

Tutorial Letter 202/2/2018

People and the Environment

GGH2604

Semester 2

Department of Geography

This tutorial letter contains feedback on Assignments 01 and 02.

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1 INTRODUCTION

Dear Student

This tutorial letter contains feedback on Assignments 01 and 02. Take note that we do not provide model answers to questions in this tutorial letter, but rather guidelines on how you could have answered the questions. When answering a question, we expect you to incorporate your own thoughts and ideas in the discussion and provide supporting evidence and acknowledge all sources consulted.

We remind you that some of the questions in the examination are based on your assignments.

2 FEEDBACK ON ASSIGNMENT 01

The following are guidelines on how you could have answered the questions of **Assignment 01**.

1. Briefly describe what is meant by the term "geoengineering".

<p>The term "geoengineering" refers to the deliberate large-scale intervention in the earth's natural systems to counteract climate change.</p> <p><i>Any other relevant information.</i></p> <p><i>Any relevant explanation, 2 marks.</i></p>	<p>2</p>
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2. According to Carolyn Merchant, the two opposing environmental worldviews should be viewed together as a means of leading to environmental recovery. Which worldview do you support the most – the human mastery of nature (technocentrism) or the deep green environmental care (ecocentrism) worldview? Motivate your answer.

<p>You were required to indicate the environmental worldview you support and provide reasons to support your answer.</p> <p><i>Any other relevant information.</i></p> <p><i>1 x mark for opinion and 2 marks for relevant explanation.</i></p>	3
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3. Study table 1 and answer the following questions.

Table 1: Population size in Khartoum over time (2000 – 2030) (Source: UN 2016)

City population in thousands			
	2000	2016	2030
Khartoum	3 505	5 265	8 158

Create a line graph from the data in table 1 to show the change in population numbers for Khartoum. Your graph must contain the following elements:

- labelled X-axis
- labelled Y-axis
- population size for the year 2000
- population size for the year 2016
- population size for the year 2030

Example of line graph created in Microsoft Excel:

3

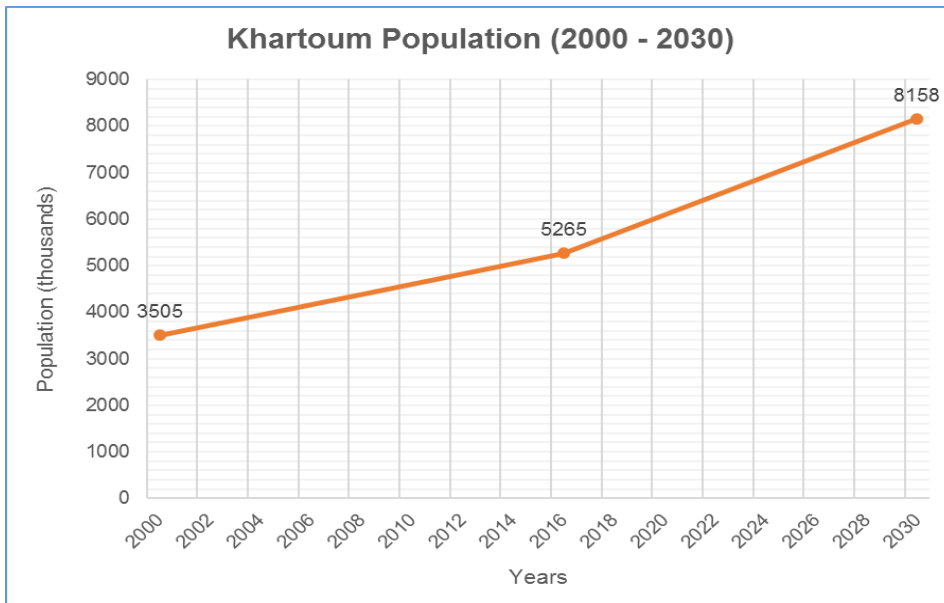


Figure 1: Line graph depicting population trend in Khartoum over time (2000 – 2030).

X-axis and Y-axis labelled correctly, 2 marks.

Population trend for the years, 2000, 2016 and 2020, 1 mark.

4. Esterhuysen et al (2016:409) argue that "Of the world's countries, South Africa is the twelfth-largest carbon emitter, because its energy-intensive economy is currently heavily dependent on carbon-based fuels. Unconventional Oil and Gas (UOG) is viewed as a transitional fuel that could, in the long term, assist in reducing carbon emissions..." Recently, the Minister of Energy and Mineral Resources issued permission for the development of shale gas extraction in the Karoo.
- a. In your opinion, is the exploitation of UOG resources an effective way of reducing South Africa's carbon footprint? Provide reasons to support your answer.

<p>You were required to answer yes or no and provide reasons to support your answer. <i>Any relevant information.</i> <i>1 x mark for opinion and 2 marks for relevant motivation.</i></p>	3
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- b. Briefly describe the ecological characteristics of the Karoo and explain how gas extraction (fracking) may negatively affect the natural environment of the Karoo.

<p>To answer this question, you should have done a bit of research on the ecological characteristics of the Karoo and the process involved in unconventional gas extraction (fracking). Understanding the ecological characteristic of the Karoo and the processes involved in fracking is essential to understand the possible negative effects of fracking in the Karoo if permission to exploit shale gas in the area is granted.</p> <p>The Karoo ecosystem is characterised by scrubby vegetation dominated by dwarf succulent shrubs. According to Cowling (1986), the Karoo is rich in fauna (e.g. rodent, tortoise and reptile fauna).</p> <p>The process of unconventional oil and gas extraction known as hydraulic fracturing (fracking), where fluid typically containing water, chemicals and sand under high pressure is injected into drilled holes below the earth's surface to open fractures in the rock to enhance the flow of trapped gas through the fractures into the well (Maule et al 2013; Suchy & Newell 2011).</p> <p>Although switching to natural gas might reduce greenhouse gas emission, shale gas extraction pose risks similar to those posed by oil and gas extraction. If preventative measures are not adequately implemented, spillage of toxic chemicals on either the ground or cracks in wells may potentially contaminate surface and ground waters</p>	8
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resources.

In addition, wastewater injection into deep wells is the most common method used to dispose toxic wastewater; this may generate large earthquakes, which may alter the natural landscape of the Karoo and possible loss of ecosystem services.

Another method involves transporting fluids generated to wastewater treatment facilities and discharged into streams (Rozell & Reaven 2012). As it stands, majority of toxic wastewater treatment facilities in the country do not comply with the requirement, they release a large amount of wastewater back into the rivers partially or untreated. Thus, if shale gas extraction is approved in the Karoo, the country's water resources may potentially be contaminated in the long run.

Some activities related to shale gas extraction, such as clearance of vegetation to construct well pad, access roads, and pipelines, may negatively affect the natural fauna and flora endemic in the area, which may lead to loss of biodiversity.

In general, techniques used in shale production usually demand a large amount of water, this excludes other operational activities that require water such as ancillary water requirements such as for sanitation and dust suppression.

Any other relevant information.

*Description of any **two (2)** relevant characteristics of the Karoo, 1 marks per fact.*

*Explanation of any **three (2)** relevant facts, 2 marks per fact.*

- 5. Explain how the process of nuclear power generation may result in severe environmental degradation. You will benefit by providing real-world examples in your answer.**

Greenhouse gas emission from nuclear power generation is considered insignificant; however, nuclear power plants use uranium as a fuel to power the reactors. The process of nuclear power generation involves uranium mining, milling and enrichment. Uranium mining is undertaken by using opencast mining (if uranium ore is near the earth surface or underground mining) and in-situ leach method (if the ore is deep into the surface) (Beneš 1999).

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The process of uranium mining, milling and enrichment is associated with an increased amount of sulphur dioxide in the atmosphere, which causes acid rain and leads to contamination of soil, damage to plants and the surrounding water bodies.

In addition, significant amounts of radionuclides and some toxic elements can be leached through atmospheric precipitation, dispersed by winds in the form of dust or seepage from contaminated water into aquifers, which leads to the contamination of ground water and the local atmosphere (Beneš 1999).

Nuclear power plants generate tons of high- and low-level radioactive wastes, which remain active for many years. As it stands, these wastes are temporarily stored in metal tanks and transported to storage facilities until an appropriate disposal method is found. During this process, spillage incidents of radioactive wastes expose the both flora and fauna to ionising radiation.

The nuclear power plants use large amounts of water to cool reactors, as such, they are commonly located close to large water bodies to draw water for cooling the systems. During the withdrawal of cooling water, some marine species such as fish and benthos are unintentionally drawn, trapped and killed in the process.

Thermal discharges of unused heat in the water bodies (Thermal water pollution) have adverse effects on the reproduction, growth and survival of larval forms, juveniles and adults. For example, fish, plankton and benthos are all affected at various degrees by thermal discharges from power plants.

Nuclear power plants increase the risks of severe environmental degradation in the event of both natural and human induced disasters. For example, the catastrophic nuclear accident in Fukushima Daiichi Nuclear Power Plant in Okuma caused by an earthquake on 11 March 2011 resulted in the release of radionuclides into the atmosphere, contaminating soil and water; and the Chernobyl nuclear accident on 25 April 1986 caused by human error. Radioactive materials contaminated a large tract of land and vast amount of radioactive materials were released into the atmosphere and transported great distances by winds (Hudson-Edwards et al 2011).

Any other relevant information.

*Explanation of **any three (3)** relevant facts, 2 x marks per fact.*

6. Identify a topic related to "environmental transformations in Africa" which recently made headlines (during the past 24 months). Consult the referencing guidelines for GGH2604 on myUnisa and then compile a five-item reference list containing the following type of sources: a book; a chapter in a book; journal article; conference proceedings; newspaper article.

<p>Example: Topic: Impacts of climate change in Africa</p> <p>A book Akhtar, R. & Palagiano, C. (eds.) 2017. <i>Climate Change and Air Pollution: The Impact on Human Health in Developed and Developing Countries</i>. Springer.</p> <p>A chapter in a book Cairncross, E, Dalvie, A, Euripidou, R, Irlam, J & Naidoo, RN. 2018. Climate Change, Air Pollution and Health in South Africa. In <i>Climate Change and Air Pollution</i>, edited by R Akhtar & C Palagiano. Springer, Cham: 327-347.</p> <p>Journal article Muluneh, A, Stroosnijder, L, Keesstra, S & Biazin, B. 2017. Adapting to climate change for food security in the Rift Valley dry lands of Ethiopia: supplemental irrigation, plant density and sowing date. <i>The Journal of Agricultural Science</i> 155:703-724.</p> <p>Conference proceedings Goyol, S, Pathirage, C. & Kulatunga, U. 2017. <i>Climate change risk on infrastructure and policy implications of appropriate mitigation measures in the Nigerian agricultural sector</i>. 13th International Postgraduate Research Conference (IPGRC) conference. 14 15 September 2017. UK, Manchester. University of Salford:786-797.</p> <p>Newspaper article Mathews, C. 2017, February. <i>Waking Africa up to the realities of climate change</i>. Available from: https://www.businesslive.co.za/bd/world/africa/2017-10-27-waking-africa-up-to-the-realities-of-climate-change. [Accessed: 19 April 2018].</p> <p><i>Journal article referenced correctly, 1 mark</i> <i>A book referenced correctly, 1 mark</i> <i>A chapter in a book referenced correctly, 1 mark</i> <i>Conference proceedings referenced correctly, 1 mark</i> <i>A newspaper article referenced correctly, 1 mark</i></p>	5
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3 FEEDBACK ON ASSIGNMENT 02

The following are guidelines on how you could have answered **Assignment 02**.

The following instructions were given:

The length of each essay must **not exceed ten (10) A4 typed pages per question**. Ensure that your student number, module code and anti-plagiarism declaration appear on the cover page. This assignment contributes **70%** to your year mark.

Question 1

South Africa is renowned for the diversity and richness of its mineral wealth, the exploitation of which has sustained the economic growth of the country since the mid-1800s. However, this minerals-driven growth has been associated with a number of undesirable environmental impacts — perhaps the most severe and insidious adverse legacy of the mining industry is acid mine drainage (AMD), especially that arising from coal and gold mining" (Humphries et al 2017:1).

You were required to write an essay in which you do the following:

a. Critically evaluate the role of mining in economic growth in Africa since the 1800s.

The African continent is endowed with vast mineral resources, although mining has been one of the important economic activities, it did not generate economic benefits for most countries. This is because during the colonial era, colonial companies that exploited resources to benefit their native countries.

To this date, after the end of colonial era, majority of mines in Africa are still owned by foreign companies who have concession agreements that are unfair to the African governments (Gajigo 2012). This is more prevalent in countries with corrupt governments, lack of transparency and accountability as well as political instability (Campbell 2009:3). An example of this is the Democratic Republic of Congo, which had mining contracts with little or no benefit to the country's population, some of the companies were exempted from either paying taxes or royalties for a given of period time.

Moreover, the African continent gains little economic benefit from their natural resources, which can be attributed to the fact that most minerals produced are processed and refined abroad. Most goods and services used by these industries is outsourced, meaning consumables used in mining are imported; consequently, there is very little tradable value for the locally economy, except in South Africa where part of the minerals are produced is

processed locally (Gajigo 2012).

Any other relevant information.

b. Outline how acid mine drainage (AMD) affects ecosystems in Africa negatively. Provide real-world examples.

Despite the benefits that the mining operations contribute to the economy, the activities of the mining industries have resulted in serious environmental consequences worldwide, notably in respect of poor environmental and water management. In your outline you should refer to specific examples in Africa where AMD had an effect on the ecosystems. The following are some of the examples of how AMD can affect ecosystems:

- Mining often exposes large amounts of pyrite and sulphide minerals that affects water and oxygen once waste rock and tailings are produced on the surface.
- The excavation process exposes sulphides in the walls of opencast and underground operations that disturbs the host rock and hydrological regime around mined out areas allowing the ingress of water and oxygen.
- The pH of the acid mine drainage that enter streams is often lower and cannot support normal aquatic life.
- The reactions that produce acid mine drainage result in a high sulphate content in the resultant water that will remain high even after the acidity is neutralised that could make it unfit for consumption.
- The acidity of the water liberates metals, including toxic metals and radionuclides from the rocks with which it interacts. This may result in acute and chronic toxicity the environment. Rising mine water levels have the potential to flow towards and pollute adjacent groundwater resources.

Any other relevant information.

c. Suggest and discuss remedial actions that will reduce or prevent acid mine drainage.

The remedial actions that can reduce or prevent acid mine drainage includes, but are not limited to the following:

- Reduction of water ingress into the mine voids.
- Prevention of recharge of the voids directly from surface water flowing or ponding above

or directly adjacent to zones of old surface operations and shallow undermining.

- Abstraction of groundwater from aquifers that directly feed the underground mine workings with clean groundwater.
- Untreated mine water needs to be neutralised and treated to remove metals. Lime or limestone can be used for partial treatment of the decant water.
- Desalination – the removal of salts from water because of the need to reduce the salt loads entering river systems; Passive treatment technologies.

Any other relevant information.

Guidelines for Question 01	Mark
Essay includes introduction and conclusion.	5
Content reflects detailed knowledge and understanding of: <ul style="list-style-type: none">○ Evaluate the role of mining in economic growth in Africa since the 1800s.○ Outline how acid mine drainage (AMD) affects ecosystems in Africa negatively. Provide real world examples.○ Suggest and discuss remedial actions that will reduce or prevent acid mine drainage	10 10 5
Language and Grammar	5
Referencing	5
TOTAL MARKS	[40]

Question 2

Ethiopia is in the final stages of constructing the largest hydropower dam in Africa within the Blue Nile Basin (called the Grand Ethiopian Renaissance Dam (GERD)) with a storage capacity of about 74 billion cubic litres (BCL). The Blue Nile Basin is a source of about 85% of Nile River water and the impoundment of water is expected to significantly reduce the flow of water in the Nile River (Yihdego et al 2017).

You were required to write an essay in which you do the following:

- Assess the possible ecological effects of the GERD construction on downstream ecosystems that depend on the Nile River.**

The construction of GERD is expected to significantly reduce water flow downstream. The following are some of the possible ecological effects on downstream ecosystems that you could have included in your discussion.

- Accelerated riverbed erosion
- A reduction in flood-deposited nutrients on fields in the floodplain
- Less nutrients for fish located downstream of the dam
- Seismic activity
- Destruction of wetlands
- Deforestation
- High rates of sedimentation leading to eutrophication
- Creation of habitats for invasive species and potentially dangerous animals (e.g. malaria);
- Destruction of natural riverine species due to the change in fluvial conditions

Any other relevant information.

According to UNEP (2016:16), Africa "... is warming faster than the global average, with projections of a rise of 3 °C to 4 °C this century.

b. Explain how climate change associated with an increase in temperature and low rainfall may exacerbate the water scarcity problem in Sudan and Egypt, the two downstream countries that depend on the Nile River.

The global mean temperature is estimated to increase to about 0.6°C to 1.5°C by 2025 due to greenhouse gas forcing alone (Hulme & Viner 1998). An increase in temperature associated with changes in precipitation and evaporation rates that may have significant impacts on river discharge. The run-off in the Nile Basin has been shown to be sensitive to changes in precipitation and temperature (Conway & Hulme 1996). Thus, higher temperature and decreased rainfall may exacerbate the water scarcity problems on the downstream countries such as Egypt and Sudan that depend on water from the Nile River. Increased rates of evaporation due to higher temperatures may reduce the amount and quality of water flowing down to these countries. The greatest shortfalls are expected to occur in the summer, leading to decreased soil moisture levels and more frequent and severe agricultural drought.

Any other relevant information.

c. Describe the role of the Paris Agreement in international climate change adaptation.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate

Esterhuysen, S, Redelinghuys, N & Kemp, M. 2016. Unconventional oil and gas extraction in South Africa: water linkages within the population–environment–development nexus and its policy implications. *Water International* 41:409-425.

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Hudson-Edwards, K.A, Jamieson, H.E and Lottermoser, B.G. 2011. Mine wastes: past, present, future. *Elements* 7:375-380.

Hulme, M. and Viner, D., 1998. A climate change scenario for the tropics. In *Potential impacts of climate change on tropical forest ecosystems*, edited by A Markham. Springer, Dordrecht:5-36.

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Rozell, D.J. & Reaven, S.J. 2012. Water pollution risk associated with natural gas extraction from the Marcellus Shale. *Risk Analysis* 32:1382-1393.

Suchy, D.R & Newell, K.D. 2011. *Hydraulic fracturing of oil and gas wells in Kansas*. Kansas Geological Survey.

5 CONCLUSION

I hope that you found this feedback on Assignments 01 and 02 useful and that it would assist you in your exam preparation.

Kind regards

Dr SC Nenwiini