MANITOBA ENVIROTHON
WATER AND AQUATIC ECOSYSTEMS

Outcome Cluster	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	Describe historical trends in groundwater use, quantity and quality on the Canadian prairies.
	A6	Describe factors affecting water, and aquatic ecosystems, including biodiversity, non-native species, habitat reduction, pollution, climate change, and human activity.
Properties of Water, Water Bodies and Watersheds, and Aquatic Species Identification	A7	Describe the physical and chemical properties of water.
	A8	Describe the physical, chemical and biological properties of different types of aquatic ecosystems.
	A9	Explain how aquifer type relates to water quality and quantity.
	A10	Explain how physical and chemical properties of water affect aquatic ecosystems.
	A11	Describe the water cycle including the processes and phases of water involved.
	A12	Explain the relationship between climate and water.
	A13	Name the zones of a lake.
	A14	Describe the zones and structure of a lake.
	A15	Explain how a riparian zone affects the physical, chemical and biological properties of the adjacent water body.
	A16	Delineate the boundary of a watershed on a topographic map.
	A17	Describe features of healthy and unhealthy watersheds.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	A18	List common solutes and particulates found in water bodies.
	A19	Describe how watershed geography and land use practices influence common solutes and particulates in surface and ground waters.
	A20	Explain how common solutes and particulates affect water quality and aquatic ecosystems.
	A21	Predict the general water quality of a specific body of water based on information about nearby sources of pollution.
	A22	Identify basic features of external and internal anatomy of fish.
	A23	Determine age and sex of a fish from features of its anatomy.
	A24	Name Manitoba's provincial fish.
	A25	Identify native and non-native aquatic species including plants, invertebrates and fish using a key.
	A26	Identify common aquatic invasive species present or anticipated in Manitoba.
Aquatic Ecology	A27	Describe the nitrogen cycle, phosphorus cycle, and carbon cycle in aquatic ecosystems.
	A28	Describe an aquatic food web, including interactions between organisms and energy flow in the web.
	A29	Give examples of aquatic organisms at different trophic levels.
	A30	Discuss the roles that groups of aquatic species play in the ecosystem.
	A31	Describe relationships of organisms within an aquatic ecosystem, including predation, competition and different types of symbiosis.
	A32	Explain why biodiversity is important in aquatic ecosystems.
	A33	Describe the preferred habitats of different types of aquatic species.
	A34	Explain the concept of carrying capacity within an aquatic ecosystem.
	A35	Name aquatic species and ecosystems that are at risk.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	A36	List factors that contribute to the status of aquatic species and ecosystems at risk.
	A37	Give examples of invasive aquatic species present or anticipated in Manitoba.
	A38	Describe characteristics of invasive species that contribute to their success over native species.
Conservation and Management of Water and Aquatic Ecosystems	A39	Discuss the relationship between sustainable development and management of aquatic ecosystems.
	A40	Explain why management of water, fisheries and other aquatic resources is important in addressing issues such as conservation of biodiversity, non-native species habitat reduction, pollution, climate change and human activity.
	A41	Name government agencies responsible for overseeing water resources.
	A42	Describe laws and other methods used to protect water quality, aquatic ecosystems and fisheries from pollution, non-native species and other human impacts.
	A43	Discuss the interaction of competing uses of water, including industry, hydropower, irrigation, agriculture, transportation, navigation, recreation/sport, wildlife and fisheries.
	A44	Discuss the impact of competing water uses on the ability of an ecosystem to sustain wildlife, forestry, fisheries and other human needs.
	A45	Describe pressures on fish populations in Manitoba.
	A46	Describe different methods of conserving water.
	A47	Describe role of physical, chemical and biological tests in assessing and managing aquatic ecosystems.
	A48	Describe how to manage a riparian zone for ecosystem health.
	A49	Propose management decisions to address the conflicts between competing water uses.
	A50	Propose management decisions that would improve and protect water quality in the face of various environmental stresses.
	A51	Use results of physical, chemical and biological tests to assess water quality and make recommendations to improve aquatic ecosystem health.
	A52	Describe how to perform physical, chemical and biological water quality tests, including sampling techniques and equipment used.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	A53	Calculate parameters related to flowing water, including velocity, volume and rate of flow.
	A54	Interpret results of physical, chemical and biological water quality tests.
	A55	Describe how Geographic Information Systems (GIS) are used in the management of water resources.

MANITOBA ENVIROTHON
NATIVE PLANTS AND FORESTRY

Outcome Cluster	Code	Manitoba Envirothon Outcomes
Native Plants and Forests as Resources	F1	Describe the ecological, economic and social benefits of native plants, horticultural trees and forests.
	F2	Describe the ecosystem services provided by native plants, horticultural trees and forests
	F3	List timber and non-timber products provided by trees and forests.
	F4	Give examples of how native plants have been used traditionally.
	F5	Describe factors affecting health and survival of native plants, horticultural trees and forests, including biodiversity, non-native species, habitat reduction, pollution, climate change, fire and human activity.
Plant Biology and Plant Identification	F6	Describe the annual growth cycle of a tree.
	F7	Explain how photosynthesis and respiration are important to the growth and reproduction of plants.
	F8	Name the structures and tissues of plants.
	F9	Describe the functions of parts and tissues of plants.
	F10	Give examples of adaptions of plants to their environments, including boggy soil, steep slopes, rocky terrain and extreme climate.
	F11	Identify the common trees and shrubs of Manitoba by common name without a key.
	F12	Name Manitoba's provincial tree and flower.
	F13	Identify other trees and shrubs by scientific and common names using a key or field guide.
	F14	Identify distinctive indicator plant species using a key.
	F15	Identify distinctive plant species at risk without a key.
	F16	Identify common invasive forest pests present or anticipated in Manitoba

Outcome Cluster	Code	Manitoba Envirothon Outcomes
Forest Ecology	F17	Describe typical forest structure, including canopy, understory and ground layers, and crown classes.
	F18	Discuss the relationship between soil and forest type.
	F19	Describe the effects of succession in forest ecosystems.
	F20	Discuss the role of fire in forest ecosystems.
	F21	Explain why snags and fallen trees are important to forest ecosystems.
	F22	Describe the effect of competition in forest ecosystems.
	F23	Recognize indicators of health and age in a forest.
	F24	Explain why biodiversity in forest ecosystems is important to forest health.
	F25	List abiotic and biotic factors in a forest ecosystem.
	F26	Explain how abiotic and biotic factors including climate, insects, microorganisms and wildlife affect forests,
	F27	List the eco-regions of Manitoba.
	F28	Describe the eco-regions of Manitoba including their geographical location.
	F29	Name the dominant tree species and key indicator species associated with each eco-region.
	F30	Name plant species that are at risk in Manitoba.
	F31	Give examples of invasive forest pests present or anticipated in Manitoba.
Silviculture and Forest Management	F32	Discuss the relationship between sustainable development and forest management.
	F33	Explain why forest management is important in addressing issues such as conservation of biodiversity, non-native species habitat reduction, pollution, climate change, fire and aesthetics.
	F34	Describe the role of government in forest management,
	F35	Describe forest certification including its components.
	F36	Name the forest certification systems in use in North America, including CSA, FSC, and SFI.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	F37	Explain why certification of sustainable management forests is important to Canada's forest industry.
	F38	Describe the status of forests and forestry in Manitoba and Canada.
	F39	Describe threats to forest resources in Manitoba and Canada.
	F40	Describe sustainable forestry management.
	F41	Give examples of Traditional Ecological Knowledge (TEK).
	F42	Explain the role TEK plays in sustainable forest management.
	F43	Describe BMPs (best/better management practices) for forestry, including those for riparian zones, water quality, fire and aesthetics.
	F44	Describe management practices used in urban forestry.
	F45	Describe the uses of forest surveys, including silviculture surveys, inventories, wood supply analysis and pre-harvest surveys.
	F46	Describe silviculture practices for planting, tending and harvesting.
	F47	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.
	F48	Describe practices for managing forest health including insect and disease control.
	F49	Determine general goals and practices for a particular forestry situation based on principles and methods of sustainable forest management.
	F50	Identify basic forestry tools, including calipers, increment borer, clinometers, prism, compass, diameter tape and tables.
	F51	Describe how to use basic forestry tools.
	F52	Measure dimensions of trees, including DBH and height.
	F53	Determine tree volume and board feet using tables.
	F54	Determine tree age from a tree cookie or core.
	F55	Describe methods and procedures used in a forest survey, including PSPs/TSPs, mapping and sampling.
	F56	Describe how Global Information Systems (GIS) are used in forest management.

MANITOBA ENVIROTHON
SOILS AND LAND USE

Outcome Cluster	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 different types, origins and deposition methods of soil parent material.
	S4	Name common parent materials in Manitoba.
	S5	Describe the five soil forming factors.
	S6	Describe the four basic soil forming processes (additions, losses, translocations, and transformations).
	S7	Describe factors affecting the health and fertility of soil, including biodiversity, non-native species, pollution, climate change and human activity.
Properties of Soil, Soil Profiles and Soil Identification	S8	Describe physical and chemical properties of soil, including texture, color, structure, CEC, pH, porosity, density.
	S9	Describe the physical, chemical and biological properties of the major soil orders found in Manitoba.
	S10	Explain how the five soil forming factors affect soil properties.
	S11	Relate soil properties to soil limitations.
	S12	Explain how soil properties and other factors affect erosion, salinity and compaction.
	S13	Identify features of a soil profile.
	S14	Define soil profile symbols.
	S15	Determine soil characteristics and limitations from a soil profile, including fertility, water movement, permeability, carbonates.
	S16	Describe how water moves into and through soil and into plants.
	S17	Explain how soil properties affect availability of water to plants.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	S18	Describe different types of soil water including their availability to plants.
	S19	Name Manitoba's provincial soil and its order.
	S20	Identify soil to sub-group using Canadian System of Soil Classification.
Soil Ecology and Fertility	S21	Describe the soil portion of the water, nitrogen, phosphorus and carbon cycles.
	S22	Explain how these cycles affect soil management.
	S23	Describe different types of soil degradation, including erosion, salinity and compaction.
	S24	Explain why biodiversity in the soil ecosystem is important for plant, environmental and human health.
	S25	Give examples of beneficial soil organisms.
	S26	Explain how the soil ecosystem affects and is affected by soil management.
	S27	List essential plant nutrients.
	S28	Describe how nutrients are held in soil.
	S29	Explain how soil fertility relates to the physical, chemical and biological state of the soil.
	S30	Explain how soil fertility relates to soil properties and limitations.
	S31	Explain how soil properties and limitations affect fertilizer use.
	S32	Indicate the geographic and ecosystem distribution of the major soil orders found in Manitoba.
Soil Conservation and Management, Soil Surveys and Land Use	S33	Discuss the relationship between sustainable development and soil management.
	S34	Explain why soil management is important to agriculture and in addressing issues such as conservation of biodiversity, non-native species, pollution and climate change.
	S35	Describe the role of government in soil management.
	S36	Describe how agriculture in Manitoba is affected by climate change.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	S37	Describe methods to prevent or reduce soil degradation.
	S38	Compare the impact of different soil conservation practices and land uses on soil health, climate change and sustainability.
	S39	Determine the best land use for a particular parcel of land based on soil knowledge and data.
	S40	Perform tests and calculations to determine physical and chemical properties of soil, including texture, porosity and density.
	S41	Describe the procedure for taking a soil sample and conducting nutrient analysis.
	S42	Describe how Global Information Systems (GIS) are used by agricultural and land use resource managers.
	S43	Explain the section-township-range system.
	S44	Locate information in a variety of sources of soil data, including soil survey reports, soil capability maps and ortho photos.
	S45	Interpret data from a variety of sources of soil data, including soil survey reports, soil capability maps and ortho photos.

MANITOBA ENVIROTHON
2016 THEME OUTCOMES
Invasive Species: A Challenge to the Environment, Economy and Society

Outcome Cluster	Code	Manitoba Envirothon Outcomes
What are invasive species	T1	Define invasive species.
	T2	Describe common characteristics of invasive species.
	T3	Explain how these common characteristics help invasive species successfully establish new populations.
	T4	Give examples of invasive species in Manitoba.
What are the impacts of invasive species	T5	Describe the environmental, economic and social impacts of invasive species.
	T6	Give examples of how invasive species affect biodiversity.
	T7	Explain the impacts of invasive species on aquatic, forest, and soil ecosystems in Manitoba.
	T8	Explain the impacts of invasive species on wildlife in Manitoba.
	T9	Explain how ecological impacts vary depending on the invasive species.
How are invasive species spread	T10	Describe how invasive species become established.
	T11	Describe multiple pathways by which invasive species can be introduced.
What is the invasive species management cycle	T12	List the stages of an invasive species management cycle.
	T13	Describe each stage of an invasive species management cycle.
	T14	Describe methods to reduce the movement of invasive species into new ecosystems.
	T15	Describe various methods of controlling invasive species after they are introduced.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	T16	Describe the development of an invasive species management plan.
	T17	Describe the various costs associated with controlling an invasive species.
Who is responsible for managing invasive species	T18	Describe the roles of government and other organizations in managing invasive species.
	T19	Give examples of policies and legislation used in the prevention, detection, monitoring, and control of invasive species.
	T20	Discuss the role of non-government organizations and citizens in managing invasive species.
What are the tools for managing invasive species	T21	Discuss techniques for detecting and monitoring invasive species.
	T22	Explain how the risk posed by an invasive species is assessed.
	T23	Discuss the importance of environmentally ethical behaviors and sound decision-making.
	T24	Discuss the pros and cons of various forms of outreach and education used to reduce the spread of invasive species.

MANITOBA ENVIROTHON
WILDLIFE AND WILDLIFE MANAGEMENT

Outcome Cluster	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 reduction, pollution, climate change and human activity.
Animal Biology and Animal 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	Determine dental formula from a skull.
	W10	Determine major mammal and bird groups from skulls without a key.
	W11	Identify common mammal, bird and herp species from recordings of animal sounds without a key.
	W12	Name Manitoba's provincial mammal and bird.
	W13	Identify common bird, mammal and herp species using a field guide or key from specimens, dental formulae, pictures, decoys, scats or tracks.
	W14	Describe key characteristics of common animal phyla.
	W15	Identify common invasive species that affect wildlife present or anticipated in Manitoba.
Wildlife Ecology	W16	Describe the impact of succession on wildlife.
	W17	Describe a food web, including interactions between organisms and energy flow in the web.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	W18	Give examples of wildlife species at different trophic levels.
	W19	Describe the role of a particular species in the ecosystem.
	W20	Describe relationships of organisms in an ecosystem, including predation, competition and different types of symbiosis.
	W21	Give examples of types of symbiosis.
	W22	Give examples of pathogens and parasites found in Manitoba wildlife.
	W23	Explain how abiotic and biotic factors affect an animal's ability to obtain resources.
	W24	Explain how specific adaptations contribute to the survival of wildlife species.
	W25	Describe the five main habitat needs of all wildlife.
	W26	Describe the specific needs and preferred habitat of common wildlife species in Manitoba.
	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	Give examples of common invasive species that affect wildlife present or anticipated in Manitoba.
	W34	Describe characteristics of invasive species that contribute to their success over native species.
Conservation and Management of Wildlife	W35	Discuss the relationship between sustainable development and wildlife management.
	W36	Explain the importance of wildlife management in addressing issues such as conservation of biodiversity, non-native species, habitat reduction, pollution, climate change and human activity.

Outcome Cluster	Code	Manitoba Envirothon Outcomes
	W37	Describe role of government and wildlife managers in conserving and managing wildlife and wildlife habitat, including planning, regulation, education and enforcement.
	W38	Describe the role of laws in conserving species at risk.
	W39	Differentiate between the main categories for species at risk.
	W40	Name organizations and agencies responsible for listing and protecting species at risk at the provincial, federal and international level.
	W41	Explain how the IUCN Red List of Threatened Species is used.
	W42	Describe information and approaches that wildlife managers use to create management goals.
	W43	Describe common practices and methods for managing wildlife and wildlife habitat, including population control, hunting and trapping regulations and habitat restoration.
	W44	Describe strategies used to manage issues involving wildlife in Manitoba, including non-native species, problem wildlife, wildlife pathogens and disease, and species at risk.
	W45	Give examples of species that are considered problem wildlife.
	W46	Evaluate habitats for a particular species according to its specific requirements.
	W47	Calculate populations using quadratic sampling and mark recapture.
	W48	Describe common research methods used by wildlife biologists, including population monitoring, diet reconstruction and ethology.
	W49	Describe how Global Information Systems (GIS) are used in wildlife management.
	W50	Describe how to perform research methods used by wildlife biologists, including sampling methods and field journals.
	W51	Determine appropriate method for a particular research study.