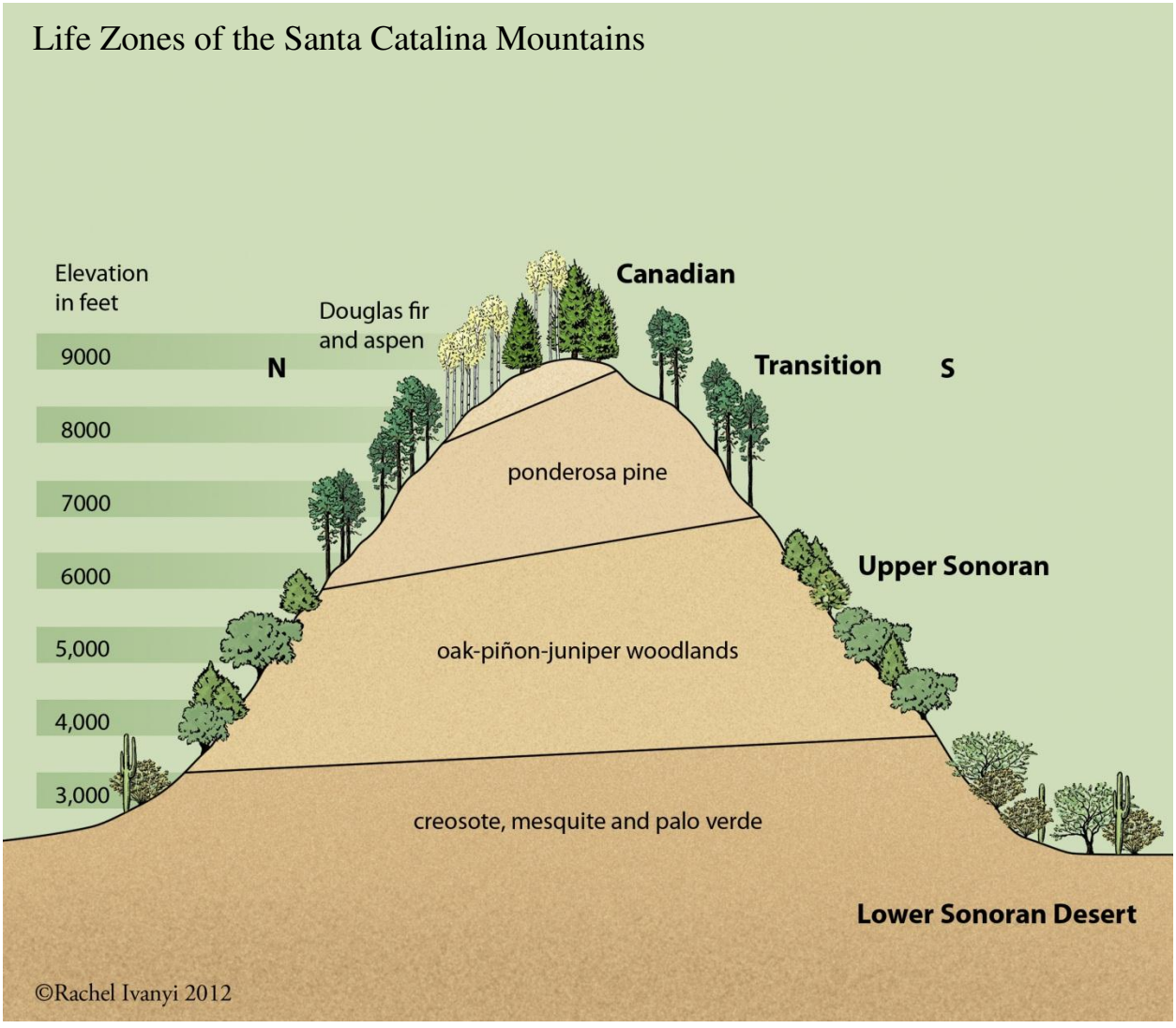
ARIZONA-SONORA DESERT MUSEUM

Ecology Field Trip Guide

Teacher Packet



Welcome! The purpose of this field trip, including the pre- and post-visit activities, is to give students the experience of scientific field research using the Arizona-Sonora Desert Museum as their field site. When they have finished their study, they are asked to create learning materials for students in an earlier grade or to propose a solution to an environmental problem that is challenging the Sonoran Desert Region.

The Ecology Field Notebook and this guide coordinate with our exhibits and with the Arizona Department of Education Ecology standards. Your students will work to complete the **data collection sheets in their notebooks** before, during, and after their visit. It may take students a few hours to complete their research at the Museum. If your class will be spending less time at the Desert Museum, we recommend students complete those sections that best correlate with your Ecology unit. Please feel free to modify, add, or delete activities to meet the goals of your visit.

Arizona Science Standards

SC07-S4C3-02
SC07-S4C3-03
SC07-S4C3-04
SC07-S4C3-05
SC07-S4C3-06 (if you choose to use the post-visit solution to an ecological problem activity)

Materials

For the entire unit, each student will need

- a copy of the Ecology Field Notebook
- a copy of the "Adaptive Characteristics" for each scientist (botanist, mammalogist, ornithologist, herpetologist, entomologist) (Note: if you choose not to assign the scientific specialty to students, then you will need a copy of all five of these for the chaperone in charge of each group.)
- pencils for sketching (possibly color)

For the field trip, each group (chaperone) will need

- a copy of the school group map
- a schedule with instructions for that group's biotic community
- the list of adaptive characteristics each scientist may focus on
- tape measure
- thermometer
- disposable or digital camera (to avoid distractions from cell phones, it would be nice to have one camera per group and not allow them to have their phones)

For the field trip, each student will ***need (these are health/safety issues so ensure all students have the following):***

- water bottle
- hat
- sun screen
- a clipboard for each student

Preparation for field trip

- Read the introduction to the Ecology Field Trip.
- Photocopy all materials.
- Prepare research kits.
- Make arm bands for the various groups by photocopying the wristbands in various colors, with one color for each biotic community.

Before leaving for field trip

Parent Chaperone Meeting or Instructions before Field Trip

- Give each chaperone a copy of the chaperone instructions, and ask if they have any questions.
- Give each chaperone a copy of the junior scientist notebook, a map, the schedule for their group's route, and the appropriate armbands.
- Give each chaperone the research kit.
- Ensure the chaperones know the importance to the safety of the museum specimens that the students under their supervision abide by all guidelines at the museum.
- Reiterate that, as much as possible, the chaperones need to keep to the schedule as the order is set so no exhibit is overcrowded and the junior scientists get the best observation experience.
- Share cell phone or other information with chaperones so they can get in touch with you if there is a situation that requires your attention (emergency, behavior, etc.)

Student and chaperone instructions

Review the rules of conduct with your junior scientists and chaperones before you begin. Remember, these are **living exhibits**. Following the rules will make your visit a more positive experience for your students and the Desert Museum's wildlife.

Upon arriving at the museum

Check daily schedule posted in the orientation area to see if there are any special events, such as a natural history lesson begin given by a trained docent, that may complement your lesson. If you have left time in your schedule for such an event, these can be extremely provocative and helpful to your students. They provide exciting, hands-on opportunities to learn more about the Sonoran Desert Region.

The Learning Experience (concept development; active participation)

Students will be grouped according to their pre-trip biotic community; it is up to you if you want to have them continue their assigned scientific roles.

Begin at the life zone walk which is right outside the aviary. (10 minutes)

- Students observe, note, and sketch plant structures they are likely to find within their biotic communities.
- Desert will focus on zones 1 and 2.
- Grassland will focus on 3 and 4
- Woodland will focus on 5 and 6

Groups will use the museum map and find the exhibit dedicated to their biotic community. (5 minutes)

- Students will disperse to collect data from their respective exhibit in the desert museum and list plants, animals, structures, there. (20 minutes each)
- Students will then follow the schedule to visit the Riparian Corridor exhibit; the Walk-in mixed-bird Aviary; Reptiles and Invertebrates exhibit; and Cat Canyon.
- Enrichment (if time)
    - Cave exhibit
        - What prehistoric animals would have lived in your biotic community?
        - Speculate what your biotic community was before it was its current biotic community (Was your desert a grassland? Was it a tropical forest?)

Pre-Visit

In order to support their learning experience, your seventh-grade scientists will need to do what adult scientists do: research prior to collecting data in the field.

Exploration (Anticipatory Set): Biotic Communities Webquest

Students will be divided into 5- member groups. (Depending on the size of the group you are escorting to the Museum, you may have more than one 5-member group for one or more of the biotic communities.) Each group will become experts about one of the following biotic communities *that occur within the Sonoran Desert region*, with their expertise encompassing the riparian zones within their communities:

- Desert
- Grassland
- Woodland

TIP: Ensure students are researching the biotic communities within the Sonoran Desert region, not in general.

- Within each group, students will be assigned scientific research expert roles:
  - Botanist
  - Mammalogist
  - Entomologist
  - Ornithologist
  - Ichthyologist

  TIP: Ensure students know all the specimens and organisms they may be studying (bats, rodents, etc.)

- The students will use a Webquest (multidisciplinary study) to fill in the accompanying data collection sheets. Note that since your students are using the Arizona-Sonora Desert Museum as their research field, and one map is of Mt. Lemmon, much of the information they will find may be unique to the part of the Sonoran Desert Region immediately surrounding Tucson. In other areas, the elevation and other aspects may differ. However, the information is representative of what they will find throughout the Sonoran Desert Region.
  - Determine the range of elevation that the Sonoran Desert region in which their biotic community occurs.
  - Sketch typical abiotic and biotic structures for their biotic communities with brief explanations of adaptations
  - Role of riparian habitats within their biotic community
  - ***Academic language necessary for the exploration:*** **ecosystem, environment, biotic community, diversity, structures, limiting factors, abiotic, biotic, niche, carrying capacity**
  - ***Additional academic language you may want to introduce:*** **mutualism, communalism, parasitism, symbiosis, keystone species**

Botanist: Adaptive Characteristics of Plants

As you go through your webquest and the exhibits at the Arizona-Sonora Desert Museum, look carefully at the stem (trunk) and leaf (spine, needle) portion of the plants. In these two structures, you will find many of the adaptive characteristics that occur in biotic communities.

Also, look for and note the presence of any nurse plants, adult plants from another species that an immature plant is using as shelter until it is old enough to withstand harsh weather and predators, or to get some of the nutrients from the nurse plant's decomposing matter.

If you are researching in a season in which no leaves are apparent, speculate as to what adaptive characteristic causes a plant to be leafless during this time.

Pay special attention to the following characteristics of stems and leaves:

- size
- shape
- texture
- color
- orientation

Once you finish looking for these specific characteristics, look for other adaptive characteristics you might see.

Entomologist: Adaptive Characteristics of Arthropods

As you go through your webquest and the exhibits at the Arizona-Sonora Desert Museum, look carefully at the body shape, jointed and segmented body parts, as well as any unusual textures on the bodies or legs of the arthropods you choose.

Many arthropods transcend biotic communities. If you choose to sketch a part of such an arthropod, you must choose an adaptive characteristic that enables it to live within your specific biotic community.

Use the signs in the exhibits to help you decide what to sketch and why.

Pay special attention to the following:

- color
- exoskeletal features
- behavior

Once you finish looking for these specific characteristics, look for other adaptive characteristics you might see.

Ornithologist: Adaptive Characteristics of Birds

As you go through your webquest and the exhibits at the Arizona-Sonora Desert Museum, look carefully at the feet and beaks of the birds. In these two structures, you will find many of the adaptive characteristics that occur in biotic communities.

Pay special attention to the following:

- shape
- size
- positioning of toes
- behavior

Once you finish looking for these specific characteristics, look for other adaptive characteristics you might see.

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Mammalogist: Adaptive Characteristics of Mammals

As you go through your webquest and the exhibits at the Arizona-Sonora Desert Museum, look carefully at the eyes, feet, color and behavior. In these four characteristics, you will find many of the adaptive characteristics that occur in biotic communities.

Pay special attention to the following when drawing the eyes and feet:

- shape
- size
- positioning

Once you finish looking for these specific characteristics, look for other adaptive characteristics you might see.

Herpetologist: Adaptive Characteristics of snakes, lizards and turtles

As you go through your webquest and the exhibits at the Arizona-Sonora Desert Museum, look carefully at the bodies, heads and mouths, and tails. In these structures, you will find many of the adaptive characteristics that occur in biotic communities. Also pay attention to behavior.

Pay special attention to the following:

- structures
- patterns
- size
- shape
- colors
- behavior

Once you finish looking for these specific characteristics, look for other adaptive characteristics you might see.

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Role of Riparian Habitats within a Biotic Community
Key

Note that answers here will vary. This is not meant to be a one-right-answer key, but a guide to support you in guiding students to plausible answers.

One characteristic that defines a riparian habitat ___is the availability of flowing surface water. Riparian habitats need water to maintain their biotic community. Some riparian habitats exist that have water only certain times a year or used to have water but no longer do. These are called dry or desert riparian areas.

The biotic community I am studying is the mountain woodland, grassland, or desert ; riparian habitats are likely to exist near the following structure(s) in my biotic community: _canyons, streams, rivers, marshes, lakes, washes, hotsprings (answers will vary because students will have a different biotic community . Many urban structures have replaced some of the roles riparian habitats used to perform within my biotic community; a few of them are man-made lakes , __landscaping and __golf courses___.

Two examples of organisms that are more likely to live within a riparian habitat than others are frogs and _fish__. Plant species that live in riparian habitats are likely to have the following adaptative characteristics: __larger leaves, taller stems to reach out of the water___. The animal species that are likely to live in riparian habitats will have these characteristics: __gills, fins, webbed toes, bills__.

Chaperone Instructions for Junior Scientist Ecology Field Trip

Good morning! Thank you so much for being part of such an exciting part of our students' learning.

As you may already know, this field trip is part of a science unit on ecology. We know that students are eager to visit the museum; we want to channel that enthusiasm into a focus on the academic assignment that has been constructed for this visit. Your role as research guide for this experience will support the students in learning a great deal and will help you keep them interested and focused.

Materials you will have:

Copy of junior scientist notebook
Research materials for your group
Schedule of your group's tour

Facilitating Discussion During Visit

- ***Help the junior scientists find what they need to see within the exhibits*** as you guide your group through the museum.
- ***Adhere to the schedule*** as much as possible. We know sometimes there is something fascinating going on in an exhibit that you will want the students to see, and we don't want them to lose out on those experiences; however, they will need to complete the assignment.
- ***Remind students to make careful observations*** of plants, animals and geologic features as well as to read the signs and labels at each exhibit.
- ***Ask questions.*** In addition to the questions for this assignment, you may ask the following questions if there is time.
    - What are some of the limiting factors for this biotic community?
    - What is the carrying capacity of this exhibit?
    - What would happen if fire occurred in this biotic community? Predict the impact on the biotic features.
    - What would happen if drought occurred in this biotic community? Predict the impact on the biotic features.
    - What would happen if flooding occurred in this biotic community? Predict the impact on the biotic features.
- To prepare for their post-trip assignment, questions regarding human-caused threats to the communities should also be asked frequently:
    - What would happen to this species if it can't get water?
    - What happens to this plant if cattle overgraze it?
    - What happens to the animals that eat this plant if cattle overgraze it?
    - What happens to this animal if it loses its nesting area?
    - What happens to this plant if its pollinator is extirpated or extinct?

Biotic Community Armbands

grassland
grassland
grassland
grassland
grassland
grassland

desert
desert
desert
desert
desert
desert

woodland
woodland
woodland
woodland
woodland
woodland

Desert Group Schedule for a Four-and-a-half-hour Trip

From arrival at the museum

Time	Activity
10:00	Arrival and schedules done
10:00—10:05	Walk to life zone (by exit of walk-in aviary)
10:05—10:20	Life zone examination of zones 1 and 2
10:20—10:30	Walk to Desert Loop Trail. Outside of aviary, turn left on main trail; stay on main trail until you see signs for Cat Canyon. Desert Loop Trail entrance is behind Cat Canyon.
10:30—10:50	Complete data collection for the desert biotic community.
10:50—11:00	Walk to Cat Canyon. When you exit the Desert Loop Trail, the entrance to Cat Canyon is on your right
11:00—11:20	Complete data collection for cats that live in the desert biotic community.
11:00—11:25	Walk through the Riparian Corridor. When you exit the side trail leading to Cat Canyon and the Desert Loop Trail, turn right on the main trail; it will take you through the Riparian Corridor.
11:25—11:45	Complete data collection for specimens you would find in a riparian system within the desert biotic community. Be sure to go through the underwater viewing part of the exhibits.
11:45—11:50	Walk to the walk-in aviary. Continue following the main trail.
11:50—12:15	Complete data collection for birds that may live in the desert biotic community.
12:15—12:20	Walk to the reptiles and invertebrates exhibit. As you exit the aviary, turn right on the main trail and follow it to the museum entrance. The reptiles and invertebrates exhibit is in two rooms just past the main entrance.
12:20—12:40	Complete the data collection for the species you would find in a desert biotic community.
12:40—1:15	Lunch
1:15—2:20	Open exploration with chaperones and biotic groups: revisit areas to complete science notebooks; explore other exhibits

Grassland Group Schedule for a Four-and-a-half-hour Trip

From arrival at the museum

Time	Activity
10:00	Arrival and schedules done
10:00—10:05	Walk to life zone (by exit of walk-in aviary)
10:05—10:20	Life zone examination of zones 3 and 4.
10:20—10:30	Walk to Desert Grassland exhibit. Outside of aviary, turn left on main trail; stay on main trail, which goes right into the Desert Grassland exhibit.
10:30—10:50	Complete data collection for the grassland. Note that the grassland exhibit leads right into the mountain woodland exhibit. Ensure you include specimens that are most likely to occur in a desert grassland.
10:50—11:00	Walk through the Riparian Corridor (you passed through it on your way to the Desert Grassland exhibit; retrace your steps through the exhibit and back on the main trail).
11:00—11:20	Complete data collection for specimens you would find in a riparian system within the desert grassland biotic community. Be sure to go through the underwater viewing part of the exhibits.
11:00—11:25	Walk to the walk-in aviary. Continue following the main trail.
11:25—11:45	Complete data collection for birds you may find in a desert grassland biotic community.
11:45—11:50	Walk to the Reptiles and Invertebrates exhibit. As you exit the aviary, turn right on the main trail and follow it to the museum entrance. The reptiles and invertebrates exhibit is in two rooms just past the main entrance.
11:50—12:15	Complete the data collection for these species you would find in a desert grassland biotic community.
12:15—12:20	Walk to Cat Canyon exhibit. As you exit the Reptiles and Invertebrates exhibit, turn left on the main trail. Follow the main trail until you come to a shortcut by the pollination gardens. There is a sign posted that the shortcut takes you to the Riparian Corridor. Follow the shortcut until it intersects the main trail in the middle of the Riparian Corridor. Turn right and follow the main trail until you see the side trail that leads to Cat Canyon.
12:20—12:40	Complete the data collection for cats you may find in a desert grassland biotic community.
12:40—1:15	Lunch
1:15—2:20	Open exploration with chaperones and biotic groups: revisit areas to complete science notebooks; explore other exhibits

Woodland Group Schedule for a Four-and-a-half-hour Trip

From arrival at the museum

Time	Activity
10:00	Arrival and schedules done
10:00—10:05	Walk to life zone (by exit of walk-in aviary)
10:05—10:20	Life zone examination of zones 5, 6, and 7.
10:20—10:30	Walk to Mountain Woodland exhibit. Outside the aviary, turn left on main trail; stay on main trail, which goes right into the Mountain Woodland exhibit.
10:30—10:50	Complete data collection for the woodland. Note that you pass through the Desert Grassland exhibit to get to the Mountain Woodland exhibit. Ensure you include specimens that are most likely to occur in a mountain woodland.
10:50—11:00	Walk to the Reptiles and Invertebrates exhibit. Continue on the main trail until you are almost at the entrance to the Museum. The Reptiles and Invertebrates exhibit is inside just before you reach the entrance.
11:00—11:20	Complete the data collection for these species you would find in a woodland biotic community.
11:00—11:25	Walk to Cat Canyon exhibit. As you exit the Reptiles and Invertebrates exhibit, turn left on the main trail. Follow the main trail until you come to a shortcut by the pollination gardens. There is a sign posted that the shortcut takes you to the Riparian Corridor. Follow the shortcut until it intersects the main trail in the middle of the Riparian Corridor. Turn right and follow the main trail until you see the side trail that leads to Cat Canyon.
11:25—11:45	Complete data collection for cats you may find in a woodland biotic community.
11:45—11:50	Walk through the Riparian Corridor. As you come out of the Cat Canyon side trail, turn right on the main trail to take you back through the Riparian Corridor exhibit.
11:50—12:15	Complete data collection for specimens you would find in a riparian system within the woodland biotic community. Be sure to go through the underwater viewing part of the exhibits.
12:15—12:20	Walk to the walk-in aviary. Continue following the main trail.
12:20—12:40	Complete the data collection for birds you may find in a woodland biotic community.
12:40—1:15	Lunch
1:15—2:20	Open exploration with chaperones and biotic groups: revisit areas to complete science notebooks; explore other exhibits

Final Project: Post Visit to Arizona-Sonoran Desert Museum
Biotic Community Research Project

Included in this post-visit to your field trip are two options. You will need to decide if your students will continue to work together in their biotic community groups to go more deeply into their learning, or if you would like them to broaden their knowledge and work with students from other biotic community groups.

Option A: Creating an Environmental Solution Project

In this option, students do not have to work with their fellow researchers to complete the projects. They will choose groups based on fellow students who have a similar interest in a human-caused problem that challenges at least one species in their biotic communities.

Students will need to learn a bit about challenges to the biotic communities within the Sonoran Desert Region. A great option for this follow-up learning would be the *Endangered and Threatened Species* program from the Arizona-Sonora Desert Museum. If you choose to use this program, an expert from the Museum would visit your class and lead your students through live animal demonstrations and student-driven questioning and discussion. If you choose to use this program, you may want to complete the pre- and post-activities for the program before the visit.

After learning a bit about the human-caused environmental challenges that face the Sonoran Desert Region, students will continue the project.

- Through class discussion, students will choose a human-caused environmental challenge to at least one species in the Sonoran Desert Region. They will find other students who have a similar interest and form a group.
- In their groups, they will discuss the environmental challenge and determine the main cause: urban sprawl causes loss of habitat; introduced species competes with native species; roads fragment habitats; overexploitation of one or more resources, etc. You might also choose one species that has multiple challenges (urban sprawl and overexploitation) or a challenge that threatens the entire biotic community.
- They will research what has already been done by an established group to protect or manage that species. The following list contains just a few examples; you may come up with your own or ask students to find others. They may research the group online, call them, visit, interview a member—what ever they would like to do to gather their information.

    - Tucson Audubon Society
    - Arizona-Sonora Desert Museum
    - Herpetology Society
    - Tucson Botanical Gardens
    - Sky Island Alliance
    - Arizona Wildlife Coalition
    - Sierra Club
    - Bat Conservation International
    - Native Seeds Search
    - Tucson Clean and Beautiful
    - Nature Conservancy
    - Coati Rescue

- Once they have researched what is already being done, students will work with their groups to develop a solution (or partial solution) to the problem.
- They will write a proposal for an effort that supports or adds a different element to the effort by the group or groups already established to protect or manage the chosen species.
- They will then create a product that showcases their solution (game, physical model, kit, presentation, simulation, etc.).

Option B: Creating a Learning Experience

- Students will work in their biotic teams to create a product that teaches a younger grade level about the biotic community. You may want to assign them to a specific grade level that has performance objectives (S.4.2) that these products will address:
    - Grade 1: "Compare the habitats (e.g., desert, forest, prairie, water, underground) in which plants and animals live."
    - Grade 3: "Examine an ecosystem to identify microscopic and macroscopic organisms."
    - Grade 4: "Differentiate renewable resources from nonrenewable resources." (This one may be a bit of a stretch.)
- Students should address the following concepts in their product:
    - The elevation at which the biotic community occurs
    - Major species of each type of organism in the biotic community
    - The average annual rainfall in the community
    - The role of riparian habitats in the biotic community
    - At least three major environmental threats to the biotic community

- The product can be a comic or coloring book, a game, a simulation, printed materials that present the community, artifacts from the biotic community, or any other product that is appropriate.

- They should think and plan carefully. They will all be responsible for contributing in their individual areas of scientific expertise (botanist, mammalogist, entomologist, ornithologist, herpetologist). They should also consider the abilities and skills of their fellow students. If they have at least one strong artist in their group, for example, then a hand-drawn comic book may be a great choice; if not, but they strongly think that a comic book is a great idea, they may be able to create one online.

- You may want to arrange for students to present their products to a genuine audience to see if the products are effective.

- When they have completed their products, you may decide to create a kit, much like a FOSS kit or an ASDM program, that teachers in younger grades can use to teach their students about biotic communities.

Environmental Solution Project Rubric

Teacher name: _____
Student name: _____
Other group members: _____

CATEGORY	4	3	2	1
Brainstorming - Solutions	Students identify a reasonable and very creative solution/strategy to encourage change.	Students identify a moderately reasonable and fairly creative solution/strategy to encourage change.	Students identify a moderately reasonable, and insightful solution/strategy. to encourage change. Creativity efforts are lacking.	Students identify unreasonable, possible solutions/strategies to encourage change. Creativity efforts are scarcely evident.
Research/Statistical Data	Students include 4 or more high-quality examples or pieces of data to support their campaign.	Students include at least 3 high-quality examples or pieces of data to support their campaign.	Students include at least 2 high-quality examples or pieces of data to support their campaign.	Students include fewer than 2 high-quality examples or pieces of data to support their campaign.
Campaign/Product	Students create an original, accurate and interesting product that adequately addresses the issue.	Students create an accurate product that adequately addresses the issue.	Students create an accurate product but it does not adequately address the issue.	The product is not accurate.

Creating a Learning Experience Rubric

Teacher name: _____
Student name: _____
Other group members: _____

CATEGORY	4	3	2	1
Knowledge Gained	All students in group could easily and correctly state several facts about the topic used for the product without looking at the product.	All students in the group could easily and correctly state 1 to 2 facts about the topic used for the product without looking at the product.	Most students in the group could easily and correctly state 1 to 2 facts about the topic used for the product without looking at the product.	Several students in the group could NOT correctly state facts about the topic used for the product without looking at the product.
Accuracy of Content	All information in the product is correct.	All but a couple of facts contained in the product are correct.	The majority of the information in product is correct, but there are a significant number of errors	Most of the information in the product is not accurate.
Text	All text was clearly; standard conventions were followed.	A few areas of text were unclear and/or needed slightly more editing/proofreading.	Text was unclear in several areas; standard conventions were followed inconsistently.	Text was nonexistent or unclear; standard conventions were not followed.
Cooperative work	The group worked well together with all members contributing significant and equal amounts of quality work.	The group generally worked well together with all members contributing some quality work.	The group worked fairly well together with all members contributing some work.	The group often did not work well together and the product appeared to be the work of only 1 or 2 students in the group.