Hubbard Brooks Experimental Forest- Case Study: Analysis Questions

Directions:

- Write your name, today's date, and the class period on the upper right corner of a piece of loose-leaf paper.
- Write the heading *"Hubbard Brooks Experimental Forest- Case Study"* on the top left corner.
- Read the *Hubbard Brooks Experimental Forest- Case Study* and analyze all of the data tables and graphs.
- Answer all of the following questions on loose-leaf paper.
- You do not need to write the question. However, be sure to number each answer clearly.

Part 1- The Effects of Deforestation on the Loss of Water and Soil Nutrients

Pre-cut period of 1958-1965

When doing field experiments, scientists try to have an understanding of how the ecosystem is working before the experimental treatment. In interpreting the results of this field experiment, it is essential to compare the watershed streamflow after the experimental treatment (deforestation) to the streamflow before the experiment, for both watersheds.

1) Analyze and compare the *Watershed 3 Annual Streamflow and Precipitation* graph to the Watershed 2 Annual Streamflow and Precipitation graph for the pre-cut period of 1958-1965. Is there a correlation between streamflow and precipitation? If so, explain.
2) How do the watersheds compare to each other for the pre-cut period of 1958-1965 (e.g., does one watershed always have higher streamflow values, or is there variability between years and watersheds)?
3) Determine the range of stream flow and precipitation that both watershed 2 and 3 stay within be during the pre-cut period of 1958-1965. This will be important baseline data (think of baseline as "normal").
4) Determine the average streamflow for the pre-cut period of 1958-1965. This too will be important baseline data.
5) Analyze *Figure 5. Loss of Nitrate from a Deforested Watershed* for the pre-cut period of 1958-1965, determine the range in nitrate concentrations in both watersheds during this period. This will be important baseline data.

Post-cut period 1966-1970

6) Analyze and compare the *Watershed 3 Annual Streamflow and Precipitation* graph to the Watershed 2 Annual Streamflow and Precipitation graph for the post-cut period 1966-1970. Do you see any changes in streamflow of either watershed (outside of the baseline range)? If so, which one?
7) By about how much did streamflow change in this watershed? Is this streamflow change connected to any change in precipitation?
8) Calculate the percent change in streamflow for this watershed between 1965 & 1966.
9) How much did the stream flow increase in the three years after deforestation?
10) To what can you attribute this change? Explain, be specific.
11) How do the two watersheds compare to each other in the five years following the treatment?
12) Analyze *Figure 5. Loss of Nitrate from a Deforested Watershed* for the post-cut period of 1966-1970, did nitrate concentrations change outside of the baseline range between 1966 and 1968 for either watershed? If so, by how much?
13) Calculate the percent change in nitrate concentration for this watershed.
14) To what can you attribute this change? Explain, be specific.
15) How would you expect these changes in streamflow (water loss) and nitrate concentrations (nutrient loss) to affect the watershed ecosystem's ability to withstand the disturbance?

Post-cut period 1971-1988

16) Did streamflow in watershed 2 return to within the baseline range in the post-cut period? If, so in which year did it happen?
17) To what can you attribute this change?
18) Did nitrate concentrations in watershed 2 return to within the baseline range in the post-cut period? If, so in which year did it happen?
19) To what can you attribute this change?
20) How did the tree species composition of watershed 2 differ between pre-cut and post-cut periods?
21) As watershed 2 (W2) returned to baseline values and secondary succession progressed some interesting trends became apparent in the data. Streamflow in W2 became even smaller than it was before the treatment. Thirteen to 23 years after treatment, the average streamflow in W2 was 7% less than it had been before the treatment. What's going on? Explain. *Think in terms of ecological succession and, of course, refer to the information in the case study.*

Part 2- The Effects of Strip-Cutting on the Loss of Water and Soil Nutrients

22) What experimental question did the researchers address and what did they hypothesize?
23) Identify and briefly explain the method of tree harvesting that was used to clear watershed 4.
24) What were the results of this experiment in terms of water and nutrient loss when compared to watershed 2?
25) What were the results of this experiment in terms of response to disturbance, ecological succession, and tree species composition when compared to watershed 2?

Conclusion

26) Given all of the streamflow and nitrate data you have seen, what can you say about the original hypothesis? Does the data support the hypothesis? In other words, did cutting all the trees in a watershed increase streamflow and nutrient loss? Explain.
27) With respect to the introductory information in this case study, do you think the experiments in this case study of the Hubbard Brooks Experimental Forest are well-designed controlled experiments? Why or why not? Explain.
28) Which logging practice, clear-cutting or strip-cutting, is least environmentally disruptive? Explain. (Be specific & cite the case study)
29) Explain how environmentalists can use the results of these experiments to inform and persuade government policy makers, the logging industry, and other stakeholders (important people or groups involved in a dilemma such as deforestation) about logging best practices. *Think about secondary succession; which method had the least environmental impact and regenerated the most commercially valuable hardwood species?*