2023 Aquatics Ecology Resources

Tips for studying for the aquatics test questions:

- Our resources provide the information needed to answer the learning objectives of the NCF curriculum guidelines: https://envirothon.org/the-competition/areas-of-study/aquatic-ecology/. Download this document and use it as a study guide. Although there are 61 items on the list, some overlap. If you answer just 3 or 4 questions per week, you will complete the study guide and be well prepared for the aquatic test.
- Our aquatics test aligns with the National Envirothon objectives and test guidelines. For better understanding of the aquatics test format and test writing go to https://envirothon.org/educational-resources/test-writing/

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- Contact Tina Harding for free curriculum resources with lesson plans to aid in teaching these concepts to you students.

Aquatics Resources – resources available for FREE upon request from **Tina Harding** (tinamharding@nd.gov)

1. Streamkeepers Field Guide-- Contact Tina Harding, ND Project WET Coordinator for hard copy: tinamharding@nd.gov

2. Healthy Water, Healthy People Water Quality Educators Guide—Contact Tina Harding, ND Project WET Coordinator for hard copy: tinamharding@nd.gov

3. Healthy Water, Healthy People Field Monitoring Guide Contact Tina Harding, ND Project WET Coordinator for hard copy: tinamharding@nd.gov

4. EPA Volunteer Stream Monitoring Manual: https://www.epa.gov/sites/production/files/2015-06/documents/stream.pdf

5. USGS Water Science School: https://www.usgs.gov/special-topic/water-science-school

Here are some additional resources that will relate to North Dakota

- North Dakota Department of Water Resources: http://swc.nd.gov
    - A reference Guide to North Dakota Waters: http://www.swc.nd.gov/pdfs/water_reference_guide.pdf
        - Prairie Waters Education and Research Center: https://www.vcsu.edu/academics/academic-centers/prairie-waters-education-research-center/

- Living with a River Handbook: https://deq.nd.gov/publications/WQ/3_WM/NPS/SWCBinder/Riparian/Living%20With%20A%20River%20Handbook%20(FINAL).pdf

National Envirothon Aquatics Resources:

Abiotic Factors:

1. USGS Water Science Basics: What is the Water Cycle? :
    - https://water.usgs.gov/edu/watercycle.html
      http://ga.water.usgs.gov/edu/watercycle.html
2. Basic concepts on Watersheds:
    - https://www.epa.gov/hwp/basic-information-and-answers-frequent-questions
    - ND Watershed Basics Fact Sheet: https://deq.nd.gov/publications/WQ/3_WM/NPS/InfoEd/1_WatershedBasics_FactSheetFinal.pdf
3. How to Read a Topographic Map and Delineate a Watershed
    - https://www.soilandwater.nyc/uploads/7/7/6/5/7765286/watershed_delineation.pdf
4. Water Quality
    - https://nepis.epa.gov/Exe/ZyPDF.cgi/P100MRC3.PDF?Dockey=P100MRC3.PDF
        - Chapter 5: Stream Flow, Dissolved Oxygen and Biochemical Oxygen Demand, Temperature, pH, Turbidity, Phosphorous, Nitrated, Total Solids, Conductivity, Alkalinity, Fecal Bacteria.
        - **Only the information under the "What is it and why is it important" section for each parameter**

Biotic Factors:

1. Introduction to Watershed Ecology: Watershed Academy Web
    - https://cfpub.epa.gov/watertrain/pdf/modules/WatershedEcology.pdf
http://cfpub.epa.gov/watertrain/pdf/modules/WatershedEcology.pdf
2. Aquatic Macroinvertebrates
    - Understand how and why we use aquatic macroinvertebrates to determine water quality. Chapter 4: https://www.epa.gov/sites/default/files/2015-06/documents/stream.pdf
    - Below are links to aquatic macroinvertebrate websites. You will be given a dichotomous key to identify macroinvertebrates, so know how to use it!
        - http://waterbug.vcsu.edu/
        - http://ndfresh.vcsu.edu/
        - https://stroudcenter.org/wp-content/uploads/StroudWebsiteMacroKeyFNL.pdf
    http://www.nmfs.noaa.gov/pr/pdfs/esa_factsheet.pdf
3. Introduction to Freshwater Fish as Biological Indicators: Pages 1-12
    - https://nepis.epa.gov/Exe/ZyPDF.cgi/P1002J1W.PDF?Dockey=P1002J1W.PDf

Aquatic Environments

- USGS Groundwater
  - What is groundwater (simplified)? https://pubs.usgs.gov/of/1993/ofr93-643/pdf/ofr93-643.pdf
  - Groundwater (more in-depth): https://pubs.usgs.gov/gip/gw/gwgip.pdf http://pubs.usgs.gov/gip/gw/gwgip.pdf
- Types of Wetlands—4 main types. Which does ND have?
  - https://www.epa.gov/wetlands/wetlands-classification-and-types#marshes http://water.epa.gov/type/wetlands/types_index.cfm
- Wetland Functions and Values
  - https://cfpub.epa.gov/watertrain/pdf/modules/WetlandsFunctions.pdf
    Read to know how wetlands function for: habitat, water quality, flood storage, shoreline and erosion protection, economic and recreation, and climate change.http://cfpub.epa.gov/watertrain/pdf/modules/WetlandsFunctions.pdf
- Benefits and Definition of Riparian Zones (Riparian Buffer)
  - Understand riparian functions for: Habitat, aquatic ecosystem (influence water temperature and aquatic habitat), water quality (turbidity, sedimentation, eutrophication)
  - What is a Riparian Buffer? https://www.fs.usda.gov/nac/assets/documents/workingtrees/infosheets/rb_info_050712v3.pdf
  - Riparian Zones: Managing Early-Successional Habitats near the Water's Edge (more in-depth)
    - http://www.state.nj.us/dep/fgw/pdf/mgtguide/ch09_riparian_zones.pdf

    http://www.wildlife.state.nh.us/Wildlife/Northeast_Mgt_Guide/Ch09_Riparian_Zones.pdf

Aquatics and Society

- Point source vs. non-point source.: https://en.wikipedia.org/wiki/Nonpoint_source_pollution
- Aquatic Nuisance Species: Know and identify invasive species in ND and how to prevent the spread.
  - North Dakota Aquatic Nuisance Species: https://gf.nd.gov/ans
  - Stop Aquatic Hitchhikers: https://stopaquatichitchhikers.org/hitchhikers/mollusks-zebra-mussel/
- Aquatic Endangered species in ND: What are the aquatic endangered species in ND and what agency is responsible in ND
  - https://www.fws.gov/office/north-dakota-ecological-services
- Summary of the Federal Clean Water Act: (SDWA)
  - https://www.epa.gov/sites/production/files/2015-04/documents/epa816f04030.pdf http://water.epa.gov/lawsregs/guidance/sdwa/upload/2009_08_28_sdwa_fs_30ann_sdwa_web.pdf
- The Quality of Our Nation's Water
  - https://pubs.usgs.gov/fs/FS-116-99/pdf/fs-116-99.pdf http://pubs.usgs.gov/fs/FS-116-99/pdf/fs-116-99.pdf
- GIS and Hydrology:
  - https://en.wikipedia.org/wiki/GIS_and_hydrology http://en.wikipedia.org/wiki/GIS_and_Hydrology
- Water Resources:
  - https://en.wikipedia.org/wiki/Water_resources
- Water Conservation:

- https://en.wikipedia.org/wiki/Water_conservation

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Current Issue: Renewable Energy for a Sustainable Future

- Refer to the ND and NCF current issue sources.

WORDS TO KNOW

Abiotic – refers to non-living components of ecological systems.

Adaptation - characteristics/behaviors acquired by organisms in response to external changes (stimuli) in their environment).

Algae – a primitive, usually aquatic organism that converts solar energy to food through photosynthesis. Can grow singly, in mats, as filaments, balls, or “slime” on rocks.

Alpine - ecological life zone associated with higher elevations, cold temperatures, relatively high levels of precipitation (snow), short growing season.

Altitude - physical elevation above sea level; as distance measured above and expressed in reference to mean sea level (MSL).

Anoxia – the absence of oxygen; the total deprivation of oxygen, as in bodies of water, lake sediments, or sewage.

Aspect - the physical direction a landform faces; example: the south-facing slope of a mountain.

Biome - large scale climatic regions of the biosphere with unique vegetation, plant and animal characteristics.

Biota - a term used to refer to the living components of an ecosystem (see also abiotic).

Biotic – an adjective referring to “living” or life.

Browser - an animal with a preference for fibrous/woody forbs, shrubs, trees.

Canopy - the highest overlaying vegetation layer in a forest.

Carnivore - a consumer which primarily consumes meat/flesh as a source of food.

Chapparal - dense, woody, shrub/brush- land type ecosystem.

Chlorophyll - green pigment found in plants which allows for the conversion of solar energy to chemical energy. Green plants/producers

Ciénega – Southwestern U.S. or Spanish term referring to a swamp or marsh, especially one fed by springs.

Climate - long-term meteorological qualities characteristic of a region. What you expect or want, weather is what you are getting.

Community - an ecological group consisting of different populations of organisms and which excludes non-living components.

Competition - species and/or populations of living things designed to provide advantage in reproduction, space, food, etc.

Consumer - an organism which is dependent on other organisms for their source of energy (food).

Cyanobacteria – similar to algae these primitive, single-celled organisms convert energy through photosynthesis; also called blue-green algae. Occasionally found in aquatic populations large enough to be toxic to humans, livestock and wildlife.

Ecology - the study of living things (biotic) as they interact with each other and their environment (abiotic).

Ecosystem - an ecological unit, with distinct, identifiable and unique characteristics consisting of different, interacting, individuals and/or populations (biotic communities), including the non-living environment.

Ecological Site - an ecological site describes a combination of biotic and abiotic characteristics in a particular location.

Effluent – the state-regulated treated outfall from wastewater treatment plants that includes mostly water, but also some of the residual chemicals and contaminants from treatment.

Effluent-dominated stream – a stream where effluent is the main source of surface flows.

Endemic – a unique organism (species) found no where else but in one specific location. Example of common usage: this plant species is *endemic* to the Huachuca Mountains.

Equilibrium – balance or status of balance between different parts of a system.

Eutrophication – the process of nutrient enrichment leading to dense plant growth, especially algae.

Evapotranspiration - the water loss by plants due to transpiration and evaporation.

Extinction – process of losing species through their failure to successfully function and/or to reproduce.

Extirpation – permanently removing a species from its normal area.

Food Web - a complex collection of interconnected/related food chains with multiple producers and consumers involved.

Forbs - broad-leaf (non-grass), green plants used as food by grazers/browsers.

Genus - a very distinct and critically descriptive taxonomical unit; the binomial systems “first’ name of an organism; genetically a very similar grouping.

Grassland - a large ecosystem /biome dominated by the presence of grasses and grass dependent organisms.

Habitat - the ecological surroundings required by an organism.

Herbivore - an organism who primarily prefers plant material as a food source.

Impervious surface – A surface that has been covered with a material that water cannot normally penetrate.

Infiltration - The entry of water into the soil.

Invasive - any organism species which tends to displace and replace native species within an ecosystem.

Invertebrate - an animal lacking an internal skeleton; may or may not possess an exoskeleton.

Macroinvertebrate – organisms without backbones, but that are large enough to be visible to the naked eye. Examples include amphipods, shrimp, snails, spiders, insects.

Microhabitat – the smallest locations in a landscape that provide specific conditions for an organism to survive.

Montane - reference to ecosystem variations and characteristics related to the influence of mountains and/or elevation.

Niche - the specific role an organism plays in the environment; dealing with function.

Perennial – year-round; also refers to a plant which can live and reproduce repeatedly over several years.

Photosynthesis – A complex chemical process powered by solar energy whereby plants produce sugars and other organic matter by combining different nutrients.

Pollution - any substance, condition or degradation capable of diminishing the quality and function of an ecosystem.

Population - an identifiable number of the same species within a given area and time.

Producer - an organism capable of producing its own food (energy) and not dependent on other organisms as a source of food; green, photosynthetic, plant.

Range - the distance/extent of the area of movement by individuals within their ecosystem; a term used by livestock operators to describe the area where animals are grazed.

Riparian - a term used to describe the area adjacent to flowing water; enhance bio-diversity associated with vegetative areas along flowing rivers and streams.

Scavenger - an organism which seeks out the remains of dead plant and animal life for its source of food

Scouring – the act of a stream clearing, digging or removing sediment, organic matter, and other light materials by a powerful current of water.

Sediment - Material deposited by wind, water or glaciers.

Silt - fine grained particulate carried by water; particles between .002 and 0.05 mm in diameter.

Slope - the change in elevation of terrain; expressed as a percentage of elevation increase or decrease.

Species - a subdivision of a **genus**; considered the most basic biological classification; individuals closely resemble one another; interbreed and successfully produce fertile offspring; individuals share similar ecological and biological traits, offspring, in nature.

Succession - a process where plant and animal populations demonstrate a series of natural changes leading to a relatively stable ecosystem. Example: bare ground and rocks to a mature forest.

Symbiosis - an extreme example of mutualism; two individuals become so dependent upon each other neither would survive if separated.

Transpiration - the physical release of water vapor from photosynthetic plants.

Wetland – an area which is frequently subjected to persistent flooding or has an elevated water table.