

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DISCIPLINE OF GEOGRAPHY
EXAMINATION: JUNE 2014
BIOPHYSICAL ENVIRONMENTS OF SOUTHERN AFRICA ENVS210

DURATION: 3 HOURS

TOTAL MARKS: 150 Marks

Internal Examiners: Ms. D. Trotter
Prof. T. Hill
Dr. S. Adelabu

Moderator: Prof. O Mutanga

PLEASE NOTE THERE ARE SEPARATE INSTRUCTIONS FOR EACH SECTION

This paper consists of 5 pages.

SECTION A: WEATHER AND CLIMATE (50)

PLEASE ANSWER IN A SEPARATE BOOK

Answer ALL questions

Question 1:

Natural fluctuations in the Earth's climate system include the occurrence of El Niño Southern Oscillation (ENSO) and La Niña in the equatorial Pacific basin that result in significant year-to-year regional and global shifts in temperature and rainfall patterns. Discuss the ocean-atmospheric circulations that occur with the onset of a La Niña event and how such an event may impact on the weather and climate of southern Africa. [25]

Question 2:

Is the synoptic chart provided below (Figure 1) representative of a summer or winter scenario for southern Africa? Describe any two (2) key weather characteristics / features / systems that are represented on the chart and that are typically experienced over the subcontinent during this season. [15]

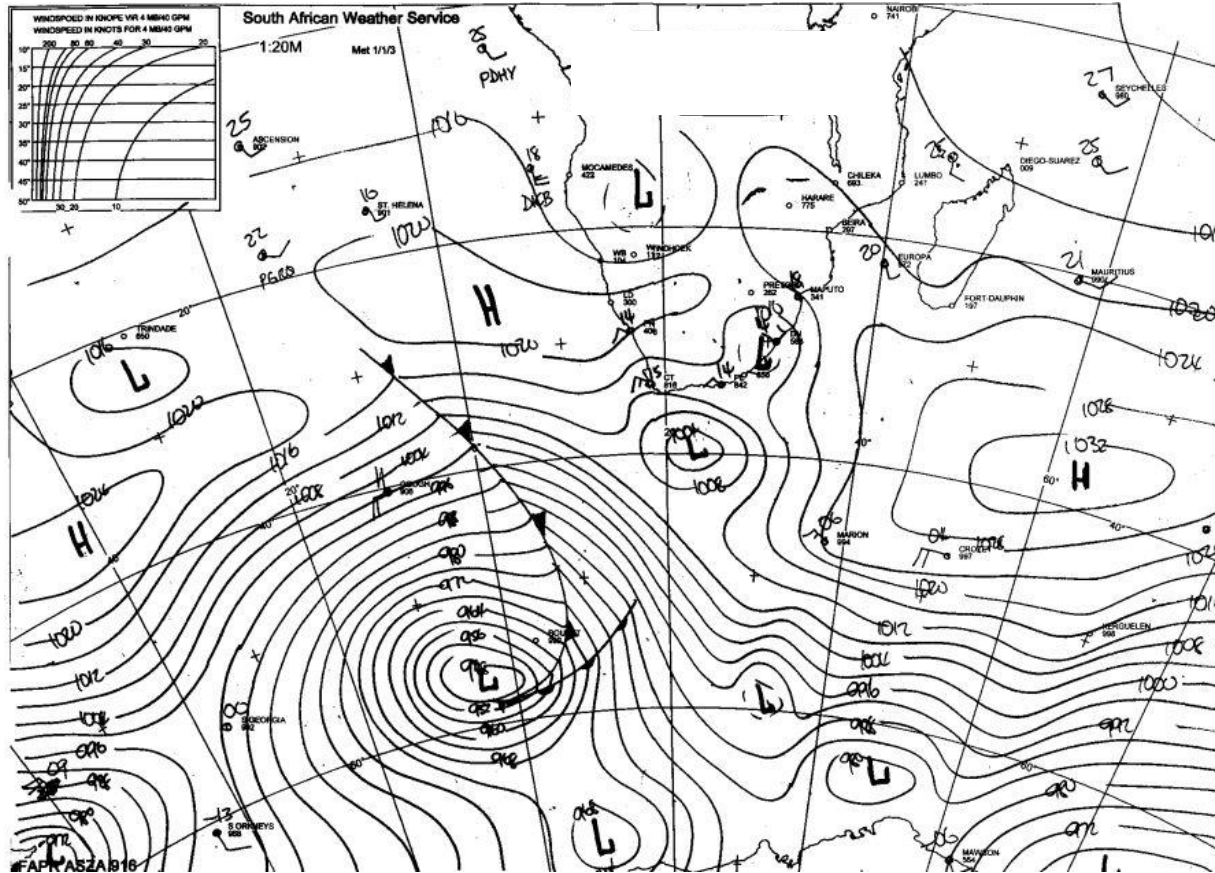


Figure 1: Synoptic chart for southern Africa (Source: South African Weather and Disaster Information Service, 2009).

Question 3:

“Science is a continual process of observation, understanding, modelling, testing and prediction. The prediction of a long-term trend in global warming from increasing greenhouse gases is robust and has been confirmed by a growing body of evidence” (National Academy of Sciences, 2014:16). With reference to this statement, what are scientists doing to address key uncertainties in our understanding of the climate system, and how and why are computer models used to study climate change? [10]

SECTION B: BIOGEOGRAPHY (50)

PLEASE ANSWER IN A SEPARATE BOOK

Answer ALL questions

Question 4:

- a) Draw a conceptual framework (mind map / flow diagram) to show the role of fire in southern African ecosystems. [5]
- b) Review the data presented in Figure 1 below. Explain the trends illustrated and discuss relevant ecological processes in operation. [10]
- c) Name a further exacerbating factor that is likely to increase biomass in the next decade. Briefly outline the mechanism behind this process. [5]
- d) How should fire be used in the management of the Fynbos and Nama Karoo biomes? What are the consequences of fire mismanagement in these biomes? [5]

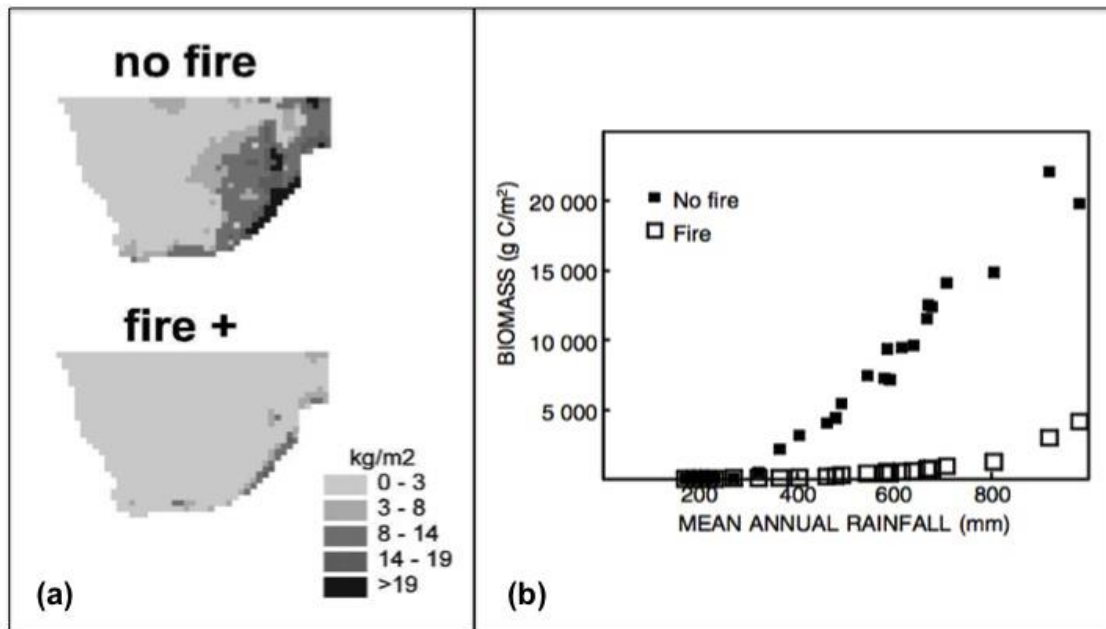


Figure 1 (a) The effect of fire on vegetation biomass in southern Africa. The above diagram shows biomass without fire (i.e. fire suppression) whereas the below diagram shows biomass with fire. (b) The relationship between vegetation biomass and mean annual rainfall compared with and without fire as a driver (source: Bond et al. 2003).

Question 5:

You have been tasked with writing an overview chapter on the “*Biogeography of southern African ecosystems*”. Write a full Introduction and Conclusion for your chapter, and provide an outline / plan of the remaining content. Pay particular attention to the structure of your ‘chapter’ plan, listing headings and subheadings, and a summary of chapter content, providing local examples where appropriate. [25]

SECTION C: GEOMORPHOLOGY (50)
PLEASE ANSWER IN A SEPARATE BOOK

Answer ALL questions

Question 6:

You have been consulted by the KZN MEC for Environment to highlight the importance of Geomorphology to our Environment. In your own words, explain how you will go about this.

[25]

Question 7:

With the aid of a diagram, briefly explain in detail each of the four processes of soil formation.

[25]

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SECTION A: WEATHER AND CLIMATE (50)

PLEASE ANSWER IN A SEPARATE BOOK

Answer ALL questions

Question 1:

Warm offshore airflow descending off the steep escarpment of southern Africa provides an input of buoyancy, which together with the cyclonic vorticity generated during the descent, act to produce a weak low pressure system. Name this system, and describe the air flow and processes involved in its generation, as well as the weather that would be experienced over southern Africa with its occurrence in late winter. [10]

Question 2:

“Southern Africa is notorious for its high frequency of thunderstorms, particularly during the (Southern Hemisphere) summer season” (Clark and Rae, SAWS, 2005: no page number). With reference to some of the severe weather phenomena related to supercell thunderstorms, provide an argument for why the monitoring and tracking of such storms by South Africa’s meteorological centre is necessary. [15]

Question 3:

What does the figure provided below (Figure 1) tell you about recent trends in the Earth's climate system? In your response, discuss the range of observations and indications from the natural world that have been argued by scientists as evidence to support this trend. [25]

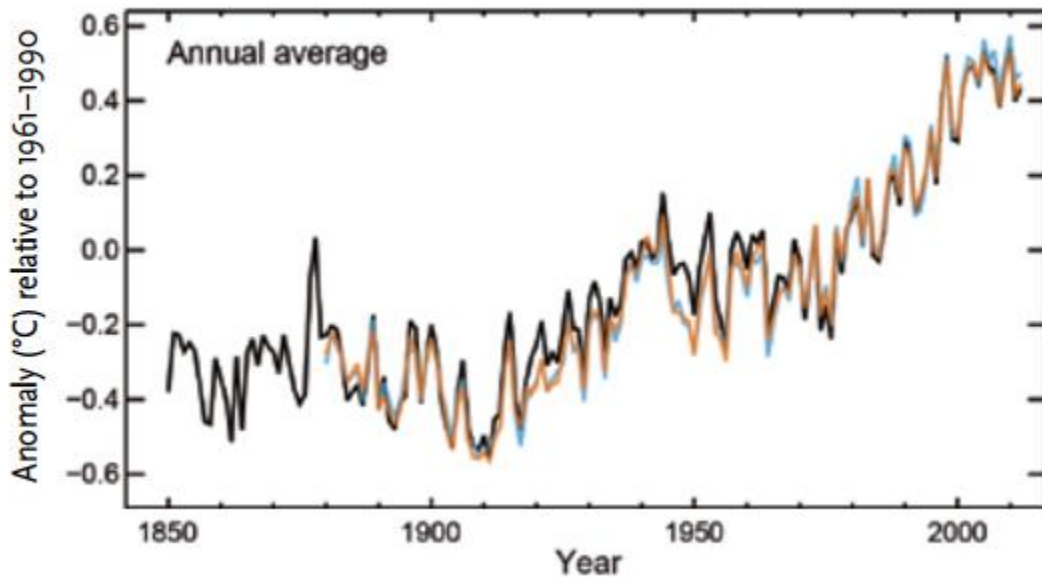


Figure 1: Plot of the Earth's average surface air temperature trends derived from three independent analyses of the available data sets (Source: IPCC AR5, data from the HadCRUT4 dataset (black), UK Met Office Hadley Centre, the NCDC MLOST dataset (orange), US National Oceanic and Atmospheric Administration, and the NASA GISS dataset (blue), US National Aeronautics and Space Administration, accessed from the National Academy of Sciences, 2014).

SECTION B: BIOGEOGRAPHY (50)

PLEASE ANSWER IN A SEPARATE BOOK

Answer ALL questions

Question 4:

Describe the ecological processes operating in Figure 1 below. How do these processes impact upon biodiversity and how can they be used to inform contemporary conservation planning. [15]

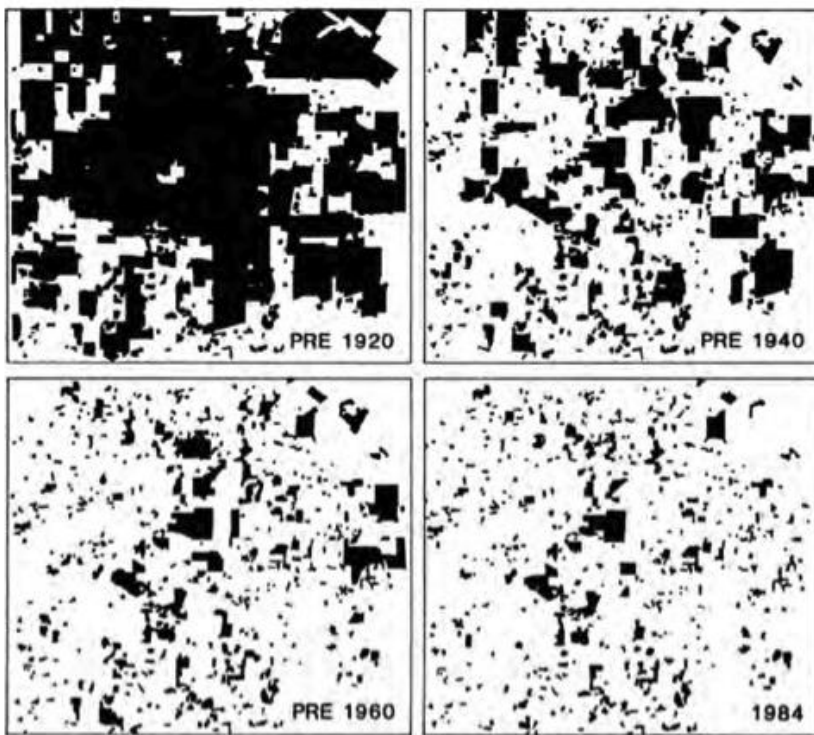


Figure 1. Changes in the extent and pattern of indigenous vegetation (indicated in black) in Western Australia from 1920 to 1984 (Source: Saunders et al. 1993).

Question 5:

Citing examples from the Nama Karoo and Fynbos biomes, explain how biodiversity can be conserved outside of the formal protected area network? [10]

Question 6:

The arid biomes of southern Africa have been described as having “*unique environmental conditions, unique adaptations and highly interesting biota*” (Jürgens *et al.* 1997: 189). With reference to the above, discuss plant adaptations to arid conditions in southern Africa. [25]

SECTION C: GEOMORPHOLOGY

PLEASE ANSWER IN A SEPARATE BOOK

Answer ALL questions

Question 7:

With reference to Figure 1, briefly explain the concept of fluvial process? [25]

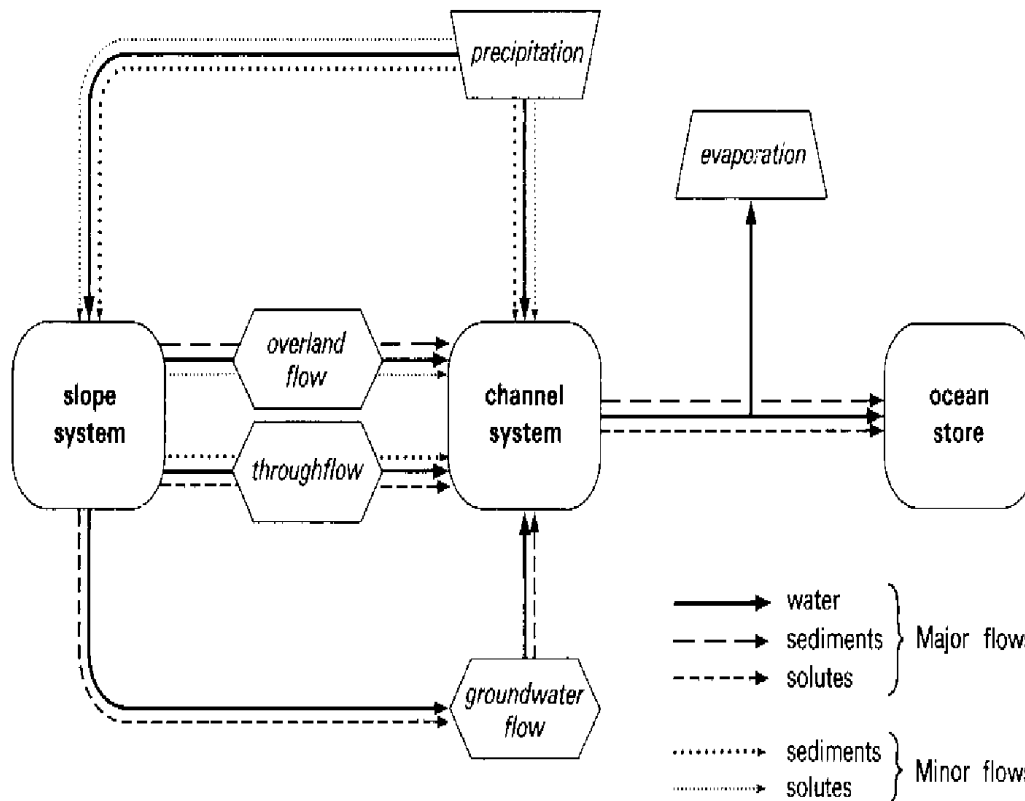


Figure 1: Fluvial Process

Question 8:

“Geomorphic Systems” is the study of deep and shallow Earth processes that integrate through time to shape the landforms and landscapes that compose our physical environment. Discuss the importance of “Geomorphic Systems to our Environment?”

[25]
