# Exercise in Remote Sensing, Geomorphology, Ecology and Development Geography based on Google Earth

1. **Aims and objectives**

This exercise will take you across an entire planet and allow you to study mainly geomorphological features but also different aspects of land use, how people get their livelihood secured and how they manage their resources under the conditions that are given by climate, soil, location in relation to other places, etc. Use Internet to search for additional information about the locations that you looking at.

1. **Starting the exercise**

For this exercise you need access to a textbook in general Physical Geography/Geomorphology and a computer with Google Earth installed. The book used during the course NGEA01 Introduction to the Earth’s Environments will serve very well for this.

You will use Google Earth to find different landforms in different parts of the world and explain their origin and relation to their surroundings.

Start the exercise by locating the file *Google and Geomorphology.kmz* on the server and then copy it to your working directory. Double click to open it in Google Earth. Another option is to open Google Earth and then use file – open and select this file.

In some cases is might be that Google has acquired new images since the text was written so please DO use the button for changing image dates to switch between image acquisition dates, one example is the first thematic stop in the World Sites section – 1. Glacial Landscapes. Here you are among other things requested to try to determine the tree limit in the area, while the current image is from December 2011 and the whole area is snow covered.

It may also be that some versions of Google do not display all images properly, e.g. the Mega Fly over Africa images that are the basis of the stops 5-8 in the World Sites section. Then try to improvise and answer the questions by using other images and materials available. Make sure you have ticked the Photo layer, which may provide valuable ground truth information.

1. **Results and presentation**

At each “stop” described in section 5 you will find some statements, tasks or assignments to undertake. Try to comments and reflect on these as comprehensive as possible. You are not expected to write pages on each site but relevant comments and reflections are required. You will be randomly asked to present your findings for at least one of the sites, and to contribute actively to your fellow students’ presentations of other sites. Whenever specific landforms are present you should be able to name and describe them properly. Please comment on human activities and image quality at each site.

**Add a feature, question, reflection or something you like to share at each site!**

**Use this template to fill in your short answers. Don’t forget to add an observation or reflection you like to share at each stop.**

**Glacial landscape**

In this location you should find the following features:

Alluvial fan
Braided river
End moraines
Glacial niche
Talus cone
U-valley

Try to determine the altitude of the tree limit in the area - Note that to do this you will have to swap to a summer image of the area. Any traces of human activity in the area? Where is it most logic to find such traces?

**Arid Landscape**

General description of the landscape:
Vegetation and agriculture

Geological structures:
Folding
Syncline and anticline

Geomorphological features:
Alluvial fan
Fluvial terrace
Meander
Ephemeral river
Gully

Human structures:
Cultivation terrace
Irrigation dam in water course (just south of Barkhan)
Irrigation canal

Barkhan is a name for a landform - which?

**Geological feature**

How has this landscape been formed? It is useful to zoom in or out to get different perspective on the area. Topography? Any distinct or marked changes?

**Extreme drainage**

What is controlling how the rivers flow in this area? General landscape characteristics?

**Details of land degradation and soil erosion**

Make sure that you check the "on" box for the layer - Gallery/National Geographic Magazine/Mega Flight over Africa. These sites will be marked with a small red aircraft. When you zoom in you will see a small overlaid image (the dimensions of the detailed "frame" is roughly 120 by 80 m) on top of the regular satellite images with a very high geometrical resolution.

Zoom in on one of the detailed images (there are at least about 20 of them close to the one indicated by the place marker) and note at least two signs of degradation/erosion by water erosion.

**Bilma**

The City of Bilma is very remote. What information can you find on the Internet about it?

In this region houses are often built from salt stones. Could you give an explanation to where the salt comes from?

Look at sand accumulations connected to many of the rock outcrops occurring in this area. What is the prevailing wind direction and in what direction are sediments moving?

About 3.5 km north of Bilma there are some sand dunes. Name of dune and direction of movement. What more do they tell you about the characteristics of sediments?

Zooming out from Bilma you see another type of dunes south of the city. Name and how are these formed?

Centre on Bilma and zoom to about 700 km altitude. You see a mountain range to the NE of the city. A main peak is called Toussidé. How is this formed? How is the mountain chain in general formed? What type of rock does the formation process imply? How hard is this rock? What exogenic processes are currently shaping it? Very close to Toussidé you find some photograph of Le Doon, or Trou au Natron, that gives very valuable information and a spectacular view.

Identify at least some traces of mass movements.

**Sandstone and drainage**

This is a very dry area but still the traces of fluvial erosion are very dominating. If you look at the Megafly over Africa images that are taken in this area you see that there is accumulation of new deposited sand in lee positions all over, indicating a very active wind erosion/transport. The very smooth rounded rock outcrops indicate tropical weathering.

So past climates were probably different. Follow the water course that flow NNW from the place marker. It turns 90 degrees towards WSW after a short while. You can see the river bed very clearly. After a while it vanish more and more but the Levees on both sides still protrude despite that the river bed is filled with blown sand. Could this be discussed in a sense of changing climate?

The river definitely disappear about 37 km W of the place marker. If you zoom to an altitude of about 1000 km you can trace a linear feature from where the river disappears that goes to the north and then gently bends west. Here you find the city of Djanet (see next place marker).

**La Grande Erg Orientale**

What does the word "erg" mean?

What is the type of dunes present in this area called and what is characteristic for their formation? Prevailing wind direction(s)?

North of the place marker there are several flat areas with whitish tone. What is this? Describe the process.

About 300 km ENE of the place marker the Tunisian city of Tataouine (yes it was from this city the name of the planet in Star Wars was derived and all scenery from the films shot) is located. Travel this distance at a fairly low altitude and make a brief description of how the dune types change and relate to availability of moving sand. What is the prevailing wind direction(s)? If you zoom in close you can see several smaller dunes superimposed on the larger ones. Why?

During the route there is a quite sharp border from the erg to a different soil, called loess. What kind of grain size builds the loess plateau ot the Matmata? Loess is very easily eroded by water erosion; some loess areas in the world have an erosion rate of up to 4 m per year.

Travelling in a NNW direction along the Matmata range will take you to the village of Matmatat Al Qadimal. Here there are a lot of round holes in the ground - what is this and how could they have been formed and why so?

**River**

Make a brief analysis of the river in this area. There are several levels of terraces and it has been cutting deep in the underlying substrate. How this river does relates to the famous Grand Canyon. What do the terraces tell about landscape development in this area? What kinds of rocks are present? Describe other processes than fluvial erosion?

**Lut Desert**

Explain the landscape in this area. Active processes and name of landforms?

Try to find some photographs from the ground to get a better view of the shapes. Which country are we in?

**Amazonas deforestation**

Use the time facility to check the development in deforestation in this area, starting by the image from 1970. As a scientist used to critical thinking you immediately discover a major error. Please describe the process over the time series that is available with one recording per year. What could have caused the error displayed in the series? What structures might have accelerated the processes?

**River disappear**

Finally back in Sweden, a last puzzle to solve.

West of the place marker a river is flowing that suddenly disappears and only re-appears about 3 km to the ENE. In the terrain you still see a lot of traces from fluvial processes, such as e.g. meanders.

What kind of bed rock is underlying the river bed?
What other indications (landforms) supports a conclusion for a specific type of bed rock?

A common name for this type of landscape is?