

AQUATIC ECOLOGY LEARNING OBJECTIVE	TERMS AND CONCEPTS	USEFUL RESOURCES (not an exhaustive list)
Describe the chemical and physical properties of water and explain their importance for freshwater and saltwater ecosystems	Bottom Substrate	http://ga.water.usgs.gov/edu/waterproperties.html http://earthguide.ucsd.edu/earthguide/diagrams/watercycle/index.html
Identify the processes and phases for each part of the water cycle	Hydrologic Cycle	http://www.ec.gc.ca/WATER/en/manage/effic/e_weff.htm http://www.ec.gc.ca/WATER/en/manage/poll/e_poll.htm
Discuss methods of conserving water and reducing point and non-point pollution		http://www.ec.gc.ca/WATER/en/info/pubs/FS/e_FSA4.htm http://www.statcan.gc.ca/pub/16-401-x/2008001/5006932-eng.htm
Analyse the interaction of competing uses of water (hydropower, navigation, wildlife, recreation, waste assimilation, irrigation, industry etc.) and propose solutions for wise use of the resource		http://www.aquatic.uoguelph.ca/habitat.htm http://atlas.nrcan.gc.ca/site/english/maps/environment/hydrology/watershed/1
Understand and describe the main components of aquatic habitats including fish (see below), plants and non-living elements (chemical and physical properties, geology)		http://ga.water.usgs.gov/edu/earthgwaquifer.html http://ga.water.usgs.gov/edu/watercycle.html http://www.env.gov.nl.ca/parks/rivers/ http://www.dfo-mpo.gc.ca/oceans/events-evenements/oceansday-journeesdesoceans/list-liste-eng.htm
Identify common aquatic organisms through the use of a key	Groundfish, pelagics, invertebrates, diadromous, marine mammals, freshwater species	http://www.dfo-mpo.gc.ca/zone/under-sous-eng.htm http://www.dfo-mpo.gc.ca/oceans/marineareas-zonesmarines/mpa-zpm/atlantic-atlantique/leadingtickles-eng.htm
Deliniate the watershed boundary for a small water body and describe how characteristics of the watershed would affect management approaches		http://www.env.gov.nl.ca/parks/wer/r_csme/ http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/policies-politique/index_e.asp
Explain the different types of aquifers and how each type relates to water quality and quantity		http://atlas.nrcan.gc.ca/site/english/learningresources/theme_modules/wetlands/index.html
Briefly describe the benefits of wetlands, both function and value	Bog, fen, marsh, swamp, pond	http://www.soil.ncsu.edu/publications/BMPs/buffers.html http://www.fao.org/fishery/topic/2880/en
Understand the purpose of a stream buffer	Riparian buffer	http://www.dfo-mpo.gc.ca/science/enviro/habitat-eng.htm
Describe how land use practices impact aquatic ecosystems		http://www.env.gov.nl.ca/Env/env/waterres/Policies/WQ-Standard-PhysicalChemical.asp
Describe the main commercial uses of aquatic/marine resources in NL	Aquaculture, Hydropower, fisheries (ocean, river), oil and gas, marine	http://www.dfo-mpo.gc.ca/species-especies/species/species_searchLocation_e.asp http://www.dfo-mpo.gc.ca/seal-phoque/faq_e.htm http://www.ec.gc.ca/soer-

	transportation etc.	ree/English/Indicator_series/new_issues.cfm?issue_id=6&tech_id=25#bio_pic
Know methods used to assess and manage aquatic environments and use water quality information to assess the general water quality of a given body of water	Sampling techniques, water quality parameters (physical, chemical, biological), point and non-point source pollution	http://www.ec.gc.ca/soer-ree/English/Indicator_series/new_issues.cfm?issue_id=7&tech_id=28#bio_pic
Understand why marine environments are important and describe methods to maintain or improve them.		http://www.ec.gc.ca/soer-ree/English/Indicator_series/new_issues.cfm?issue_id=3&tech_id=10#bio_pic
Be familiar with the laws and methods used to protect water quality (surface, ground) and aquatic environments and use this information to make management decisions to improve the quality of water or aquatic environment in a given situation		For a slide show on Stream buffers, try http://www.riparianbuffers.umd.edu/slide.html
Identify the main species of freshwater fish found in Newfoundland and be familiar with some aquatic species at risk on the island		For information on water quality testing, see the following links http://www.nrw.qld.gov.au/education/teachers/water/resources/sheet_08.pdf
Identify the main species of freshwater fish found in Labrador and be familiar with some aquatic species at risk in Labrador		http://www.nrw.qld.gov.au/education/teachers/water/resources/sheet_09.pdf
Understand and describe the life cycle of the main freshwater fish found in NL		http://www.nrw.qld.gov.au/education/teachers/water/resources/sheet_10.pdf
Understand basic fish anatomy and the importance of body shape, mouth shape, fins and gills	Mouth shape, barbells, fins (barbells, caudal, anal, pelvic, pectoral, dorsal), scales, gills, lateral line, swim bladder	

FORESTRY LEARNING OBJECTIVE	TERMS AND CONCEPTS	TOOLS	USEFUL RESOURCES (not an exhaustive list)
Identify the major forest regions of Canada			http://www.canadianforestry.com/html/forest/forest_regions_e.html
Identify the main tree species and forest types in Newfoundland and Labrador	Boreal Forests		http://www.sfmcanada.org/english/map.asp
Describe typical forest stand types	Softwood, Mixed wood, Hardwood		http://www.sfmcanada.org/english/bp_ecosystem.asp
What is forest ecology? What concepts, factors and relationships are important in forest ecology?	Tree communities, Regeneration, Competition, Succession, Even/uneven aged forest		http://atlas.nrcan.gc.ca/site/english/learningresources/theme_modules/borealforest/forest_regions.jpg/image_view
Be able to explain the importance of the forests to the people, history, natural environment and economy of Newfoundland and Labrador			http://www.nr.gov.nl.ca/forestry/ourforest/treespecies/default.stm
Describe the value added industry in NL	Value Added manufacturing		http://www.nr.gov.nl.ca/forestry/industry/services.stm
Identify non-timber products derived from the forests of NL	Non-timber forest products		http://www.nr.gov.nl.ca/forestry/ourforest/history.stm
Provide common and Latin names for the most common NL trees (Balsam fir, white spruce, black spruce, larch, white birch) and identify these trees (without a key) from needles, leaf and bark etc.			http://www.nr.gov.nl.ca/forestry/publicinfo/valueadded/
Identify less common NL trees and shrubs through the use of a key			http://cfs.nrcan.gc.ca/news/296
Explain tree growth from photosynthesis to branch growth, from trunk growth to the role of roots			http://cfs.nrcan.gc.ca/subsite/nontimber/interest
Understand how wildlife habitat relates to forest communities, forest species, forest age structure and availability of food/homes	Snags, Den trees, Riparian zones		http://cfs.nrcan.gc.ca/index/education3
Discuss harvesting techniques/methods and where/why selected	Clear cutting, selective harvesting, riparian zones		http://www.sfmcanada.org/english/topics-harvesting.asp
Describe the uses of the main tree species harvested in NL	Hardwood, softwood, pulp, lumber		http://www.sfmcanada.org/english/pdf/SFMBooklet_E_US.pdf
What is silviculture? Understand the various components of silviculture	Scarification, Site preparation, pre-commercial thinning, harvesting techniques, Best		http://www.nr.gov.nl.ca/forestry/management/silviculture/ http://canadaforests.nrcan.gc.ca/articl

	Management Practices etc.		etrend/top_suj/22
Identify the different concerns and issues that are incorporated into forest management	Environmental Recreation Wildlife Aesthetics Economic Sustainable Forest Management		http://www.nr.gov.nl.ca/forestry/management/ http://cfs.nrcan.gc.ca/news/588 http://www.borealforest.org/index.php?category=world_boreal_forest&page=overview http://www.cnr.vt.edu/dendro/forsite/Equip.htm
Explain the role that fire and insects play in boreal and other forest ecosystems			
Describe and be able to identify the principle insects, diseases and other wildlife that affect NL's forests. Know common and Latin name for 4 main insect pests in NL.	Balsam Fir Sawfly Hemlock Looper Spruce Budworm Spruce Bark Beetle Butt Rot Moose browsing		If you want to practice tree identification using the needles or twigs, try these sites: http://forestry.about.com/library/treekey/bltree_key_id_pfs.htm http://www.cnr.vt.edu/dendro/dendrology/syllabus/twigkey/key1.cfm
Explain forest certification and briefly describe the three most common certification systems in Canada	CSA, FSC, SFI		
Be able to use basic forest equipment, tables and forest type maps in order to measure tree diameter, height, age, volume and location etc. Summarize the history of a tree by looking at growth rings (periods of growth, faster growth, scarring etc.).	Diameter tape, increment borer, prism, clinometer, tree cookie, stocking charts, volume tables, compass, GPS		
Understand the difference between clear-cutting and deforestation. Explain why clear-cutting is the main harvesting method in NL			
Examine current forestry issues from the perspectives of different user groups (forest companies, Department of Natural Resources, general public, recreational groups, tourist operator etc.)	Harvesting techniques, pesticide use, old growth forests, prescribed burns, protected areas etc.		
Be familiar with forestry safety equipment	Boots, first aid, safety glasses, chainsaw pants etc.		

SOILS/LAND USE LEARNING OBJECTIVE	TERMS AND CONCEPTS	TOOLS	USEFUL RESOURCES (not an exhaustive list)
What is soil? What are the main components of soil?	Humus, Soil Ped, Colloid, cation, clay, silt, sand, loam, peat, chalk, podzol		http://www.realtrees4kids.org/ninetwelve/soil.htm
Recognize soil as an important resource.			http://sis.agr.gc.ca/cansis/glossary/
Gain a level of understanding of the main factors that influence soil development	Climate, parent material, topography, organisms (including humans), and time.		http://sis.agr.gc.ca/cansis/taxa/genesis/pmdep/atlantic.html
What is parent material?	Know the main parent material types		http://www.soilcc.ca/resources.htm
Understand soil formation processes.	Weathering, illuviation, eluviation, organic matter enrichment, gleying.		http://www.mun.ca/botgarden/plant_bio/
Understand terms used to describe soils and soil properties Be able to identify and describe these soil properties in soil from a pit	Horizon, texture, colour, structure, consistence, permeability, porosity, bulk density, pH, mottles, gleying	Munsell Color Chart, Measuring Tape	http://www.nr.gov.nl.ca/agric/soil_land_new/pdffiles/Beneficial.pdf
Understand soil water and factors that affect its movement, storage and availability for plants.	Water table, aquifer, hard water, soft water		http://www.nr.gov.nl.ca/agric/soil_land_new/pdffiles/nl_riparian_brochure.pdf
Understand soil drainage classes and the soil/site features that can be used to assess drainage class.			http://www.nr.gov.nl.ca/agric/soil_land_new/pdffiles/atlantic_soils_lime.pdf
Understand the role of soils in maintaining or enhancing water quality.			http://www.nr.gov.nl.ca/agric/soil_land_new/pdffiles/fertilguide.pdf
Explain the role of soil in the hydrological, nutrient and oxygen cycles			http://www.nr.gov.nl.ca/agric/soil_land_new/envseries/horticulture/soilmanagement.pdf
Understand the nature of plant nutrients and how they are made available in soil.	Mineralization		http://www.nr.gov.nl.ca/agric/soil_land_new/envseries/livestock/SLM053.pdf
Understand the role of soil microbes and the process of decomposition in a healthy soil ecosystem.			http://www.borealforest.org/index.php?category=world_boreal_forest&page=overview
Recognize some general characteristics and distinguishing features of wetland soils, forest soils, agriculture soils, and urban soils.			http://soilerosion.net/
Describe and explain the process of peat formation			http://www.omafra.gov.on.ca/english/engineer/facts/87-040.htm

Appreciate the concept of matching land use to soil type.			http://www.ec.gc.ca/soer-ree/English/Indicator_series/new_issue.s.cfm?issue_id=10&tech_id=40#bio_pic http://animalrangeextension.montana.edu/LoL/Module-2/2-Glossary.htm
Gain a level of understanding of the ways soils can be damaged	Erosion, compaction, organic matter loss, nutrient depletion, salinization, pollution, acidification		
Understand some of the ways soil damage can be avoided or reduced	Best management practices, cultivation patterns, buffer zones, fertilization, incorporation of organic material, limited cultivation		
Understand how to use soil survey reports to glean information on different soils and their sustainability for different uses.			
Identify types of soil erosion and discuss methods for reducing erosion.			
Understand boreal forest soil types and the main soil type/s found in Newfoundland and Labrador			
Identify the major land based industries in NL and how these are affected by the soil.	Forestry, Mining, Agriculture		

WILDLIFE LEARNING OBJECTIVE	TERMS AND CONCEPTS	USEFUL RESOURCES (not an exhaustive list)
Define wildlife.	Wildlife	http://www.env.gov.nl.ca/env/wildlife/ourwildlife/index.htm
Identify common species and signs of wildlife of Newfoundland & Labrador (keys will be used for more extensive identification).	Common animal signs include: Scat, tracks, sounds, patterns on trees, nests, fur, feathers	http://www.env.gov.nl.ca/env/wildlife/ourwildlife/exotic.htm http://www.wildspecies.ca/
Identify native and non-native mammals in Newfoundland		http://www.env.gov.nl.ca/env/wildlife/biodiversity/biodiversitymon.htm
Identify native and non-native mammals in Labrador		http://www.naturewatch.ca/english/ http://www.env.gov.nl.ca/SNP/
Understand habitat types and associated wildlife, explaining how each habitat is suited to the needs of the species found in that habitat	Habitat, wetlands, riparian	http://www.env.gov.nl.ca/env/wildlife/specialplaces/wilderness.htm http://www.env.gov.nl.ca/env/wildlife/publications/coyoteneeds2.pdf
Describe specific adaptations of wildlife to their environment and role in the ecosystem.	Ecosystem, hibernation, migration, climax community	http://www.env.gov.nl.ca/env/wildlife/publications/collisions.htm
Describe predator/prey relationships and examples.	Predator, prey, herbivore, carnivore, omnivore, succession	http://www.nr.gov.nl.ca/nr/enforcement/ http://www.env.gov.nl.ca/env/wildlife/wildlife_rm/index.htm
Describe the potential impact of the introduction of non-native species.	Native species, non-native species	http://www.ducks.ca/conservation/index.html http://www.cbin.ec.gc.ca/index.cfm?lang=eng http://www.ec.gc.ca/eee-ias/Default.asp?lang=En
Describe the major factors affecting threatened and endangered species, and methods used to improve the populations of these species.	Threatened species, endangered species, wilderness and ecological reserves, no hunt zones	http://www.nwf.org/ http://www.env.gov.nl.ca/env/wildlife/wildlife_at_risk.htm
Identify some rare, threatened and endangered species (terrestrial and aquatic) in NL as listed by the Committee on the Status of Endangered Wildlife in Canada	Terrestrial species, aquatic species, COSEWIC	http://www.cosewic.gc.ca/ http://www.cwf-fcf.org/en/ http://www.hww.ca/index_e.asp http://www.ns.ec.gc.ca/wildlife/index.html http://wwf.ca/
Describe ways habitat can be improved for specific species by knowing their requirements.		Wild Species 2005 CD - sent to all Envirothon teams
Discuss the concepts of carrying capacity and	Carrying capacity	

limiting factors.		
Understand the impact that non-native species (plants, mammals, amphibians, birds and insects) have had on our ecosystems and on other wildlife species	Predator - control	
Describe the food chains/webs and cite examples.	Food chain, food web	
Describe factors that limit or enhance population growth.	Population Density	
Define species richness	Species Richness	
Discuss various ways the public and wildlife managers can help in the protection, conservation, management, and enhancement of wildlife populations.	Canada Wildlife Act, Wildlife Act (provincial)	
Discuss conservation and management issues, including regulation of hunting and fishing, habitat protection and provincial, federal and non-government groups that protect wildlife resources.		
Understand the role of hunting in wildlife management in NL		
Understand that wildlife species are an important component of biodiversity	Biodiversity	
Discuss issues surrounding the conservation of Species at Risk.		
Describe the levels of protection for Species at Risk under the Endangered Species Act.		
Many of the species in Newfoundland and Labrador are at the northern, southern and eastern edge of their range. Explain what this means and describe the challenges this places on wildlife managers		

SPECIAL TOPIC LEARNING OBJECTIVE	TERMS AND CONCEPTS	TOOLS	USEFUL RESOURCES (not an exhaustive list)
How do public officials determine priority use when allocating a limited water supply?	Water supply		http://www.eoearth.org/article/Surface_water_management http://www.groundwater.org/kc/gwwatercycle.html http://www.env.gov.nl.ca/env/Env/waterres/water_resources.asp http://www.ec.gc.ca/cegg-rcqe/English/cegg/water/default.cfm
Should urban uses have priority over agriculture?	Agriculture, pesticides		
Should agriculture have a higher priority which may preclude or limit urban growth?			
What about environmental uses such as maintaining instream flows, aquatic life and habitat?	Aquatic life and water resources, instream flow		
What is the role of storm water management?			
What is the link between threats to both surface and groundwater quality/quantity? How can they be addressed?	groundwater		
Who should have jurisdiction to oversee the protection and management of large groundwater basins for both quality and quantity (e.g recharge)?			
What are the consequences of poor planning, unreasonable decisions, and lack of effective actions?	Land use planning		
How can public officials address future threats to surface and groundwater resources?	Surface water		
Explain the hydrologic relationship and the environmental benefits of groundwater and surface water			
How does global warming affect water supplies? Explain how this effect on water supplies impacts both groundwater and energy supplies.	Global warming		
Know the two greatest users of fresh water in North America and explain why conjunctive use of			

groundwater and surface water is important to ground water management and optimizing supply.			
Appraise the value of groundwater as a component to an integrated regional water management plan, and propose strategies to increase and replenish groundwater supplies,			
Describe the sources of pollution to groundwater and evaluate strategies for clean up or improving groundwater quality.	Point and non point sources		
Assess the negative energy impact that is associated with desalination and explain why this is a major concern for the construction of desalination facilities for San Diego, CA			
Evaluate the impact of energy production on fresh water supplies. Compare and contrast the effect on groundwater resulting from increased production of energy from nuclear and fossil fueled power plans and from biofuels necessitated by a large increase in the use of electric cars including the direct effect on groundwater resulting from the production of biofuels from both algae and cultivated plans such as soy beans and switch grass.	Biofuels, nuclear energy, fossil fuels		
Outline a management policy that will protect and manage groundwater resources for the needs of humans, the environment, and the economy and energy production. Differentiate the different roles that government agencies will have in protecting and managing groundwater resources as well as how water use is regulated at the state/province and federal level.			
Describe where groundwater depletion is occurring, the areas at risk in the future and explain how is groundwater depletion in the San Joaquin Valley watershed.			

<p>Analyze the impact of over pumping of groundwater and justify reasons why land use planning is necessary for groundwater management. Students should design, propose and justify management practices to achieve water conservation and water use efficiency as part of a groundwater management plan in both an urban and rural/agricultural watershed.</p>			
<p>Identify the concept of conjunctive use management for groundwater basins and the integration of basin recharge programs to accomidate urban and agricultural overdraft challenges. Identify the advantage and disadvantages of instituting basin management programs.</p>			