Name:_____

Date: _____

Class: _____

IB ESS

1.4 Sustainability

Significant Ideas:

All systems can be viewed through the lens of sustainability.

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.

Environmental indicators and ecological footprints can be used to assess sustainability. Environmental Impact

Assessments (EIAs) play an important role in sustainable development.

Sustainability and Natural Capital

1. Define "sustainability"

Sustainability is the use and management of resources that allows full natural replacement of the resources exploited and full recovery of the ecosystems affected by their extraction and use.

2. List the ways in which a nation might measure sustainability

There are several tools (indicators)to measure sustainability, such as Biodiversity (Environmental vulnerability); Pollution (Air quality), GDP (Gross Domestic Product); Ecological footprints

3. State at least one advantage of measuring sustainability...

...on a local scale:

It is important to measure the sustainability on a local scale, in order to guarantee a proper sustainable development, by the adoption of sustainable solutions that favour a local community. Also, the smaller the scale of the measurement, the more accurate it can be.

...on a global scale:

It is important to measure the sustainability on a global scale because there are global issues that compromise the sustainability of the planet (for example the use of fossil fuels as energy resources instead of renewable energies. An effort to do this are the sustainable development goals set by the UN, to be achieved by 2030.

3. Define "natural capital"

Natural capital includes all the raw materials from the environment; which can be renewable and non-renewable; that are used (by producers) to generate natural income, in the form of goods and services (for consumers)

4. For the country you live in (or you could choose the country you're from if it's different to the country you currently live in), list as many items of natural capital as you can think of that are provided by the ecosystem.

Portugal – main terrestrial ecosystem: temperate forest. Main items: raw materials such as cork, food (fruits such as oranges and olives), rocks such as granite, marble,etc.

Main aquatic ecosystem: Atlantic ocean – fish (sardines for example), crustaceans, mollusks

Sustainability vs Natural Capital vs Natural Income

1. Define "natural income"

It is the yield obtained from natural resources (what we get from it), including products or goods and services.

2. Using examples, distinguish between natural income of goods and natural income of services.

When thinking about the ocean, goods are for example food resources, such as fish; services are for example the climate regulation (by the absorption of carbon dioxide); another example - a forest is an example of renewable natural capital, as it can produce an income in the form of a GOOD *e.g.* timber/game and a SERVICE, for recreation;

3. Explain how unsustainable land use might affect natural income for the current and future generations.

Hints:

- *Think about the benefits of unsustainable land use (there are some, at least in the short- term) as well as the drawbacks.*
- *Consider the various goods as well as services that land can provide, and the different people that benefit.*
- *Provide a balanced argument: should future generations be prioritized over the current generation? How might a technocentric person's opinion differ from an ecocentric person's opinion?*

- Unsustainable use of land is linked to unsustainable agricultural practices (link with Topics 5.3. and 5.3.), such as commercial farming, with the use of machinery that has a high impact in the environment. The benefits of this unstainable land use is the high yield due to large scale production; drawbacks are the reduction in the soil fertility and pollution.
- Land provides goods such as food, medicines, raw materials. They serve different communities – tribes, which use the land for subsistence and western people that benefit from being or producers and or consumers
- With regards to this question – an ecocentrist view would value the needs of the present generations without compromising the needs of the future generations; they would advocate for the reduction in the use of non renewable resources investing more in renewable resources. This means that ecocentrists aim at becoming self-sufficient by the use of solar cells for their electricity, use of rain water and grey water recycling for their water supply, grow their own food. Technocentrists would argue that the presents needs must be met and that tecnhological innovation can lead to the production of more resources which can guarantee not only the present needs but also the needs of the future generations.

The Millennium Ecosystem Assessment

- The MEA is very extensive and a lot of information has been published. To explore this research, a good place to start is the "Ecosystems and Human Wellbeing: Synthesis", available here: http://www.millenniumassessment.org/documents/document.356.aspx.pdf.
- The research has also been summarised in a more accessible format at this website: http://www.greenfacts.org/en/ecosystems/index.htm

1. Summarise the purpose of the Millennium Ecosystem Assessment

To think about

The **Millennium Ecosystem Assessment** (**MEA**), funded by the UN and started in 2001, is a research programme that focuses on how ecosystems have changed over the last decades and predicts changes that will happen. In 2005, it released the results of its first four-year study of the Earth's natural resources. It was not happy reading.

2. Summarise the key findings of the MEA with regards to:

a) The percentage of ecosystems worldwide that are currently being degraded.

b) Fishstock exploitation

c) Surface freshwater use

d) Mangroves

The report said that natural resources (food, freshwater, fisheries, timber, air) are being used in ways that degrade them so make them unsustainable in the longer term.

Key facts reported are:

- 60% of world ecosystems have been degraded.
- About 25% of the Earth's land surface is now cultivated.
- We use 40–50% of all available surface freshwater and water withdrawals from underground sources have doubled over the past 40 years
- Over 25% of all fish stocks are overharvested.
- Since 1980, about 35 % of mangroves have been destroyed.
- About 20% of corals have been lost in 20 years and another 20% degraded.
- Nutrient pollution has led to eutrophication of waters and dead coastal zones.
- Species extinction rates are now 100–1,000 times above the background rate.
- We have had more effect on the ecosystems of Earth in the last 50 years than ever before.

Some recommendations were to:

- Remove subsidies to agriculture, fisheries and energy sources that harm the environment.
- Encourage landowners to manage property in ways that enhance the supply of ecosystem services, such as carbon storage and the generation of fresh water.
- Protect more areas from development, especially in the oceans.

Use the "Ecosystems and Human Wellbeing: Synthesis" to get information to answer the following question:

3. Regarding biomes (see page 4)

a) Which three biomes had the most area converted by 1950?
Mediterranean forest, Temperate forest, Temperate broadleaf and mixed forests.

b) Which three biomes had the most area converted between 1950 and 1990?
Tropical and subtropical dry broad-leaf forests, flooded grasslands and savannas, tropical and subtropical grasslands

c) What is the main cause for biome conversion? Agriculture

4. Regarding extinction rates (see page 5):

a) What is the current situation on global animal extinction rates?

The rate of known extinctions of species in the past century is roughly 50–500 times greater than the extinction rate calculated from the fossil record of 0.1–1 extinctions per 1,000 species per 1,000 years. The rate is up to 1,000 times higher than the background extinction rates if possibly extinct species are included.

b) How is this expected to change in the future?

It is projected that the future extinction rate will be more than 10 times higher than the current rate.

5. The report states (Page 6) that "*The degradation of ecosystem services often causes significant harm to human well-being*."

a) Figure 8 on page 9 will help answer the following:

i) State the natural income of goods a forest can provide

Timber and fuelwood

ii) State the natural income of services a forest can provide

Carbon sequestration; watershed protection

b) In what way(s) might a forest ecosystem's services become "degraded"?
When forests are cut; also services can be degraded with pollution.

c) Using forests as an example, explain how the use of natural capital for "marketed benefits" may be less economically sustainable than use for "nonmarketed benefits".

The commonly marketed benefits come from timber, fuel wood and grazing. These can be less economicaly sustainable for the long term because they cause the direct degradation (of forests) and loss of resources (such as soil).

Environmental Impact Assessments

1. Outline the purpose of an Environmental Impact Assessment.

(EIA) Environmental Impact Assessment is a process used to establish the impact of a project/development on the environment; it enables the possible impacts on habitats, species and ecosystems to be predicted; and helps decision makers decide if the development should go ahead; and if steps to mitigate effects should be put in place. Typical projects requiring EIA's: dams, roads, ports, airports, power plants, etc.

2. Using the table, briefly outline the stages of creating an EIA answers can be found here https://www.soas.ac.uk/cedep-demos/000_P507_EA_K3736-Demo/unit1/page_14.htm

Stage	Details
Screening	
Scoping	
Baseline study	
Impact prediction	
Mitigation	
Monitoring/ Assessment	

3. Outline the reasons for creating a non-technical summary of an EIA.

To be used by the media and make it more accessible to the general public.

4. Summarise *at least* four criticisms of EIAs.

- often difficult to put together a complete baseline study due to lack of data;
- often all impacts are not identified;
- information and suggestions in EIA are often not acted upon;
- EIA offer advice, but whether or not they are adopted depends on the EVS of the government involved. In China for example, the EIA for the Three Gorges Dam showed the damage that would be done to the environment, but the government showed to focus on the benefits for the country – link to environmental philosophies

Ecological Footprints

5. Outline what is meant by the term "ecological footprint".

An ecological footprint (EF) is the area of land and water required to sustainably provide all resources at the rate at which they are being consumed by a given population. If the EF is greater than the area available to the population, this is an indication of unsustainability

6. Outline how the following factors relate to the ecological footprint of a country.

The first one has been done for you.

Factor	Details
Cropland	The amount of land required to provide food for humans consumption (including food, animal feed, and other products taken from crops
Grazing land	The amount of land required to feed the animals which are also for human consumption. More grazing land means higher EF.
Carbon sequestration	Refers to the uptake of CO_2, so less land will be used to absorb the wastes; this decreases the EF
Forests	Absorb the waste products such as CO_2; this decreases the EF.
Built-up land	This land is used for infra-structure, so this increases EF
Fisheries	Amount of water needed to provide the resources to sustain the population

An ecological footprint is often expressed as an area of land: if the size of a nation's ecological footprint is larger than their actual land mass, then they are living beyond their means and this is probably not sustainable.

3. Explain the link between EF and sustainability

The measure of an EF takes into account the area required to provide all the resources needed by the population, and the assimilation of all wastes. Therefore, EF is a model used to estimate the demands that human populations place on the environment. The resources need to be managed in a sustainable way. If the EF is greater than the area available to the population, this is an indication of unsustainability.

Another convenient way to think about an EF is "number of Earths". For example, how many Earths would we need if everybody on the planet lived your lifestyle?

4. Using the "number of Earths" method, make a sensible estimate of your ecological footprint.
Justify the answer your give.
Variable answers**.**

5. Do some online research: find the ecological footprint of the country you live in, and compare it to the ecological footprint of one other country, and **explain** the differences. You may find data to explain the differences and/or you may use your own knowledge about lifestyle differences between the two countries.

http://data.footprintnetwork.org *is a useful resource for this.*