A RESTORATION PROJECT--A GRADE 9 ACADEMIC INQUIRY PROJECT FOR SUSTAINABLE ECOSYSTEMS

AISHA CEDRONE (/USERS/AISHA-CEDRONE)

Grade Level/Course Code: Grade 9 Academic Science-SNC 1D

Strand(s) and Unit(s): Biology: Sustainable Ecosystems

Introduction: It is important that as human beings we reduce our ecological footprint. Human beings have impacted local ecosystems by:

- urban sprawl and development which leads to habitat loss,
- overexploitation of various organisms which can lead to endangerment and extinction of one or many species;
- introduction of non-native species. This has the potential to lead to endangerment or extinction of one or more species
- pollution of atmospheric, terrestrial and aquatic ecosystems;

In areas that have been negatively impacted by human beings, municipalities and other organizations propose restoration plans. Restoration ecology is a set of strategies that are used to restore an area to the former level of biodiversity, both in the number of organisms and the variety of organisms. In order to do this properly, one must know a few factors:

- The types of organisms that the area supported before biodiversity was lost
- The reason that biodiversity was lost in the area (i.e. human impact or ecological impact)

Once these factors have been determined, action can be put in place to repair the area so that more native species will be able to live in this area again. While a restoration plan may not completely restore an area to the way it used to be, it at least allows the area to have increasing diversity of species interacting in a sustainable ecosystem.

Inquiry Focus: .

Ecosystem Sustainability

How can we as students create or restore green spaces that benefit all organisms that use this area? Areas can include a local park, the student's backyard (if the student has one), or another area of the student's choosing

Overview and Timeline :

The restoration proposal will be introduced at the start of the Sustainable Ecosystems Unit in the Grade 9 Academic Science course (SNC 1D). The lessons that accompany this package provide teachers with some inquiry activities to support student understanding of abiotic factors (non-living things) such as water quality, and soil quality, as well as biotic factors (living things) such as invasive species, which will give students insight of specific problems in the specific area that they are choosing to restore.

Lesson	Timeline

Examining Water Quality	Two, 75 minute lessons Lesson 1 (75 minutes): Constructing a Turbidity Tube Lesson 2 (75 minutes): Shoreline Water testing—75 minutes*** *** Water can be obtained directly from the shoreline, where students do not have to enter the water. *A cautionary note, student safety should always be ensured when working around bodies of water. If students have to enter a body of water, parental permission must be given and students must be supervised by local conservation authorities who offer these types of field trips.*
Examining Soil Quality	Two 75 minute lessons Lesson 1 (75 minutes): Part 1 of Soil lab activity—gather soil sample and place it in tap water. Let it sediment overnight Soil Lesson—see attached lesson outline and PowerPoint Lesson 2 (75 minutes): Complete note on soil Complete Soil lab analysis
Examining Invasive Species	Two 75 minute lessons Lesson 1 (75 minutes): Invasive species lab—see attached Lesson 2***(75 minutes): Research to complete Consequence map for the analysis section of the lab ***If students require additional time, they can do this for homework.

Overall Expectations:

B1. assess the impact of human activities on the sustainability of terrestrial and/or aquatic ecosystems, and evaluate the effectiveness of courses of action intended to remedy or mitigate negative impacts;

B2. investigate factors related to human activity that affect terrestrial and aquatic ecosystems, and explain how they affect the sustainability of these ecosystems;

B3. demonstrate an understanding of the dynamic nature of ecosystems, particularly in terms of ecological balance and the impact of human activity on the sustainability of terrestrial and aquatic ecosystems.

Big Ideas:

People have the responsibility to regulate their impact on the sustainability of ecosystems in order to preserve them for future generations.

Specific Expectations:

Science

B2.1 use appropriate terminology related to sustainable ecosystems, including, but not limited to: *bioaccumulation, biosphere, diversity, ecosystem, equilibrium, sustainability, sustainable use, protection,* and *watershed* [C]

B2.2 interpret qualitative and quantitative data from undisturbed and disturbed ecosystems (terrestrial and/or aquatic), communicate the results graphically, and, extrapolating from the data, explain the importance of biodiversity for all sustainable ecosystems [PR, AI, C]

B2.3 plan and conduct an investigation, involving both inquiry and research, into how a human activity affects soil composition or soil fertility (e.g., changes to soil composition resulting from the use of different compostable materials, organic or inorganic fertilizers, or pesticides), and, extrapolating from the data and information gathered, explain the impact of this activity on the sustainability of terrestrial ecosystems [IP, PR, AI, C]

B2.4 plan and conduct an investigation, involving both inquiry and research, into how a human activity affects water quality (e.g., leaching of organic or inorganic fertilizers or pesticides into water systems, changes to watersheds resulting from deforestation or land development, diversion of ground water for industrial uses), and, extrapolating from the data and information gathered, explain the impact of this activity on the sustainability of aquatic ecosystems [IP, PR, AI, C]

B3.1 compare and contrast biotic and abiotic characteristics of sustainable and unsustainable terrestrial and aquatic ecosystems

Geography

E2.1 assess the impact of urban growth on natural systems *(e.g., impact of urban sprawl, vehicle use, and waste disposal on water and air quality)*

E3.2 explain how the natural environment may influence land-use patterns within the built environment *(e.g., roads tend to be on flatter land; parks are often near water)*

Key Concepts:

- Part 1: Students' understanding how nearby ecosystems are affected by human use and how these areas can be modified to increase biodiversity.
- Part 2: Restoration Plan—Student creating a practical proposal to tackle environmental problems and ensure ecosystem sustainability.

Prior Skill Sets:

Prior Knowledge:

Before beginning this inquiry project, students should have a good understanding of the following:

- The abiotic and biotic factors that impact ecosystems. These can be, but are not limited to, soil (abundance and quality), sunlight, temperature, water (abundance and quality), species diversity, ecosystems diversity, native vs. invasive species, habitat, species at risk (threatened, endangered, extirpated, extinct)
- Land space available and how it is currently being used and how it was used before the area was urbanization.
- What a restoration plan is and what it attempts to achieve

Materials and Equipment:

- Appropriate outdoor attire
- Internet access
- Google Maps
- Students need their own device or can borrow school device to take pictures.
- Clipboard
- Pencils/pens/calculator
- Lab worksheets

Safety:

- Students should wear the appropriate attire and be supervised by a teacher when examining a local, nearby ecosystem.
- Students should not venture into water areas unless doing a stream study led by teacher or outside group. Use directives from your specific school board when bringing students near water.
- Teacher be aware of students with known allergies . Use appropriate medical procedure (i.e. Epipen) if student has this in their medical plan.

Instructional Planning and Delivery:

Lesson	Timeline	Materials Required
Examining Invasive Species	Two 75 minute lessons Lesson 1 (75 minutes): Invasive species lab—see attached Lesson 2***(75 minutes): Research to complete Consequence map for the analysis section of the lab ***If students require additional time, they can do this for homework.	Lesson on Invasive Species ID—see attached file Internet access Meter stick Pencil

Examining Water Quality	Two, 75 minute lessons Lesson 1 (75 minutes): • Constructing a Turbidity Tube Lesson 2 (75 minutes): • Shoreline Water testing—75 minutes*** *** Water can be obtained directly from the shoreline, where students do not have to enter the water. *A cautionary note, student safety should always be ensured when working around bodies of water. If students have to enter a body of water, parental permission must be given and students must be supervised by local conservation authorities who offer these types of field trips.*	Water Quality Study—see attached file with this name Yogourt containers Exacto knives Permenant Marker Large clear cylinder (i.e. 1 L graduated cylinder, fluorescent light tube) Internet access School Board Water Safety permission forms
The importance of Soil in Biodiversity	Two 75 minute lessons Lesson 1 (75 minutes): • Part 1 of Soil lab activity—gather soil sample and place it in tap water. Let it sediment overnight • Soil Lesson—see attached lesson outline and PowerPoint Lesson 2 (75 minutes): • Complete note on soil • Complete Soil lab analysis	Soil lesson—see attached plan Soil PowerPoint Mason jars Trowels Tap water Rulers Calculators Pencils Soil Key
Final Project: Create a restoration proposal	Two, 75 minute class work periods: Using the various information that students have collected from the various activities students are to create a restoration plan the increases the biodiversity richness and biodiversity evenness in the area.	See attached “Restoration Plan Proposal” assignment[AJ10] .

Student Support Resources:

Blake, L. et al (2009) “Restoration Proposal” p. 110-113 McGraw Hill Ryerson, ON Science 9 McGraw-Hill Ryerson; 1 edition (Aug. 4 2009)

Related Background Resources and/or Links:

Assessment Opportunities:

Assessment for learning—Restoration Plan

Assessment of learning Project rubric—see attached to Restoration Plan Project

Future Opportunities / Extensions: Where else could this lead? List possible classroom and/or community based extension activities (e.g. school/community fairs, audits, field trips, guest speakers, investigations, debates, interviews....).

See attached extensions in individual lessons on soil, water, invasive species ID

.

WATCH THE VIDEO

03:59 min

(//www.youtube.com/embed/kvwP2ty5CWk?width=800&height=450&iframe=true)

RESOURCES

- Invasive Species Information (https://www.invasivespeciesinfo.gov/whatis.shtml)
- The threat of invasive species - Jennifer Klos (https://www.youtube.com/watch)
- Selecting Native Plants (https://cvc.ca/your-land-water/countryside-stewardship/stewardship-resource-centre/home-and-garden/selecting-native-plants/)
- Native Prairie and Meadow Plants (https://cvc.ca/wp-content/uploads/2015/05/21310-prairie-and-meadowweb.pdf)
- Native Woodland Plants (https://cvc.ca/wp-content/uploads/2015/11/Woodland-Plants_Landscaping-WEB.pdf)
- Invasive Species List (http://www.invadingspecies.com)
- Ontario Wild Flowers (http://ontariowildflowers.com/main/species.php)
- Conservationists debate 'invasive species' vs. 'non-native' labels (https://www.cbc.ca/news/technology/conservationists-debate-invasive-species-vs-non-native-labels-1.3474200)

- Invasive Plants Sometimes Offer Help Instead of Harm (https://www.livescience.com/30119-invasive-species-plants-good.html)
- The USGS Water Science School (https://water.usgs.gov/edu/color.html)
- The Turbidity Tube: Simple and Accurate Measurement of Turbidity in the Field (http://www.virginia.edu/blandy/blandy_web/education/Bay/TurbidityTubeConstruction&Use_Myre_Shaw.pdf)
- Dirt Poor (https://haitirescuecenter.wordpress.com/2008/08/22/article-on-rice-and-the-soil-in-haiti/)
- TEDx video “Soil -- from dirt to lifeline” Fred Kirschenmann at TEDxManhattan (https://www.youtube.com/watch)
- Understanding Your Soil (http://www.rainbird.com/homeowners/understanding-your-soil)
- An inquiry based activity where students evaluate how soil plays a key role in increasing biodiversity. (https://connex.stao.ca/sites/default/files/lesson_3_the_importance_of_soil_in_biodiversity.pdf)
- An inquiry based activity where students evaluate how invasive species can reduce biodiversity (https://connex.stao.ca/sites/default/files/lesson_1_invasive_species_id.pdf)
- An inquiry based activity where students evaluate the importance that water quality plays in ecosystems (https://connex.stao.ca/sites/default/files/lesson_2_water_quality_study.pdf)
- An inquiry based assignment where students can see how they have to alter an ecosystem to increase biodiversity, (https://connex.stao.ca/sites/default/files/assignment_restoration_plan_proposal.pdf)
- A lesson to accompany the soil inquiry based activity (https://connex.stao.ca/sites/default/files/lesson_3_soil_.pdf)

ELEMENT

- Inquiry (/expert-elements/inquiry)

(/classroom-catalysts) RETURN TO CATALYSTS (/classroom-catalysts)

STAO/APSO WEBSITE (http://stao.ca/cms/)
SEARCH (/search)
PRIVACY POLICY (/privacy-policy)
TERMS OF USE (/terms-of-use)
CONTACT (/contact)

FACEBOOK (https://www.facebook.com/STAOAPSO?fref=ts)
TWITTER (https://twitter.com/staoapso)
GOOGLE+ (https://plus.google.com/u/0/+ScienceTeachersAssociationofOntarioDresden/about)
INSTAGRAM (https://instagram.com/staoapso/)