



Teacher's Corner Lesson Plans

*Helping Teachers and Students Make the Most of
their Outdoor Classroom*

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Investigating the Process of Plant Succession

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Grade level: Grade 11.

Provincial curriculum links: Ontario and Pan-Canadian.

Subject: Science.

Keywords: Ecological succession, secondary succession, transect study, pioneer species, index species.

Description

In this field study, students will investigate how plant communities undergo change through the process of secondary succession. They will also analyze the role of plants in the maintenance of diversity and stability of ecosystems.

Curriculum Framework

This lesson is linked directly to the learning expectations described in the Ontario Curriculum for Grades 11 science.

The learning expectations are also broadly applicable to other Canadian curricula, including the Pan-Canadian Science Curriculum.

A: Ontario Curriculum Grade 11 Biology, University Preparation (SBI 3U)

Strand: Plants: Anatomy, Growth and Functions

Specific Lesson Goals:

- illustrate the process of succession and the role of plants in the maintenance of diversity and the survival of organisms

B: Pan-Canadian Curriculum

Knowledge:

- 318-9 analyze interactions within and between populations.

Preparation

Preparation time: Approximately 30 minutes to collect materials, prepare student worksheets, read educator notes (provided) and review references/resources (as noted below), plus time to locate a study area.

Length of lesson: Approximately 200 minutes for class discussion and field trip.

Resources required: Tape measure (10 m), metre stick, hand lens, plant identification guides and lesson worksheets.

Procedure

1. As a class, brainstorm examples of natural events and human activities that have resulted in biological communities undergoing secondary plant succession on the school ground and in the community. If possible, choose a study site where a relatively undisturbed area is adjacent to a relatively disturbed area.
2. Explain how to set up a 5m or 10m wide transect line through the disturbed and undisturbed areas. Review the procedures to inventory the plant species and their relative abundance using the four-point scale:
 - (a) *Abundant* - The species is easily found in high numbers in the study area.
 - (b) *Frequent* - The species is easily found but the number is not the highest in the study area.
 - (c) *Occasional* - The species is not always detectable in the study area, but can usually be found in small numbers through persistent searches.
 - (d) *Rare* - The species is seldom found in the study area.
3. Organize students into research teams of no more than 5 or 6 members. Assign specific tasks (e.g. group leader, equipment manager, data collector, identification coordinator and safety officer).
4. Assign transect line study areas to each research team. Spread them well apart to avoid interfering with each other. Remind students to avoid damaging or removing plants.
5. Provide time to compile results and complete the discussion questions. Conduct a class discussion on how the plant community underwent secondary succession as a result of the disturbance. How are the plants adapted to the existing conditions?

Discussion and Questions

Conduct a whole-class discussion around the results and the following questions. Formulate explanations of how the biodiversity of an ecosystem contributes to its sustainability.

1. Explain how the plants might change the existing conditions in the study area during the next two years.
2. Summarize how plant species diversity, population numbers and niche availability change through succession and with disturbance in your study area.
3. Why is complexity important in an ecosystem?
4. What factors add to the complexity of an ecosystem?
5. Why are ecosystems in advanced stages of succession more stable than those in earlier stages?
6. Why does succession occur?

Student Evaluation

- Completion of worksheets and quality of observations
- Observation
- Peer and self-evaluation

Enrichment and Extension Activities

- Initiate secondary succession by thoroughly digging up a square metre of land either in the yard at home or at school. Break up the lumps and remove all plants. Then visit this plot every two weeks for as long as time permits. Make a careful record of the secondary succession that occurs. This extension is best done either in spring or early fall, so that succession plants have a chance to germinate and grow.
- Make a summary of the stages of secondary succession in your geographical region beginning with bare soil.
- Compare the climax communities for the prairies, the St. Lawrence River Valley, Great Lakes Region, British Columbia, Northern Boreal Forests of the United States and Canada. What would your school ground look like if it hadn't been disrupted?
- Conduct an investigation on how the biotic and abiotic factors change as succession proceeds from an undisturbed meadow to an adjacent woodlot.
- Research how sustained yield forestry practices in southern Ontario apply the knowledge of succession to prevent disruptive environmental changes in farm woodlots. What forestry practices are applied to hasten succession back to clear-cut Northern Ontario coniferous forests?

Connections to the Outdoor Environment

This lesson requires the teacher to find an area where the vegetation has been disturbed by human activity or natural events, and an area where the vegetation has been left relatively undisturbed. If possible, either or both of these should be on the school grounds.

Educator Notes

- Students should have prior knowledge of the following terms, and should be able to cite examples of: ecological succession, primary succession, secondary succession, pioneer plants, dominant plant, index plants, climax community.
- Students should be able to explain why plant succession occurs using an example such as: succession from bare soil to climax forest.
- To find an appropriate study site, survey the school ground and local community for areas where vegetation has been disturbed by human activities or natural events. Examples of study sites are: the edge of a roadside or sidewalk; an abandoned lot left vacant for one or more years; a lawn not mowed, fertilized or watered; a forest/woodlot destroyed by fire or lumbering; an area of vegetation killed by pests, drought or road salt. If this lesson is likely to be taught for several years in a row, you could even create a study site on the school grounds by leaving an area of the yard unmowed for a year.
- Assemble plant identification guides.
- Try to minimize habitat disturbance during the study.
- It is recommended that this investigation be conducted in the early fall.
- SAFETY NOTE: Consult your school board's policy regarding safety precautions for outdoor excursions and plan your trip accordingly. Be aware of any students with allergies to insect bites and plants and ensure they carry the required medications. Students should wash their hands after handling soil, plants and equipment. Encourage students to wear sunscreen and appropriate clothing (e.g. hat, long-sleeved shirt) to minimize the damaging effects of sun exposure. If conducting the study along a roadside, stay at least 2 m away from the edge.

References

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Worksheets

Student Worksheet

Date: _____

Group Members: _____

In this field study, you will investigate how plant communities undergo changes through the process of secondary succession caused by human disturbance. You will also analyze the role of plants in the maintenance of diversity and stability of ecosystems.

1. Name the study area under investigation (e.g., a rural roadside).
2. How has human activity disturbed this study area? (e.g. road constructed; salt sprayed during winter months; mowed a 1m swath along roadside).
3. Depending on the size of the assigned study area, use the metre tape to lay down a 5m or 10m transect line perpendicular to the base line identified by your teacher (e.g. edge of road). Try to minimize your disturbance of the organisms and habitats.
4. Sketch a map of your study area. Note the general distribution of the vegetation, rocks, bare ground, cemented areas and other significant features 3 metres out on both sides of the transect line.
5. Use the field guides to identify the plants growing along the transect at 1m intervals. Record their names and relative abundance (abundant, frequent, occasional or rare) in the chart. If you do not know a plant's name, provide a sketch instead.
6. On your sketch map, indicate the location of the plants. A legend would be helpful.
7. Where is there a greater abundance of plants on the transect? Explain why.
8. Where is the greatest diversity of plants? Explain why.
9. Where is the lowest diversity of plants? Explain why.
10. Identify the pioneer plant species.
11. Examine these plants. How are they adapted to the existing conditions?
12. Use your lists to identify the index species.
13. Examine two or more index species. How are they adapted to the existing conditions?
14. Examine the soil at three locations in your study area. Describe the soil characteristics in the table provided (e.g. colour, texture, composition, depth).

Table 1: Inventory of Plant Species Along Transect

Distance Along Transect (m)	Plant Name (or diagram), including latin name	Relative Abundance (a, f, o, r)	Pioneer Species	Index Species
e.g. 1 metre	Common Dandelion (<i>Taraxacum officinale</i>)	a	X	X

Table 2: Soil Characteristics

Criteria	Sample 1	Sample 2	Sample 3
Location			
Colour			
Texture			
Composition			
Depth			