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Station

## 2009 Missouri Envirothon Aquatics Ecostation

1. Headwater streams are dry most of the year; therefore, they are often overlooked as important. Name two threats to headwater streams and explain the consequences of those threats. (4 points)

**Clearing native vegetation from corridor** – increases water velocity, increases erosion, increases runoff, decreases roughness provided by vegetation, increases overland flow, decreases infiltration, reduces habitat and water quality

**Urbanization or paving the channels** – increases water velocity, increases erosion, increase runoff, decreases roughness provided by vegetation, increases overland flow, decreases infiltration, reduces habitat and water quality

**Agriculture practices** – (filling, grazing, row cropping, tiling, etc.) – increases water velocity, increases erosion, increases runoff, decreases roughness provided by vegetation, increases overland flow, decreases infiltration, reduces habitat and water quality, compacts soil, increased nutrient loading (fertilize or cattle excretions)

**Building headwater impoundments** – changes flow regimes, introduces predator species and non-native species into areas they normally do not inhabit, higher stream temperatures, impedes fish migration

**(1 pt. for each threat named and 1 pt. for each explanation)**

2. Define the terms **ephemeral**, **intermittent** and **perennial stream**. Hint: discuss the role of groundwater, stream type, and when each stream type has flowing water. (6 points)

**Ephemeral streams** receive no groundwater input and only has water during runoff events

**Intermittent streams** receive groundwater inputs during wet portions of the year. Only has water part of the year.

**Perennial streams** are fed year round with groundwater contributions and have flowing water most or all of the time.

**(1 pt. for discussing role of groundwater input for each term and 1 pt. for discussing when the stream has water running in it.)**

3. Based on the above question, what kind of stream would you consider the example at this ecostation? (1 points)

*Ephemeral*

4. Development around Lake of the Ozarks is common. Suppose you are the biologist in this area and developers want to clear the trees around this stream for housing. They ask for your professional opinion before proceeding with the tree removal. How would you respond? Hint: Discuss affect to stream and lake. (6 points)

**In Stream:** increased stream velocity, increased stream power, more runoff (water not slowed by canopy), decreased water filtration by plants, reduced bank stability, increased water temps, reduced water quality, more turbid, less retention of nutrients (no more logjams), decreased species diversity (fish & invertebrates)

**In Lake:** increased sedimentation (gravel will be flushed down to lake with increased power), more turbid, loss of Macrophytes with increased gravel deposits and decreased water clarity (reduced light penetration), increased Nutrients (from runoff, lawn fertilizer, developers equipment, reduced water quality, higher water temperature, possible algal blooms)

**( 1 pt. for each negative listed)**

5. What are two (2) Best Management Practices that the developer in Question 4 could use to minimize the effects? (2 points)

Maintain a riparian corridor on both sides of stream, keep the amount of paved surfaces to a minimum, disturb as small an area as possible, disturb land in phases to minimize, replant vegetation as soon as possible, green parking lots

6. Land use is one of the most influential factors affecting streams, lakes and organisms within a waterbody. Look around the landscape of this stream. Is land use currently a problem for this stream? Why or why not? (2 points)

NO, keeping the area forested will minimize erosion and runoff, slow rainfall, and allow water infiltration

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7. Lake of the Ozarks is unique; it is the largest non-flood control reservoir in the country. Thus, this reservoir experiences only minor water level fluctuations when compared to many flood control reservoirs. Suppose that Lake of the Ozarks did experience drastic water level fluctuations each year. Explain the possible side effects on the aquatic community and its organisms in the lake (4 points)

*Large water level fluctuations may eliminate macrophytes from the littoral zone of reservoirs. This could result in poor spawning habitat for fishes and a decrease in numbers of offspring produced. Fish eggs may be exposed to the air and dried out during periods of high discharge resulting in fewer eggs that successfully hatch. Aquatic vegetation also provides cover (i.e., nursery habitat for young) for young-of-the-year fishes. A lack of aquatic vegetation may reduce survival of fishes early during their life history. Aquatic vegetation also provides a home for many invertebrates that young-of-the-year fishes rely on. High reservoir discharges may be too swift for young fishes and may flush these fishes out of the reservoir. Loss of aquatic vegetation may also negatively affect adult fish, such as largemouth bass, that use shallow vegetation to ambush prey.*

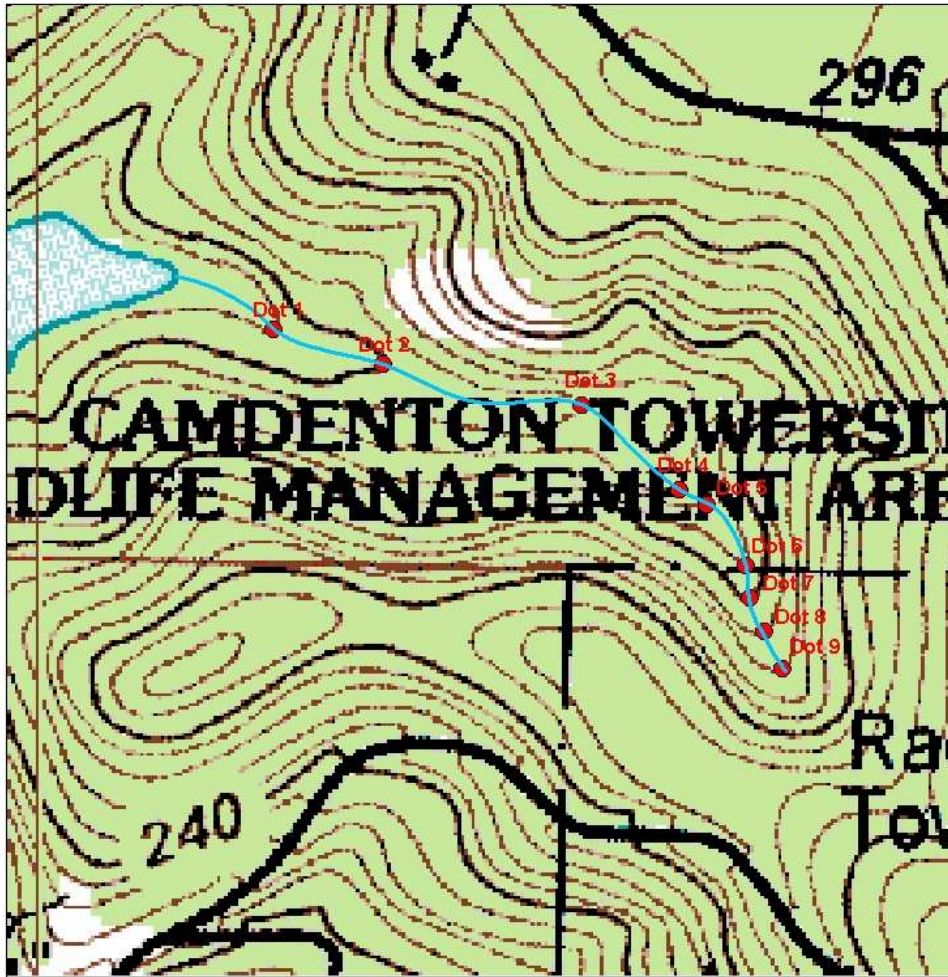
8. The gradient of a stream is important for determining stream power and, subsequently, the ability of a stream to transport sediment. Determine the gradient of this stream (marked by the blue line on map provided below) by constructing a gradient plot for this stream. To do this, you must determine the distance from the mouth of the stream (i.e., where the stream enters the lake) to each point where the stream crosses an elevation line (this point is marked with a red dot). First, measure the distance from the mouth to dot 1, then from dot 1 to dot 2, dot 2 to dot 3 and so on. Enter these values in the second column of the spreadsheet provided below the map. Second, calculate the cumulative distance from the mouth to each dot in the third column of the spreadsheet using your data from the second column. Third you must also determine the elevation at each dot using the elevation lines on the map. Fourth, plot the cumulative distances (x values) and elevations (y values) on the excel grid provided below and connect the dots with straight lines. (15 points).

	Distance between dots (meters)	Cumulative distance (meters) (X-Values)	Elevation (meters) (Y-Values)
Mouth	0	0	228
Dot 1	81	81	234
Dot 2	80	161	240
Dot 3	145	306	246
Dot 4	94	400	252
Dot 5	24	424	258
Dot 6	49	473	264
Dot 7	24	497	270
Dot 8	29	526	276
Dot 9	32	558	282

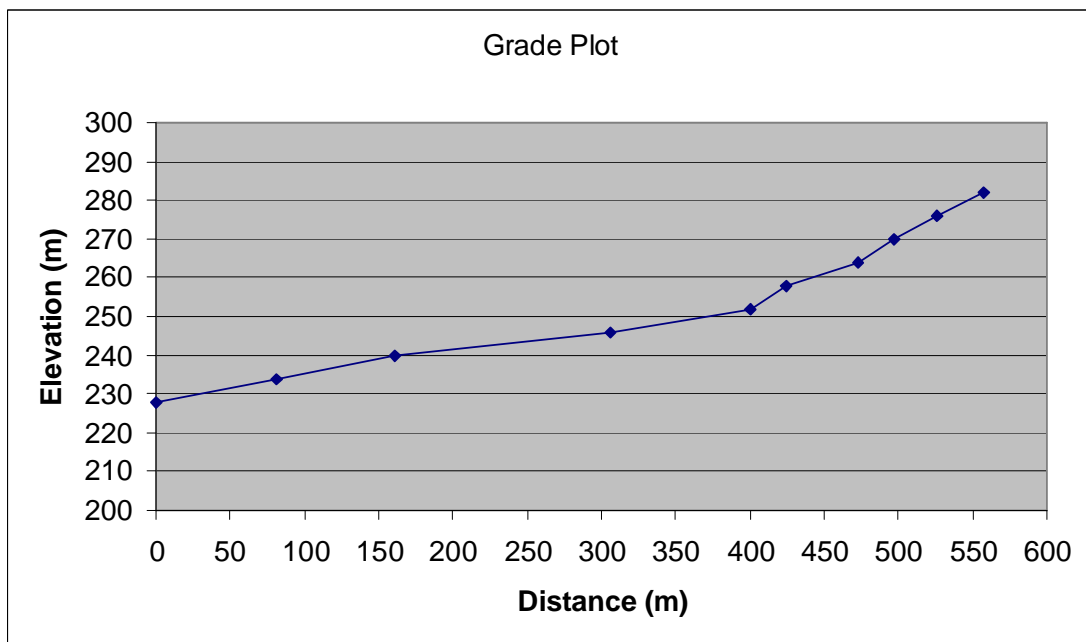
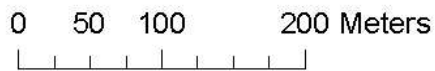
( 1 pt. for each correct row. The distance in the second column can be  $\pm 20$  meters from key to be counted correct. The cumulative distance in the third column must be added correctly. The elevation must be the exact elevation from key to be correct. Additionally, 0.5 pts for correctly plotting each point on the X,Y graph. The distances and elevations do not need to be correct from the spreadsheet. For this part it only matters if they correctly plot the distances and elevations they came up with.)



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Note: **Not to scale.**  
 This example is smaller than map provided on test.



1. List four (4) ways that trees help protect streams. (4 points)

*Tree roots act like rebar in concrete to hold soil in place*  
*Tree canopy slows water falling in the form of precipitation*  
*Trees on gravel bars slow water velocities during high water events*  
*Trees shade the stream from sunlight; this keeps water temperatures*  
*Tree help filter excess nutrients*

2. Suppose that you are a fisheries management biologist and a cattle rancher in your region has decided he wants to improve fish habitat and water quality in his stream where his cattle have unlimited access. What might you recommend this rancher do to improve stream habitat and water quality. Why? (4 points)

*The rancher should fence his cattle off of the riparian corridor and stream and replant more trees if necessary, and find an alternate source of water for his cattle. Keeping the cattle off the corridor will give the corridor a much higher chance of establishing. Fencing the cattle will also reduce stream bank erosion and excess nutrients from cattle excrement from entering the stream, which will improve water quality. This will also reduce soil compaction and surface runoff within the buffer.*

3. By looking at exposed tree roots on a streambank you can sometimes determine if the bank is actively eroding; describe how the roots would look if it was active (recent) vs. inactive. (4 points)

*Actively eroding banks will have freshly exposed tree roots that often appear orange, and dangle out from the bank, inactively eroded banks will have roots that have bark on them and will be conforming to the streambank shape.*

**(2 points for description of active and 2 points for description of inactive)**

4. List three (3) reasons why water run-off from urban areas typically has more adverse effects on the receiving stream as compared to run-off from forested environments. (3 points)

*Increase in water temperatures*  
*Increase in water velocities*  
*Increase in contaminants*  
*Increase in water volume*

**(1 point for each reason listed, up to three)**

1. Benthic invertebrates can provide information about water quality and habitat within streams because they are:(2 points) *choose the best answer and circle only one of the letters below*

- A. Sensitive to PHYSICAL changes in streams
- B. Sensitive to CHEMICAL changes in streams
- C. Sensitive to PHYSICAL and CHEMICAL changes in streams**
- D. None of the above

2. Three orders of benthic macroinvertebrates are particularly sensitive to pollution in streams. Give the Latin name of each order (Hint: the acronym is EPT) and the common name for each order. (6 points)

*Ephemeroptera – Mayflies ,  
Plecoptera – Stoneflies, and  
Trichoptera – Caddisflies*

3. In natural stream systems how do fish benefit terrestrial floodplain ecosystems? (2 points)

*When streams are allowed to inundate floodplains during high flow events some fish will utilize the shallow backwater areas in the floodplains. When the water recedes, some of the fish get stranded on the floodplain; as they decay, they provide important nutrients to the floodplain soils. Also, the fish are a major food source for many terrestrial mammals, birds and reptiles.*

**(1 point for each correct benefit)**

4. Stream invertebrates are often classified by Functional Feeding Groups (i.e., how the invertebrates gather or consume their food). List the five (5) functional feeding groups used to classify invertebrates. (5 points)

*Shredders, Collectors, Scrapers (also called Grazers), Piercers, Engulfers (also called Predators)*

**(1 point for each functional feeding group listed)**

1. Define a watershed. (2 points)

*The area of land from which precipitation drains to a single point or the entire area of land whose runoff of water, sediments, and dissolved materials drain into a river, lake or ocean.*

**(1/2 point for each point of definition related to land area, runoff, drain point, and final waterbody)**

2. In this watershed, a major nonpoint source problem is the influence of development surrounding the lake. List 2 specific items that might be part of the problem. (4 points)

*Excess fertilizers, herbicides, and insecticides from residential areas  
Oil, grease, and toxic chemicals from urban runoff and energy production  
Bacteria and nutrients from livestock, pet wastes, and faulty septic systems*

3. Here in the Ozarks, most streams have gravel bottoms. Name two sources of gravel in an Ozark watershed and how that gravel gets into the stream. (4 points)

*Gravel can come from the surrounding hillsides and be washed down into the stream during rainfall events, especially if tree clearing has occurred on these hills. Gravel can also come from the streambanks and floodplain adjacent to the stream. This can be washed into the stream during high water events, especially if vegetation has been cleared along stream banks and in the floodplain.*

**(1 point for each source and 1 point for each explanation of how it gets there)**

4. Soils influence water quality by: (2 points)

- a. Absorbing and neutralizing potentially harmful chemicals
- b. Adding minerals to water
- c. Adding organic matter to water
- d. Absorbing and slowing runoff
- e. **All of the above**

5. How do watershed boundaries affect the movement of groundwater? (2 points)

*It is important to consider that while watershed boundaries identify surface-water runoff divides, they often do not represent ground-water flow divides. Ground water generally follows the topography in its flow direction, just as surface-water runoff does. However, the movement of water in the subsurface is more complex and ground-water flow directions may not coincide with surface-water flow directions.*

6. Why do floodplains typically have very lush and fertile soils? (1 point)

*Because the river deposits soils eroded from the uplands onto floodplains during high flow events.*

1. List four (4) methods used to reduce or eliminate an invasive aquatic plant and explain the disadvantages of each. (8 points)

**Biological methods** – insects or plant disease – control agents may attack desirable species too, total elimination is difficult

**Chemical methods** – herbicides – may impact non-target species, repeat applications may be needed and linger in the environment

**Mechanical methods** – cutting, dredging or hydroraking – seasonal control only, shoreline dispersal needed, may cause disruption of bottom sediments, increased turbidity, may cause significant disruption of the ecosystem

**Physical methods** - benthic barriers- expensive to install, require removal for cleaning, barrier to all plants

**Drawdown** – weather and sediment dependent, impact on wildlife and other

**Reduce Light** – Impacts non-target species, repeat procedure necessary,

**Flooding** – significant environmental impact, non-target species impacted, increases dispersal of seeds

**Flushing** – significant environmental impact, non-target species impacted, increases dispersal of seeds

2. The water cycle has a number of different features. One of these is the aeration zone. Where is the aeration zone located and what is its hydrologic function? (3 points)

*The aeration zone lies between the earth's surface and the water table. The hydrologic functions of the aeration zone include the following. It stores rainfall during separate storm events. It then releases this stored water gradually. Some of its goes back into the atmosphere as **evapotranspiration**, following a daily and seasonal cycle. Some is gradually brought to the water table by **infiltration**. Infiltration generally takes place during the winter and spring months. Thus the aeration zone is a gate keeper. It collects rainfall, which occurs over a few hours, and releases that water over days and even months.*

**(1 point for location and 1 point each for evapotranspiration and infiltration)**

3. See the small constructed water garden marked with a flag. Explain the difference between a water garden and rain garden. (4 points)

*Water gardens are designed to hold water year-round and include fish and aquatic plants. Frequently they must be lined with synthetic materials to keep them from drying out.*

*Rain gardens are designed to catch stormwater runoff in a basin type structure. However, they are designed to hold water no longer than 72 hours. They frequently have to be dug out and filled with more permeable soils.*