Topic 5: Soil systems and terrestrial food production systems and societies

1. Investigate differences in soil profiles (on a slope/around your school)

This could be used to practise the following IA skills:
- Results, analysis and conclusion
- Discussion and evaluation
- Communication

Soils vary enormously and they are easy to investigate. To do a good soil study you really need to see as much of the soil profile as possible. This can sometimes be achieved at natural exposures such as the one shown in figure 3e.1. Failing that you will need to expose the soil profile by digging a soil pit. Soil pits are a bit destructive (they are a large hole in the ground) so it is essential to get permission before you start digging.

▲ Figure 3e.1 Naturally exposed soil profile

To investigate soils you should select three or four very different sites, perhaps different locations in your local area. Look at changes with zonation – up a hill, away from a river, away from a road etc. The sites should have undisturbed soil, not a garden or a farm where the soil has been turned over and mixed by humans.
At each site you need to expose the soil profile as much as possible. If you need to dig a soil pit try and remove the vegetation intact as a grass mat. Once you have conducted your fieldwork you can replace the soil in the hole and put the vegetation back on top. Another possible way to check out soil is using a soil auger (figure 3e.2). These are screwed into the ground and then pulled straight out. It will bring a column of soil with it which can then be laid out for study.

▲ Figure 3e.2 Soil augers

**Method**

For each soil profile:

1. Draw a field sketch of the soil profile and identify and label the horizons.
2. Put a stick in the profile at the junction of each horizon then take a picture of the soil profile.
3. There is a range of tests you can do on each horizon of the soil:
   
   a. Colour
   
   b. Texture
   
   c. pH
   
   d. Water content
   
   e. Organic content.
4. To conduct some of these tests you must take a sample of soil from each horizon and test it back in the lab. This must be done very carefully.
   
   a. Use ziplock bags that you can write on.
   
   b. Label each bag with the site and the horizon that the sample is taken from.
   
   c. Seal the bag tightly to avoid loss of moisture.
5. Once you have finished your tests replace the soil in the soil pit and replace the vegetation mat.

**Colour test**

The easiest way to do this is to take a small sample of the soil and rub it on to your field sketch. Alternatively there are colour charts (e.g. Munsell colour chart) that can be used as a point of comparison. Match the colour of the soil to the chart and you will get a description and a number for that colour. The advantage of this is that a person in another part of the world could use the chart to see what the colour of the soil in your study is.
Texture

You can take a sample of soil from each horizon, return to the lab and use a sediment settling technique (Mix each soil sample with a known volume of water. Pour each into a large measuring cylinder. Record settling times and then compare depth and types of layers once the soils have settled.). Alternatively you can do field tests to assess the soil texture. You can find a number of ‘soil feel tests’ – here is one example: [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/kthru6/?cid=nrcs142p2_054311](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/kthru6/?cid=nrcs142p2_054311)

You can print this key (figure 3e.3) and use it to assess soil texture.

![Figure 3e.3 Soil feel test chart. Modified from SJ Thien, 1979, 'A flow diagram for teaching texture by feel analysis', *Journal of Agronomic Education*, 8: 54–55](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/kthru6/?cid=nrcs142p2_054311)
**pH**
This can be done using soil testing kits back in the lab or in the field.

**2. Investigate soil erosion**
In this investigation you can look at the impact of vegetation cover on soil erosion.

This could be used to practise the following IA skills:
- Identifying context
- Results, analysis and conclusion
- Discussion and evaluation

**Method**

1. Take four large soda bottles.
2. Cut them as shown in figure 3e.4.

![Figure 3e.4 Cut out bottle for soil experiment](image)

3. Place soil in all of the bottles, as follows:
   - b. Bottle 2: Cover with a mulch or leaf litter.
   - c. Bottle 3: Plant half with grass seeds.
   - d. Bottle 4: Plant completely with grass seeds.
4. Place bottles 3 and 4 in a sunny position, water regularly (not too much), and leave for a while until the grass has grown.
5. Get the four bottles ready.
   - a. Take bottle 1 and place it on a table with the lid on hanging over the edge.
   - b. Place a measuring cylinder under the bottle lid (leave the lid on for now).
   - c. Fill a watering can with a set amount of water. The amount will depend on how big the soda bottles are – use your judgment.
   - d. Remove the lid and water the bottle with the prepared water in the watering can. Pour at a constant rate and for a set amount of time.
   - e. Leave it in place for about 30 minutes.
6. Repeat with bottles 2, 3 and 4.
7. After about 30 minutes check the measuring cylinders and see how much soil is in each of them.

8. For statistically valid results you should repeat this 5 times for each cover type.

The same experiment can be done to assess the impact of slope angle on soil erosion.

Instead of different contents in each of the bottles, set them all up with the same ‘filling’ but when you water them place them at different angles.

3. Investigate the effect of soil salinization on plant growth (or seed germination)

This could be used to practise the following IA skills:

- Identifying context
- Results, analysis and conclusion
- Discussion and evaluation
- Application
- Communication

You could investigate:

- the impact of different salt concentrations on the growth of a particular plant (germination of particular seeds)
- the impact of salinity on different types of plants (seeds).

4. Investigate food consumption and/or production patterns

This could be used to practise the following IA skills:

- Identifying context
- Results, analysis and conclusion
- Discussion and evaluation
- Application
- Communication

There is a range of data available on food consumption and production. You could look at:

- The relationship between food consumption and level of development of selected countries. Good websites for food consumption:
  - [http://chartsbin.com/view/1150](http://chartsbin.com/view/1150) (daily calorie intake / capita)
PART 3 PSOW activities by topic (topics 1–8)

  - Select country of interest.
  - Select ‘people and society’.
  - Scroll down to find ‘obesity’ % adults.

- The relationship between food production and level of development of selected countries. Good websites for food production
  - http://www.indexmundi.com/facts/indicators/AG.PRD.FOOD.XD/rankings
  - Nationmaster.com has a range of agricultural data.
    - Go to http://www.nationmaster.com/
    - Under categories select ‘agriculture’ and there are a number of production indicators given.

- The relationship between consumption and production.

Method

This investigation is looking at the relationship between the level of development of a country and its food production/consumption.

1. Choose a sampling system to use. Systematic sampling – every nth country from a ranked list.
   Random stratified sampling – taking a set number of countries from each of the development categories:
   a. very high human development
   b. high human development
   c. medium human development
   d. low human development.

2. Decide which method you will use then go to the HDI list http://hdr.undp.org/en/data:
   a. Click on Human Development Index (HDI) value.
   b. This will give a list of all countries according to the categories above.
   c. Using the sampling method you have selected to generate a minimum of 30 countries and record them on a data recording table (similar to that below).

<table>
<thead>
<tr>
<th>Country</th>
<th>Daily calorie intake per capita (Chartsbin)</th>
<th>Food production index (baseline 100) (Indexmundi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>3,460</td>
<td>95.85</td>
</tr>
<tr>
<td>New Zealand</td>
<td>3,150</td>
<td>106.60</td>
</tr>
</tbody>
</table>

▲ Figure 3e.4

3. Go to http://chartsbin.com/view/1150 (or whatever website you select), hover over each country on your list and record the daily calorie intake per capita.
4. Go to Indexmundi http://www.indexmundi.com/
5. Find each country on your list and record the food production index.
6. Draw a scattergraph.
7. Conduct an appropriate statistical test.

5. Investigate your food consumption

This could be used to practise the following IA skills:
- Results, analysis and conclusion
- Discussion and evaluation

There are many aspects of your food consumption that you could
investigate. Here are two fun activities. They are interlinked and follow on
from each other.

Method
1. Select 30 food items in your home and record the country they are
from. Try and go for a mix of items.
   a. For packaged food: check the labels and find country of origin.
   b. For fruit and vegetables and meat and fish: you may need to ask
      where the items were purchased.
2. Go to http://www.foodmiles.com/. Follow the instructions on the
   right-hand side of the page and record the:
   a. food miles
   b. kg CO₂ or kg Carbon if the distance was covered by plane
   c. kg CO₂ or kg Carbon if the distance was covered by car
   d. kg CO₂ or kg Carbon if the distance was covered by train.

<table>
<thead>
<tr>
<th>Food item</th>
<th>Country of origin</th>
<th>Kg CO₂ or Carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato sauce</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>Cereal</td>
<td>UK</td>
<td></td>
</tr>
<tr>
<td>Olives</td>
<td>France</td>
<td></td>
</tr>
</tbody>
</table>

▲ Figure 3e.5

3. The clearest way to present the data on the country of origin is a flow
   line map. See http://geographer-at-large.blogspot.co.uk/2011/11/map-
of-week-11-28-2011the-spread-of.html for an example of a flow line
   map by Haisam Hussein on the spread of disease.

4. You can then calculate the amount of carbon generated by getting
   your food items to you and present it in the clearest way possible.

BEWARE
Having done all this, check out this website:
http://shrinkthatfootprint.com/food-miles. What conclusions can
you draw?