

The Living World

The Sonoran Desert: South-western USA and North-west Mexico

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Teacher's Introduction

This resource has been developed to provide case studies and exam preparation material to support the GCSE AQA specification (8035) **Section B: The Living World**.

This detailed case study is on **The Sonoran Desert, USA** representing a **hot desert** within a **high income country** based on World Bank classifications.

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/8795



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 AQA 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.

Four other detailed case studies are available for this topic area (a small-scale ecosystem, two tropical rainforests, and a cold environment):

- The River Otter, Devon
- Tropical Rainforests: Madagascar
- Tropical Rainforests: Sumatra
- Sakha (Yakutia) Republic, Russia



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.

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The Sonoran Desert – south-western USA and n

Part 1: Case Study



Content

Introduction

The Sonor Table Covers an area of 260,000 km² within Arizona, Clear ia, Baja California and the Sonora region of northern Mexico – the desert crosses the border between the two countries. Within the large Sonoran Desert, smaller deserts are located including the smaller Colorado and Yuma Deserts.

The Sonoran Desert is a classic hot desert due to its high temperature (reaching 48 °C), the largest desert in North America; however, the desert has unusually high biodiversity – its coastal location influences weather, meaning that there are unusually two set seasons per year. Naturally, coastal areas to the west are wetter than those to the east, and this supports high biodiversity.



Figure 36:

People have lived in the region for the and Is or years; however, due to poptechnology, the desert is not the analytic repeated to live – air conditioning mand large-scale wat the systems allow for wasteful uses of water, as technologically and the region to prosper ecomine has been proposed. These examples, and the encroachment of cities the natural environment and increase the risk of desertification. Parts of the protected – there are national parks in the United States and the Pinacate N conservation plan established, in order to protect the most important areas development elsewhere.



Figure 37: Typical vegetation cover in the Sonoran Desert

Description and Sonoran Desert

The Sonoran Desert hottest, second la desert. A wide recommunities are species such as tracti), ranging fro xeric shrublar close to rivers. I mountainous are volcanic activity cut off, allowing

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The desert is home to around 2,000 species of plant – many are adapted to such as palms, agave and cacti. Sixty mammals (including mountain lion and coyote), 350 birds (including eagles, and the pygmy owl – endangered reptiles (including the Gila monster and rattlesnakes), 20 amphibians and the creosote bush bloom, on higher ground grow sub-trees and shrubs, such mesquite, jojoba and acacia. There are also areas of semi desert grassland, dominated ecosystems), evergreen woodlands area of semi desert grassland, aspen at the highest altitudes where the more precipitation.



Figure 38: A Gila monster

So what is the climate like in causes it? The Sonoran Deser latitude – where high pressur air sinks. High pressure wear – little rain and hot daytime too – as the heat is lost to spart to reflect the outgoing (infrarin temperature between night range. The sun's rays are fair not blocked by clouds.

During the summer, tempera although this is unusual – hig Night time temperatures are are warm and usually frost-fi

Phoenix, the most populous city in the Sonor. I es., there are around 10 mercury rises to 100 °F (38 °C). Night temperatures are warmer than because of the urban heat istrated to the urban surfaces absorb heat during during the night, continued to the heat from electrical equipment and air continued to the urban surfaces absorb heat during the night, continued to the heat from electrical equipment and air continued to the urban surfaces absorb heat during the night, continued to the urban surfaces absorb heat during the night, continued to the urban surfaces absorb heat during the night, continued to the urban surfaces absorb heat during the night, continued to the urban surfaces absorb heat during the night, continued to the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces absorb heat during the night of the urban surfaces are urban surfaces.

Rainfall do word ur in the Sonoran Desert – in fact, it's rather wet for a deseyear, but with different causes, and is the reason for the desert's unusually

- During December and January, rainfall is due to Pacific storm tracks from the ocean. Rain is frequent but very light.
- In July and August, rainfall is formed from monsoon thunderstorms. Intense heating of the ground causes air at the surface to warm and rise where it cools to form large cumulonimbus storm clouds. The heavy rain can result in flash flooding because the ground surface is fairly impermeable. Soil is generally stony and free-draining. Creosote bushes are found in valleys where the water table is high.
- Precipitation is variable from year to year.
- Precipitation varies by location regions may be ween 76 mm and 500 mm of rainfall each year. In areas of ich revation, precipitation can fall as snow.
- Coastal areas to the species alive to be areas.
- After 1 Federal ged rainfall, the desert blooms as buried seeds germinate.

The Sonoran Desert has witnessed a long human history and has been used thousands of years. Farming has taken place in the area for 3,000 years, and American reservations including 17 different tribes. The largest settlement residents) and Tucson (1 million residents) – both are in the state of Arizona

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Since the arrival of the Europeans, land has been intensively used in the debeen introduced. Recent examples include grasses from South Africa, brou and to stop erosion. Such uses have caused a degradation of the native des

The 1850s saw a peak in overgrazing, which led to temporary abandonmenthe 1900s, farmers, miners and ranchers had all arrived.

While some industries have declined a true in use today. During the was firmly established: 'cattle, or in true, climate and cotton'. Look at this thirsty plant grown is a true and still grown there today? This will

Developm 29 portunities

Mineral Extraction

Although copper is one of the five Cs, current prices are fairly low. An open pit copper mine (Rosemont Copper) was proposed in 2006 in Pima County in Arizona by Hudbay Minerals Inc. If built, the mine could supply 10% of America's copper demand, and also produce molybdenum, silver and gold. The mine would have a 21-year lifespan, as proven reserves are 5.9 billion lbs – almost 2.7 million tonnes of copper over the 21-year lifespan of the mine. Advantages of the mine would include jobs, taxes and increased copper security in the United States.



Fig

However, there are plenty of environmental disa (v) fages to the mine and processing plants – 6,400 acres directly tea and 145,190 acres indirectly destruction of important habit (s) is population decrease of species, an indiamage to surface with the area of species, and indicate the surface with the area of species (pollution from waster) with the area of species (pollution from waster) and the surface with the area of species (pollution from waster) and the surface with the area of species (pollution from waster) and the surface with the surface of species (pollution from waster) and the surface with the surf

In 2016, the scheme was 'put on hold indefinitely'; however, Hudbay Mine would like the scheme proposals to be reconsidered when the price of copp scheme suggest that reasons also include the environmental impact of the sreport is still pending – there have been reports of certain animal sightings water pollution regulation problems and water supply issues.

Energy Production

Arizona and the Sonoran Desert is one of the sunniest places in the United States – this makes it an ideal place for solar power installations.

Renewable energy has already been install identified in the region – for example, geothermal in the expensive to install) is produced in the sea, and wind turbines have a minimum in the sea,



Figure 41: Photovoltai

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Zig Zag Education There are, however, environmental problems associated with the generation environmental pressure groups criticise such schemes; for example, those doesert Renewable Energy Plan promotes solar, wind and geothermal energe but makes trade-offs of areas developed and areas protected. Pressure group ristine land is used for this purpose, habitats are degraded, animals are kill Some renewable energy schemes have already failed fire ncially.

In 2010, permission was granted to install 30 Nov solar electricity plant



Figure 42: A Sonoran tortoise

Threats associnclude:

- Pollution
- Dust
- Habitat [
 - Ground of undergroumbrella home to la surface rudrier and creosote la extensive die, the caroots as the contribute.
- Shading
- Damage and increased of sion of the soil surface, leading to secondary species
- Increa 79 oi trusts and droughts
- Power education are also constructed
 Noise from construction affects population
- Noise from construction affects populations of kangaroo rats and rattle hear their prey as easily!
- Strong beams of sunlight can kill birds as they fly through them. Birds by wind turbines by flying into the moving blades.

Farming

Farming is now in decline in the Sonoran Desert; however, agricultural actidecline has partly allowed for the rapid increase in population because wat irrigation can now be used within settlements. During the 1930s, large dam supply water from far afield. A large quantity of groundwater was pumpe water table and, with economic problems, caused a remaind to be abar also pumped from the Salt River and stored in reservoirs. As a result, this is

Crops grown in the Corpin imperial valleys include figs, mangoes a most valuable rright lattle grazing less so.

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Figure 43: Cotton farm in Arizona

the 1930s) – even though it doesn't make a lot of sense for this crop to be gr price and demand have both decreased – other countries such as China can had a long legacy in the region, based on past cotton import restrictions.

Government incentives and protection (not granted for lops such as alfalfa growers a feeling of safety. When groundwat at it lies dwindled, the government still pays farmers or a scotton; full repayment of these loans prices fall after plantic in government also pays for insurance for farmer protected is a successful successful after plantic in government also pays for insurance for farmer protected is a successful successful





Tourism

Tourism is a major industry in the region, with centres such as Palm Desert California. The Coachella Valley, where these two resorts are located, is a

destination due to its warm temperature.

A wide variety of activities take place in the Sonora Desert.

Although every environme certain carries are ways to reduce the impact – such as golf courses which use recycled water for irrigation.

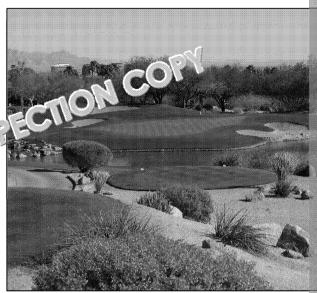


Figure 44: A golf course – who would know that

Activities include:

- Hiking
- Horse riding
- Cycling
- Climbing
- Kayaking and rafting on rivers

- Birdwatching
- Golf
- Open-air Jeep tour Seaplane trips
- Hot-air ballooning

To provide an enhance of a texperience, the Arizona Office of Tourism Arizona C Tourism beautiful and geotourism. A wide range of activities are proculture, signature, signature, signature of a cultural heritage, local cuisine and agritourism (farms)

Challenges

Extreme Heat

The Sonoran Desert is very hot. Within its cities, there have been sustained past. In Tucson, temperatures frequently rise to 100 °F (approx. 38 °C), and time temperatures are warmer than the desert due to the urban heat island temperatures increase the number of heat-related deaths. However, respite and Phoenicians – cheap electricity means that air conditioning is widely used to the urban heat island temperatures increase the number of heat-related deaths.

Limited Water Supply

One problem that can't be solved at the press of a control is that of water supply, cities such as Phoenix still and a control in the desert, of and, therefore, irrigation. Some and a control is used on outdoor landscapir rivers and for the control in the future water could be gained from the control in the salt and colorado rivers. For example, the Roosevelt Dam was built on supply schemes also provide electricity for the region.

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However, can Ph Population growl water supply. Fo obtained from gro as early as 2025, go not recharge (refi depleted.

Limited water su of water-intensive

The region covered by the Sonoran Desert is susceptible to erosion – but thi 17 states are at risk, although parts of Arizona are especially at risk.

What is desertification, and what are the causes?

Desertification is the expansion of the desert, from areas that were used for vegetation previously grew on. In the United States, one of the biggest cau stress causes plants to die. Without the plants to protect the ground, and the fertile layer of topsoil is exposed and eroded away: Or example, by the then likely to grow, and the chances of wildfire reliefly to increase. Recodifficult process.

Other causes in the Up 3 5 ies include population increase and tourism, infrastruct 79 ith the desert. Although off-roading is banned in the Sor causing soil to the causing plants as the tyres run them over.

Desertification isn't a recent phenomenon in the United States – the 1930s s droughts coupled with poor agricultural practices caused enormous dust st this, the government provided financial assistance and helped improve agr

Currently, the government (US Forest Service and Bureau of Land Manage region's land and uses a permit grazing system. It can, therefore, control the of animal and timing of grazing. A range of different methods are noted be policies can be contradictory!

Other methods of control include:

- Different ploughing techniques (e.g. and we poughing and strip plous
- Crop rotations
- Covering crops
- Government silver of sustainable farming on private land
- Efficie 1%
- ering techniques
- Using arought-tolerant species
- Wetland restoration

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Human Impact of Settlement



Figure 46: Central Phoenix

In the past, urbanisation mainly occurred on agricultural land – such as ora lowland agricultural use. However, today, expansion also occurs in uplant vegetation. As this supporting vegetation is destroyed, its animals are disp

Problems resulting from urbanisation include

- Fires
- Soil erosion and increased sur a crun-off
- Invasive species
- Pollut 79 g. 1 rumes)
- Noise (Education affic)
- Decline in bird populations (supporting plants are lost)
- Destruction of the physical look of the landscape

The Sonoran Desert Conservation Plan

The Sonoran Desert Conservation Plan has been established in Pima County, Arizona – the county where Tucson is located. The plan aims to decide upon suitable land use to allow for habitat conservation in important regions, and to allow sustainable development in others, help focus public spending money and use consultation with scientists and the public. As part of the plan, he desert was mapped based on vegation and priority habitats were consultation with the priority habitats were consultation.



In 20 of development of development of the control of the control

has rapid the 1 1990

NAT Free sout now air of might ward as sy

Figure 47: Org to the

The plan also aims to protect culture and heritage in the region (for example sprawl, decrease development in upland areas, increase the amount of unrebuffer zones to promote heritage tourism in mountain parks (and enlarge tourses.

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The Maeveen Marie Behan Conservation Lands System was established to protected but also to ensure that development could still take place in other terms of habitat value, with percentages of 'undisturbed natural open space

Conclusion

The Sonoran Desert has witnessed human activity thousands of years, vecosystems, sometimes in a negative vecosystems, sometimes in a negative vecosystem population growth and the extraction renewable energy installations. The farming are being replicable access, growing at phenomenal rates.

The USA is eloped country; therefore, many of the challenges of living be overcome – water supplies are brought into the region from far afield, at large desert cities such as Phoenix to develop.



Fact Table

Area:	260,000 km ²
High temperature:	48 °C
Usual summer temperature:	40 °C
Annual precipitation:	6 500 mm
Number of plant species:	2,000
Number of mammal species	60
Population of Phoen	4.3 million
Number 79 iv Ses:	17
Growth r Phoenix (2007):	4,000 m ² per hour

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ICT Interactive Page

Rather than type out these web

Videos:

Biodiversity in the Sonoran Desert

https://www.youtube.com/watch?v=utFhr at \(\text{1}\)

A Day in the Desert

https://www.ya

on watch?v=xWM0hYyHDvQ

Desert Farr Educa

https://www.youtube.com/watch?v=se720JXdXkY

The Sonoran Desert Conservation Plan

https://www.youtube.com/watch?v=4uMlomLOGFg

News Stories:

Surviving Summer in the Desert

http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/explore/surviving-summer-in-the-sonoran-desert.xml

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- http://tucson.com/business/local/low-copter-vie-delay-rosemont-minb116-3229d2f17221.html
- http://www.tucsonweek' om liekange/archives/2016/03/01/rosemont-hudbay-minera's

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http://www.desertsun.com/story/tech/science/energy/2014/10/11/renewaltplan/17131299/

Agricultural future?

http://www.azcentral.com/story/money/business/2015/05/11/historical-croagriculture/27033035/ and http://www.azcentral.com/news/articles/2012016inds-old-ways-new-again.html

Where to go as a tourist

http://www.experiencescottsdale.com/the-top-5-ways-to-explore-scottsdale.com/the-to-explore-scottsdale.com/the-to-explore-scottsdale.com/the-to-explore-scottsdale.com/the-to-explore-scottsdale.com/the-to-explore-scottsdale.com/the-to-explore-scottsdale.com/the-to-explore-scottsda

United States population growth

http://www.slate.com/blogs/mc/s/b) \(\sum \) 15/03/04/u_s_urbanization_big

Dystopian view of

http:// 🏰 henixmag.com/valley-news/future-phoenix.html





Springboards

Springboard 1



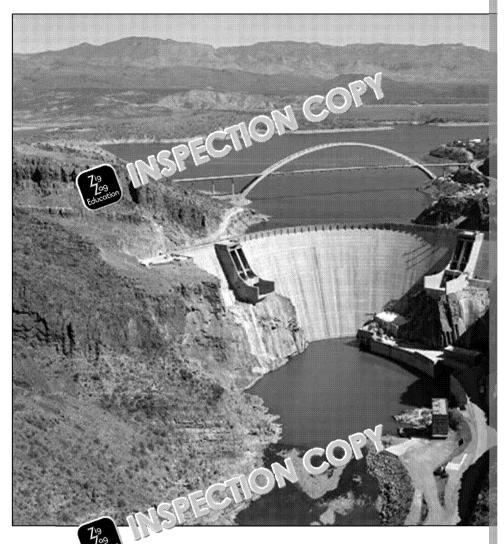
- 1. What types of plant can you see in this photograph?
- 2. This photograph was taken in April. Does this surprise you?
- 3. How are plants adapted to live in a hot desert such as the Sonoran Des



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1. Why deducated think this dam was built?

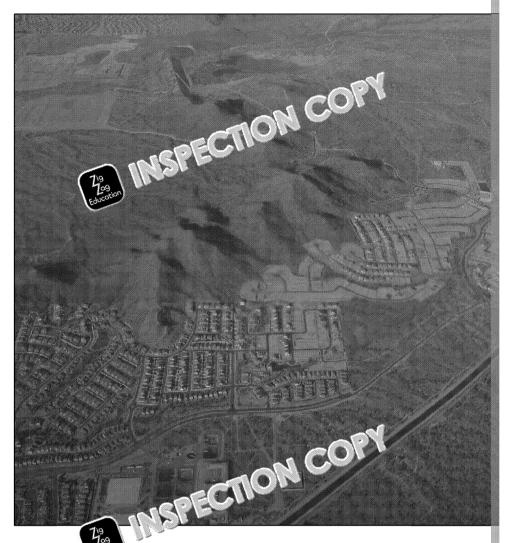
2. Do you think that the desert is a suitable place to grow crops such as α

3. What do you think are the problems caused by abstracting groundwate





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- 1. This ae photograph shows some of the newest suburbs of northern is this expansion consuming?
- 2. Why is this damaging to local habitats?
- 3. Why do you think that desert cities, such as Phoenix, are expanding so





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- 1. Where do you think the first notograph was taken?
- 2. What Toportunities are offered in the Sonoran Desert?
- 3. How can tourism be more sustainable in the Sonoran Desert?





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- 1. What is shown in the paper?
- 2. How I Togon in installation such as the one shown in the photograph at
- 3. Do you agree with the development shown in the photograph? Do you CO₂ offset the environmental issues?







Springboard Suggested Answers

Springboard 1

$\overline{}$	
	Cacti and succulents
1	Shrubs/bushes
	Flowering plants
١,	• No – a lot of pro in the region occurs over the winter. Theref
	plant have their seeds
	• 139 uaro cacti store water in their trunks. Small spiny and waxy le
	disourage browsing animals.
	• The timing of growth and seed dispersal is adapted to the timings of r
3	• Shallow roots to absorb light rainfall and dew, and extend far from the
	Uses a form of photosynthesis which uses little water.
	Some species are toxic to animals.
	Some shrubs and trees have very deep tap roots.

Springboard 2

1	•	To provide irrigation water to desert farmers – for example, to water co suggestions such as dwindling groundwater supplies.
2	•	Allow the students to argue their case either way, but the students will is ill-suited – because of the large volume of irrigation water required to over-abstraction of groundwater supplies, an including and reservoir construction, so not of the soil and disruption are areas far better suited to our intensive crop species! There are also many their suppling uses of water; for example, an included the students will be a supplied to the soil and disruption are areas far better suited to our intensive crop species!
3	•	Reportion to vater table – crops and native plants alike may be killed subsidence Reported river flow Overreliance on a finite resource in the case of fossil water. May take a long time to recharge.

Springboard 3

1	The land appears to be desert – the natural ecosystem rather than farm! than cropland.
2	 Destroys the habitat in areas built upon – once the native vegetation is the area. The habitat becomes fragmented – parts become cut off – for example, thouses and the water canal. There are many pathways through the canal and including oppoint indicating disturbance. Roads and other infrastructure to the expand into the desert – including collisions.
3	 Lences such as air conditioning make the region inhabitation growth. Trends and fashions to like in the south-west. Retirement to a warmer climate. Development of facilities and infrastructure. Water supply is manageable because of a decrease in irrigation used in

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Springboard 4

1	•	Allow any suggestion of a suitable town or city within the Sonoran Des Springs.
2	•	Hiking Horse riding Cycling Climbing Kayaking and rafting on river Birdwatching Golf The tirk of the cours Laborated the trips Hot-air ballooning
3	•	Development of geotourism, encompassing a wide range of experience Increase education and awareness.
	•	Higher taxes from tourism to pay for conservation.

Springboard 5

1	•	Photovoltaic (PV) cells – the generation of renewable energy using the				
	•	The array of panels is clearly shading the ground – the native vegetation				
		installation.				
	•	The ground surface is bare and exposed to rain and winds – soil erosion				
2	•	The soil may be compacted – burrowing animals may have problems d				
	•	The area is fenced off, excluding animals ar so so g habitat fragments				
	•	Power transmission lines must be buil for the buried.				
	•	Noise from construction.				
	•	Allow the stude of real either way. Since the South West experient				
3		are ich ich CO2 savings are likely to be significant – climate chan				
3		en, damaging ecosystems anyway. However, there are significan				
		e Education ment from such large-scale installation of PV.				



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Part 2: Exam Preparation

Summary



Sonoran Desert

How big it is now an Desert? What type went is the Sonoran? Why is the desert so important ecologically? Why is the desert so important ecologically? What are the high temperatures experienced in the desert? What are the high temperatures experienced in the desert? When are the two wet times of year? What are the two wet times of year? What appens after it rains? What appens after it rains? What are the populations of Phoenix and Tucson? How many native American tribes live in the area? What are the populations of Phoenix and Tucson? How long have people been farming in the region? What proposal was put forward by Hudbay Mir rail of the work of supplying 10% of American tribes are the sonoran Desert. Why was the project of the Sonoran Desert. Are these energy developments which could be implemented in the Sonoran Desert. What types of crops are grown in the Sonoran Desert? What types of crops are grown in the Sonoran Desert? Which crop uses a lot of water in particular? Which crop uses a lot of water in particular? What is the traditional agricultural use? What is the traditional agricultural use? What form of fourish made in Arizona? What form of fourish made in Arizona? How can the affect mortality rate? What form of fourish made in Arizona? How can the saffect mortality rate? What form of fourish made in Arizona? How can the saffect mortality rate? What form of fourish made in Arizona? How can the saffect mortality rate? What form of fourish made in Arizona? How can the saffect mortality rate? What form of fourish made in Arizona? How can the saffect mortality rate? Why can urban areas continue to grow even though	Question	
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rainfall? Which crop uses a lot of water in particular? In 2013, what was the area planted of this crop? Why is this crop grown? What is the traditional agricultural use? Name a popular tourist destination in 'e in a property of the Sonoran Deserty. What form of touristy of the extreme heat? How do recompled from dams and containing the conditioning affect mortality rate? Why can urban areas continue to grow even though initially, but as that resounce initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initially, but as that resounce channelled from dams and containing initiality channe	What types of crops are grown in the Sonoran Desert?	
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In 2013, what was the area planted of this crop? Why is this crop grown? What is the traditional agricultural use? Name a popular tourist destination in t'e in arrival are located. What form of tourist moved in Arizona? How do not be affect mortality rate? Why can urban areas continue to grow even though 161,000 acres 162,000 acres 161,000 acres 162,000 acres 162,000 acres 162,000 acres 162,000 acres 163,000 acres 164,000	Which crop uses a lot of water in particular?	Cotton
Why is this crop grown? What is the traditional agricultural use? Name a popular tourist destination in t'e in rmian region of the Sonoran Desert. What form of tourist moved in Arizona? How do not be affect mortality rate? Why can urban areas continue to grow even though The Coachella valley – what are located. Geotourism Air conditioning Higher number of heat-ready. Agriculture is in decline—		161,000 acres
What is the traditional agricultural use? Name a popular tourist destination in the coachella valley – what region of the Sonoran Desert. What form of tourist moved in Arizona? How do not be with the extreme heat? How can the coachella valley – what are located. Geotourism Air conditioning Higher number of heat-rewith the coachella valley – what are located. Why can urban areas continue to grow even though Agriculture is in decline	Why is this crop grown?	orical legacy, govern
Name a popular tourist destination in the Coachella valley – who region of the Sonoran Desert. What form of tourist moved in Arizona? How do not be a with the extreme heat? How can the word affect mortality rate? Why can urban areas continue to grow even though The Coachella valley – who are located. Are located. Air conditioning Higher number of heat-real affect mortality rate? Agriculture is in decline	The state of the s	
region of the Sonoran Desert. What form of touris med in Arizona? Geotourism How do recombined in Arizona? How can the second affect mortality rate? Why can urban areas continue to grow even though Agriculture is in decline—		
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How do not 2000 affect mortality rate? Why can urban areas continue to grow even though Air conditioning Higher number of heat-real Agriculture is in decline		Geotourism
How can the decay affect mortality rate? Higher number of heat-real Mhy can urban areas continue to grow even though Agriculture is in decline		Air conditioning
Why can urban areas continue to grow even though Agriculture is in decline	How can the Education affect mortality rate?	Higher number of heat-re
		previously used for irrigat

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Question	
Where does water come from?	Groundwater and major (River and Colorado River
What is the largest cause of desertification in the United States?	Overgrazing
When vegetation cover is lost, what happens to the soil?	he sopsoil is eroded by t
How can other human activity cause (e) tion?	Illegal off-roading can kill
How can desertification by the United States?	Better ploughing techniques, wetland
Why has n. Education banisation taken place in the Sonoran Desert?	The desert is a desirable p technology such as air co pleasant. Increase in ind
How has recent development changed from historic urban expansion?	In the past, much of the uagricultural land. Today, areas of traditional veget
How can the region be more sustainable?	Conservation, protected a management plans.
What plan was developed in Pima County?	The Sonoran Desert Cons
What are the goals of this plan?	Map vegetation and evaluing the region.





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Quick-fire Questions

2 7.7		
1	Where is the Sonor Se. 5	
2	Describe the climate of the Sonoran Desert.	
3	Why are deserts cold at night?	
4	Why are cities hotter at night than the surre in in Sert?	
5	Why is the Sonoran (2.) of diverse?	
6	How: 79 pecces of plant are found in the Sonoran Desert?	
7	Name two plant species that are endemic to the Sonoran Desert.	
8	What species of owl was endangered between 1997 and 2006?	
9	Would you describe habitation in the region as recent?	
10	Why did the population of the region expected the last century?	
11	Why digged db is als apply to open a copper mine in Pima County?	



	1
12	Are there any problems caused by mining?
13	Why were plans for the mine officially shelved?
14	Why is solar energy a viable endeavour in the the contract of
15	How could the beauty of the affected by the development of renewable energy
16	Name three types of renewable energy which could be implemented in the area.
17	How has water been provided for crop irrigation?
18	How can developments such as golf courses be more water-efficient?
19	Name a type of tourism promoted in Arizona.
20	What is the largest cause of desertification for the largest cause of the largest cause o
21	What desertification area in the United States during the 1930s?
22	Name a city in Arizona which is rapidly growing in population.
23	Where did urban sprawl initially take place?
24	Where does some of this growth now take place?
25	How has Pima County sought to reduce the high feet on the desert?





Quick-fire Answers

- 18 ¹¹ "		
1	Where is the Sonory I & F	South-wester
2	Describe the climate of the Sonoran Desert.	Hot summers seasons cause summer. Rai
3	Why are deserts cold at night?	Without cloud meaning that
4	Why are cities hotter at night than the surroun ing 4 ext?	The urban hea
5	Why is the Sonoran De Si a verse?	Two wet seaso
6	How: 79 per coor plant are found in the Sonoran Desert?	2,000
7	Name two plant species that are endemic to the Sonoran Desert.	The organ pip
8	What species of owl was endangered between 1997 and 2006?	The pygmy or
9	Would you describe habitation in the region as recent?	No! The region
10	Why did the population of the region expand (ver last century?	The five Cs – groundwater afield.
11	Why did Hydb 1 lb ls apply to open a copper mine in Pima County?	There is a rich



12	Are there any problems caused by mining?	Yes – a large are of land would be damaged by the operations – over 150 000 acres affected, with toxic
13	Why were plans for the mine officially shelved?	The low price of copper.
14	Why is solar energy a viable endeavour in the 1 Levert?	The region receives a lot The area is also vast, will ecologically valuable.
15	How could the beauty of the carried by the development of renewable energy	The natural beauty will
16	Name three types of renewable energy which could be implemented in the area.	Wind Solar Geothermal
17	How has water been provided for crop irrigation?	Groundwater, and from
18	How can developments such as golf courses be more water-efficient?	By using recycled water
19	Name a type of tourism promoted in Arizona.	Geotourism
20	What is the largest cause of desertification for the largest cause of the largest cause o	Overgrazing
21	What desertification area in the United States during the 1930s?	The dustbowl – caused the removal of native gra
22	Name a city in Arizona which is rapidly growing in population.	Phoenix, Arizona's state
23	Where did urban sprawl initially take place?	On agricultural land (lo PROTEC
24	Where does some of this growth now take place?	In desert (upland) areas
25	How has Pima County sought to reduce the high feecon the desert?	By implementing the So the desert to choose when present – essentially to i

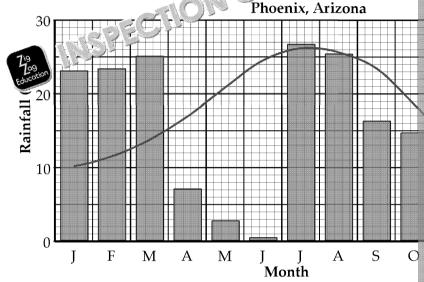




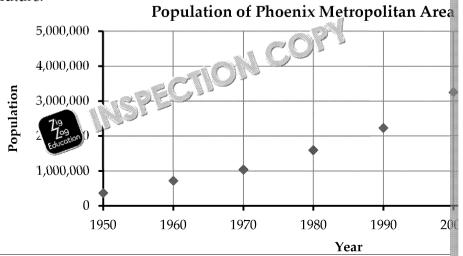
Extension Questions

1. Study the climate graph below, which shows the average temperature average high temperature in January is around 19 °C!

Describe and explain the graph.



- 2. Explain why the Sonoran Desert is ecologically valuable.
- 3. Summarise the human habitation of the Sonc refer.
- 4. Explain why the Sonoran Desert to the the seed a variety of different la
- 5. Why is the desert of a prace to live and work?
- 6. Do yo so that operations such as copper production and cotton far Sonora sesert?
- 7. Evaluate whether renewable energy should be allowed to develop in
- 8. Suggest why the Sonoran Desert is a popular tourism destination.
- 9. Outline the process of desertification.
- 10. Study the graph below, which shows the population of the Phoenix me Connect the points of the graph. Explain whether you think that the trifuture.



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Extension Answers

- 1. There are two drier periods April–June and September–November. The spr the driest month with less than half a millimetre falling average! In the win the Pacific Ocean – storms bring the rain. In the property of the pr
 - During the winter, and perature ranges from 13–20 °C, but reaches in summer by the warmest month at almost 35 °C average temperature change Top perature because of its distance from the equator.
- 2. Wide range of plant species 2,000, which supports many animals and reptile endemic, meaning that they are inherently fragile because they are found in a nowhere else on Earth (in the wild).
- 3. Human habitation for at least 3,000 years. There are 17 Native American tribe Europeans, there have been periods of economic boom and bust in the region, cattle ranching.
- 4. There are a number of mineral resources in the region which can be exploited cattle ranching, and the use of groundwater and later surface water meant that
- 5. High temperature! Summer highs are unpleasant without artificial cooling. I region shortages make some activities, such as min , lifficult, and crops region.
- 6. This question could be argued either who have amounts of copper ore in especially as a domestic structure. However, due to price fluctuation to develop copper the g.
 - In term ton production there are more suitable crops that could be plate industry is kept alive through government incentives without these, the difficult. Some argue that cotton would be better suited to be grown in other
- 7. Climate change is a huge issue and will affect the Sonoran Desert by reducir of climate change will be reduced. The South West is an ideal location based receives. However, campaigners cite many negative effects upon the immedia
- 8. The desert is warm during the winter, giving winter sunseekers a place to escar desert has many different tourist opportunities and facilities, promoted by tou government alike. The desert is also a very beautiful place where people wan native saguaro cactus.
- 9. The vegetation is disturbed, removed or kille . The inderlying topsoil is, the blown away (e.g. during dust storm and dearby water as there is less interested decreases, and turns into day at. A cost may also form on the soil. Associate vegetation.

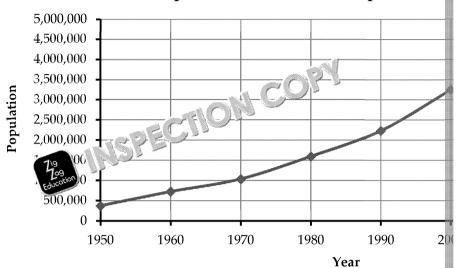


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10. The points have been connected on the graph below.

Population of Phoenix Metropolitan Area



The availability of water is likely to be an ever increasing pressure on cities su some groundwater – but this resource is likely to decrease and become unsus decade. There will, therefore, be increasing pressure on water supplies obtain able to cope? Therefore, the student may argue that water may be a limiting f

The student may also argue that population growth, decreased demand from water-efficiency measures could mean that the city expands for many years to



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Exam-style Question

Using ample of a hot desert, assess the extent to which presents more challenges than opportunities.

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Level Marking

Level	Mark	Description
1	1–3	 The student evidences basic knowledge of (AO1) The student evidences limited understand that exist between places, environments at A limited ability of alluate is evidenced the knowledge of a change and an arrangement.
2 7/9 Falucoti	11453	 AO1) The student evidences good understandin exist between places, environments and p A reasonable ability to evaluate is evidence application of knowledge and understanding
3	7–9	 The student evidences thorough knowledge (AO1) The student evidences a firm understanding exist between places, environments and period A strong ability to evaluate is evidenced the of knowledge and understanding. (AO3)

Indicative Content

- The student should clearly identify the challenges and opportunities pre
- The student should offer an evaluation of these challenges and opportunities extent the environment holds more challenges than opportunities. Low to students who do not form an argument.

Suggested Content

Challenges	Opportur
 Each opportunity Lars and conflicts. The experimental heat of the desert presents a considerable challenge for development opportunities – temperatures regularly reach up to 46.1 °C. This makes working in the desert virtually impossible. Limited water supply is also a problem in the desert, although in the Sonoran they seem to have largely overcome this by irrigation, although it does affect where mining can take place. 	 Mineral extractions for Energy production – to one of the sunniest point is ideal for the production addition, the Sonor to wind turbines and of Earming, in particular Tourism; for example Valley is home to two people come to enjoy

Spelling and Grammar (SPaG) - Total of 3 marks

For 1 mark:

- Student shows some ability to spell and punctus of prrectly.
- Student shows limited use of grammar to which argument.
- Student utilises a basic range of policial phrases.

For 2 marks:

- Student ganer: by styling and punctuation throughout.
- Stude 7 vs. some accurate use of grammar to convey their argume.
- Studer students es an adequate range of geographical phrases.

For 3 marks:

- Student uses correct spelling and punctuation throughout.
- Student shows accurate use of grammar to clearly convey their arguments.
- Student utilises a broad range of geographical phrases.

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