

## WATER AND AQUATIC ECOSYSTEMS

Major Topics	Code	Manitoba Envirothon Outcomes
Water and Aquatic Ecosystems as Resources	A1	Describe the ecological, economic and social benefits of aquatic ecosystems and riparian zones.
	A2	Describe the ecological functions of riparian zones.
	A3	Describe the different types of aquatic ecosystems.
	A4	Describe the different types of aquifers.
	A5	Explain how each type of aquifer relates to water quality and quantity.
	A6	Describe historical trends in groundwater use, quantity and quality on the Canadian prairies.
	A7	Describe factors affecting water quality and quantity, and aquatic ecosystems, including biodiversity, non-native species, habitat reduction, climate change, pollution, and human activity.
Properties of Water, Water Bodies and Watersheds	A8	Describe the physical and chemical properties of water.
	A9	Explain how physical and chemical properties of water affect aquatic ecosystems.
	A10	Describe the water cycle including the processes and phases of water involved.
	A11	Explain the relationship between climate and water.
	A12	Describe the physical, chemical and biological properties of different types of aquatic ecosystems.
	A13	Name the zones of a lake.
	A14	Describe zones and structure of a lake.
	A15	Describe a riparian zone.
	A16	Explain how a riparian zone affects the physical, chemical and biological properties of the adjacent water body.
	A17	Describe a watershed, including its components.
	A18	Delineate the boundary of a watershed on a topographic map.

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	A19	Describe features of healthy and unhealthy watersheds.
	A20	List common solutes and particulates found in water bodies.
	A21	Describe how watershed geography and land use practices influence common solutes and particulates in surface and ground waters.
	A22	Explain how common solutes and particulates affect water quality and aquatic ecosystems
	A23	Differentiate between point and non-point source pollution.
	A24	Predict the general water quality of a specific body of water based on information about nearby sources of pollution.
	A25	Describe how to perform physical, chemical and biological water quality tests, including sampling techniques and equipment used.
	A26	Interpret results of physical, chemical and biological water quality tests.
	A27	Calculate parameters related to flowing water, including velocity, volume and rate of flow.
Aquatic Ecology	A28	Describe the nitrogen cycle, phosphorus cycle, and carbon cycle in aquatic ecosystems.
	A29	Describe an aquatic food web, including interactions between organisms and energy flow within the web.
	A30	Give examples of aquatic organisms at different trophic levels.
	A31	Explain why biodiversity is important in aquatic ecosystems.
	A32	Discuss the roles that groups of aquatic species play in the ecosystem.
	A33	Describe relationships of organisms within an aquatic ecosystem, including predation, competition and different types of symbiosis.
	A34	Describe the preferred habitats of different types of aquatic species.
	A35	Identify native and non-native aquatic species using keys, including plants, invertebrates and fish.
	A36	Identify external and internal features of fish anatomy.
	A37	Explain how features of fish anatomy relate to age and sex.

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	A38	Explain the concept of carrying capacity within an aquatic ecosystem.
	A39	Explain how aquatic ecosystems are affected by climate change, non-native species, pollution and human activity.
	A40	Name aquatic species and ecosystems that are at risk.
	A41	List factors contributing to the status of at risk aquatic species and ecosystems.
	A42	Give examples of invasive aquatic species in Manitoba.
	A43	List characteristics of invasive species that contribute to their success over native species.
Conservation and Management of Water and Aquatic Ecosystems	A44	Explain why it is important to conserve and manage water and other aquatic resources.
	A45	Describe different methods of conserving water.
	A46	Discuss the relationship between sustainable development and aquatic ecosystems.
	A47	Discuss the interaction of competing uses of water, including industry, hydropower, irrigation, agriculture, transportation, navigation, recreation/sport, wildlife and fisheries.
	A48	Discuss the impact of competing water uses on the ability of an ecosystem to sustain wildlife, forestry, fisheries and other human needs.
	A49	Describe pressures on fish populations.
	A50	Explain the importance of fishery management.
	A51	Use the Manitoba Angler's Guide to determine provincial fishing regulations
	A52	Describe how Geographic Information Systems (GIS) are used in the management of water resources.
	A53	Describe how to perform a riparian health assessment.
	A54	Interpret the results of a riparian health assessment to determine what needs improvement for a riparian area to function optimally.
	A55	Describe role of physical, chemical and biological tests in assessing and managing aquatic ecosystems.

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	A56	Use results of physical, chemical and biological tests to assess water quality and make recommendations to improve aquatic ecosystem health.
	A57	Propose management decisions to address the conflicts between competing water uses.
	A58	Propose management decisions that would improve and protect water quality in in the face of various environmental stresses.
	A59	Name government agencies responsible for overseeing water resources.
	A60	Describe laws and other methods used to protect water quality, aquatic ecosystems and fisheries from pollution, non-native species and other human impacts.

## NATIVE PLANTS AND FORESTRY

Major Topics	Code	Manitoba Envirothon Outcomes
Trees and Forests as Resources	F1	Describe the ecological, economic and social benefits of trees and forests.
	F2	List products provided by trees and forests.
	F3	Differentiate between timber and non-timber products.
	F4	Describe the ecosystem services provided by trees and forests.
	F5	Describe factors affecting health and survival of trees and forests, including biodiversity, non-native species, habitat reduction, pollution, climate change, fire and human activity.
Plant Biology and Identification	F6	Name the parts and tissues of a plant.
	F7	State the function of parts and tissues of a plant.
	F8	Describe the annual growth cycle of a tree.
	F9	Describe the processes of photosynthesis and respiration.
	F10	Explain how photosynthesis and respiration are important to the growth and reproduction of plants.
	F11	Identify the common trees and shrubs of Manitoba by common name without a key.

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	F12	Use a key or identification guide to identify other trees and shrubs by scientific and common names.
	F13	Identify distinctive indicator plant species using a key.
	F14	Identify distinctive at risk plant species without a key.
	F15	Give examples of how native plants have been used traditionally.
	F16	Name Manitoba's provincial tree.
Forest and Grassland Ecology	F17	Describe typical forest structure, including canopy, understory and ground layers, and crown classes.
	F18	Describe concepts related to forest ecology, including soil, forest types, tree communities, biodiversity, competition, succession, forest fire, regeneration, snag, climate change and riparian zone.
	F19	Discuss relationships between those concepts.
	F20	Explain the importance of those concepts to ecosystem health.
	F21	List abiotic and biotic factors in a forest ecosystem.
	F22	Explain how abiotic and biotic factors affect forests, including climate, insects, microorganisms and wildlife.
	F23	Give examples of how trees have evolved or adapted to their environments, including boggy soil, steep slopes, rocky terrain and extreme climate.
	F24	List the eco-regions of Manitoba.
	F25	Describe the eco-regions of Manitoba including their geographical location.
	F26	Name the dominant tree species and key indicator species associated with each eco-region.
	F27	Name plant species that are endangered or at risk in Manitoba.
Silviculture and Forest Management	F28	Describe silviculture practices for planting, tending and harvesting.
	F29	Explain how silviculture practices are used, including tree improvement, seedling production, weeding, herbiciding, thinning, burning, even-aged and uneven-aged stands, selection, clearcutting, seed-tree and shelter wood.

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	F30	Identify basic forestry tools, including calipers, increment borer, clinometers, prism, compass, diameter tape and tables.
	F31	Describe how to use basic forestry tools.
	F32	Measure dimensions of trees, including DBH and height.
	F33	Determine tree volume and board feet using tables.
	F34	Determine tree age from a tree cookie or core.
	F35	Describe the status of forestry in Manitoba and Canada.
	F36	Describe threats to forest resources in Manitoba and Canada.
	F37	Describe how forest management and health affect biodiversity, habitat reduction, air quality, climate change, fire and aesthetics.
	F38	Discuss the relationship between sustainable development and forest management.
	F39	Describe sustainable forestry management.
	F40	Describe Best Management Practices (BMPs) for forestry, including those for water quality, fire and aesthetics.
	F41	Determine general goals and practices for a particular forestry situation based on principles and methods of sustainable forest management.
	F42	Give examples of Traditional Ecological Knowledge (TEK).
	F43	Explain the role TEK plays in sustainable forest management.
	F44	Describe the uses of forest surveys, including silviculture surveys, inventories, wood supply analysis and pre-harvest surveys.
	F45	Describe methods and procedures used in a forest survey, including PSPs/ TSPs, GIS/GPS, mapping and sampling.
	F46	Describe forest certification including its components.
	F47	Name the forest certification systems in use in North America, including CSA, FSC, and SFI.
	F48	Explain why certification of sustainable management forests is important to Canada's forest industry.

## SOILS AND LAND USE

Major Topics	Code	Manitoba Envirothon Outcomes
Soil as a Resource	S1	Describe the ecological, economic and social benefits of soil.
	S2	Explain why soil is a dynamic and limited resource.
	S3	Describe the five soil forming factors.
	S4	Explain how these factors affect soil properties.
	S5	Describe the different types, origins and deposition of soil parent material.
	S6	Name common parent materials in Manitoba.
	S7	Describe the four basic soil forming processes (additions, losses, translocations, and transformations).
	S8	Describe factors affecting the health and fertility of soil, including biodiversity, non-native species, pollution, climate change and human activity.
Properties of Soil and Soil Profiles	S9	Describe physical and chemical properties of soil, including texture, color, structure, CEC, pH, porosity, density.
	S10	Perform tests and calculations to determine physical and chemical properties of soil, including texture, porosity and density.
	S11	Relate soil properties to soil limitations.
	S12	Identify features of a soil profile.
	S13	Define soil profile symbols.
	S14	Determine soil characteristics and limitations from a soil profile, including fertility, water movement, permeability, carbonates).
	S15	Identify soil to sub-group using Canadian System of Soil Classification.
	S16	Describe the major soil orders found in Manitoba including their geographic and ecosystem distribution.
	S17	Describe how water moves into and through soil and into plants.
	S18	Explain how soil properties affect availability of water to plants.

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	S19	Describe different types of soil water including their availability to plants.
Soil Ecology and Soil Fertility	S20	Describe the soil portion of the water, carbon and nutrient cycles.
	S21	Explain how these cycles affect soil management.
	S22	Explain why biological diversity is important for soil, plant, environmental and human health.
	S23	Give examples of beneficial soil organisms.
	S24	Explain how the soil ecosystem affects and is affected by soil management.
	S25	List essential plant nutrients.
	S26	Describe how nutrients are held in soil.
	S27	Explain how soil fertility depends on the physical, chemical and biological state of the soil.
	S28	Explain how soil fertility relates to soil properties and limitations.
	S29	Explain how soil properties and limitations affect fertilizer use.
	S30	Describe the procedure for taking a soil sample and conducting nutrient analysis.
Soil Conservation and Management, Soil Surveys and Land Use	S31	Discuss the relationship between sustainable development and soil conservation.
	S32	Describe different types of soil degradation, including erosion, salinity and compaction.
	S33	Explain how soil properties and other factors affect erosion, salinity and compaction.
	S34	Describe methods to prevent or reduce soil degradation.
	S35	Describe how agriculture is affected by climate change.
	S36	Compare the impact of different soil conservation practices and land uses on soil health, climate change and sustainability.
	S37	Explain why soil management is important to agriculture, water quality and climate change.
	S38	Describe how Global Information Systems (GIS) are used by agricultural and resource managers for soil management and environmental protection.



Major Topics	Code	Manitoba Envirothon Outcomes
	S39	Determine the best land use for a particular parcel of land based on soil knowledge and data.
	S40	Locate information in published and on-line soil data, including soil survey reports, soil capability maps and ortho photos.
	S41	Interpret data from such sources.
	S42	Explain the section-township-range system.
	S43	Describe the role of government in soil management.

## WILDLIFE AND WILDLIFE MANAGEMENT

Major Topic	Code	Manitoba Envirothon Outcomes
Wildlife as a Resource	W1	Describe the ecological, economic and social benefits of wildlife.
	W2	Explain the importance of the three components of biodiversity to wildlife and to humans.
	W3	Describe factors affecting wildlife and wildlife habitat, including biodiversity, non-native species, habitat loss, pollution, climate change and human activity.
Animal Biology and Identification	W4	Identify basic features of external and internal anatomy of birds and mammals.
	W5	List the components of the main organ systems of animals.
	W6	Describe the functions of the main organ systems of animals.
	W7	Give examples of anatomical, physiological and/or behavioral adaptations of common wildlife.
	W8	Determine an animal's general diet, habitat, and daily activity pattern from its gross anatomy.
	W9	Differentiate between pathogens and parasites.
	W10	Give examples of pathogens and parasites found in Manitoba wildlife.
	W11	Describe key characteristics of common phyla.

	W12	Determine major mammal and bird groups from skulls without a key.
	W13	Identify common wildlife species using a field guide or key from specimens, dental formulae, pictures, decoys, scats or tracks.
	W14	Identify common mammal, bird and herp species from recordings of animal sounds without a key.
	W15	Determine dental formula from skull.
	W16	Identify common invasive species present or anticipated in Manitoba.
Wildlife Ecology	W17	Describe the five main habitat needs of all wildlife.
	W18	Describe the specific needs and preferred habitat of common wildlife species in Manitoba.
	W19	Explain how abiotic and biotic factors affect an animal's ability to obtain resources.
	W20	Explain how specific adaptations contribute to the survival of wildlife species.
	W21	Describe a food web, including interactions between organisms and energy flow in the web.
	W22	Give examples of wildlife species at different trophic levels.
	W23	Describe the role of a particular species in the ecosystem.
	W24	Describe relationships of organisms in an ecosystem, including predation, competition and different types of symbiosis.
	W25	Give examples of types of symbiosis.
	W26	Differentiate between an ecosystem, a community and a population.
	W27	Explain how carrying capacity affects wildlife populations.
	W28	Give examples of limiting factors for wildlife populations.
	W29	Describe how birth, mortality, age structure, sex ratio, and mating systems affect wildlife populations.
	W30	Name wildlife species that are at risk in Manitoba and Canada.
	W31	List factors that contribute to the status of species at risk.
	W32	Describe common characteristics of at risk species that contribute to their status.

	W33	Name common invasive species present or anticipated in Manitoba.
	W34	Explain how non-native plant and animal species can affect wildlife and wildlife habitat.
	W35	Describe common characteristics of invasive species that contribute to their success over native species.
	W36	Describe the impact of succession on ecosystems.
Conservation and Management of Wildlife	W37	Explain the importance of wildlife management in addressing factors that affect wildlife and wildlife habitat, including biodiversity, non-native species, habitat loss, pollution, climate change and human activity.
	W38	Describe the relationship between sustainable development and wildlife management.
	W39	Describe role of government and wildlife managers in conserving and managing wildlife and wildlife habitat, including planning, regulation, education and enforcement.
	W40	Describe information and approaches that wildlife managers use to create management goals.
	W41	Describe common practices and methods for managing wildlife and wildlife habitat, including population control, hunting and trapping regulations and habitat restoration.
	W42	Evaluate habitats for a particular species according to its specific requirements.
	W43	Describe strategies used to manage issues involving wildlife in Manitoba, including non-native species, problem wildlife, wildlife pathogens and disease, and species at risk.
	W44	Differentiate between problem wildlife and invasive species.
	W45	Give examples of species that are considered problem wildlife.
	W46	Name organizations and agencies responsible for listing and protecting species at risk at the provincial, federal and international level.
	W47	Describe the role of laws in conserving species at risk.
	W48	Explain how the IUCN Red List of Threatened Species is used.
	W49	Differentiate between the main categories for species at risk.
	W50	Describe common research methods used by wildlife biologists, including population monitoring, diet reconstruction and ethology.

	W51	Determine appropriate method for a particular research study.
	W52	Describe how to perform research methods used by wildlife biologists, including sampling methods and field journals.
	W53	Calculate populations using quadratic sampling and mark recapture.