

Lesson 4: Lichens and Air Quality Monitoring Research Paper

Objective: *Students will be able to apply their knowledge of lichen structure and ecology to the task of biomonitoring for air pollution.*

Students will write a 2 page research paper explaining why lichens are or are not good indicators of air quality. Use the references below and include a Works cited page, as well as in text citations. In the paper, students should explain:

1. Why do (or don't) lichen morphology and ecology make them well suited to be bioindicators? Explain what a bioindicator is and what makes a good bioindicator. (see Holt and Forest Inventory references below)
2. To which pollutants are some lichen particularly sensitive and what research results support this conclusion? (See Jovan reference below to read the results of studies of lichen diversity on the West Coast. See Cleavitt article abstract for results from the northeast. What were their conclusions about air quality based on the lichen species diversity and abundance?)
3. What factors affect lichen health and diversity besides air pollution and how would you design a study to isolate the effects of air pollution on lichen? Did existing studies take these other factors into account?

References to use:

- Holt, E. A. & Miller, S. W. (2011) Bioindicators: Using Organisms to Measure Environmental Impacts. *Nature Education Knowledge* 3(10):8
<http://www.nature.com/scitable/knowledge/library/bioindicators-using-organisms-to-measure-environmental-impacts-16821310>
- Hinds, James W. and Hinds, Patricia L. *The Macrolichens of New England*, The New York Botanical Garden Press, 2007, p. 22-30,44-49, 60-61.
- Forest Inventory and Analysis National Program at
<http://www.fia.fs.fed.us/library/fact-sheets/p3-factsheets/lichen.pdf> see Background section on pages 3-4 of the report.
- USFS National Lichen and Air Quality Data Base
<http://gis.nacse.org/lichenair/?page=airpollution#Ndep>
- *Epiphytic macrolichen communities correspond to patterns of sulfur and nitrogen deposition in the northeastern United States*, Author(s): Natalie L. Cleavitt, James W. Hinds, Richard L. Poirot, Linda H. Geiser, Alison C. Dibble, Bennet Leon, Ralph Perron and Linda H. Pardo Source: *The Bryologist*, 118(3):304-324. Published By: The American Bryological and Lichenological Society, Inc. DOI:
<http://dx.doi.org/10.1639/0007-2745-118.3.304>

- Lichen Bioindication of Biodiversity, Air Quality, and Climate: Baseline Results From Monitoring in Washington, Oregon, and California, by Sarah Jovan, US Forest Service, March 2008. http://www.fs.fed.us/pnw/pubs/pnw_gtr737.pdf see pages 29, 53,69 for key findings.

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