Finding Succession in Changing Ecosystems
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Tuscaloosa County, Alabama

*Overview:

This outdoor, inquiry based activities allows students to model the basic stages of primary succession and explore the different environmental factors that drive successional stages. Students are assigned an object that represents a single step in terrestrial plant succession and must work together with the rest of the class to place each object in the correct order of succession. Students will not only describe this process under normal conditions but also be able to predict changes that can occur as a response to a variety of environmental disturbances. Throughout this activity, students will be prompted to formulate explanations that will help them understand the broader implications of succession on an ecosystem scale and how humans affect it. This lesson results from collaboration between the Alabama State Department of Education and ASTA.

*Content Standard(s):

<table>
<thead>
<tr>
<th>Course of Study:</th>
<th>Course: Biology</th>
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</thead>
<tbody>
<tr>
<td>Grade Level: 9</td>
<td>Content Standard # 10</td>
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</tbody>
</table>

Content Standard:
Construct an explanation and design a real-world solution to address changing conditions and ecological succession caused by density-dependent and/or density independent factors.

*Primary Learning Objectives(s):

- Students will be able to compare and contrast resource availability and different successional species during primary and secondary succession.
- Students will be able to discuss how the effect of density dependent and density independent factors drives species replacement in each successional stage.
- Students will be able to predict effects of disturbance on succession.
- Students will be able to predict what changes will occur in succession as a result of specific ecological disturbances.

*Total Duration:

90 minutes: This activity could be completed in one ninety minute block or two forty-five minute class periods.
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*Materials and Equipment:

- Access to an outdoor area with a variety of vegetation (moss, grasses, shrubs, trees). These items can be collected ahead of time if there is no outdoor area available.
- Printed and cut-out handouts (laminating these handouts is optional)

*Technology Resources Needed:

Internet access for teacher and remediation resources and teacher resources

Background/Preparation:

- Primary Succession
- Secondary Succession
- Pioneer species
- Lichen
- Climax Community
- Limiting Resources
- Density dependent
- Density independent
- Competition
- Competition for resources
- Density dependent and density independent factors
- Resources and environmental factors are different depending on the environment in which succession is taking place.

*Procedures/Activities:

**Part 1**

This portion of the lesson should be completed outside. If you do not have access to an outdoor area, items to complete this activity can be gathered ahead of time by the teacher and brought into the classroom (such as rocks, lichen, cut grass, wildflowers, shrub and tree branches). These items can be placed around the classroom (out of order).

1. Take students to an outdoor area with access to variety of plants such as mosses, grasses, vines, shrubs and trees.
2. Hand each student a **Succession Card** with a word describing an item or plant that represents a successional stage.
3. Give the students five minutes to collect a sample representing their successional item and return to you.
4. When all students have returned, give a brief definition of primary succession.
5. Instruct students to form a line, arranging them in the correct order of primary succession. (give students about five minutes to arrange in the correct order)

6. Check the order of students. If a student or groups of students are not in the correct order, ask those students why they chose to be in that position. Allow students to correct their order at this time.

7. Ask the students who have rock and soil to step forward. Ask the class "what must happen to form soil?"

8. Split students into three groups (rock-mosses, grasses-small shrubs, large shrubs- trees). Hand each group a **Discussion Card** with the following prompt and questions.
   - Develop a list of resources needed for the organisms in this group.
   - What the organisms in your group competing for?
   - How would you describe the organisms in your group?
   - Why are species changing?

9. Have students read about succession, limiting factors, density dependent and density independent factors their textbook for homework to prepare for the next part of the lesson.

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<table>
<thead>
<tr>
<th>Lesson Materials to be attached:</th>
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</thead>
<tbody>
<tr>
<td><strong>Title:</strong> Succession cards</td>
</tr>
<tr>
<td><strong>Annotation:</strong> Each group will get a card with one or two words on it that describes a living or non-living thing at a given point in succession question cards</td>
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</tbody>
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<table>
<thead>
<tr>
<th>(Attach files as needed)</th>
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</thead>
<tbody>
<tr>
<td><strong>Title:</strong> Discussion Card</td>
</tr>
<tr>
<td><strong>Annotation:</strong> One card per group that contains the following questions and prompts (Develop a list of resources needed for the organisms in this group. What are organisms competing for? Why are species changing?)</td>
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</tbody>
</table>
### Step 2

This portion of the activity should be completed in the classroom.

1. Have students get in groups of four to six students.
2. Tell students the following: Change in the environment is natural. Disturbances in an ecosystem can be natural or anthropogenic. How does human activity affect Ecological Succession?
3. Assign each group one of the following anthropogenic disturbance:
   - Clear-cutting forest (logging)
   - Mountain top Removal Mining
   - Herbicides on Agricultural Land
   - Urbanization
   - Introduction of an invasive species during early succession
4. Give each group of students a Disturbance Handout describing an anthropogenic disturbance. Each student group must answer the following questions addressing their disturbance:
   - How will this disturbance affect succession?
   - What resources may be limiting due to your disturbance?
   - Does this disturbance affect any other density dependent and density independent factors? Why?
   - How will this affect natural, ecological succession?
   - Develop a plan that could remediate this problem and restore (in some part) succession.
5. Give students twenty minutes to answer the questions and develop a remediation plan.
6. Each group will take a few minutes to present their answers and ideas to the class.

### Lesson Materials to be attached:

(Attach files as needed)

<table>
<thead>
<tr>
<th>Title:</th>
<th>Disturbance Handout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annotation:</td>
<td>One handout will be given to each group. The questions on the handout will allow students to explore a specific type of disturbance and understand how can affect succession.</td>
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</tbody>
</table>

| Title: | |
|--------| |
| Annotation: | |
Ecological succession is a concept in which students must integrate and synthesize information and apply them to the overall process. The ideal assessment for this activity would be to have students write a response to a prompt. Using information gathered during this activity, students should be able to make predictions and support those predictions with evidence. Students should be able to explain what resources are available at each successional stage and how that affects species replacement. Students should be able to not only describe succession under reference conditions but also be able to predict changes that can occur as a response to a variety of environmental factors.

Remediation:
Explain what may be done for students who need extra preparation before or extra assistance after the lesson.

If remediation is needed, students can watch an online animation simulation or animations to aid in understanding this topic.
https://www.youtube.com/watch?v=V49IovRSJDs
http://www.ecoplexity.org/?q=node/496