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"

The use and management of resources that allows full natural replacement of the resources exploited and full recovery of the ecosystem affected by their extraction and use

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

Measuring the regrowth/renewal of natural capital

eg. if the rate of forest removal is less than the annual growth then the forest removal is sustainable.

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

...on a *local* scale:

Advantage - includes local methods/cultures that are ecosystem specific

Disadvantage - does not include inter-relationships between systems.

...on a *global* scale:

Advantage - many problems have worldwide impact

Disadvantage - individual and small scale community action can be more effective or problem is local in nature (point source pollution)

4. Define "natural capital"

resources that can produce a sustainable natural income or goods or services

Natural capital can be renewable or non-renewable

5. 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.

Frankincense, oil and gas, tourism, iron ore, fisheries

Sustainability vs Natural Capital vs Natural Income

1. Define "natural income"

the yield obtained from natural capital can be products or services

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

Using the ocean as an example the goods provided are the fisheries products and the services are the recreational activities (guided snorkelling for example)

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?*

Benefits of unstainable land use is high food yield but the drawbacks are reduction in soil fertility and pollution

Land can provide food (local), medicines (local + global), CO_2 absorption (local and global)

Ecocentric view would value the needs of the present generation without compromising the future generation; they would advocate the reduction in the use of non-renewable resources and invest more in renewable. They would encourage education targetted towards self-sustainability - use of grey water, grow their own food, reduce ecological footprint

Technocentrics argue that the present needs must be met and that technological innovations can lead to the production of more resources which can then guarantee present as well as future needs

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

Funded by the UN and started in 2001, is a research programme that focuses on how ecosystems have changed over time and predict what will happen in the future

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

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

60% of the world's ecosystems have been degraded

b) Fishstock exploitation

over 25% of all fish stocks are overharvested

c) Surface freshwater use

we use 40%-50% of all available surface freshwater

c) Mangroves

35% of mangroves have been destroyed

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?

Mediterrancan 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 savannahs, 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?

rate is roughly 50 - 500 times greater than 0.1 - 1 extinctions per 1000 species for 1000 years

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

The rate will be more than 10 times higher

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, fuel, food, medicine

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

carbon sequestration, watershed protection, aesthetic, recreation

b) In what way(s) might a forest ecosystem's <u>services</u> become "degraded"?

when forests are cut services can be degraded with pollution or eliminated

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 economically sustainable for the long term because they cause direct degradation and loss of resources (eg soil)

Environmental Impact Assessments

1. Outline the purpose of an Environmental Impact Assessment.

Establish the impact of a project on the environment. Predicts possible impacts on habitats, species and ecosystems and helps to determine if the project should go ahead or to mitigate impact

2. Using the table, briefly outline the stages of creating an EIA

Stage	Details
Screening	once all project designs have been considered determine if the development will impact the environment significantly
Scoping	Define issues that need to be addressed. Focus on impacts that will have a significant effect on the environment
Baseline study	study current state of the environment against which change due to the development can be measured
Impact prediction	Interpretation of the importance or significance of the impacts. Conclusions used to decide fate of project.
Mitigation	Taking measures to reduce or remove environmental impacts
Monitoring/ Assessment	Used to determine; accuracy of predictions, degree of deviation from predictions, reason for deviations, effect of mitigation

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

Make the report more accessible to non-scientists including media and general public.

Allows involved parties to be informed

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

- baseline studies are often inaccurate or incomplete
- not all impacts may be identified
- there is no standard to the acceptance of the EIA some countries use it within their legal framework, some use it to inform policy decisions and others ignore it.
- accurate monitoring dependent on baseline study and may also be inaccurate.

Ecological Footprints

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

The area of land and water required to sustainably provide all the resources at the rate at which they are being consumed by a given population

2. 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 needed for meat production. The greater the meat consumption the greater the EF
Carbon sequestration	The more land with healthy vegetation the more carbon uptake for photosynthesis so reduced EF
Forests	Increase carbon sequestration so reduce EF
Built-up land	Reduces the 2 preceeding points more likely built-up land emits fossil fuel emissions so increases EF
Fisheries	The greater the fisheries the higher the EF whether fishing or fish farming

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 EF measures the land and water needed to provide resources for the population if this exceeds the land and water that is available (fixed) that is not sustainable. The higher the EF the greater the 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.

5. Do some online research: find the ecological footprint of <u>the country you live in</u>, and compare it to the ecological footprint of <u>one other country</u>, 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.*

Oman:	Biocapacity	1.5 gha	Finland	Biocapacity	12.7 gha
	EF	6.9 gha		EF	6.1 gha
	Difference	-5.4 gha		Difference	6.6 gha

Environment	hot and dry	cold and wet
	high GHG emissions	
	high water use	
	limited recycling	