**Topic 4 Ecology**

**Essential Ideas:**

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| 4.1 The continued survival of living organisms including humans depends on sustainable communities.  4.2 Ecosystems require a continuous supply of energy to fuel life processes and to replace energy lost as heat.  4.3 Continued availability of carbon in ecosystems depends on carbon cycling.  4.4 Concentrations of gases in the atmosphere affect climates experienced at the Earth’s surface. |

**4.1 Species, communities and ecosystems - Understandings:**

* Species are groups of organisms that can potentially interbreed to produce fertile offspring
* Members of a species may be reproductively isolated in separate populations
* Species have either an autotrophic or heterotrophic method of nutrition (a few species have both methods)
* Consumers are heterotrophs that feed on living organisms by ingestion
* Detrivores are heterotrophs that obtain organic nutrients from detritus by internal digestion
* Saprotrophs are heterotrophs that obtain organic nutrients from dead organisms by external digestion
* A community is formed by populations of different species living together and interacting with each other
* A community forms an ecosystem by its interactions with the abiotic environment
* Autotrophs obtain inorganic nutrients from the abiotic environment
* The supply of inorganic nutrients is maintained by nutrient recycling
* Ecosystems have the potential to be sustainable over long periods of time

**Skills**

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| Classifying species as autotrophs, consumers, detrivores or saprotrophs from a knowledge of their mode of nutrition |
| Setting up sealed mecocosms to try to establish sustainability |
| Testing for association between two species using the chi-squared test with data obtained from quadrat sampling |
| Recognizing and interpreting statistical significance |

**NOS**

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| Looking for patterns, trends and discrepancies- plants and algae are mostly autotrophic but some are not ( 3.1) |

**4.2 Energy Flow - Understandings:**

* Most ecosystems rely on a supply of energy from sunlight
* Light energy is converted to chemical energy in carbon compounds by photosynthesis
* Chemical energy in carbon compounds flows through food chains by means of feeding
* Energy released from carbon compounds by respiration is used in living organisms and converted to heat
* Living organisms cannot convert heat to other forms of energy
* Heat is lost from ecosystems
* Energy losses between trophic levels restrict the length of food chains and the biomass of higher trophic levels

**Skills**

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| Quantitative representations of energy flow using pyramids of energy |

**NOS**

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| Use theories to explain natural phenomena- the concepts of energy flow explains the limited length of food chains |

**4.3 Carbon cycling - Understandings:**

* Autotrophs convert carbon dioxide into carbohydrates and other carbon compounds
* In aquatic ecosystems carbon is present as dissolved carbon dioxide and hydrogen carbonate ions
* Carbon dioxide diffuses from the atmosphere or water into autotrophs
* Carbon dioxide is produced by respiration and diffuse out of organisms into water or the atmosphere
* Methane is produced from organic matter in anaerobic conditions by methanogenic archaeans and some diffuses into the atmosphere or accumulates in the ground
* Methane is oxidized to carbon dioxide and water in the atmosphere
* Peat forms when organic matter is not fully decomposed because of acidic and/or anaerobic conditions in waterlogged soils
* Partially decomposed organic matter from past geological eras was converted either into coal or into oil and gase that accumulate in porous rocks
* Carbon dioxide is produced by combustion of biomass and fossilized organic matter
* Animals such as reef-building corals and Mollusca have hard parts that are composed of calcium carbonate and can become fossilized in limestone

**Applications**

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| Estimation of carbon fluxes due to processes in the carbon cycle |
| Analysis of data from air monitoring stations to explain annual fluctuations |

**Skills**

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| Construct a diagram of the carbon cycle |

**NOS**

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| Making accurate, quantitative measurements-it is important to obtain reliable data on the concentrations of carbon dioxide and methane in the atmosphere |

**4.4 Climate Change - Understandings:**

* Carbon dioxide and water vapour are the most sifnificant greenhouse gases
* Other gases including methane and nitrogen oxides have less impact
* The impact of a gas depends on its ability to absorb long wave radiation as well as on its concentration in the atmosphere
* The warmed Earth emits longer wavelength radiation (heat).
* Longer wave radiation is absorbed by greenhouse gases that retain the heat in the atmosphere
* Global temperatures and climate patterns are influenced by concentrations of greenhouse gases
* There is a correlation between rising atmospheric concentrations of carbon dioxide since the start of the industrial revolution 200 years ago and average global temperatures
* Recent increases in atmospheric carbon dioxide are largely due to increases in the combustion of fossilized organic matter

**Applications**

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| Threats to coral reefs from increasing concentrations of dissolved carbon dioxide |
| Correlations between global temperatures and carbon dioxide concentrations on Earth |
| Evaluating claims that human activities are not causing climate change |

**NOS**

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| Assessing claims- assessment of the claims that human activities are producing climate change (5.2) |