New Hampshire Wildlife Learning Objectives for the NCF-Envirothon

Wildlife may be the first topic that comes to mind when you think of conservation: the panda, the elephant, the snow leopard, the grey wolf, the bald eagle, or any other well-known current or former endangered animal. These charismatic species are easy to rally behind, but the wildlife in your backyard or local park need the same basic resources as a rhinoceros: food, water, shelter, and space. Conservation for local wildlife is just as important as conservation for big-name species in exotic locales. Through understanding wildlife biology, ecology, and conservation, humans can reduce our negative impacts to wildlife and implement management strategies to help species thrive, both locally and globally.

Just like the ecosystems we study, human society and culture are incredibly diverse. In the same way that biodiversity makes ecosystems more resilient, these differences in human perspective and experience make us stronger as a global community. Every person's story and relationship with the environment is important, and we must work together to ensure that everyone's stories are heard, including the historically marginalized and economically disadvantaged. We invite you to seek out stories from your own communities – to discover the unsung conservation heroes, to learn the histories that aren't typically taught in classrooms, to highlight local environmental issues, and to explore what types of natural resource conservation are occurring in your local community, state/province, and nation.

Students should be able to:

- Provide an informed opinion about current issues in wildlife conservation.
- Think critically about solutions to current wildlife conservation issues.
- Work collaboratively in a team to synthesize and apply knowledge.
- Make connections between concepts in Wildlife and the subjects of Soils and Land Use, Forestry, Aquatic Ecology, and the Current Issue.

Why are there blanks? Please note that the following list has been reduced to only show the objectives that the New Hampshire wildlife test will be focusing on in 2025.

Students will be able to:

Wildlife Biology

1. Distinguish between major taxonomic classifications of wildlife, their typical roles in ecosystems, and their habitat requirements (including mammals, birds, fish, reptiles, amphibians, and insects).
2. Identify anatomy of various wildlife species and describe the functions of anatomical parts, particularly special adaptations.
3. *

4. Identify the different stages in a species' life cycle and describe how each stage relates to the species' biology, behavior, adaptations, habitat requirements, and ecological niche.
5. Provide examples of physical and behavioral adaptations (such as mimicry, camouflage, freeze response, hibernation, special organs, et cetera) and how these adaptations benefit wildlife.
6. Describe the significance of migration in the life cycle of certain wildlife species.
7. Explain how the needs of a species might change throughout its life cycle, and how these changing needs are addressed in management strategies.
8. Describe the roles that circadian and seasonal rhythms play in the life cycles of different wildlife species.
9.
10. Explain the difference between generalist and specialist species and provide examples of each.

Wildlife Biology Study Resources:

- Nature Works from NHPBS: https://nhpbs.org/natureworks/
- NH Fish and Game - Wildlife Habitats: https://www.wildlife.nh.gov/wildlife-and-habitat/wildlife-habitat-program/habitat-types-and-species
- Audubon for Kids: https://www.audubon.org/get-outside/activities/audubon-for-kids
- National Geographic: https://education.nationalgeographic.org/resource/generalist-and-specialist-species/

Wildlife Ecology

11.
12. Identify biotic and abiotic factors in ecosystems and how they are related to wildlife habitat requirements, ecosystem variation, and wildlife conservation.
13.
14.
15.
16.
17.
18.
19. Identify common wildlife diseases, their causes, and their effects.
20. Identify the biological and social carrying capacities for a species, along with the limiting factors that influence these numbers.
21. Describe how changes in demographic parameters (such as birth, mortality, reproduction rate, immigration, emigration, age structure, sex ratio, et cetera) affect wildlife populations.
22. Apply concepts of landscape ecology as they relate to wildlife conservation, including:

a. Patterns in landscape and habitat type, and how this affects the distribution of wildlife species
b. Use and proximity of different habitat types over the course of a species' life (migration, species that undergo metamorphosis, et cetera)
c. Effects of disturbance on an ecosystem and its impacts to wildlife
d. Habitat connectivity and the importance of wildlife corridors
e. Genetic diversity in species across landscapes and the importance of this genetic diversity to healthy species populations

23. Describe the different levels of ecosystem organization, including individuals, populations, communities, and ecosystems.
24. Define an ecological niche and describe how species fulfill these different roles in an ecosystem.
25.
26. Describe different habitat characteristics that are important to wildlife (such as ecotones, edges, snags, downed logs, riparian areas, early successional stages, et cetera).
27. Explain the importance of the edge effect for species diversity and wildlife habitat.
28. Define succession and describe how each successional stage is important for different species of wildlife.
29. Describe wildlife adaptations to unique ecosystems (such as high elevations, deserts, fire dependent ecosystems, et cetera).
30. Identify sources of disturbance in an ecosystem and predict how different types of disturbance may impact wildlife species.
31. Define resilience and describe what it means for ecosystems and wildlife species.
32.
33. Explain the importance of pollinators in natural and agricultural ecosystems.

Wildlife Ecology Study Resources:

- NH Audubon *State of the Birds*: https://stateofthebirds.nhaudubon.org/
- NH Fish and Game - Habitat Management: https://www.wildlife.nh.gov/wildlife-and-habitat/wildlife-habitat-program
- Ecological Concepts and Wildlife Management Techniques (concentrate on pages 5-15, 43-45, and 118-141): https://www.nhenvirothon.org/_files/ugd/2c48e6_2e40a523ac0c4ca193dbd1bb4dd35fae.pdf
- NH Wildlife Action Plan: https://www.wildlife.nh.gov/wildlife-and-habitat/nh-wildlife-action-plan
- Emerging Wildlife Diseases from USGS: https://www.usgs.gov/centers/nwhc/science/emerging-wildlife-diseases

- Landscape Ecology from Nature: https://www.nature.com/scitable/knowledge/library/principles-of-landscape-ecology-13260702/
- Pollinators: https://www.pollinator.org/pollinators

Wildlife, Conservation, and Society

34.
35.
36. Recognize important issues facing wildlife on a local, state/provincial, national and international scale, propose solutions to current problems, and evaluate viability of solutions.
37.
38. Explain the differences between conservation and preservation.
39.
40. Describe the role and history of hunting in wildlife management.
41. Identify positive and negative human-wildlife interactions and describe how these interactions are taken into consideration when creating management plans.
42. Define invasive and exotic species, describe their characteristics, name examples, describe how they are spread, and explain their impact on local ecosystems.
43. Describe the impact of changes in climate on wildlife and their habitats.
44.
45. Identify the costs and benefits of various wildlife management strategies (for example, a farmer sacrifices tillable acreage to maintain a wildlife buffer, losing potential crop revenue, but gaining better water quality for the farm, reducing erosion, and fostering habitat area for pollinators, quail, and other wildlife).
46.
47. Describe the use of technology such as remote sensing, GPS, and GIS in wildlife management.
48.

Wildlife, Conservation, and Society Study Resources:

- North American Model of Wildlife Conservation: https://www.fws.gov/story/2022-04/north-american-model-wildlife-conservation-wildlife-everyone
- NH Endangered and Threatened Wildlife Species: https://www.wildlife.nh.gov/wildlife-and-habitat/nongame-and-endangered-species/endangered-and-threatened-wildlife-nh
- Forest Stewardship from UNH: https://extension.unh.edu/resource/forest-stewardship
- Invasive Species from UNH: https://extension.unh.edu/natural-resources/forests-trees/invasive-species
- NH Bugs and Forest Health: https://www.nhbugs.org/
- Invasive Species from USFWS: https://www.fws.gov/program/invasive-species

- Forest Pests: https://www.nhdfl.dncr.nh.gov/forest-health/pests-pathogens
- Climate Change and Wildlife from NH Fish and Game: https://www.wildlife.nh.gov/wildlife-and-habitat/climate-change-and-wildlife
- Climate Change and Wildlife from USFWS: https://www.fws.gov/climate-change
- National Fish, Wildlife, and Plants Climate Adaptation Strategy: https://toolkit.climate.gov/tool/national-fish-wildlife-and-plants-climate-adaptation-strategy

Field Skills

49. Identify common local wildlife species from preserved specimens, skulls, skeletons, pelts, tracks, scat, and other animal signs without the use of a key.
50. Explain an animal's habitat, dietary requirements, and life cycle based on animal signs.
51. Identify wildlife based on communication methods (bird and frog calls, et cetera).
52. Use a field guide or dichotomous key to identify uncommon wildlife species.
53.
54. Assess a particular site for wildlife habitat and make recommendations for best management practices.
55. Recommend wildlife management practices for a variety of uses (including conservation, connectivity, and hunting) for a variety of landscapes (including grasslands, forests, croplands, wetlands, and urban settings).
56.
57.

Field Skills Study Resources:

- Refer to the list of wildlife species below to focus on for the New Hampshire test.
- NH Fish and Game: Borrow a Furbearer Fundamentals Kit (pelts, scat, tracks, skulls): https://www.wildlife.nh.gov/education/curriculum-resources/curriculum-kits
- NH Fish and Game: Wildlife Species Profiles: https://www.wildlife.nh.gov/wildlife-and-habitat/species-occurring-nh
- US Fish and Wildlife Service: Wildlife Species Profiles: https://www.fws.gov/species
- Cornell Lab of Ornithology (All About Birds): http://www.allaboutbirds.org/
- National Audubon Society (Birds): https://www.audubon.org/
- NH Fish and Game: Fish Species Profiles: https://www.wildlife.nh.gov/fishing-new-hampshire/fish-species-nh
- Calls of Frogs and Toads in the Northeast from Lang Elliott: https://musicofnature.com/calls-of-frogs-and-toads-of-the-northeast/
- NH Fish and Game - Habitat Management: https://www.wildlife.nh.gov/wildlife-and-habitat/wildlife-habitat-program

Wildlife Identification List:

Below are the lists of New Hampshire wildlife species students should know. Students should practice using a field guide or key to identify the following wildlife of New Hampshire from pictures, drawings, mounts, pelts, skulls, tracks, scat, and vocalizations. In addition, it is important to be familiar with their habitat requirements and natural histories. (*Note*: Students are not expected to know scientific names.)

Invertebrates:

Black fly, *Prosimulium mixtum*
Common bluet, *Enallagma cyathigerum*
Common green darner, *Anax junius*
Emerald ash borer, *Agrilus planipennis*
Fairy shrimp, *Eubranchipus bundyi*
Hemlock wooly adelgid, *Adelges tsugae*
Common house mosquito, *Culex pipiens*
Spongy moth, *Lymantria dispar*

Mammals:

Beaver, *Castor canadensis*
Big brown bat, *Eptesicus fuscus*
Black bear, *Ursus americanus*
Bobcat, *Lynx rufus*
Canada lynx, *Lynx canadensis*
Eastern cottontail, *Sylvilagus floridanus*
Fisher, *Pekania pennanti*
Gray squirrel, *Sciurus carolinensis*
Moose, *Alces alces*
New England cottontail, *Sylvilagus transitionalis*
Northern long eared bat, *Myotis septentrionalis*
Porcupine, *Erethizon dorsatum*
Red squirrel, *Sciurus vulgaris*
Snowshoe hare, *Lepus americanus*
White-tailed deer, *Odocoileus virginianus*

Fish:

Brook trout, *Salvelinus fontinalis*
Rainbow trout, *Oncorhynchus mykiss*

Birds:

American redstart, *Setophaga ruticilla*
Barred owl, *Strix varia*
Black throated green, *Setophaga virens*
Brown headed cowbird, *Molothrus ater*
Cooper's hawk, *Accipiter cooperii*
Great horned owl, *Bubo virginianus*
Hermit thrush, *Catharus guttatus*
Northern saw-whet owl, *Aegolius acadicus*
Northern goshawk, *Accipiter gentilis*
Ruffed grouse, *Bonasa umbellus*
Sharp-shinned hawk, *Accipiter striatus*
Wild turkey, *Meleagris gallopavo*
Yellow-rumped warbler, *Setophaga coronata*

Reptiles and Amphibians:

Blanding's turtle, *Emydoidea blandingii*
Garter snake, *Thamnophis sirtalis*
Gray tree frog, *Hyla versicolor*
Spotted salamander, *Ambystoma maculatum*
Timber rattlesnake, *Crotalus horridus*
Two-lined salamander, *Eurycea bislineata*
Wood frog, *Lithobates sylvaticus*
Wood turtle, *Glyptemys insculpta*

Current Issue

Key Topic #2 – Forest Health in a Changing Climate
Key Topic #4 – Vulnerability Assessments and Adaptation Strategies

Current Issue Study Resources:

- Forest Stewardship from UNH: https://extension.unh.edu/resource/forest-stewardship
- Invasive Species from UNH: https://extension.unh.edu/natural-resources/forests-trees/invasive-species
- NH Bugs and Forest Health: https://www.nhbugs.org/
- Invasive Species from USFWS: https://www.fws.gov/program/invasive-species
- Forest Pests: https://www.nhdfl.dncr.nh.gov/forest-health/pests-pathogens
- Climate Change and Wildlife from NH Fish and Game: https://www.wildlife.nh.gov/wildlife-and-habitat/climate-change-and-wildlife
- Climate Change and Wildlife from USFWS: https://www.fws.gov/climate-change
- National Fish, Wildlife, and Plants Climate Adaptation Strategy: https://toolkit.climate.gov/tool/national-fish-wildlife-and-plants-climate-adaptation-strategy
- NH Fish and Game - Habitat Management: https://www.wildlife.nh.gov/wildlife-and-habitat/wildlife-habitat-program
- Ecological Concepts and Wildlife Management Techniques (concentrate on pages 5-15, 43-45, and 118-141): https://www.nhenvirothon.org/_files/ugd/2c48e6_2e40a523ac0c4ca193dbd1bb4dd35fae.pdf
- NH Wildlife Action Plan: https://www.wildlife.nh.gov/wildlife-and-habitat/nh-wildlife-action-plan
- Emerging Wildlife Diseases from USGS: https://www.usgs.gov/centers/nwhc/science/emerging-wildlife-diseases
- Landscape Ecology from Nature: https://www.nature.com/scitable/knowledge/library/principles-of-landscape-ecology-13260702/