BIG IDEAS

Complex roles and relationships contribute to **diversity of ecosystems**.	**Changing ecosystems** are maintained by natural processes.	Human practices affect the **sustainability of ecosystems**.	Humans can play a role in **stewardship and restoration** of ecosystems.

Learning Standards

Curricular Competencies	Content
Students are expected to be able to do the following: **Questioning and predicting** • Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest • Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world • Formulate multiple hypotheses and predict multiple outcomes **Planning and conducting** • Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative) • Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods • Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data • Apply the concepts of accuracy and precision to experimental procedures and data: – significant figures – uncertainty – scientific notation **Processing and analyzing data and information** • Experience and interpret the local environment	*Students are expected to know the following:* • abiotic characteristics: – **aquatic** – **atmospheric** – **edaphic** • **levels** of biotic diversity • ecosystem complexity: – **roles** – **relationships** – **population dynamics** • **energy flow** through ecosystems • **matter cycles** through and between living systems • **succession** • **First Peoples knowledge and other traditional ecological knowledge** in sustaining biodiversity • benefits of **ecosystem services** • **human actions** and their impact on ecosystem integrity • **First Peoples ways of knowing and doing** • resource **stewardship** • **restoration practices**

Learning Standards (continued)

Curricular Competencies	Content
• Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information • Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies • Construct, analyze, and interpret graphs, models, and/or diagrams • Use knowledge of scientific concepts to draw conclusions that are consistent with evidence • Analyze cause-and-effect relationships **Evaluating** • Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions • Describe specific ways to improve their investigation methods and the quality of their data • Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled • Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and in primary and secondary sources • Consider the changes in knowledge over time as tools and technologies have developed • Connect scientific explorations to careers in science • Exercise a healthy, informed skepticism and use scientific knowledge and findings to form their own investigations to evaluate claims in primary and secondary sources • Consider social, ethical, and environmental implications of the findings from their own and others' investigations • Critically analyze the validity of information in primary and secondary sources and evaluate the approaches used to solve problems • Assess risks in the context of personal safety and social responsibility	

Learning Standards (continued)

Curricular Competencies	Content
Applying and innovating • Contribute to care for self, others, community, and world through individual or collaborative approaches • Co-operatively design projects with local and/or global connections and applications • Contribute to finding solutions to problems at a local and/or global level through inquiry • Implement multiple strategies to solve problems in real-life, applied, and conceptual situations • Consider the role of scientists in innovation **Communicating** • Formulate physical or mental theoretical models to describe a phenomenon • Communicate scientific ideas and information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations • Express and reflect on a variety of experiences, perspectives, and worldviews through **place**	

Big Ideas – Elaborations

- **diversity of ecosystems:**
  Sample questions to support inquiry with students:
  - What are the roles and relationships in a local ecosystem?
  - How do some of the roles and relationships in ecosystems contribute to biodiversity?
  - Why is diversity an important feature of sustainable ecosystems?
- **Changing ecosystems:**
  Sample questions to support inquiry with students:
  - How does energy drive ecological processes?
  - How has an ecosystem in your local area changed over time?
  - How do energy and matter move through an ecosystem?
- **sustainability of ecosystems:**
  Sample questions to support inquiry with students:
  - How do human actions affect the sustainability of an ecosystem? How do your actions affect the sustainability of your local ecosystem?
  - How do First Peoples traditional practices contribute to dynamic equilibrium in an ecosystem?
  - How do healthy ecosystems influence the well-being of humans?
- **stewardship and restoration:**
  Sample questions to support inquiry with students:
  - How do First Peoples perspectives and knowledge inform sustainable practices?
  - How could you become involved in a local stewardship project?

SCIENCE – Environmental Science
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Curricular Competencies – Elaborations

- **Questioning and predicting:**
  Sample opportunities to support student inquiry:
  - What is the level of biodiversity within a local stream?
  - What type of human activities has an ecosystem in your local area sustained over the years?
  - Which of your actions and decisions do you think influence your ecological footprint?
  - How detrimental are invasive plants in your local ecosystem?

- **Planning and conducting:**
  Sample opportunities to support student inquiry:
  - How can we measure the level of biodiversity within a local stream?
  - How would you gather data about the human activities that have shaped your local environment?
  - What tools and technologies can you use to determine your local ecological footprint?
  - How would you gather data on the population size and distribution of an invasive species and native species?
- **Processing and analyzing data and information:**
  Sample opportunities to support student inquiry:
  - What is the relationship between water quality and biodiversity within a local stream?
  - What is your ecological footprint?
  - How would you interpret your findings about your ecological footprint? Could local people provide you with additional perspectives on this matter?
  - What ecosystem models can you formulate to explain your findings on invasive and native species populations?
- **Evaluating:**
  Sample opportunities to support student inquiry:
  - What other factors, besides biodiversity, can be considered to determine the overall health of a local stream?
  - What are the implications of your findings about your ecological footprint? Does traditional ecological knowledge (TEK) align with them?
  - How has your ecological footprint affected an ecosystem in your local area?
  - What assumptions can you make in formulating an ecosystem model?
- **Applying and innovating:**
  Sample opportunities to support student inquiry:
  - What kind of changes can be made to improve the biodiversity of a local stream?
  - How can traditional ecological knowledge (TEK) inform future sustainable practices in your local area?
  - How can you both directly and indirectly reduce your family's ecological footprint?
  - How can you engage in a local ecosystem restoration project?
- **Communicating:**
  Sample opportunities to support student inquiry:
  - How can your findings be used to advocate for the importance of the biodiversity of a local stream?
  - How can you share your findings about your ecological footprint with local community groups?
  - How might you motivate others to reduce their ecological footprint?
  - How can you share with others what you have learned from your experience with a local ecosystem restoration project?
- **place:** Place is any environment, locality, or context with which people interact to learn, create memory, reflect on history, connect with culture, and establish identity. The connection between people and place is foundational to First Peoples perspectives.

Content – Elaborations

- **aquatic:** pH, flow, dissolved oxygen, turbidity, salinity
- **atmospheric:** sunlight, wind, temperature, pressure
- **edaphic:**
  - soils (e.g., pH, mineral content, water content, temperature, acidity, aeration, nutrients, humus)
  - topography (e.g., altitude, slope, exposure, mountain chains, valleys, plains)
- **levels:** ecosystem, species, genetic
- **roles:** niche, autotrophs, heterotrophs, producers, consumers, decomposers, scavengers, keystone species
- **relationships:**
  - between organisms (e.g., predator/prey, competition, pollination, symbiosis, mutualism, parasitism, commensalism, mimicry)
  - interactions between biotic and abiotic
- **population dynamics:** cyclic fluctuations, birth rate, fertility rate, carrying capacity
- **energy flow:** food chains, food webs, photosynthesis, respiration, trophic levels, productivity, pyramids of energy and biomass
- **matter cycles:** water, nitrogen, carbon, phosphorus
- **succession:** primary and secondary
- **First Peoples knowledge and other traditional ecological knowledge:** agriculture, ethnobotany, forestry, fisheries, mining, energy, controlled burning, harvesting cycles
- **ecosystem services:** water purification, pollination, climate regulation, medicines, food production, waste management
- **human actions:** harvesting, resource extraction and consumption, population growth, urbanization, habitat loss and fragmentation, climate change, pollution, introduced species, invasive species, forest fires
- **First Peoples ways of knowing and doing:** prescribed fire, selective harvesting, plant propagation and pruning, clam gardens
- **stewardship:** sustainable use of, and care for, local resources (e.g., school garden, shoreline cleanup, citizen science projects)
- **restoration practices:** the process of renewing and recovering a degraded, damaged, or destroyed ecosystem (e.g., riparian zone recovery, invasive species removal, native species planting, ecological engineering, dam removal, hatcheries, wildlife, forestry and fisheries management)