well.
- 2007 = 27th Venue in UK, 2010 = 12th = rise of 15 places! (Exeter 37th to 29th)

ALSO Urban regeneration
Bristol Harbour was the original port of Bristol but, as ships and their cargo have increased in size, it has now been largely replaced by the docks at Avonmouth and Portbury. These are located three miles downstream where the mouth of the river Avon flows into the Severn estuary.
Bristol was a wealthy port, partly thanks to its involvement in the Slave and Tobacco trade, but also to engineering works (locks and sluices) to maintain the water level in the ‘Floating Harbour’.
By the 1970s, however, the inner city area had declined and was a rundown part of Bristol with tracts of empty, derelict and contaminated land.
Since the 1980s millions of pounds have been spent regenerating the Harbourside. Three zones have been created within the Harbourside. These are:
1. Commercial offices – converted warehouses & Lloyds Bank HQ
2. Leisure /Recreation – explore@bristol, museums, night clubs and restaurants
3. Residential – Waterside apartment and houses.
**The Great Japanese Tsunami (Earthquake in MEDC) (JPE)**

<table>
<thead>
<tr>
<th>When?</th>
<th>March 11, 2011 2.46pm local time. Lasted 5-6 minutes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>What?</td>
<td><strong>Magnitude-9</strong> earthquake <em>(the Tohoku earthquake)</em>.</td>
</tr>
<tr>
<td>Where?</td>
<td>Northeastern Japan - 45 miles east of Tohoku on island of Honshu 20 miles depth</td>
</tr>
<tr>
<td>Who?</td>
<td>18,000 initially killed, most by drowning and crush injuries Total raised to 25,000 after missing included after 2 years.</td>
</tr>
<tr>
<td>Why?</td>
<td>Involved the <strong>Pacific</strong> oceanic plate subducting under <strong>North American</strong> plate, at 9cm per year, causing friction. The earthquake lifted the seafloor by <strong>10m</strong> causing vertical displacement in the ocean, unleashing a <strong>1m</strong> tsunami wave. As this approached the shore, the shallow sea floor caused the wave to rise up to <strong>10m</strong>.</td>
</tr>
</tbody>
</table>

### Short term effects
- **18,000** killed immediately, **25,000 in total after missing included**.
- Tsunami wave travelled 6 miles inland, overtopping sea walls.
- Tsunami wave reached height of **39 metres** at Miyako
- Tsunami wave flooded **217 miles**
- Thousands of after-shocks along east coast, largest = 7.9
- About 250 miles of Japan's northern Honshu coastline dropped by 0.6 -1 metre so sea walls less effective
- **Fukushima Daiichi** Nuclear Power Plant suffered a level 7 nuclear meltdown after the tsunami
- Contamination of water and food supplies

### Long term effects
- Nuclear reactors were shut down due to fears and stricter safety standards
- Contaminated water continues to leak from Fukushima
- Suicides and marriage breakdowns have increased.
- Debris continues to be washed up on beaches in North America
- 2013 – 300,000 still living in temporary accommodation
- Ban on fresh food produce hurt farmers in this rural community. (But helped save lives)

### Short term Responses
- Japan's Meteorological Agency was criticised for issuing an initial tsunami warning that underestimated the size of the wave.
- But many failed to react to tsunami warnings, believing sea walls would save them.
- One area, Kamaishi, had received special **Disaster Preparedness Training** – only 5 school children died there (they were absent ...).
- Tokyo received a minute of warning before the strong shaking hit the city, thanks to Japan's earthquake early warning system.
- The country’s stringent seismic building codes and early warning system prevented many deaths from the earthquake, by stopping high-speed trains and factory assembly lines.
- People in Japan also received texted alerts of the earthquake warning on their mobile phones.
- Immediate evacuation around Fukushima, 6 weeks late people 25 miles away evacuated. People given Iodine tablets to reduce absorption of radiation.

### Long term responses
- Protests have started about the long term impact of cancers on people around Fukushima.
- 40% of children tested have early signs of thyroid cancer.
- 12 mile exclusion zone remains around Fukushima
- Top soil around Fukushima has been washed to remove radiation
- Scientists from all over world visited Japan to study sediments to look at past history of tsunami
- More Disasters Awareness with children being told to save themselves & not wait for instructions.
- Japanese have tried to recover all debris from Pacific Ocean, returning bodies or things to families.
- 2/50 Nuclear power stations have reopened to help Japanese economy (Nuclear produced 30% of Japan’s electricity).
Location map of the 2011 Japan (Tohoku) M 9.0 subduction Earthquake with the approximate fault outline shown in pink. Previous large earthquakes in the epicentral region are shown in yellow and occurred in 1896 and 1933. The Pacific plate is subducting beneath Japan at about a rate of 9 cm per year. Plate boundaries are marked by red lines. Volcanoes are shown as red triangles. Cities with populations greater than 250,000 are shown as red squares.
Indian Ocean Tsunami 2004 – Tectonic Hazard LEDC

Indian Ocean Tsunami: The Deadliest in History

On Dec. 26, 2004, a 9.0 magnitude earthquake—the largest earthquake in 40 years—ruptured in the Indian Ocean, off the northwest coast of the Indonesian island of Sumatra. The earthquake triggered the deadliest tsunami in world history, so powerful that the waves caused loss of life on the coast of Africa and were even detected on the East Coast of the United States. More than 225,000 people have died from the disaster, a half a million have been injured, thousands still remain missing, and millions were left homeless.

Eleven countries bordering the Indian Ocean—all relatively poor and vulnerable—suffered devastation. Hardest hit were Indonesia (particularly the province of Aceh), Sri Lanka, India, Thailand, and the Maldives. The catastrophic damage included the destruction of entire cities, the contamination of farmland and forests, and the depletion of fishing stocks. Some areas faced starvation and increased susceptibility to disease. Even countries with relatively low death tolls suffered enormous damage—the Maldives, for example, had less than 100 deaths, yet the tsunami left 14 of the archipelago’s islands uninhabitable, requiring its inhabitants to be permanently evacuated, and another 79 islands without safe drinking water.

Countries Damaged by the Indian Ocean Tsunami

| Table 2.1 Overview of tsunami damage in Indonesia, Sri Lanka, Thailand and the Maldives |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Impact of tsunami14 (% of national population) | Indonesia | Sri Lanka | Thailand | Maldives |
| Population loss % | 166,364 (0.1%) | 35,262 (0.2%) | 8,240 Less than (0.1%) | 108 Less than (0.1%) |
| Displaced people12 (% of national population) | 566,898 (0.3%) | 519,063 (2.7%) | — | 21,663 (7.3%) |
| Total cost of damage (US$ million) | 4,451 (2% of GDP) | 1,454 (7.6% of GDP) | 2,108 (1.4% of GDP) | 603 (33.6% of GDP) |
| Private/public (%) | 71.2/28.8 | 72.9/27.1 | 97.2/2.8 | 62.1/37.9 |
| Housing damage (% of total) | 31.4% | 28.3% | 1.0% | 15.6% |
| Physical infrastructure (% of total) | 14.3% | 18.8% | 1.2% | 20.4% |
| Social sectors (% of total) | 6.2% | 5.7% | 0.4% | 5.4% |
| Productive sectors (% of total) | 7.9% | 25.0% | 20.5% | 21.1% |
| Impact on worst-affected province (cost as % of GDP) | 97.0% | 90.0% | 8.0% | 84.0% |

14 All figures in the table are rounded to one decimal point.
## Merapi (Volcanic eruption in LEDC)

| What? | Merapi is the most active volcano in Indonesia and has erupted regularly since 1548. Designated as one of the 17 Decade Volcanoes by UN as such a danger to people. It is an active STRATOVOLCANO |
| Why? | Indonesia has 129 active volcanoes in an island chain along the meeting point of the Eurasian continental plate and the Indo-Australian tectonic plate. The line of volcanoes is formed by the **subduction** of the Indo-Australian plate under the Eurasian plate. On Pacific Ring of Fire. |
| Where? | Mount Merapi is on the densely populated island of Java in Indonesia. East of capital of Jakarta but only 17 miles north of the large city of Yogyakarta (pop 600,000+). |
| When? | Smoke can be seen over crater 300 days/year. 1994 – 60 killed by PYROCLASTIC CLOUD 2006 – Large lava eruption (killed 2) shortly before Yogyakarta earthquake which killed 5000. 2010 – October – alerts & evacuations with 500 earthquakes recorded. Lava erupted on south & east slopes Erupted throughout November December – alert reduced to level 3 – mountain now 38 metres lower. 2013 – November – smoke rose 2000 metres. (Phreatic eruption = caused when magma heats ground or surface water. This was a first for Merapi & was caused by hot volcanic gases and heavy rainfall.) |
| Who? | • Over 5000 people live in many small villages on the slopes; most are **subsistence farmers**. • The local villagers revere the volcano and make sacrifices to it; it is a sacred site, home to ancient Javanese spirits. |
| Short term effects | • **1994** = 60 killed in burning cloud • **2006** = 2 killed  • **2010** = 273 people were killed and 577 people were injured (The following effects & responses refer to the 2010 eruption)  • Volcanic bombs and hot gases of up to 800°C spread over 11km away  • Pyroclastic flows spread 3km down the mountain  • Ash fell up to 30km away and 5km into the sky. 15km away, villages were under 30cm of ash  • Weight of ash caused houses to collapse  • Sulphur Dioxide was blown across Indonesia and as far South as Australia  • Planes were grounded in Yogyakarta airport and even in Western Australia because of the risk of damage to aircraft from the ash cloud |
| Long term effects | • Vegetable prices increased because of the damage to crops • Emergency shelters had to be moved over 15km away • **Danger area extended to 20km** from the mountain and 278,000 people living in this area had to flee their homes  • Ash, rock and lava deposited on the sides of the volcano is still being washed down into towns by rainfall creating **lahar** (a mudflow that often flows along river valleys)  • The evacuation centres were overcrowded leading to poor sanitation, no privacy and serious disease risk  • People, particularly farmers, lost their homes and livelihoods  • 360,000 people were displaced from their homes  • Ash from the volcano will eventually lead to more fertile soils in the area (but this will attract even more people). |
| Short term Responses | • Many villagers will not leave as they fear others will steal their land or animals. • Many waited for Maridjan (Spiritual Gatekeeper to the volcano) to tell them to leave. Although |
he persuaded many to go, he died in 2010 eruption.
- 210 evacuation centres were set up either as tents, in schools, churches, stadiums or government offices
- 1,600 people, either volunteers or military, were part of the national aid response
- International aid was offered from organisations such as the Red Cross

<table>
<thead>
<tr>
<th>Long term responses (many of these have been happening before 2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Long term monitoring (Decade volcano!)</td>
</tr>
<tr>
<td>• Mapping of earthquakes and routes of previous lava and lahar flows to help prediction</td>
</tr>
<tr>
<td>• Barriers are built to try to funnel lahar (rain + pyroclastic flows)</td>
</tr>
<tr>
<td>• Formal evacuation centres were eventually set up because buildings, such as schools and government offices, were needed for their official uses</td>
</tr>
<tr>
<td>• 2,682 people have had to be moved to new, safer houses permanently</td>
</tr>
<tr>
<td>• The government is making money available to farmers to help replace their livestock</td>
</tr>
<tr>
<td>• The government has set up a special task force to support people that have been affected by the volcano either by family issues or because they have lost their jobs</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Effect</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Negative effects</strong></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>Lava can kill people, plants and animals, and falling ash can make it impossible for them to breathe. Some deaths from famine, fires, tidal waves and earthquakes can be related to volcanic eruption.</td>
</tr>
<tr>
<td>Damage</td>
<td>People lose their possessions as volcanoes can destroy houses, roads and fields. Lava ruins all objects in its path, including gardens, fields and houses. Ash covers a wide area.</td>
</tr>
<tr>
<td>Disruption</td>
<td>Traffic affected, including aircraft, road and rail. Affects economy and activities.</td>
</tr>
<tr>
<td>Weather</td>
<td>Can cause rain, thunder and lightning. Volcanoes can also have long-term effects on the climate, making the world cooler.</td>
</tr>
<tr>
<td>Economic</td>
<td>Loss of infrastructure and communications causes economic losses, and the costs of clearance and rebuilding are high.</td>
</tr>
<tr>
<td>Social</td>
<td>Loss of family, belongings and homes causes social distress. Many sick and elderly people may die due to the living conditions in the evacuation area. People separated from their families.</td>
</tr>
<tr>
<td><strong>Positive effects</strong></td>
<td></td>
</tr>
<tr>
<td>Soil</td>
<td>Volcanic ash is very good for the soil, so plants grow quickly and strongly after a volcanic eruption.</td>
</tr>
<tr>
<td>Plants</td>
<td>The slopes left after an eruption are very steep, so rare and delicate plants and animals can establish themselves there and be protected.</td>
</tr>
<tr>
<td>Development</td>
<td>Volcanic disasters can be an opportunity for development organisations to challenge unjust political, social and economic systems.</td>
</tr>
</tbody>
</table>

Figure 9: Some effects of volcanoes
Mt Etna – Volcanic Eruption in MEDC

Factfile:

Mount Etna is the tallest active volcano in Europe. It is one of the most active volcanoes in the world, and has been erupting for thousands of years. Some eruptions last for a few minutes, whilst others continue for many months.

Mount Etna is a composite volcano, which has formed along a destructive boundary, where the African and Eurasian plates meet. Subduction along this margin results in the build-up of pressure within the Earth’s mantle, forcing magma up through fissures and weaknesses in the Earth’s crust resulting in regular eruptions of ash and steam as well as lava and volcanic bombs.

Some of Etna’s more memorable eruptions have taken place since 2000, with lava outflows and lava fountains accompanied with huge columns and clouds of ash. In 2003, the ash cloud from Mount Etna extended as far as Libya, some 500 miles away. An eruption which began in 2007, continued for 417 days, during which over 200 minor earthquakes took place.

Mount Etna has been designated as one of the world’s 17 United Nations “Decade Volcanoes” because of its large, destructive eruptions near to populated areas, and as a result, it is very closely monitored and studied. http://bigthink.com/eruptions/the-decade-volcanoes

1 million people live on or near to Mount Etna, benefitting from fertile soils which support the very important agricultural industry of Sicily. Farmers grow grapes, oranges, pistachios and mushrooms amongst other crops.

http://www.tompgalvin.com/places/it/mt_etna.htm

Mount Etna also supports a flourishing tourist industry, boasting ski resorts, hotels, cable cars, bars, a narrow gauge railway and locations for films including Star Wars “Revenge of the Sith”. Tourism and agriculture provide vital sources of income for the island of Sicily.

http://www.walksofitaly.com/blog/sicily/mount-etna-ski-sicily

There are obviously many negative effects caused by Mount Etna’s eruptions over the years. Villages, homes and businesses have been destroyed; farms and vineyards devastated; evacuations have been necessary, as have the closure of Sicily’s airports, with forests destroyed, income from tourism affected and states of emergency declared.

Many efforts have been taken to manage or control the damage caused by Etna’s eruptions. Barriers have been built to divert lava flows, explosives dropped and all activity within the volcano is very closely monitored.

http://www.bbc.co.uk/science/earth/collections/mount_etna
## Notable cyclones in Bangladesh

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<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cyclone Name</strong></td>
<td>Bhola</td>
<td>Gorky</td>
<td>Sidr</td>
<td>Aila</td>
</tr>
<tr>
<td><strong>Area affected</strong></td>
<td>West on Bay of Bengal coastline</td>
<td>SE Around Chittagong</td>
<td>Central &amp; west Bangladesh</td>
<td>West on Bay of Bengal coastline</td>
</tr>
<tr>
<td><strong>Wind speeds</strong></td>
<td>185 km/hr (115mph) Category 3</td>
<td>250 km/hr (155mph) 600km wide Category 5</td>
<td>260 km/hr (160mph) Category 5</td>
<td>110-120km/hr (70-75 mph) Category 3</td>
</tr>
<tr>
<td><strong>Storm surge</strong></td>
<td>10 metres</td>
<td>6 metres</td>
<td>3-4 metres</td>
<td>3 metres</td>
</tr>
<tr>
<td><strong>Deaths</strong></td>
<td>500,000 estimated Deadliest tropical storm on record</td>
<td>138,000 most from drowning</td>
<td>5-10,000 (Save the Children &amp; Red Crescent) 3,447 officially.</td>
<td>330 (Numbers are lower according to some Bangladeshi sources) 8000+ missing</td>
</tr>
<tr>
<td><strong>Cost of damage</strong></td>
<td>$86.4 mill (inflation adjusted)</td>
<td>$1.5 - 2 bill (inflation adjusted) $60 bill Tk</td>
<td>$1.7 billion</td>
<td>$552.6 million</td>
</tr>
<tr>
<td><strong>Short term Effects</strong></td>
<td>Crops wiped out Villages washed away. (This happens each time) Worst hit areas lost 50-75% of their populations. Radio warning not given due to previous warning which hadn’t been needed...</td>
<td>Diarrhoea from contaminated water Washed away concrete levee. Land erosion of farmland 70,000 cattle</td>
<td>‘Cyclone Preparedness Program’ evacuated up to 2 million to emergency shelters. 3000 fishermen lost their lives.</td>
<td>Fishermen ignored warnings and over 500 died at sea. Embankments broke &amp; villages &amp; farming land submerged. A dam also broke. 800 injuries.</td>
</tr>
<tr>
<td><strong>Long term effects</strong></td>
<td>Led to downfall of government who were criticised for slow responses. Beatle George Harrison organised ‘Concert for Bangladesh’ 1971 – forerunner of Live Aid. Red Cross sent report to United Nations about lack of preparation.</td>
<td>Cost of building materials rose. 90% of crops washed away leading to food shortages. Shrimp farms devastated leading to loss of income.</td>
<td>2007 saw many areas flooded several times so disease was again rampant as people never recovered.</td>
<td>Diarrhoea outbreak affected 7000 and dysentery 3000 people 2 million at risk as many had no food or clean water for over a week Salt water covered a lot of farmland ruining fertility of soil Sunderbans endangered Bengal Tiger sanctuary inundated. Many tigers drowned. 50,000 deer missing.</td>
</tr>
<tr>
<td><strong>Responses</strong></td>
<td>By 2000, over 200 cyclone shelter had been constructed By 1991 volunteers from Cyclone Preparedness Programme gave warnings 2-3 days before so 350,000 fled to shelters in time.</td>
<td>Detailed program for storm protection devised by Ministry of Disaster Management &amp; Relief + 32000 volunteers of Red Crescent. International aid given to help. 2500 cyclone shelters built (dual purpose = schools in normal weather) More concrete levees. Afforestation = green belt.</td>
<td>Success shown of international donations (especially USA &amp; EU) helping to fund the emergency shelters on stilts, cyclones walls within trees, education and early warning systems which prevented a higher death toll.</td>
<td>United Nations employing Australian Lifeguards to teach Bangladeshi children to swim.</td>
</tr>
</tbody>
</table>
Drought in Australia (MEDC)

A drought is a prolonged, abnormally dry period when there is not enough water for users' normal needs. Drought is not simply low rainfall; if it was, much of inland Australia would be in almost perpetual drought. Because people use water in so many different ways, there is no universal definition of drought.

Living with Drought, Australian Government Bureau of Meteorology

Causes

- Australia is often affected by droughts because of their geography and changeable rainfall patterns.
- Australia is located in a subtropical area of the world that produces dry, sinking air that creates clear skies and little rain. For most of the country, our rainfall is very low and irregular.
- Another cause of drought in Australia is from the El Niño weather pattern.
- When there are El Nino weather conditions, Australia becomes drier than normal and the chance of rain decreases.
- El Nino causes a rise in sea temperature, weak easterly winds and the movement of rain clouds away from Australia. (Rain happens in areas of low pressure)

ENSO = El Niño Southern Oscillation refers to the cycle of warm and cold temperatures, as measured by sea surface temperature, SST, of the tropical central and eastern Pacific Ocean. El Niño is accompanied by high air pressure in the western Pacific and low air pressure in the eastern Pacific.

2002-2007, the Millennium Drought

The 2002–2007 drought, or ‘big dry’, was actually two separate droughts, each of about 12 months duration, 2002–03 and 2006–07, which resulted from two separate El Niño events. Crucially, there was no significant wet period between the two events to alleviate the rainfall deficiencies. Not only did the 2002–2007 drought significantly reduce farm production during the event but ongoing effects continued to be felt in many regions following the return of ‘normal’ rainfall patterns.

Irrigated industries that rely on water storages were particularly affected as major reservoirs in the Murray–Darling Basin, Australia’s most important irrigation region, fell to 17 per cent of capacity in 2003, and remained below pre-drought levels until late 2010


2012+ Queensland Drought

Australia’s Queensland is suffering its most widespread drought on record, with almost 80% of the state now included in the list of affected areas. In 2011 much of this state was flooded but, in February 2014, normally the wettest month, there was only a little rain on the coast. It was the hottest spring on record and worst conditions in recorded history. No significant rainfall since 2012 in more than 70% of Queensland and 62% of New South Wales.

Effects

- Farmers suffer, particularly those in marginal areas.
- With no rain for over a year, the land becomes barren = soil erosion
- Crops fail, feed prices rise.
- Cattle are dying (10,000 per day some estimate – many have to be shot by farmers….)
- Livestock have to be sold off but at rock bottom prices as over-supply.
Some farmers have had no income for 3 years (Dec 2014)
Other local businesses in area also suffer as farmers’ incomes plummet
Six-fold increase in number of suicides among farmers (1 every 4 weeks)

Australian bushfires can be particularly severe as eucalyptus trees contain large amounts of oil which can burn very fast and very hot. Other human management factors which have contributed to the severity of bushfires include high fuel loads, a change from fire prevention to fire-fighting measures, and not building adequate buffer zones to protect built assets (Nairn Inquiry, 2003). As Australians learn to understand more about bushfires, bushfire prevention strategies are being adopted.

Black Saturday bushfires, Victoria, 2009
The Black Saturday bushfires were a series of bushfires that ignited or were burning across Victoria on and around Saturday, 7 February 2009. As many as 400 individual fires were recorded that day. The fires occurred during extreme bushfire-weather conditions. 

Background temperatures reached 46 degrees Celsius (115°F) and winds were in excess of 100 km/h (62 mph). This had been precipitated by an intense heat wave and almost two months of little or no rain. A cool change hit the state in the early evening, bringing with it lower temperatures but gale-force south-westerly winds in excess of 120 km/h (75 mph). This change in wind direction caused the long eastern flanks of the fires to become massive fire fronts that burned with incredible speed and ferocity towards towns that had earlier escaped the fires.

Wikipedia
The fires affected 78 townships, including Marysville and Kinglake.
An estimated 7,562 people were displaced from their homes.
The fires on 7 February 2009 resulted in the nation’s highest ever loss of life from a bushfire: 173 people died and 414 were injured as a result of the fires.

Responses
- Suicides increase among farmers
- A$100m (£53m) in drought assistance from the Australian government – loans will be cheaper.
- Detailed list of water restrictions with alerts given as to severity. Includes rules over use of hoses, sprinklers, swimming pools, grey water etc
- Melbourne is building a desalination plant which should provide water for 1/3 of the city.
Aid project in an LEDC – Medic Malawi and St. Peter’s Exeter Education Trust

Support and direct aid given to St. Andrew’s Hospital, Omau Orphanage, All Saint’s Secondary School, Mtunthama and Chilisya Government Primary Schools in the Kasungu region of Malawi

Projects include:

- paying children’s school fees
- Micro Loans for small business
- Setting up a solar light business at the secondary school
- Fundraising at St. Peter’s Exeter for New School Buildings including £21,000 in 2011
- Mosquito net project to donate a net to every family with a child U5
- Prizes, equipment and training given to All Saints Secondary school

Partnership working with the Charities Solar Aid and Dress a Girl around the world.
<table>
<thead>
<tr>
<th>Name of scheme</th>
<th>Description of project</th>
<th>Positive aspects</th>
<th>Negative aspects</th>
</tr>
</thead>
</table>
| **Cluster villages on raised land.** | A cluster village is like a normal village but with lots more people living in the same space with shared facilities. They include a tube well (*floodwater cannot contaminate water*), latrine, a school and a cattle shed – so there's a huge number of facilities in a small space together with the households settled there. Built on raised ground to keep above flood level. | • Protects from flooding  
• More sustainable way of living  
• Less facilities and resources needed and used per home  
• Allows people to focus on jobs, work, money, education etc. | • Cannot protect from all flooding risk  
• Expensive to build in first instance  
• Relies on AID and Non-Governmental Organisation (NGO) in first place |
| **Faruk’s fish** | He raises ‘tilapia’ and other fish in three cages. The great thing about this business is that when the floods come Faruk simply moves the cages nearer the embankment and can still get an income. *Practical Action* gave free basic training in fish culture and a low interest loan to buy first cage. Next year he’s planning on expanding to 25 different cages. | • Flood-proof farming method  
• More sustainable way of living  
• Increased income used for children’s education and home improvements | • Loan must be repaid |
| **Moshuir’s pumpkins** | *Practical Action* have provided seeds and training to grow pumpkins on infertile soil that is near to the river bank. *(Sand-bar cropping)* Appropriate technology used | • Farms land that is otherwise unused  
• Pumpkins have a long shelf live  
• They are a versatile vegetable  
• Can be harvested more than once per year  
• Can be stored and sold | • Seeds and training needed |
| **Noor’s super ducks** | Micro-loan from NGO to buy several ducks. They breed fast and provide meat and eggs. Have allowed Noor to diversify his farming outside of crop growing. | • Ducks can be farmed during floods  
• Provide income to raise house above flood water  
• Ducks eat pests and fertilise crops with waste  
• Ducks webbed feet push methane back into soil! | • Loan needed |