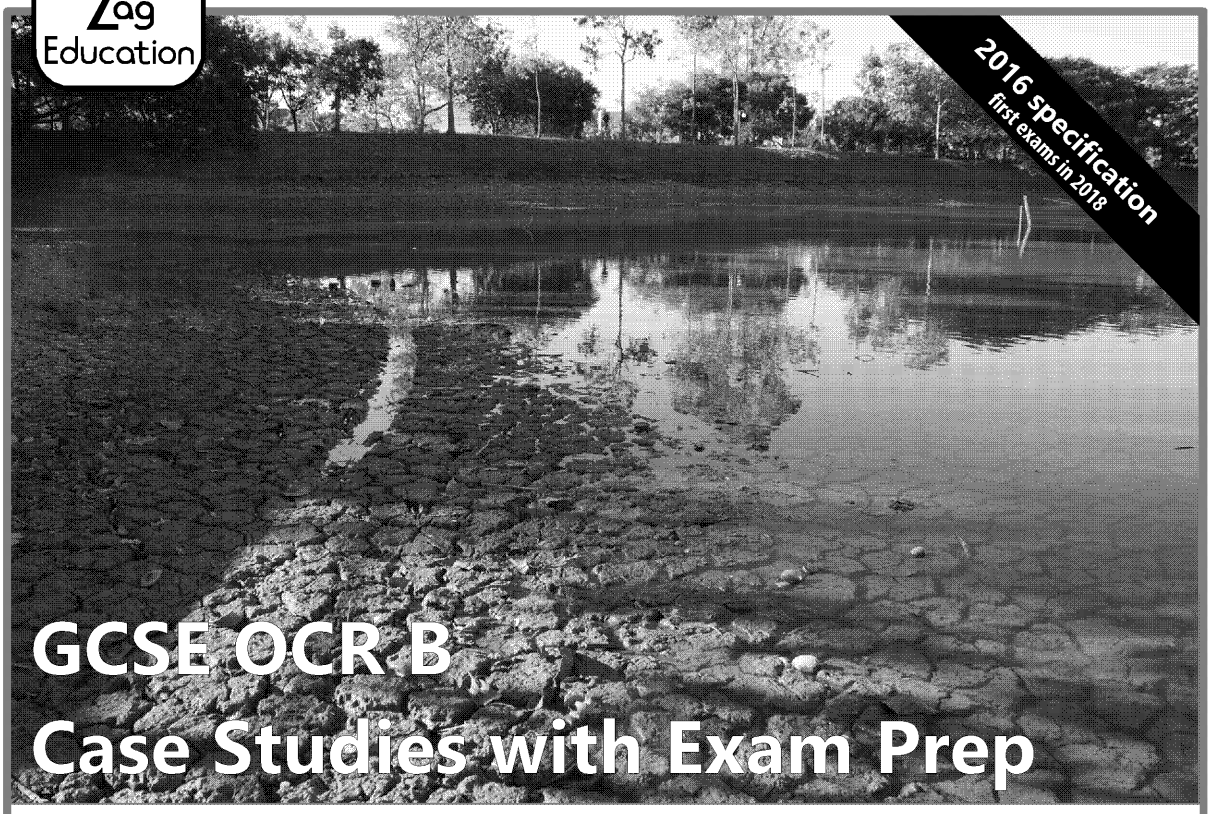
Zig Zag Education

Geography

GCSE | OCR B | J384



GCSE OCR B
Case Studies with Exam Prep

Global Hazards: Weather

Drought in Brazil (2014–2016)

zigzageducation.co.uk

POD 8848

Contents

Teacher's Introduction

This resource has been developed to provide case studies and exam preparation material to support the GCSE OCR B specification (J384) **Topic 1: Global Hazards: Weather.**

This detailed case study is on **Drought in Brazil (2014–2016)** representing a non-UK **drought event**.

The case study includes a main content section which can be used as part of a lesson plan or distributed to students for self-guided research; a selection of ICT interactive links to further students' research around each topic and a set of Springboard Images and discussion questions (also available as a PPT file accessible by digital download) which makes a fantastic starter activity.

*A webpage containing all the links listed in this resource is conveniently provided on ZigZag Education's website at **zzed.uk/8848***

You may find this helpful for accessing the websites rather than typing in each URL.

The exam preparation section which follows the case study contains a summary table, bringing together all of the key facts and figures relating to the case study; rapid-fire revision questions (with answers) to help recall and retention of the main points; and an exam-style question and mark scheme, written in the style of the OCR B sample material, so that students can practice answering questions relating to case studies and applying relevant knowledge in their answers.

The resource may be used as a source of reference for the required case studies for individual study, or for group work leading to discussion or debate. Subheadings in the information sections are designed to enable tabulated comparisons of social, economic and environmental impacts.

Other detailed case studies are available for this topic area representing contrasting natural weather hazard events arising from extreme weather conditions (tropical storms, flash flooding, heatwaves, and drought) in the UK and globally:

- Hurricane Sandy, USA (2012)
- Tropical Storm Chedza, Madagascar (2015)
- Flooding, Morpeth, UK (2008)
- Flooding, Texas, USA (2015)
- Heat wave, UK (2015)
- Heat wave, Pakistan (2015)
- Drought, UK, (2004–2006)

A PowerPoint presentation containing the Springboard Images starter activity to accompany this resource is available as a free digital download. Just register for free updates using the link below to download all available content for your school or purchasing site.

November 2018

Part 1: Case Study

Content

Causes and Prior Weather Conditions

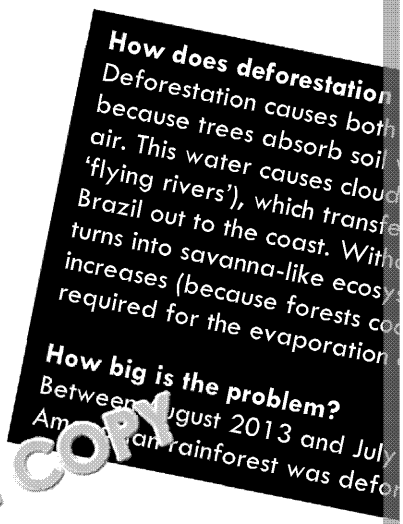
In total, four Brazilian states were affected by drought between 2014 and 2016. The four states were:

- São Paulo
- Rio de Janeiro
- Espírito Santo
- Minas Gerais

Figure 1: The af

São Paulo and Rio de Janeiro saw the greatest shortages, where droughts were the worst for 80 years – since the 1930s. Coastal regions also have a very high population, which has added to the pressure. The most affected regions are located in Brazil's south-eastern region, which is already classified as 'semi-arid'. For example, Minas Gerais only saw 900 mm rainfall in 2014 – half of its normal precipitation.

The drought was caused by several factors – including deforestation of the Amazon (which causes a decrease in rainfall), high population, agricultural use and industrial output (increasing demand), and the drought also coincided with particularly strong El Niño years. For this last reason, the states of Espírito Santo and Minas Gerais saw a continuation of the drought into 2016, and in fact a worsening.



Criticism and warnings (for example, by the scientific community) have also been levied at the water distribution and management network as an additional contributor of problems – pipes are old and leaky – up to 37% of water is lost, including water that is illegally stolen. In addition to these problems, development in the catchments has also caused reducing the water available for use.

Large urban centres also contribute to droughts due to their urban heat isla cloud cover over the cities.

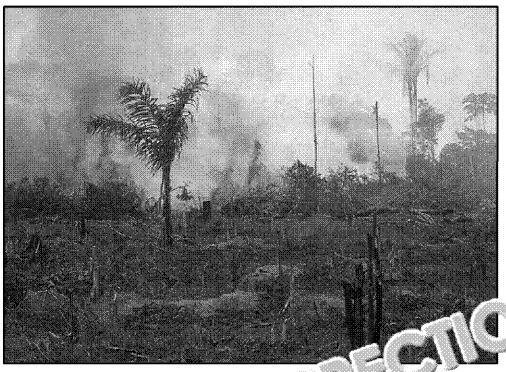


Figure 2: Deforestation is a major cause of

During the rainy season of 2014–1
normal, starting the drought cond
18 reservoirs were drawn down fu
Rainfall is very seasonal in south-
the entire year's rainfall occurs in
further pressure on suppliers to st
through the dry season.

In late 2015 and early 2016, rainfa
drought, but the intensity of the ra

Social Impact

One of the greatest implications of the drought was the shortage of water – both to domestic and commercial users. This led to water cut-offs and rationing. Reservoir supplies dwindled, sometimes to around 5% normal capacity (water at such levels is used as emergency reserves), and one reservoir outside Rio de Janeiro was completely drained. Additionally, electricity was lost at times (rolling blackouts) to many areas, because Brazil generates between 65% and 70% of its electricity from hydroelectric power. At times, the water storages resulted in residents protesting in the streets, which was picked up by the media.

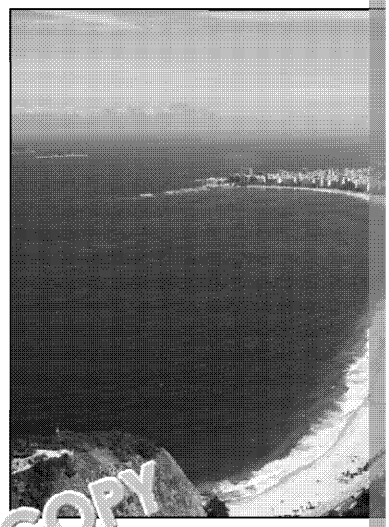


Figure 3: Rio de Janeiro was just

- Around cities experienced water rationing in various forms in January 2015.
- This equated to approximately 3.9 million people.
- In Olinda, water was only supplied on three days each week.
- In Vila Madalena (São Paulo), water was cut off from 3.30pm each day to 8am the following day.
- Starting in January 2015, São Paulo's residents occasionally had their water supplies cut off.
- Customers who reduced their water consumption were rewarded with cheaper water rates; however, customers who used more water than in previous years were forced to pay higher tariffs than normal, called 'punitive tariffs'.
- As a result, water recycling by residents increased.
- Some affluent people bought disposable items such as paper plates to avoid needing to wash up!
- Residents also stored water; however, this resulted in a larger mosquito number and dengue outbreaks.
- Health was affected as hospitals experienced water shortages.
- Carnivals were cancelled in some areas.
- Some jobs were also lost; for example, those of 800 workers who produced the sugar and ethanol industries. For example, the Bom Retiro mill and years.

Figure

Economic Impact

In February 2015, São Paulo's main reservoir was critically low at only 6% capacity. This was not an isolated occurrence, however. Water companies scrambled to source water from elsewhere, and pool together their existing resources. Rio's largest reservoir, Paraibuna, dried up for the first time since 1978.

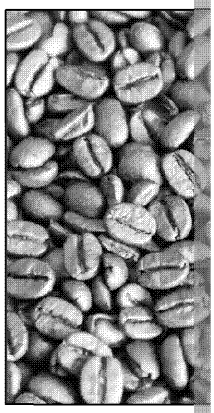


Figure 5: Coffe

Shortages of water, and, therefore, power, caused significant economic damage to the region. Businesses and agriculture were affected due to the shortages and rationing. For example, in the states of Rio de Janeiro and Minas Gerais, residents and businesses were asked to reduce their water consumption by 30% – almost a third.

Economic losses included:

- Reduction in commercial activity due to power cuts and associated los which led to significant losses.
- Reduction in tourist arrivals.
- Electricity companies lost money because they had to import electricity countries, or generate electricity from other sources. The government companies with $1 billion from state-owned banks.
- Some companies that relied on large quantities of water to function – c boat companies – were temporarily closed and lost money.
- Agricultural losses included:
  - Coffee production – half of Brazil's coffee is grown in Minas Gerai increased slightly.
  - Soya bean yield decreased.

Environmental Impact

- Fish populations were impacted.
- The risk of forest fire increased – there were over 11,000 forest fires in Southern Brazil.
- A greater reliance on thermal power stations (using fossil fuels) increased greenhouse gas emissions.

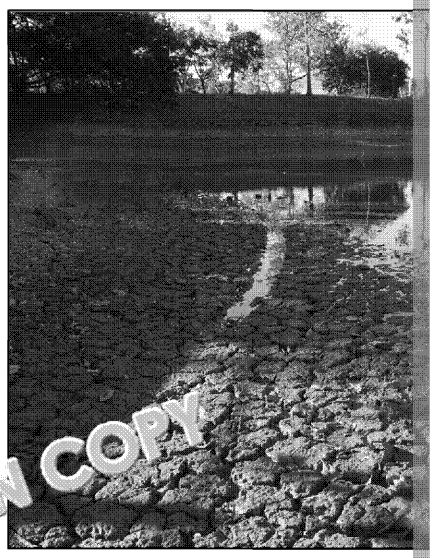


Figure 6: Water bodies dried u

Management to Reduce Risk

In areas such as São Paulo, water supply is a long-term issue that will need to be managed. Therefore, the management strategies can be divided into temporary/short-term issues (i.e. implemented during the drought), and lo stop similar events from occurring.

Short Term:

- Reservoirs were linked together to pool reserves, allowing for an overa 2015.
- Extra electricity, to make up for the shortfall from the loss of hydroelec from Argentina and northern Brazil, and thermal power stations also i blackouts were also used to protect supply.
- Water companies lowered pressure, water was cut off and rationed.
- More wells were dug.
- Local people collected rainwater where possible.

Long Term:

- Reduce water leakage – repair pipes (e.g. could reduce São Paulo's supply by 6%).
- Install water-efficient taps (a possibility).
- The generation of renewable power could be increased.
- Import water from further afield – permission was granted for a 15 km connection from the Paraiba do Sul river basin to the Catareira system.
- A scheme costing $550 million began construction for a pipeline to supply additional water to São Paulo (due for completion in 2018).
- The World Bank provides funding to those at risk – to build water reservoirs and provides workshops, etc.
- The Ministry of National Integration produces plans to increase prepar planning and risk identification – which started before the current drou

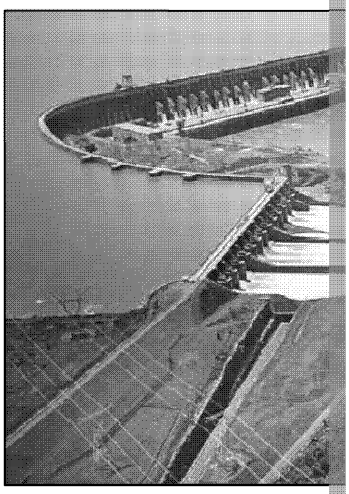


Figure 7: Brazil generates alm from h

Evidence for Future Extreme Weather

While Brazil has experienced droughts in the past (for example, caused by El severe for 80 years. Deforestation is a major threat to the Amazon rainforest demand for timber and crops (such as palm oil), and, therefore, without prop threat. This event could simply have been caused by natural weather variati because the effects of climate change may not be seen significantly for the ne

Fact Table

Number of states affected:	4
Time since last severe drought like this:	80 years
Percentage of water lost via the distribution system or theft:	37%
Water capacity of some reservoirs:	6% and one capacity
Number of cities that experienced water rationing in January 2015:	93
Number of beef farmers who lost their jobs:	800
Percentage businesses and residents were asked to reduce water consumption by:	30%
Number of forest fires as a result of the drought:	11,000
Percentage of water that could be saved in São Paulo by reducing leaks:	6%
Cost of building a pipeline to supply water to São Paulo:	$550 millio

ICT Interactive Page

Rather than type out these we

Videos and interactive content

Images of the drought:

- **http://www.telegraph.co.uk/news/pic[illegible]ies/earth/11242908/Bra years-from-the-air-in-picture[illegible]m**

and

- **http://[illegible]imes.com/sao-paulo-drought-2015-photos-historic-wat brink-collapse-1912767**

Three maps which help explain the effects of the drought:

- **http://www.wri.org/blog/2014/11/3-maps-help-explain-s%C3%A3o-pa water-crisis**

News Stories

Brazil's drought problem:

- **http://www.cnbc.com/2015/06/30/worries-grow-as-serious-drought-hi**

Protests and blackouts:

- **https://www.theguardian.com/world/201[illegible]/brazil-worst-drough**

How to stop the drought?

- **https://www.the[illegible]com/global-development-professionals-net drough[illegible]ance-50-ngos-saving-water-collapse**

An end to drought?

- **http://www.reuters.com/article/us-brazil-water-idUSKCN0VR1YJ**

Springboards

Springboard 1

1. Suggest how deforestation can be linked to drought.
2. What are the social problems caused by drought in Brazil?
3. Describe short-term responses to drought in Brazil.

Springboard 2

1. Why is electricity production in Brazil affected by drought?
2. Suggest how businesses can be affected by loss of water and/or power.
3. How can the effects of drought in Brazil be reduced?

Springboard Suggested Answers

Springboard 1

1	• Deforestation changes the temperature of the land – there is less temperature increases. • There are fewer clouds, therefore, less rainfall. • There is less transpiration because there are fewer trees.
2	• Interference to residents and disruption to daily life and activi • Higher water bills for high users. • Need to store water – increased mosquito population. • Decrease in healthcare capability. • Cancellation of social events such as carnivals. • Some people lost their jobs.
3	• Increase water recycling and storage. • Water cut-offs/rationing. • Reservoirs were linked together to pool storage. • Wells were dug. • Electricity was imported from Argentina and northern Brazil.

Springboard 2

1	• Almost three quarters of Brazil's electricity is generated from hy less water exiting reservoirs, less electricity was produced, whic
2	• Some industries temporarily shut down, at the expense of staff. • Crop yields were lower for farmers. • Communications were impacted because of power loss.
3	• Brazil can reduce its demand for water – such as by fixing leaky efficient equipment. • Large capital infrastructure schemes allow for water and electric further afield. • Implementing robust plans and risk identification. • External funding and resilience preparedness, such as provided

Part 2: Exam Preparation

Summary

Drought in Brazil

Question	
Name the four states affected by the drought in Brazil.	• *São Paulo* • *Rio de Janeiro* • *Espírito Santo* • *Minas Gerais*
The drought was the worst in how many years?	*80*
In 2014, how much rainfall fell in Minas Gerais?	*900 mm*
What were the main causes of the drought?	*Deforestation, El Niño growth*
How much water was lost through leaking pipes and theft?	*37%*
How many reservoirs fell below 2001 drought levels?	*17 (of 18)*
How low did reservoirs reach in 2015?	*Down to around 5%*
In January 2015, how many cities experienced some form of water rationing?	*93*
How many people did this affect?	*3.9 million*
How did water companies deter people from using lots of water?	*By charging more for than during the previous*
Why was storing water a problem?	*Increased number of outbreaks*
What social events were cancelled?	*Carnivals*
How many beef producers were laid off?	*800*
Identify other industries that were affected by the drought.	*Sugar and ethanol, oth*
Name Rio's largest reservoir.	*Paraibuna*
By what percentage were residents and businesses asked to lower their water use?	*30%*
State two agricultural crops that were affected by the drought.	*Coffee and soybean*
How many forest fires were caused or worsened by the drought?	*11,000*
How was electricity production increased?	*Greater use of thermal imported from Argent*
By linking reservoirs together, what was the full capacity by the end of 2015?	*12%*
In São Paulo, how much water could be saved by fixing leaks?	*6%*
Which scheme cost $550 million?	*A new pipeline into S*
Who provided funding for new resources and provided workshops?	*The World Bank*
Which ministry draws up plans to cope with and reduce the effects of droughts?	*The Ministry of Natio*

Quick-fire Questions

1	What is the normal classification for the climate in south-eastern Brazil?	
2	How does deforestation cause drought?	
3	How can cities also reduce the amount of rainfall overhead?	
4	Describe the climate in south-eastern Brazil.	
5	Why did drought in Brazil also affect electricity generation?	
6	How did water companies decrease customers' water use?	
7	How were jobs affected?	
8	How was the environment affected by the drought?	
9	How could a greater reliance on thermal power stations affect the environment?	
10	How did local people increase their resilience to the drought?	
11	How could water provision be improved in cities?	
12	Suggest whether climate change was responsible for the drought.	

Quick-fire Answers

1	What is the normal classification for the climate in south-eastern Brazil?	*Semi-arid*
2	How does deforestation cause drought?	*Fewer clouds form, b… leaves of trees.*
3	How can cities also reduce the amount of rainfall overhead?	*Cities are warmer du… cities, and hence prec…*
4	Describe the climate in south-eastern Brazil.	*A wet-dry climate – … Brazil is located in th…*
5	Why did drought in Brazil also affect electricity generation?	*Most of Brazil's pow… be a store and flow of…*
6	How did water companies decrease consumers' water use?	*By charging different r… others.* *By limiting the press… certain hours, or on c…*
7	How were people affected?	*Some people were ma… where water supply is…*
8	How was the environment affected by the drought?	*Fish populations were… fires, destroying habi…*
9	How could a greater reliance on thermal power stations affect the environment?	*Thermal power station… CO_2.*
10	How did local people increase their resilience to the drought?	*By reducing their wa…*
11	How could water provision be increased?	*Water can be provided … $550 million scheme w…*
12	Suggest why climate change was responsible for the drought.	*It is unlikely that the … Therefore, it is most l… human factors, such a…*

Extension Questions

1. Sources claim that under water rationing, supply may only be provide the morning. Discuss the disadvantages that this could pose to residen

2. Comment on the problems caused by reduced water supply in São Pau water supply into the reservoirs 3,563 gallons per second. In 2014, the fig second.

3. Brazil is one of the 'BRIC' countries – a group of countries which are ex growth. Suggest how water shortages could harm Brazil's economy.

Extension Answers

1. Women in particular need to be up at this time to use or store water in bucket sleeping patterns and daily routine. For people who can't store water easil chores such as washing clothes needed to be completed during this time.

2. The data shows that in June 2015 the supply into the city was less than hal the following year. This would have limited industrial users in terms of outpu users – through rationing and cut-offs at different times. The use of open stora mosquito population, and, therefore, the spread of mosquito-borne disease.

3. Reduced industrial output – for example, industries that need a lot of water, s This would have resulted in some workers being made redundant, as some m years. In addition, investors from outside the country could be discouraged.

Exam-style Question

Question 1

Case s – extreme weather event in a UK and non-UK loca

Explain how the consequences of extreme weather events di contrasting countries.

Level Marking

Level	Mark	Description
1	1-2	• The student evidences basic knowledge • The student evidences limited understan exist between places, environments and • The ideas expressed by the student are • A named ex[illegible] provided but place-
2	3-4	• The student evidences some knowledge • The student evidences good understand between places, environments and proc • The ideas expressed by the student are • A named example is provided with some
3	5-6	• The student evidences thorough knowle (AO1) • The student evidences a firm understan exist between places, environments and • Ideas expressed by the student are in-de • A named example and place-specific de

Suggested Content

Name of UK extreme weather event: Morpeth flash floods, 2008
Name of non-UK extreme weather event: Brazil drought, 2015

- As the two weather events are different and in contrasting countries, th events are also different. The table below demonstrates the differences and environmental consequences.

	Brazil	
Soci Consequ	• Brazil suffered extreme wat restrictions as a conse[illegible] of the drought, with [illegible] 3. million people experi[illegible] rationing. • [illegible] was lost to some residents as much of Brazil's power is run through hydroelectric power stations. • Residents attempted to store water, which resulted in a larger mosquito population and increased number of dengue outbreaks. • Healthcare was affected as hospitals experienced water shortages. • Some jobs were also lost due to lack of water.	• In Mor were e damag • Many were d • **Simila** electri custom
Economic Consequences	• Brazil suffered various economic losses. For example, there was a reduction in tourist arrivals and electricity companies ended up losing money as power had to be imported from neighbouring countries. • Agricultural loses in coffee [illegible] ba[illegible]s also occurred.	• Morpe damag proper
Environment Consequences	• In Brazil, fi[illegible]o[illegible]ations were affected by l[illegible] of [illegible]ter. • [illegible]e was also an increased risk of forest fires, with over 1,100 occurring in Southern Brazil	• Morpe surrou coveri