

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DISCIPLINE OF GEOGRAPHY
EXAMINATION: NOVEMBER 2013
MODULE NAME & CODE: ENVIRONMENTAL SYSTEMS, ENVS120H2

DURATION: 3 HOURS

TOTAL MARKS: 160

**INTERNAL EXAMINERS: DR S PILLAY, MS C CHINZILA AND
MR T WIGGILL**
INTERNAL MODERATOR: DR J ODINDI

INSTRUCTIONS TO CANDIDATES:

This question paper consists of eight pages AND a multiple choice question grid. You are provided with three answer books and a multiple choice question grid answer sheet (attached to this question paper).

1. Detach the Multiple Choice Grid answer sheet, fill in the details required and use it to answer the questions for Section A. **Please note that negative marking will apply for incorrect answers in the Multiple Choice Section.**
2. **Use the three answer books:** one for Section B, one for Section C and the third for Section D. On each answer book, clearly indicate the section and the numbers of the questions you have answered.

SECTION A: MULTIPLE CHOICE QUESTIONS (COMPULSORY)

ANSWER ALL QUESTIONS (40 MARKS)

On the answer grid provided, insert an 'X' over the letter corresponding to your choice of the correct answer for each of the following questions.

- 1) **Oceanic-continental plate interactions lead to subduction. What occurs if two oceanic plates collide?**
 - a) The oceanic plate is trapped under the other causing upliftment and eventually volcanoes eg. Hawaii
 - b) The oceanic plate that is denser will subduct under the other and a trench is formed
 - c) The oceanic plate separates from the other and pulls apart forming a ridge
 - d) Oceanic plates are rigid and build to form underwater mountains, underwater caves and canyons

- 2) **Why are earthworms important in soils?**
- Earthworms are segmented which means that they cause more caverns for other bacteria and microbes to be present underground
 - Earthworms produce fluids which enrich the soil aiding for nitrogen to be present for plant growth
 - Earthworms inhibit gaseous exchange killing other bacteria which can be harmful to plants
 - Earthworms ingest soil and excrete soil which allows for some chemicals to be bio-available for plant growth
- 3) **A cross-sectional view of the ____ in a soil is correctly termed a soil ____.**
- Strata sample
 - Horizons profile
 - Structures peds
 - Surface litter organic matter
- 4) **The four main bases in a soil are**
- Calcium, magnesium, sodium and potassium
 - Vitamins A, B, C and D
 - Nitrogen, Phosphorus, Iron and Potassium
 - Magnesium, Vanadium and Iron and Aluminum
- 5) **The surface litter horizon is described by the letter**
- A
 - B
 - L
 - O
- 6) **Iron Sesquioxides in soils impart**
- A black colour due to oxidation of Aluminum
 - A yellow-orange colour due to iron reduction
 - A yellow-orange colour due to iron oxidation
 - A brown-black colour due to organic matter
- 7) **Coarse sand has ____ permeability and ____ porosity**
- High high
 - High low
 - Low high
 - Low low
- 8) **Clay has ____ permeability and ____ porosity**
- High high
 - High low
 - Low high
 - Low low

- 9) **Soil is a complex mixture of**
- a) Soil biota
 - b) Eroded rock
 - c) Gases and water
 - d) All of the above
- 10) **The deposition / accumulation of material into a soil layer and derived from overlying soil layer(s)**
- a) Enrichment
 - b) Illuviation
 - c) Eluviation
 - d) Concentration
- 11) **The movement of lithospheric plates is significant because it**
- a) Explains the formation of waterfalls and river canyons
 - b) Predicts where certain natural hazards are likely to be found
 - c) Explains formation of ocean currents
 - d) Predicts where endangered species might be found
- 12) **Which of the following is *not* a characteristic of a mineral?**
- a) Crystal structure
 - b) Solid
 - c) Naturally occurring
 - d) Organic
- 13) **The process of formation of a sedimentary rock is known as:**
- a) Lithification
 - b) Petrography
 - c) The Rock Cycle
 - d) Consolidation
- 14) **The addition of lime:**
- a) Reduces soil acidity
 - b) Causes decomposition of organic material
 - c) Increases porosity of soil
 - d) Will change soil texture
- 15) **The velocity of P-waves changes as it travels through the Earth because of**
- a) Subduction
 - b) Transform fault
 - c) Changing rock densities
 - d) Increasing Pressure
- 16) **Which is correct?**
- a) Crust, Asthenosphere, Upper mantle, Mantle, Spintra-core, Inner core
 - b) Crust, Upper mantle, Asthenosphere, Mantle, Outer core, Inner core
 - c) Crust, Mesosphere, Upper mantle, Mantle, Outer core, Inner core
 - d) Crust, Exosphere, Upper mantle, Mantle, Outer core, Inner core

- 17) Iceland is known as an island of ice and fire because it occurs on a**
- a) Divergent Boundary
 - b) Convergent Boundary
 - c) Transform Boundary
 - d) None of the above
- 18) All these are examples of a poorly sorted sediment except**
- a) River deposits or alluvium
 - b) Mass wasting deposits or colluvium
 - c) Dune sand deposits
 - d) Glacial deposits
- 19) The least amount of devastation is caused by**
- a) shallow earthquakes
 - b) earthquakes originating from moderate depths
 - c) deep-seated earthquakes
 - d) Mantle quakes
- 20) The age of rocks is youngest at**
- a) The East Pacific Rise spreading Margin
 - b) The Peru-Chile Trench where the Nazca Plate is being subducted
 - c) The continental areas away from the mountain ranges
 - d) The central region of Africa where no tectonic activity has taken place
- 21) Which type of ultraviolet radiation is harmless?**
- a) UVA
 - b) UVB
 - c) UVC
 - d) UVD
- 22) Which of the following is an effect of ultraviolet radiation exposure?**
- a) Eye cataracts
 - b) Weak immune system
 - c) Sun burns
 - d) All of the above
- 23) What is direct radiation?**
- a) Shortwave radiation
 - b) Longwave radiation
 - c) Radiation that reaches the earth's surface without attenuation
 - d) None of the above
- 24) The pressure gradient force acts...**
- a) From low pressure to high pressure
 - b) High pressure to low pressure
 - c) From low pressure to high pressure and high pressure to low pressure
 - d) None of the above

- 25) Which of the following defines environmental lapse rate?**
- a) Change in temperature of a parcel of air with altitude
 - b) the change in air temperature with a change in vertical height
 - c) increase in temperature of a parcel of air with altitude
 - d) none of the above
- 26) Where is ozone concentration highest?**
- a) Troposphere
 - b) Biosphere
 - c) Stratosphere
 - d) Mesosphere
- 27) What is an ozone hole?**
- a) Vortex of air circulating over the Antarctica from the ozone layer
 - b) Reduction in concentration of ozone in the ozone layer
 - c) Holes in the mesosphere blanketing layer
 - d) All the above
- 28) What are Rossby waves**
- a) Waves formed in a tropical cyclone
 - b) Jet streams with a wavy path and a long wavelength
 - c) Polar front waves
 - d) None of the above
- 29) What causes global circulation?**
- a) Coriolis force
 - b) Unequal heating of the earth
 - c) Pressure gradient force
 - d) All the above
- 30) Which of the following is one of the reasons why a ‘one cell model’/Hadley cell is impossible?**
- a) Rotation of the earth results in Coriolis Force, which deflects winds
 - b) Geostrophic winds produce their own circulation
 - c) Radiative loss of heat prevents direct flow from equator to poles
 - d) a. and c.
- 31) Scientists previously thought that there was no life at the greatest depths of our oceans because of**
- a) Absence of light
 - b) Too much heat
 - c) Absence of air
 - d) All of the above

- 32) When we find 2 (or more) species with no present day competition between them, this is an example of**
- a) Extinction
 - b) Speciation
 - c) Competitive exclusion
 - d) Adaptation
- 33) According to _____, two species that compete for the exact same resources cannot stably coexist.**
- a) Bergmann's Rule
 - b) Golger's Rule
 - c) Frost's Law
 - d) None of the above
- 34) Which of the below is not a living organism**
- a) Bacteria
 - b) Fungi
 - c) Virus
 - d) None of the above
- 35) Scientific names for species must be written**
- a) In italics and/or underlined
 - b) In bold and/or underlined
 - c) In a different font
 - d) In the same format as the rest of the text
- 36) Which of these is a limiting factor for plant distribution?**
- a) Temperature
 - b) Rainfall
 - c) Nutrients
 - d) All of the above
- 37) The type/s of scale/s important within the study of biogeography are**
- a) Temporal scales
 - b) Spatial scales
 - c) Both temporal and spatial scales
 - d) Neither temporal nor spatial scales
- 38) Fynbos is an important biome because it**
- a) Has an extremely rich biodiversity
 - b) Has a very high level of endemism
 - c) Is situated in a very small area
 - d) All of the above
- 39) The Quagga, Tasmanian Tiger and Dodo are all examples of**
- a) Recently discovered species
 - b) Extinct species
 - c) Hybrid species
 - d) None of the above

40) Convergent evolution is

- a) When two or more related species evolve near each other
- b) When two or more unrelated species evolve similar biological traits
- c) When two or more species have a common ancestral species but evolve to have very distinct biological characteristics
- d) When a species evolves to better utilise a new area it has found itself in

SECTION B: LITHOSPHERIC AND HYDROSPHERIC PROCESSES

ANSWER ONE OF THE FOLLOWING ESSAY QUESTIONS: 30 MARKS

- B.1 Write an essay on the characteristics of any four soil pedogenic regimes. (30)
- B.2 Using the slope hydrological model as a guide, discuss the pathways that water, falling as rain in humid, tropical areas, may take before finally reaching the river and contributing to streamflow. (30)
- B.3 The distribution of precipitation varies greatly across southern Africa as a consequence of its latitudinal position, topography and several climatic factors. Discuss the influence of FOUR of these factors on the amount and distribution of rainfall in the region. (30)
- B.4 Discuss the characteristics and importance of Organic Matter in soils. (30)

ANSWER ONE OF THE FOLLOWING SHORT QUESTIONS: 10 MARKS

- B.5 Explain how rainfall is generated in the ice-crystal process of precipitation formation. (10)
- B.6 Use a labelled diagram to describe the components of the flood hydrograph. (10)

SECTION C: ATMOSPHERIC PROCESSES

ANSWER ONE OF THE FOLLOWING ESSAY QUESTIONS: 30 MARKS

- C.1 Solar radiation is attenuated in various ways, one of which is scattering. Discuss the greenhouse gas effect with reference to radiation attenuation. (30)
- C.2 Carbon dioxide is one of the greenhouse gases whose atmospheric concentrations increased from Pre-industrial concentration of 275-285 ppm to 370 ppm in 1998. Discuss the reasons why greenhouse gases have been increasing since the industrial revolution. (30)
- C.3 Discuss the global circulation using the three cell model. (30)

SECTION C continued...

ANSWER ONE OF THE FOLLOWING SHORT QUESTIONS: 10 MARKS

- C.4 Discuss the formation and characteristics of land breezes. (10)
- C.5 Discuss the characteristics and importance of the Stratosphere for life on Earth. (10)

SECTION D: BIOSPHERIC PROCESSES

ANSWER ALL THE QUESTIONS:

40 MARKS

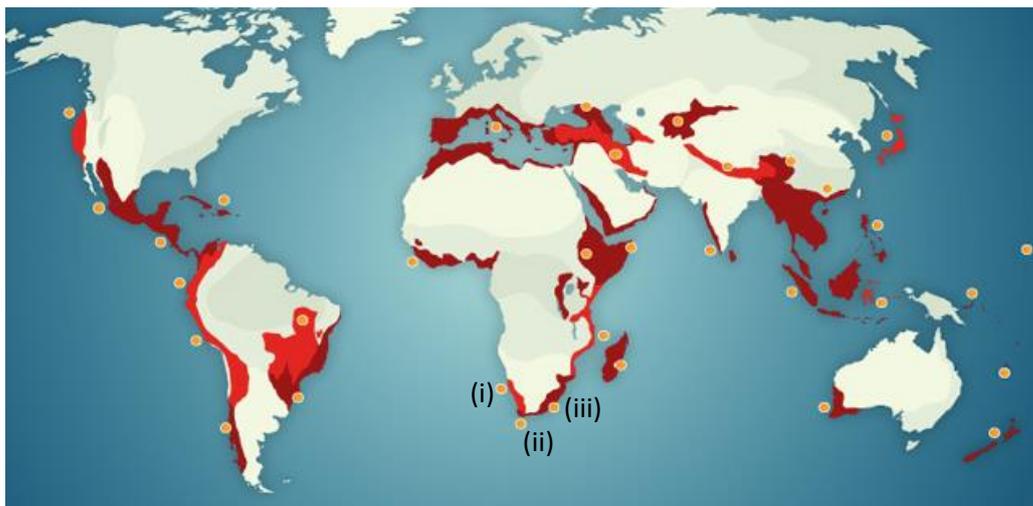


Figure 1. Global distribution of biodiversity hotspots.

- D.1 (a) Provide labels for (i), (ii) and (iii) indicated in Figure 1 above. (3)
- (b) Which of these would you associate with a “vacant tree niche”? (1)
- (c) Which of these is an arid biodiversity hotspot? (1)
- (d) There are two main types of conserving biodiversity: conservation and preservation. Compare these and explain why there has been a shift from one to the other. (5)
- D.2 Define and compare the 3 types of dispersal events. Give examples to help explain each. (6)
- D.3 What is the main difference between continental and ocean islands? Use diagrams if necessary. How does the biogeography of each type of island differ? (4)
- D.4 The Cichlid species of the Rift Valley Lakes provide excellent examples of evolutionary and ecological processes at work. Write an essay to highlight and explain these processes within the Rift Valley Lake context. (20)

ENVS120 EXAMINATION 2013
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ANSWER SHEET

Surname: _____ Initials: _____

Student Number: _____ Seat Number _____

Mark the correct answer with an X

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28	A	B	C	D
29	A	B	C	D
30	A	B	C	D
31	A	B	C	D
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34	A	B	C	D
35	A	B	C	D
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37	A	B	C	D
38	A	B	C	D
39	A	B	C	D
40	A	B	C	D

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SECTION A: MULTIPLE CHOICE QUESTIONS (COMPULSORY)

ANSWER ALL QUESTIONS (40 MARKS)

On the answer grid provided, insert an 'X' over the letter corresponding to your choice of the correct answer for each of the following questions.

- 1) **The velocity of P-waves changes as it travels through the Earth because of**
 - a) Subduction
 - b) Transform fault
 - c) Changing rock densities
 - d) Increasing Pressure

- 2) **During acid deposition and infiltration, the replacement of some ions attached to clay mineral particles by hydrogen ions can result in:**
 - a) Increased crop growth
 - b) Less vulnerability to drought, disease and pests
 - c) Decreased soil fertility
 - d) Increased tree growth

- 3) **Tectonic plates move apart at opposite directions at a**
- Divergent plate boundary
 - Transform fault
 - Convergent plate boundary
 - Subduction zone
- 4) **Tectonic plates move in opposite but parallel directions along a**
- Divergent plate boundary
 - Transform fault
 - Convergence plate boundary
 - Subduction zone
- 5) **Which of the following is not a characteristic of a mineral?**
- Crystal structure
 - Organic
 - Naturally occurring
 - Solid
- 6) **All of the following are broad classes of rock *except*:**
- Sedimentary
 - Igneous
 - Metamorphic
 - Crystal
- 7) **The change of rocks from one type to another is known as**
- Metamorphism
 - The rock cycle
 - Petrography
 - Consolidation
- 8) **Soil is developed most directly through**
- Moving tectonic plates
 - Earthquakes
 - Weathering
 - Mass wasting
- 9) **Soil is a complex mixture of:**
- Mineral nutrients
 - Eroded rock
 - Air and water
 - All of the above
- 10) **A cross- sectional view of the _____ in a soil is properly termed a soil _____**
- Horizons ... profile
 - Horizons ... sample
 - Profile ... Sample
 - Surface litter ... profile

- 11) As it is weathered, _____ gives rise to the C- horizon
- Parent material
 - Translocation
 - Subsoil
 - Bed rock
- 12) Leaching occurs when
- Humus is dissolved
 - Water removes soluble soil components
 - Organic compounds slowly decay
 - Rock is shattered by frost action
- 13) Humus is
- Indicative of very acidic soils
 - Light coloured or nearly white
 - Poisonous to soil microorganisms
 - Decomposed organic matter
- 14) Red and yellow colours in a soil horizon usually indicate
- A high percentage of sand
 - A high percentage of lime and gypsum
 - Oxidation of iron in the soil
 - Low organic matter content
- 15) Clay has _____ permeability and _____ porosity:
- High ... high
 - High ... low
 - Low ... high
 - Low... low
- 16) Sand has _____ permeability and _____ porosity:
- High ... high
 - High ... low
 - Low ... high
 - Low ... low
- 17) Soil textures with moderate physical and chemical properties include:
- Clay and silt
 - Sand and loam
 - Clay and loam
 - Silt and loam
- 18) Which of the soils would most likely become waterlogged?
- Silt
 - Loam
 - Clay
 - Sand

19) The addition of lime:

- a) Reduces soil pH
- b) Causes decomposition of organic material
- c) Increases porosity of soil
- d) Will change soil texture

20) Clay content accumulated in the B horizon is significant as:

- a) Clay is an important component allowing for infiltration of water for soil growth
- b) Clay allows for more binding the soil which aids in restricting sheeting
- c) Clay allows for attachment of minerals by electrostatic forces aiding plant growth
- d) Clay moves laterally and adds to suspended load in the main trunk of the river promoting turbidity

21) Which of the following is a characteristic of the subtropical high pressure

- a) Ascending air
- b) Descending air
- c) Converging air
- d) None of the above

22) How does air rotate in a low pressure in the southern hemisphere?

- a) Clockwise
- b) Anticlockwise
- c) Both clockwise and anticlockwise
- d) None of the above

23) What factor is responsible for formation of dew or frost INSTEAD of mist or fog?

- a) Wind
- b) Temperature
- c) Humidity
- d) All the above

24) Which of the following determines the reflectivity of a substance?

- a) Altitude
- b) Latitude
- c) Albedo
- d) All the above

25) Which of the following are responsible for redistributing heat around the globe/earth?

- a) Land
- b) Oceans
- c) Atmosphere
- d) All of the above

- 26) What is the importance of greenhouse gases?**
- a) Maintain temperature
 - b) Ozone formation
 - c) Plant productivity
 - d) All the above
- 27) Which of the following is a control of incoming radiation?**
- a) Distance from the sun
 - b) Albedo
 - c) Solar output
 - d) All the above
- 28) Which of the following contributes significantly to increasing greenhouse gases?**
- a) Conservation
 - b) Farming
 - c) Ozone depletion
 - d) All the above
- 29) What is an ozone hole?**
- a) Vortex of air circulating over the Antarctica from the ozone layer
 - b) Reduction in concentration of ozone in the ozone layer
 - c) Holes in the mesosphere blanketing layer
 - d) All the above
- 30) Which of the following is a secondary pollutant through photochemical reactions with nitrogen oxides, carbon monoxide and hydrocarbons?**
- a) Biomass burning
 - b) Lightening
 - c) Urban-industrial emissions
 - d) All the above
- 31) Hybrid species are**
- a) The parents of sterile offspring
 - b) The offspring of 2 individuals of the same species and are sterile
 - c) The offspring of 2 separate species and are sterile
 - d) The parents of offspring that are not sterile
- 32) During sexual reproduction**
- a) Offspring are produced by the fusion of male and female gametes
 - b) Offspring are produced from the somatic cells
 - c) Somatic cells are obtained from the male and female sex organs
 - d) None of the above

- 33) Why is the genus *Xenopus* widespread across the globe?**
- a) It was introduced as an alien species to act as a pest control
 - b) It was exported to be used as a pregnancy test for humans
 - c) It was sucked into the ballast tanks of ships and inadvertently transported globally
 - d) It is not widespread across the globe (the above statement is false)
- 34) Oceanic islands are formed by**
- a) Sea level rising
 - b) Undersea volcanos
 - c) Climate change
 - d) None of the above
- 35) Owls hunting at night and eagles hunting during the day is an example of**
- a) Temporal niche partitioning
 - b) Competitive exclusion
 - c) Speciation
 - d) None of the above
- 36) Number of species usually _____ with an increase in organism size**
- a) Decreases
 - b) Increases
 - c) Remains unaffected
 - d) None of the above
- 37) Species richness is generally greatest near**
- a) The polar regions
 - b) High altitudes
 - c) The equator
 - d) All of the above
- 38) Some southern African biomes include**
- a) Grassland, savannah and tundra
 - b) Mediterranean-type, grassland and desert
 - c) Boreal forest, rainforest and temperate deciduous forest
 - d) None of the above
- 39) Fossil records have shown the same species being present in Africa, South America, Antarctica and Australia, the leading explanation for this is**
- a) Diffusion dispersal
 - b) Convergent evolution
 - c) Continental drift
 - d) None of the above
- 40) According to _____, the extremities of warm-blooded vertebrates are often larger in warmer climates relative to cooler climates.**
- a) Bergmann's Rule
 - b) Golger's Rule
 - c) Cope's Rule
 - d) None of the above

SECTION B: LITHOSPHERIC AND HYDROSPHERIC PROCESSES

ANSWER ONE OF THE FOLLOWING ESSAY QUESTIONS: 30 MARKS

- B.1 Using an annotated diagram, discuss the flow pathways of water as outlined in the slope hydrological model. (30)
- B.2 Discuss the formation of precipitation in the Ice-Crystal Process and in the Collision and Coalescence Models. (30)
- B.3 Write an essay outlining the physical properties of soil and also explain the significance of each property for soil fertility. (30)
- B.4 Discuss the characteristics and importance of the Mineral component of soils. (30)

ANSWER ONE OF THE FOLLOWING SHORT QUESTIONS: 10 MARKS

- B.5 Discuss the use of paleomagnetism in explaining sea-floor spreading. (10)
- B.6 Discuss the characteristics of the Earth's Lithosphere. (10)

SECTION C: ATMOSPHERIC PROCESSES

ANSWER ONE OF THE FOLLOWING ESSAY QUESTIONS: 30 MARKS

- C.1 Mathematical models are developed by scientists to predict future climatic conditions which provide scenarios based on various assumptions and data fed into the model. Discuss the future climatic predictions. (30)
- C.2 Discuss the causes of atmospheric circulation/global circulation. (30)
- C.3 Discuss the Radiation Budget. (30)

ANSWER ONE OF THE FOLLOWING SHORT QUESTIONS: 10 MARKS

- C.4 Discuss any 2 (two) of the following concepts: (5 marks each) (10)
- Mountain breeze
 - Subtropical high pressure
 - Chlorofluorocarbons

SECTION D: BIOSPHERIC PROCESSES

ANSWER ALL QUESTIONS:

40 MARKS

- D.1 What is the phenomenon some scientists call the 'sixth mass extinction'? What is thought to be the main cause? Why is this of concern to people? (6)

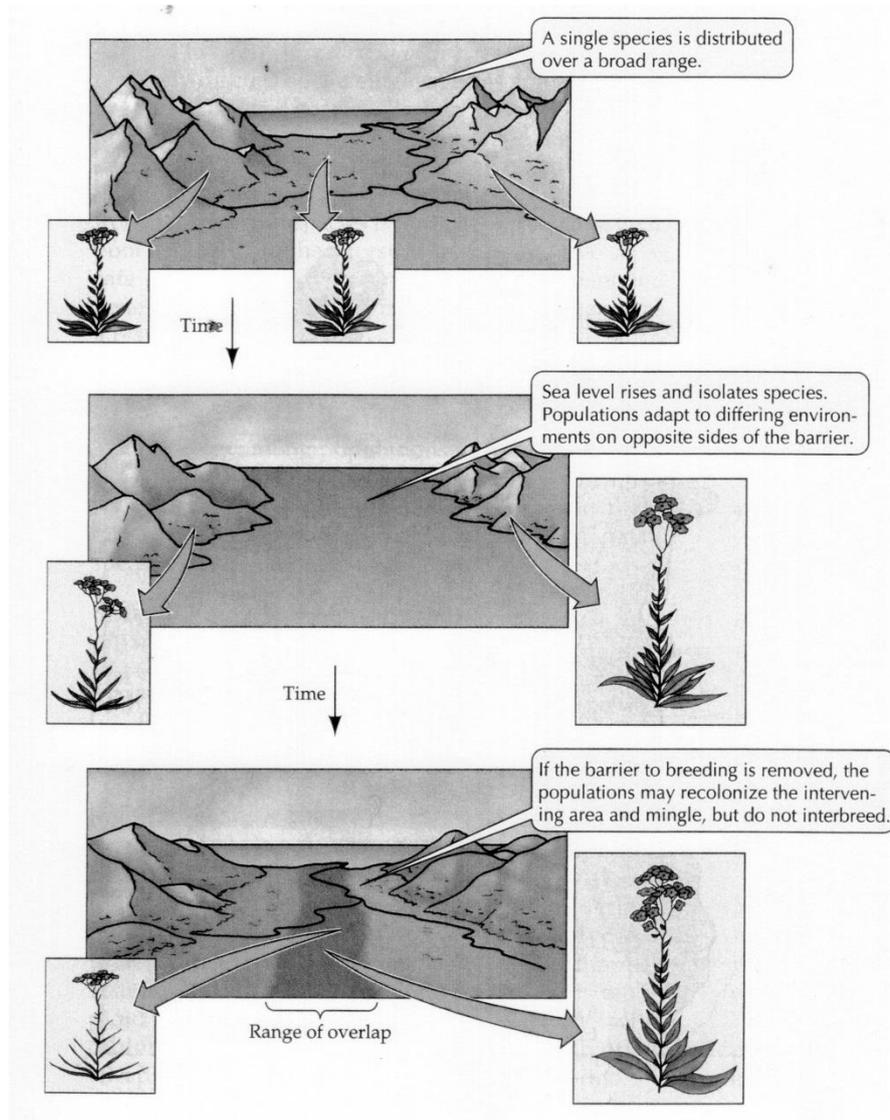


Figure 1. (Purves et al., 2000)

- D.2 *Figure 1* illustrates an important process in the biosphere. Define this process and explain how it occurs. Make reference to the diagram to help explain your answer. (4)
- D.3 Write an essay explaining what is 'The Ghost of Competition Past'. Use diagrams to help illustrate this process in action. (10)

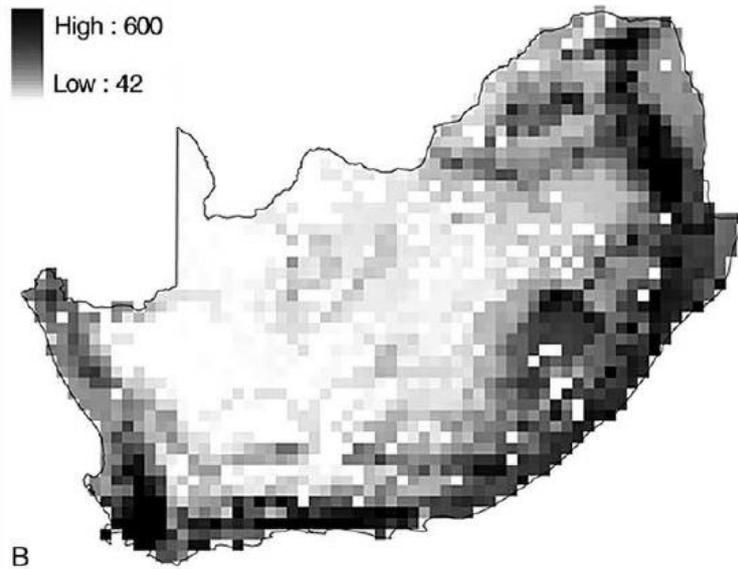


Figure 2: Map of Species Diversity in South Africa

- D.4 Write an essay describing the species diversity distribution of South Africa using *Figure 2* (above). Explain which the major environmental factors influenced this distribution and how. Highlight the biodiversity hotspots for the country. (20)

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Student Number: _____ Seat Number _____

Mark the correct answer with an X

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35	A	B	C	D
36	A	B	C	D
37	A	B	C	D
38	A	B	C	D
39	A	B	C	D
40	A	B	C	D