**Understandings, Applications and Skills** (This is what you may be assessed on)

**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.​

**Big questions**

* What strengths and weaknesses of the systems approach and the use of models have been through this topic?
* What have you learned about sustainability and sustainable development in this chapter?
* What are the differences between sustainability and sustainable development?
* Ecological Footprint is a model used to estimate the demands that human populations place on the environment; what are the limitations and benefits of these models
* How do EIAs ensure that development is sustainable?

|  |  |  |
| --- | --- | --- |
|  | **Statement** | **Guidance** |
| 1.4.U1 | 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 |  |
| 1.4.U2 | Natural capital is a term used for natural resources that can produce a sustainable natural income of goods or services |  |
| 1.4.U3 | Natural income is the yield obtained from natural resources | You need to be able to explain the relationship between natural capital, natural income and sustainability, and discuss the value of ecosystem services to a society. |
| 1.4.U4 | Ecosystems may provide life-supporting services such as water replenishment, flood and erosion protection, and goods such as timber, fisheries, and agricultural crops. |  |
| 1.4.U5 | Factors such as biodiversity, pollution, population or climate may be used quantitatively as environmental indicators of sustainability. These factors can be applied on a range of scales, from local to global. The Millennium Ecosystem Assessment (MA) gave a scientific appraisal of the condition and trends in the world’s ecosystems and the services they provide using environmental indicators, as well as the scientific basis for action to conserve and use them sustainably | You need to be able to discuss how environmental indicators (such as Millennium Ecosystem Assessment) can be used to evaluate the progress of a project to increase sustainability. |
| 1.4.U6 | EIAs incorporate baseline studies before a development project is undertaken. They assess the environmental, social and economic impacts of the project, predicting and evaluating possible impacts and suggesting mitigation strategies for the project. They are usually followed by an audit and continued monitoring. Each country or region has different guidance on the use of EIAs | There is no expectation to explore an EIA in depth, but rather to focus on the  principles of their use. |
| 1.4.U7 | EIAs provide decision-makers with information in order to consider the environmental impact of a project. There is not necessarily a requirement to implement an EIA’s proposals, and many socio-economic factors may influence the decisions made. |  |
| 1.4.U8 | Criticisms of EIAs include: the lack of a standard practice or training for practitioners, the lack of a clear definition of system boundaries and the lack of inclusion of indirect impacts. |  |
| 1.3.U9 | 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. |  |
| 1.4.A1 | Explain the relationship between natural capital, natural income and sustainability |  |
| 1.4.A2 | Discuss the value of ecosystem services to a society. |  |
| 1.4.A3 | Discuss how environmental indicators such as MA can be used to evaluate the progress of a project to increase sustainability |  |
| 1.4.A4 | Evaluate the use of EIAs. |  |
| 1.4.A5 | Explain the relationship between EFs and sustainability. |  |

1.4.U1 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

1. Identify the UN Sustainability Development Goals <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html#:~:text=The%20Sustainable%20Development%20Goals%20(SDGs,peace%20and%20prosperity%20by%202030>.



1. Define sustainability
2. Outline the origin of the word “sustainability”.
3. Using a named example, define natural resource

1.4.U2 Natural capital is a term used for natural resources that can produce a sustainable natural income of goods or services.

1.4.U3 Natural income is the yield obtained from natural resources.

1.4.U4 A Ecosystems may provide life-supporting services such as water replenishment, flood and erosion protection, and goods such as timber, fisheries, and agricultural crops.

1.4. A1 Explain the relationship between natural capital, natural income and sustainability.

1.4.A2 Discuss the value of ecosystem services to a society.

1. Using a named example, define natural capital.
2. Natural capital can be separated into three different classes. Using a named example, define these three classes
3. Give an example of goods used as a resource
4. Using named examples, services
5. Watch the video Forests: The Heart of a Green Economy <https://www.youtube.com/watch?v=A3jb2k93tZM&feature=emb_logo>. Identify the natural capital you saw in the video
6. Read the list of ecological goods and services in the Metro Vancouver image.
   1. Which of the items in grey are ecological goods?
   2. Which are ecological services
7. List two goods and two services provided by a rainforest.
8. Explain the relationship between natural capital, natural income and sustainability.
9. Discuss the value of a named ecosystem service to a named society.

1.4.U5 Factors such as biodiversity, pollution, population or climate may be used quantitatively as environmental indicators of sustainability. These factors can be applied on a range of scales, from local to global. The Millennium Ecosystem Assessment (MA) gave a scientific appraisal of the condition and trends in the world’s ecosystems and the services they provide using environmental indicators, as well as the scientific basis for action to conserve and use them sustainably.

1.4.A3 Discuss how environmental indicators such as MA can be used to evaluate the progress of a project to increase sustainability.

**The Millennium Ecosystem Assessment (MEA)** is a United Nations project designed to assess the consequences of ecosystem changes for human well-being. The objective of the multiyear exercise was to both assess the consequences of ecosystem changes for human well-being, and to establish a scientific basis for action to conserve the sustainable use of ecosystems and their contribution to human well-being.

**Five Main Assessments:**

* Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth.
* The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people.
* These problems, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems.
* The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the [Millennium Development Goals](http://www.un.org/millenniumgoals/).
* The challenge of reversing the degradation of ecosystem while meeting increasing demands for services can be partially met under some scenarios considered by the MA, but will involve significant changes in policies, institutions and practices that are not currently under way. Many options exist to conserve or enhance specific ecosystem services in ways that reduce negative trade-offs or that provide positive synergies with other ecosystem services.

1. State how biodiversity is used quantitatively as an environmental indicator of sustainability
   1. How is biodiversity measured
   2. Identify the importance of quantifying diversity
2. State how pollution is used quantitatively as an environmental indicator of sustainability
   1. State how pollution can change an ecosystem
3. State how population is used quantitatively as an environmental indicator of sustainability
4. State how climate is used quantitatively as an environmental indicator of sustainability
5. Range of scales
6. Identify the aim of the Millennium Ecosystem Assessment
7. Discuss the findings of the Millennium Ecosystem Assessment and how they related to sustainability
8. Have a look at some of the key facts reported from the MEA. Imagine you were the Minister for Environment and Urban Planning in Manitoba What changes could you make on a national level to help Manitoba achieve [its vision](https://gov.mb.ca/waterstewardship/questionnaires/surface_water_management/pdf/connected_docs/tomorrowNowBook.pdf) whilst taking the findings of the MEA into account?
   1. Note: our 5 priorities are:
      1. Good for our Economy – Good for our Environment
      2. Changing our Ways for a Changing Climate
      3. Safeguarding our Water, Air and Land
      4. Nurturing our Living World
      5. Simple PERSONAL Choices – Big Result
9. List five changes you decide upon into the table below

* 60% of the world’s ecosystems have been degraded
* About 25% of the Earth’s land surface has been 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 the fish stocks are overharvested
* Since 1980, about 35% of the mangroves have been destroyed
* About 20% of the corals have been lost in 20 years and another 20% degraded
* Nutrient pollution has led to eutrophication of the waters and dead coastal zones
* Species extinction rates are now 100-1000 times above the background rate
* We have had more effect on the ecosystems of the Earth in the last 50 years than ever before

|  |  |
| --- | --- |
| **Changes** | |
| 1. |  |
| 2. |  |
| 3. |  |
| 4. |  |
| 5. |  |

1.4.U9 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

1.4.A5 Explain the relationship between EFs and sustainability.

Watch the video clip on Ecological Footprints <https://www.youtube.com/watch?v=g_aguo7V0Q4>

1. Define ecological footprint
2. List the components of the EF. How are these measured?
3. Go to the Earth Overshoot Day website <https://www.overshootday.org/>. Find out when we will use our resources for the year
   1. How was the date calculated?
   2. From the website, what are some ideas to help move the date?
4. Compare and contrast the EFs of MEDCs and LEDCs

39. Go to <https://www.footprintcalculator.org/> and calculate your Ecological Footprint. What is your calculated ecological footprint?

1. List five changes in the table below that could help make your life more sustainable

|  |  |
| --- | --- |
| ***What I’m doing now*** | ***How could I change to lead a more sustainable lifestyle?*** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

1.4.U6 EIAs incorporate baseline studies before a development project is undertaken. They assess the environmental, social and economic impacts of the project, predicting and evaluating possible impacts and suggesting mitigation strategies for the project. They are usually followed by an audit and continued monitoring. Each country or region has different guidance on the use of EIAs.

1.4.U7 EIAs provide decision-makers with information in order to consider the environmental impact of a project. There is not necessarily a requirement to implement an EIA’s proposals, and many socio-economic factors may influence the decisions made.

1.4.U8 Criticisms of EIAs include: the lack of a standard practice or training for practitioners, the lack of a clear definition of system boundaries and the lack of inclusion of indirect impacts.

1.4.A4 Evaluate the use of EIAs.

I am going to cover this section in Topic 1.5 Humans and Pollution

ESS can be like learning a new language. So many words are not commonly used in everyday English. This can be challenging. To help you keep up with ESS Terms, you will need to create your own ESS DICTIONARY. You should add to this over the year and keep it in your notebook or on a page file THAT YOU CAN UPDATE AND ADD TO EASILY. Most of the vocabulary words can be found either on your STUDY GUIDE or at mrgscience.com.

You will be responsible for leaning the words and their meaning. Periodic quizzes will be given on the words. So, make your dictionary creative and you will remember the words more easily.

**KEY TERMS**

positive feedback

tipping-point

resilient

stability

diversity

stability

monoculture

Laws of Thermodynamics

negative feedback

entropy

destabilizing

stabilizing

work

global warming

albedo

​Principle of the Conservation of Energy

sustainability

thermodynamics

energy transfer

equilibria

transformation

transfer

predator/prey

entropy

​albedo

ecosystem

equilibrium

storage

energy

static equilibrium

unstable equilibria

transformations

​homeostasis

​keystone species

energy efficiency

flows

steady-state equilibrium

energy transformation

stable equilibria

complexity

​precautionary principle

​eutrophication