Fall 2014 - Spring 2015
Biodiversity Tour Teachers Guide:

Field Trip Preparation &
Classroom Activities
Introduction

The Center for Native and Urban Wildlife on the campus of Scottsdale Community College is an environmental education organization founded in January 2000 through partnerships with the City of Scottsdale, the McDowell Sonoran Conservancy and the Nina Mason Pulliam Charitable Trust. CNUW demonstrates how conservation of native plants and animals can best be accomplished through preservation of the diverse natural habitats and ecosystems on which they depend.

We offer 3½-hour guided tours of our conservation facilities to fourth grade classes in the Valley of the Sun. There is no charge for the tour. We also provide this packet of classroom activities to perform before and after your field trip. We suggest you do these activities in the order presented.

- Please note vocabulary list on page 20 may be introduced before beginning activities.
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Field Trip Information

Your field trip to the Center for Native and Urban Wildlife begins as your bus arrives at the campus of SCC at 9:30 am. Following a brief orientation, students will spend the next three and a half hours touring CNUW, eating lunch, and attending a talk on biodiversity.

Field Trip Itinerary

**Arrive SCC 9:15 - 9:30**
Meet in Turquoise Room  (see map provided on page 34)

**9:30 -10:00. Orientation in Turquoise Room**
Welcoming introduction by a CNUW staff member begins the tour. Classes will be subdivided into small groups, and started on their tours.

**10:00 -12:00. Tour CNUW facilities**
Docents guide students through Toad Hall, Hall of Biodiversity Past, and a presentation by Liberty Wildlife. Part of the tour is outside so we recommend students bring sunscreen, walking shoes, hats, sunglasses and water (see handout on page 24)

**12:00-12:30 Lunch Turquoise Room or Outside if possible**
Students provide their own lunch.

**12:30 -1:00 Demonstration Gardens. Pond and Reptile House tours.**
Docent or CNUW staff presents the native plants and animals and ponds that support several endangered species of fish and frogs and the abundant birds and wildlife it supports. Scottsdale Community College is committed to sustainable solutions, one way is through xeriscaping, using native plants which require less water, our most important resource here in the desert.

**Leave SCC 1:00-1:15 pm**
CNUW Facilities

To promote our mission of preserving Sonoran Desert biodiversity, CNUW operates the following facilities on the SCC campus and our Tours will be visiting some of these sites. Docents are likely to discuss some or all of the topics delineated below.

Toad Hall
Our learning center, Toad Hall, serves as the gateway for our elementary school tours, and is the hub for all activities and functions of CNUW. Toad Hall houses live animal displays and educational exhibits that aid students in learning about Sonoran Desert wildlife.

Topics:
- Definition of biodiversity
- Three levels of biodiversity (genetic, species, ecosystem)
- The value of biodiversity and reasons for its preservation
- Species no longer found in Arizona (e.g. ocelot)
- McDowell Sonoran Preserve lizard biodiversity & the scientific method
- Global and local amphibian decline & the scientific method
- Individual and group efforts to help preserve desert biodiversity

SCC Wildlife Demonstration Garden
The Wildlife Demonstration Garden is an area of the SCC campus that has been landscaped using native plants in order to educate and demonstrate how landscaping with native plants benefits native wildlife.

Topics:
- Native plant and animal interconnections
- Plant pollinators and the significance of their decline
- The importance of water to desert species
- The value of incorporating aquatic features into desert landscaping
- Endangered fish and plant species native to Arizona

Hall of Biodiversity Past
Included in our Learning Center we have a mural detailing the Age of Dinosaurs beginning 250 million years ago and ending with the one of the survivors of the major extinctions, the softshell turtle. We educate students about the importance of changes in biodiversity and evolution over earth’s 14.5 billion years.

Topics:
- Dinosaur replica exhibits
- Educational mural
- Interactive birds of flight
- Arizona near extinctions
- Soft shell turtle exhibit

Greenhouse/Vivarium
CNUW has a new greenhouse to cultivate native plant species for use in various habitat restoration projects. We have a new vivarium in which we are currently house desert tortoises and native lizards.
Topics:
- *How a Greenhouse works*
- *Natural History of desert tortoises and chuckwallas*
- *Conservation of amphibian species reared by CNUW*
- *Plant propagation efforts*

**CNUW Projects**

**McDowell Sonoran Conservancy Surveys:** Ongoing restoration and research taking place. Chelsea Hull from CNUW was involved in the three year flora study and with Steve Jones has published a peer reviewed study of the biodiversity of plants within the thirty thousand acre preserve. Seed bank field studies are ongoing as part of this restoration effort. CNUW also participated in the small mammal surveys within the preserve.

Other projects include propagation of native trees for landscaping at Scottsdale Community College. CNUW’s main fundraiser includes native plant sales two or three times a year.

**Educational opportunities:**
- *Observation of the diverse plants and animals in their natural desert environment.*
- *Learning real-life applications of habitat restoration and conservation biology.*
- *Demonstration of the importance of biological preserves and their necessity for the survival of wildlife.*
- *Consideration of practical questions concerning preserve design and maintenance such as, “Is it better to have one large preserve or several small preserves?”*

**Web Site cnuw.scottsdalecc.edu**

Our web page, which we are always upgrading, has resources for teachers, students, and community members. This includes native plant and animal species photographs and educational activities, species lists and natural history information from various valley sites as well as native landscaping techniques for backyards.

**Educational opportunities:**
- *Exploring the web for more information regarding conservation biology, desert wildlife, and links to environmental education.*
- *Recognizing how desert landscaping can benefit wildlife*
- *Learning techniques for xeriscaping your own yard.*
- *Playing educational games about Sonoran desert biodiversity and understanding causes of its decline.*
- *Participating in, and staying informed about current environmental news & events, and the status of wildlife in Arizona.*
CNUW Activities and Scottsdale Unified School District Standard Objectives

Activities in our education packet are designed to address certain fourth grade science standard objectives in use by the Scottsdale Unified School District. Some exercises also address SUSD language arts objectives. Listed below are the objectives that our activities directly address or can be made to address with slight modifications.

Pre-Visit Lesson #1: What is Biodiversity?
Sci. 1.1.4-Locate information (e.g. book, article, website) related to an investigation
Sci. 1.4.1-Communicate verbally or in writing the results of an inquiry
Sci. 4.1.2-Classify plants and animals by identifiable group characteristics
Sci. 4.3.1-Describe ways various resources (e.g. air, water, plants, animals, soil) are utilized to meet the needs of a population.
Sci. 4.3.3-Analyze the effect that limited resources may have on an environment.
Sci. 4.4.1-Recognize that characteristics of an organism are inherited and result from environmental conditions.

Pre-Visit Lesson #2: Why is Biodiversity Important?
Sci. 3.1.1- Describe how natural events and human activities have positive and negative impacts on environments.
Sci. 4.3.1-Describe ways various resources (e.g. air, water, plants, animals, soil) are utilized to meet the needs of a population.
L.A. 5.1.1-Writes descriptive/expressive text
L.A. 6.3.4-Illustrates text
L.A. 7.1.4-Uses clear/specific vocabulary

Pre-Visit Lesson #3: Scientific Method & Burrowing Owls
Sci. 1.1.2-Formulate a relevant question through observations that can be tested by investigation
Sci. 1.1.3-Formulate predictions in the realm of science based on observed cause and effect relationships
Sci. 2.2.1-Explain the role of experimentation in scientific inquiry.
Sci. 2.2.3-Explain various ways scientist generate ideas (e.g. observation, experiment, collaboration, theoretical and mathematical models).
L.A. 6.1.1-Uses idea-generating strategies
L.A. 7.1.4-Uses clear/specific vocabulary
L.A. 10.1.1-Demonstrates group participation skills

Pre-Visit Lesson #4: Scientific Method & Lizard Diversity
Sci. 1.1.2-Formulate a relevant question through observations that can be tested by investigation
Sci. 1.1.3-Formulate predictions in the realm of science based on observed cause and effect relationships
Sci. 1.1.4-Locate information related to an investigation
Sci. 4.4.2-Give examples of adaptations that allow plants and animals to survive

Field Trip to CNUW at SCC: Guided Tour & Biodiversity Lecture
Sci. 2.2.3-Explain various ways scientist generate ideas
Sci. 3.1.1-Describe how natural events and human activities have positive and negative impacts on environments
Post-Visit Lesson #1: Natural History Story - A Writing Assignment
Sci. 4.3.1-Describe ways various resources (e.g. air, water, plants, animals, soil) are utilized to meet the needs of a population.
Sci. 4.3.3-Analyze the effect that limited resources may have on an environment.
Sci. 4.4.1-Recognize that characteristics of an organism are inherited and result from environmental conditions.
L.A. 5.1.1-Writes descriptive/expressive text
L.A. 6.3.1-Prints legibly
L.A. 6.3.4-Illustrates text
L.A. 7.1.1-Develops clear and consistent focus
L.A. 7.1.4-Uses clear/specific vocabulary

Post-Visit Lesson #2: Schoolyard Biodiversity Surveys
Sci. 1.1.2-Formulate a relevant question through observations that can be tested by investigation
Sci. 1.1.3-Formulate predictions in the realm of science based on observed cause and effect relationships
Sci. 1.1.4-Locate information related to an investigation
Sci. 1.2.3-Conduct controlled investigations in life, physical, and earth and space sciences
Sci. 1.3.1-Analyze data obtained in a scientific investigation to identify trends
Sci. 1.3.2-Formulate conclusions based upon identified trends in data
Sci. 1.3.3-Determine that data collected is consistent with the formulated question
Sci. 1.3.4-Determine whether or not the data supports the prediction for an investigation
Sci. 1.3.5-Develop new questions and predictions based upon the data collected in the investigation
Sci. 1.4.1-Communicate verbally or in writing the results of an inquiry
Sci. 1.4.3-Communicate with other groups/individuals to compare the results of a common investigation
Sci. 4.3.1-Describe ways various resources are utilized to meet the needs of a population.
Sci. 4.3.3-Analyze the effect that limited resources may have on an environment
Sci. 4.4.2-Give examples of adaptations that allow plants and animals to survive

Post-Visit Lesson #3: Solving a Biodiversity Problem?
Sci. 1.4.3-Communicate with other groups/individuals to compare the results of a common investigation
Sci. 1.4.1-Communicate verbally or in writing the results of an inquiry
Sci. 4.3.1-Describe ways various resources are utilized to meet the needs of a population.
Sci. 4.3.2-Differentiate renewable resources from nonrenewable resources
Sci. 4.3.3-Analyze the effect that limited resources may have on an environment
Sci. 4.3.4-Describe ways in which resources can be conserved
Pre-Visit Lesson #1: What is Biodiversity?

Teacher Notes
The term "biodiversity" can be defined at three levels. It can refer to the diversity of genes that exist within the population of a particular species. It can refer to the diversity of species that exist within an ecosystem, an ecoregion, or even the whole planet. It can also refer to the diversity of ecosystems found throughout varying regions of the earth. In this lesson you will help your students explore biodiversity at the genetic, species and ecosystem levels.

Handout: What is Biodiversity? (Page 25)

An Imaginary Balloon Trip
Have your students research one of the biomes described below or another type of biome that is threatened.

They could explore:
- coral reefs
- rain forest
- savannahs
- temperate forest
- deserts
- wetlands
- or tundra

Then have your students write a creative story about taking a balloon trip over the biome they researched. Encourage them to describe what they see, including the animals and plants that live there, how humans depend on the ecosystem, what problems the system is facing and how they feel about what they're seeing. You can also have them illustrate their stories or create colorful mini murals. Share the stories and feelings that students have had while exploring their habitats.

List some of their responses on the board, separate their observations into plant and animal categories.

Make your list as comprehensive as you need, but have in mind that you would like to get enough general categories for Step Two below. (Don’t erase the board, yet, either. In fact you’ll need plenty of room to make more lists.)

Step One: Genetic Biodiversity
Note that you are not surprised by all the different plants and animals your students experienced during their balloon trip. After all, it is easy to see how different each one of them is. Do a quick tally of how many blond, dark-haired, and red-heads are in your class. Ask them if they know that genes control their hair color, and that different hair colors means you have different genes.

Ask them how many have blond, dark or red pets, and tell them that different colored cats or dogs have different genes. Extend this notion to the natural world by noting different colored birds, fish, or flowers also have different genes.

Tell them their genes control a lot of things, like whether or not they can roll their tongue, and whether they have ear lobes. This can lead to a fun “search” (and tally, if you choose) to determine which students are tongue-rollers with earlobes.
**Step Two: Species Biodiversity**

Get back to their balloon adventure, and comment on how many different things just one classroom of students were able to see. Ask them, "Wouldn’t it be easier if we all just saw one type of animal or plant on our trip? We could see that animal/plant every day of the year, everywhere we went and it would just be so much easier, I think." When your class decides against that, you can mention it seems they would rather have a “diversity” of plants and animals available instead of the same species time and time again.

For each of your general categories (or a select few categories) have your students brainstorm a list of other plants and animals that fit into each category. Some general categories will fill with specific examples, (for fruits you will get apple, banana, orange, etc.) Other categories will fill with more general examples (for mammals you will get cat, dog, etc.)

Take one or two of the new general categories and ask for specific examples of cat species, or types of dogs. Try to steer them into providing a couple of marine examples, arctic examples, and rainforest examples. This will come in handy for step three. Before going on, compliment your students for their fantastic range of knowledge about plants and animals.

**Step Three: Ecosystem Biodiversity**

Use the variety of plants and animals that were given to you by your students, and organize whichever ones you can into groups by the distinct part of the world in which they are found, or by the distinctly different type of habitat in which they explored on their balloon trip. Examples include deserts, forests, oceans, polar regions, tropical regions and so on.

Comment on how many different areas there are in the world. Ask them which ones they would like to visit some day. Share any of your own travel adventures with them and what types of biodiversity you experienced.

**Step Four: Summary of Biodiversity (refer to handout on p.24)**

Introduce the term biodiversity and relate it back to the three levels of biodiversity you just explored in class. Genetic biodiversity refers to the variation seen within members of a species (hair color, pet/animal color, tongue rolling, flower color) Species biodiversity refers to the variety of plant and animal life forms seen in natural settings (plants and animals seen on the balloon trip, types of fruits, types of dogs) Ecosystem biodiversity refers to the diverse types of ecosystems in which all these plants and animals are found (deserts, oceans, rainforests.)

Conclude by referring to their field trip to the Center for Native and Urban Wildlife, and tell them we are experts in Sonoran Desert biodiversity, and we try to preserve biodiversity at all three of these levels.
Pre-Visit Lesson #2: Why is Biodiversity Important?

Teacher Notes
The value of biodiversity is a complex and sometimes controversial issue. One has only to imagine supporters of biodiversity from a wealthy nation demanding a poor country forgo development opportunities so a creature like, say, the poison dart frog, has a home. On the other hand, that frog might hold the key to a fantastic medicine that would improve the human condition on a global scale. What course of action is best in such a situation?

It is with situations like this in mind that we have developed this lesson to give your students a chance to explore how they feel about plants and animals in the world around them.

Step One: Drawings
Have your students consider the following two questions, “What is the most important plant in the Sonoran Desert?” and “What is the most important animal in the Sonoran Desert?” Have them make a drawing of their plant that conveys why it is the most important plant. Have them make a similar drawing for their animal. Have them write below their drawing the reason or reasons they feel their choices are so important.

Step Two: Summary
Make a list of some (or all) of your students’ plant and animal choices, and a list of the reasons why they feel a plant or animal is important. Record their votes on the board.

<table>
<thead>
<tr>
<th>Favorite Plant</th>
<th>Reason</th>
<th>Favorite Animal</th>
<th>Reason</th>
</tr>
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<tr>
<td>________________</td>
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</tbody>
</table>

After you do this, distinguish between reasons that are tied to human interactions and benefits, and reasons that have little or nothing to do with humans. If their list is short on reasons that do not involve humans, you may prod them to think about a place they may never visit (like Antarctica, or the bottom of the sea) and ask them: “What good is biodiversity to a place like that?”

They will probably be able to come up with a reason that relates to the importance of a species’ “role in an ecosystem”. They may also say species have a right to exist (an “existence value”), or that your students just feel better knowing certain species (whales, for example) are alive (an “aesthetic value”).

Step Three: Transition
Conclude your summary by noting the place they will be taking their field trip, the Center for Native and Urban Wildlife, CNUW, is involved with preserving the plant and animal biodiversity of the Sonoran Desert.
Pre-Visit Lesson #3: Scientific Method and Burrowing Owls

Teacher Notes
At the Center for Native and Urban Wildlife, we stress the use of the scientific method to test hypotheses relating to the conservation of native plants and animals in the Sonoran Desert. This lesson introduces your students to the scientific method using a common Sonoran Desert bird.

Handout: “The Scientific Method - Inquiry” (page 25)

Step One: Observations--Burrowing Owl Observations
- Found in open country, prairie, and desert.
- Stands about 8 inches high.
- Brown, spotted with tan, and lacks ear tufts.
- Its long legs are nearly featherless.
- Stands on mounds or fence posts during the day.
- Uses the burrows of other animals for nest sites and shelter.
- Lays 5 to 10 eggs in underground nests.
- When disturbed in a burrow, the owl mimics a rattlesnake’s rattle for defense.
- Decorates around its burrow with animal carcasses (such as mummified toads), debris, and animal scat.

Step Two: Questions
Ask the following question, “Why does a burrowing owl ‘decorate’ around its burrow?”

Step Three: Hypotheses
Have the class come up with a list of hypotheses that could potentially answer the question, “Why does a burrowing owl decorate its burrow?” If you need to get them started, or if you need to add to the list, you might consider the following hypotheses:

Hypothesis #1--Decorations attract mates to their burrows.
Hypothesis #2--Decorations help owls find their burrows when they return from hunting trips.
Hypothesis #3--Decorations smell bad and keep predators away from the burrow.
Hypothesis #4--Decorations attract carrion beetles, a good food source for owls.

Step Four: Experiments (or Tests)
Divide the class into groups and assign each group one hypothesis to evaluate. Have the students design an experiment, which could determine if their hypothesis is right or wrong. One suggestion to give them is to consider that if their hypothesis were true, then what could be predicted to be true as a result. This prediction is what can then be tested by means of an experiment.

For example, if the hypothesis “Decorations attract mates to owl burrows” were correct, one might predict that only males decorate burrows. One could then test, through observation whether or not females decorate burrows.

Teacher Notes
You should have wide latitude and an encouraging attitude for this part of the exercise. Many professional scientists have difficulty coming up with the best experiment to test a hypothesis.
Step Five: Conclusions
For the groups that come up with reasonable experiments, you can have them evaluate the possible results they might expect to see. If females are observed decorating burrows, then you could reject your mate attraction hypothesis. If females are never observed decorating burrows, you conclude your mate attraction hypothesis might be right.*

*Note that you do not conclude you have proven your hypothesis. It is a mistake of the most fundamental nature to conclude you have proven a hypothesis. In the real practice of science, one either rejects a hypothesis or does not reject a hypothesis based on the results of an experiment. In science a “theory” is a hypothesis that is repeatedly not rejected.
Pre-Visit Lesson #4: Scientific Method and Lizard Diversity

Quick Fact:
An undisturbed area of Sonoran Desert the size of an elementary school is typically home to twelve lizard species. The state of Montana, by comparison, is home to four.

Teacher Notes
At the ecosystem level, biodiversity is easy to understand. Students can see the need for an ecosystem to have plants, plant eaters, and predators. However, if you were to ask, “Why do we need 12 different lizards, all in the same area?” then things become less intuitive.

We have designed this lesson to explore the issue of lizard biodiversity as a function of the diversity of available habitats in a natural environment, such as the Sonoran Desert. The commonly accepted hypothesis explaining lizard coexistence is termed “niche segregation.” Each lizard, it seems, overlaps very little in its ecological role.

This suggests that preservation of diverse habitat areas is one of the best ways to ensure the preservation of the biodiversity that results. (This powerful argument guides CNUW as we promote preservation as the key to preserving plant and animal diversity.)

Handouts:
- Lizards (page 27)
- Lizard Habitats (page 28)
- Teacher’s Key (page 29)

Step One: Observations
Begin by asking, “How many different lizards can you name?” “What is the biggest lizard?” (Answer: Komodo dragon of Indonesia) “How many different lizards live in the Sonoran Desert?” (Answer: At least 12 species.) “Can you name any of these?”

At this point you can mention that on one amazing trip to one of their restoration sites, biologists at the Center for Native and Urban Wildlife observed 11 different species of lizards in one morning. Tell them the observation made by those biologists has made you think of an interesting question about lizard biodiversity and a good use of the scientific method.

Step Two: Questions
The observation of coexisting lizards leads to the question, “How do all these lizards coexist (live together) in one place?” Or, worded slightly differently, “Why doesn’t one species of lizard out-compete all the others?”

Step Three: Hypotheses
Note that you would like to apply the scientific method to this question, and make a list of hypotheses that could be potential answers. Students will probably come up with some interesting propositions. Three to consider are described below:

- There are enough resources to support all the species at the same time (i.e., its one big lizard party out there.)
- Lizard species depend on each other. That is, they cooperate with each other so that they are all able to get along.
- Lizard species occupy different ecological niches. That is, they all have different “jobs” to do in the ecosystem.
**Step Four: Experiment (or Test)**
After students list alternate hypotheses for lizard coexistence, tell them you would like to attempt to address the hypothesis with an observational experiment. You will study 11 species of lizards, and see if doing this helps you rule out or accept any of your alternate hypotheses.

Proceed to the lizard cut-and-paste exercise (on pages 27-29) Have your students read the brief descriptions for each lizard found in the McDowell Sonoran Preserve, and then cut and paste each lizard onto the desert habitat in which it would most likely be found.

**Step Five: Conclusions**
When you discuss their results, you will be able to conclude there is little overlap in the area two lizards are found if they share similar food preferences. Likewise, you will notice food preferences differ between lizards that share similar habitats. In other words, the “job” of each lizard is different. (Or, more technically, the ecological niche occupied by each of the eleven lizards is different.)
Post-Visit Lesson #1: Natural History Story - A Writing Assignment

CNUW has many native animals to look at and learn about. During their tour students have observed these live animals:

<table>
<thead>
<tr>
<th>Toad Hall</th>
<th>Pond and Greenhouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round tail ground squirrel</td>
<td>Desert pupfish</td>
</tr>
<tr>
<td>Woodhouse toad</td>
<td>Gila topminnow</td>
</tr>
<tr>
<td>Sonoran desert toad</td>
<td>Woodhouse toads</td>
</tr>
<tr>
<td>Lowland leopard frog</td>
<td>Desert Tortoise</td>
</tr>
<tr>
<td>Tiger Salamander</td>
<td></td>
</tr>
<tr>
<td>Rosy Boa</td>
<td></td>
</tr>
<tr>
<td>Gopher snake</td>
<td></td>
</tr>
<tr>
<td>California king snake</td>
<td></td>
</tr>
<tr>
<td>Chuckwalla</td>
<td></td>
</tr>
<tr>
<td>Desert spiny lizard</td>
<td></td>
</tr>
<tr>
<td>Gila monster</td>
<td></td>
</tr>
<tr>
<td>Western banded gecko</td>
<td></td>
</tr>
<tr>
<td>Desert iguana</td>
<td></td>
</tr>
<tr>
<td>Regal horned lizard</td>
<td></td>
</tr>
<tr>
<td>Desert tortoise</td>
<td></td>
</tr>
</tbody>
</table>

Bird Room (The Liberty Wildlife birds vary with each visit.)

- Red-tailed hawk
- American kestrel
- Burrowing owl
- Harris’ hawk
- Turkey vulture
- Great horned owl

Writing Assignment:

1. Using the above list, have students pick a favorite animal they saw at CNUW. Ask them to write a one page story about one of the native animals in its’ natural setting going about its daily life.

2. Some points they might include:
   - What specific habitat does your animal like? (Does it live on the rocky slopes, sandy washes, on a mesquite tree, nest in a cactus?)
   - Does it rest and find shelter under a rock, in the ground in a hole?
   - How does it find its’ mate?
   - What food does it eat and how does it catch the food?
   - How does it feed its’ babies?
   - How does it avoid being eaten by a predator?
   - If it is a plant eater, what plants might it eat?
   - Where does it find its’ food? (underground, on branches, under a bush?)
   - What time of day is it out and about – during the day, or is it nocturnal?

3. Stories with the natural history style are creative, and may have the student present to observe or “talk to” the animal! It is better not to sound like a field guide, but the facts should be correct.

4. If you wish, you may like to send stories to CNUW!
Post-Visit Lesson #2: Schoolyard Biodiversity Plant & Animal Surveys - Field Studies

Ask the question: Does my schoolyard campus have native plants that provide a good habitat for native animals?

Schoolyard Plant Biodiversity Survey/Field Study
Observe and make a list of all native plants on your school grounds by making a map of plants, by species, on your school grounds. You may wish to take measurements of the height, area of the ground covered and the size of the trunk 1 foot about the ground.

To increase the biodiversity of small wildlife at school, especially birds, have the students plant a few native plants. (Hint: 1 gallon plants need a much smaller planting hole.)

Excellent plants to consider (lack severe thorns, have flowers, low water use, bloom year after year) are:

**Large trees:** Blue Palo Verde, Velvet Mesquite, Ironwood, Foothills Palo Verde
**Perennial flower bushes:** Brittlebush, Chuparosa, Baja or native Fairy Duster, Globe mallow, Desert milkweed, Creosote, Yucca species.
**Perennial flowers:** Parry’s or Firecracker Penstamon, Desert marigold

Ask the question? Is my school campus a good habitat for native birds?

Schoolyard Bird Biodiversity Survey/Field Study
You can answer that question by determining if most of the birds on campus are non-native birds (starlings, house sparrows and pigeons) or a variety of native species.

Quietly observe and make a list of all birds seen on campus, by date. This can be done virtually any time of the school year.

Birds are the most easily seen wildlife, other than insects. As more native plants are added to the school habitat, more native birds will find food and even make a nest.

For tips on identifying birds, consider purchasing the *Beginner’s Field Guide to Birds of Phoenix* by Jim Burns & Michael Rupp for the Maricopa Audubon Society ($1.00) available at www.maricopaaudubon.org.
Post-Visit Lesson #3: Solving a Biodiversity Problem

After the students have completed their visit to the Center for Native and Urban Wildlife and participated in some of these lessons, they should have a good understanding of biodiversity and the importance of its preservation. This lesson introduces the idea that individuals can make a difference in preserving biodiversity. Students will design and evaluate plans to increase amphibian biodiversity in a place they care about.

Step One: Recognizing the Problem
Begin by telling students you want them to think about the question, “What can you do to help preserve (or increase) the biodiversity of frogs and toads?” Tell them it is a good idea to think about the question at different scales. For example, “What could you do in your backyard? At school? In Arizona? In the United States? In the whole world?”

Have your students choose one of these areas and make a list of the main problems for amphibians at that level. For example, “What is preventing frogs and toads from doing well in your backyard?” Or, “What factors are affecting frogs and toads in the whole world?”

Step Two: Design a plan
Have your students design a plan to help increase amphibian biodiversity at the level they have selected.

Step Three: Evaluate their plan
Have them describe the best part of their plan and the part of their plan that will be the most difficult to accomplish. What help might be necessary from parents or other adults?
Post-Visit Lesson #4: CNUW’S OUTDOOR EYES

Are you a budding young wildlife photographer (ages 6-16)? Care to share your best recent wildlife photos with others? If you would like to see your picture(s) posted on our website please send us a copy by e-mail to edward.weigand@scottsdalecc.edu regular mail to:

CNUW
Attn: Ed Weigand
Scottsdale Community College
9000 E. Chaparral Rd.
Scottsdale, AZ. 85256

Be sure to include the location and the date of where and when the photo was taken. If we use your photo on our website we will send you a complimentary bandana from the Center for Native and Urban Wildlife at Scottsdale Community College.

Post-Visit Assessment

All teachers are invited and encouraged to fill out the teacher survey found on pages 30-32. Please return completed surveys to the CNUW:

Ed Weigand
Center for Native and Urban Wildlife
Scottsdale Community College
9000 E. Chaparral Road
Scottsdale, AZ 85256-2626
Phone: 480-423-6731
Addendum #1: Relevant CNUW Vocabulary Terms

**Biodiversity** The variety of living organisms, including their genetic make-up, and the ecosystems in which they are found.

**Conservation** An approach to managing wildlife and other natural resources so that they do not go to waste, and will not disappear.

**Desert** A geographic area that receives less than 10 inches of rainfall per year on average.

**Ecology** The study of the relationship between organisms and their environment.

**Ecosystem** The biotic (living) community and its abiotic (non-living) environment functioning as a system.

**Endangered Species** A species that is in danger of going extinct (usually because of habitat loss, competition from—or predation by—introduced species, or diseases with which it is unable to cope.)

**Exotic Species (also called “non-native” species)** A species that is not naturally found in an area to which it has been introduced. (A problem if it becomes dominant or invasive)

**Habitat** The place, within an ecosystem, where a plant or animal lives.

**Metamorphosis** Changes that occur as an organism reaches major developmental milestones, and takes on new physical and/or behavioral characteristics. Examples include tadpoles changing to adult frogs, and caterpillars changing to adult butterflies.

**Native Species** A species that has historically been found in the area in which individual members occur.

**Niche** The specific role or function of a particular species in its community or ecosystem.

**Plant Propagation** The process of growing plant species, (specifically, in CNUW’s case, for purposes of transplanting into restoration projects.) For this purpose, plant propagation requires collecting seeds, causing them to germinate, and growing and caring for seedlings until they are ready to be transplanted.

**Preserve** An area of land set aside by humans so that natural conditions and occurrences determine the fate of organisms found there.

**Restoration Ecology** Planting native plants in disturbed ecosystems, in such a manner that native animals return to occupy newly created niches.

**Riparian** Term describing the location of plants and animals found at or near the edge of a river, stream, or other body of water.

**Species** All the individuals of an organism that could successfully reproduce with each other.

**Taproot** A plant root that grows deep into the soil typically in search of water, but also providing plant with strong anchorage.

**Urban** Term used to describe areas of land that are mostly occupied by humans.
Addendum #2: Global and Local Amphibian Decline

Teacher notes
During a field trip to CNUW, your students will typically receive a 1hr and 15min presentation about the recent plight of amphibians worldwide. The information on this page offers you some background information so that you may discuss the issue with your students if you wish.

Our field trip presentation of the subject involves application of the scientific method to try to gain insight into global and local amphibian decline. Conservation biologists, meanwhile, are themselves vigorously debating the same issue.

Global and local amphibian decline
Over the last 50 years, many species of amphibians (frogs, toads, salamanders and newts) throughout the world have declined markedly in numbers; some species have become extinct. In many instances, these declines are attributable to adverse human influences acting locally, such as deforestation, draining of wetlands, and pollution.

In 1988, however, herpetologists from many parts of the world reported declines in amphibian populations in protected, apparently pristine habitats, such as national parks and nature reserves where such local effects could not be implicated. This led to the suggestion that there may be one or more global factors that are adversely affecting amphibians. Possible candidates for such influences are climatic and atmospheric changes, such as increased UV-B radiation, widespread pollution, such as acid rain, and disease.

Why do they matter?
Amphibians are declining, as are most, if not all other groups of life on Earth. This loss of biodiversity should be a cause of concern to all of us. However, there are good reasons for thinking that disappearing amphibians are especially significant.

The current global loss of biodiversity is a process generated by the activities of humans. As we modify our environment for our own ends, it is clear that the destruction of the habitats of other species leads directly to their disappearance. However, more recently we have begun to observe, and to speculate about more subtle impacts that human activities may be having, acting at a global level.

Disappearing Arizona Amphibians
Ten of the 25 species of amphibians native to Arizona are regarded as “special concern” wildlife by the Arizona Game & Fish Department because of declining or small populations. The state’s 24 native species of frogs and toads range from the dinner plate-sized Colorado River Toad, which can top two pounds and is common in the low desert, to the inch-long Western Chorus Frog, common in the White Mountains.

Leopard Frogs (*Rana spp.*)
Despite arid conditions, the Southwest has the greatest diversity of Leopard Frogs in the United States. Arizona has at least five native species and one introduced species. Leopard Frogs can be found in the wetland and riparian areas around the state. Although it is difficult for humans to tell these species apart, Leopard Frogs recognize each other by unique calls that function to attract mates and ward off competing males. As with many other frog species worldwide, all five Arizona Leopard Frog species appear to be declining in number. Since the 1970’s, introduced Bullfrogs have played a role in the decline of several of these species. Other factors include wetland habitat destruction, chytrid fungus, pesticides, and increased parasites.
**Tarahumara Frog (Rana tarahumarae)**

In 1983, the last known Tarahumara Frog in the United States was found dead. Historically, the Tarahumara Frog was found in seasonal and permanent streams, and riparian areas of Southern Arizona and Northwestern New Mexico. The exact causes of its disappearance from Arizona remain uncertain. Declines in the ozone layer, and increases in acid rain and chytrid fungus have each been suggested as playing a role. The introduced Bullfrog is also a prime suspect; perhaps it outcompeted and preyed upon the smaller Tarahumara Frog. Another prime suspect in the disappearance of the Tarahumara Frog is heavy metal poisoning. Water samples taken from extinction sites contained elevated levels of cadmium and mercury, which possibly came from copper smelters in the same area.
Addendum #3: Learning More About What Individuals Can Do

Below are some brief descriptions of things individuals can do to preserve Sonoran Desert biodiversity. These suggestions, and the links to web sites that follow below, may be useful as a resource to help develop presentations to your class on the topics covered in this education packet, topics CNUW promotes.

- **Landscape around your home in a way that helps birds, lizards, and other smaller wildlife species to survive.** Or develop a school garden or schoolyard habitat. Check this web site for more information at: [http://www.nwf.org/schoolyard/planthotline@dbg.org 480-941-1225]

- **Support the creation and the preservation of biological preserves.** Teachers who wish to look at this subject a little more deeply might explore preserve design features, such as size, high and low elevation areas, minimizing edge effects and fragmentation as well as biological corridors and their importance, particularly in urban areas.

- **Learn about organizations and institutions that promote conservation and natural resources such as:**

<table>
<thead>
<tr>
<th>Local Organizations</th>
<th>National Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona Sonora Desert Museum</td>
<td>Maricopa Audubon Society</td>
</tr>
<tr>
<td><a href="http://desertmuseum.org">http://desertmuseum.org</a></td>
<td><a href="http://www.maricopaaudubon.org">http://www.maricopaaudubon.org</a></td>
</tr>
<tr>
<td>Center for Urban and Native Wildlife</td>
<td>National Wildlife Federation</td>
</tr>
<tr>
<td><a href="http://www.scottsdalealec.edu/cnuw">http://www.scottsdalealec.edu/cnuw</a></td>
<td><a href="http://www.nwf.org">http://www.nwf.org</a></td>
</tr>
<tr>
<td>McDowell Sonoran Conservancy</td>
<td>Desert Butterfly Gardening, AZ Native Plant Society, painted lady butterflies</td>
</tr>
<tr>
<td><a href="http://www.mslt.org">http://www.mslt.org</a></td>
<td><a href="http://www.wildlifehotline.com">Insectlore.com</a></td>
</tr>
<tr>
<td>Arizona Game &amp; Fish Department</td>
<td>The Nature Conservancy</td>
</tr>
<tr>
<td>Desert Botanical Garden</td>
<td>Conservation International</td>
</tr>
<tr>
<td>Phoenix Zoo</td>
<td>Project Feederwatch</td>
</tr>
<tr>
<td><a href="http://www.phoenixzoo.org/zoo">http://www.phoenixzoo.org/zoo</a></td>
<td><a href="http://www.birds.cornell.edu/pfw/">www.birds.cornell.edu/pfw/</a></td>
</tr>
<tr>
<td>Southwest Center for Wildlife</td>
<td>Great Backyard Bird Count</td>
</tr>
<tr>
<td><a href="http://www.southwestwildlife.org">http://www.southwestwildlife.org</a></td>
<td><a href="http://www.audubon.org/gbbc">www.audubon.org/gbbc</a></td>
</tr>
<tr>
<td>City of Scottsdale Eco Gecko</td>
<td>Roots &amp; Shoots</td>
</tr>
<tr>
<td><a href="http://www.scottsdalearz.gov">http://www.scottsdalearz.gov</a></td>
<td><a href="http://www.janegoodall.net">www.janegoodall.net</a></td>
</tr>
<tr>
<td>Liberty Wildlife Rehabilitation Foundation</td>
<td>Desert Rivers Audubon</td>
</tr>
<tr>
<td><a href="http://www.libertywildlife.org">http://www.libertywildlife.org</a></td>
<td><a href="http://www.desertriversaudubon.org">www.desertriversaudubon.org</a></td>
</tr>
<tr>
<td><strong>Wildlife Hotline 480.998.5550</strong></td>
<td></td>
</tr>
</tbody>
</table>
What students should bring when visiting the Center for Native and Urban Wildlife

- Hat
- Water
- Lunch
- Walking Shoes
- Sunglasses
- Sunscreen
- And a SMILE!!!!
**What is Biodiversity?**

**Bio = Life**

**Diversity = Variety**

Biodiversity is the spectacular variety of living things on Earth and the interdependence among them.

Biodiversity exists at three basic levels: genes, species, and ecosystems.

**Genetic diversity:**
The diversity that exists within a particular kind of plant, animal, or other organism.

**Species diversity:**
The diversity that exists among and between the many different kind of living organisms.

**Ecosystem diversity:**
The diversity of biological communities or groups of species and the complex interdependencies that occur among them.

**Why do we need Biodiversity?**

The Earth’s biodiversity supports our basic needs by providing us with food, fiber, fuel, medicine, clean air, rich soil and water.
THE SCIENTIFIC METHOD / INQUIRY PROCESS

Observations
Make observations. Wow! There are so many different lizards!

Question/Problem
Ask a question. How can so many species of lizard co-exist?

Hypothesis
Speculate about reasons for this co-existence. List hypotheses.

Test
Test ideas for why many types of lizards can occupy the same area. Collect data.

Conclusion
Based on results of data determine which outcomes seem to support or refute hypothesis. Revise and retest hypotheses as necessary.
### Lizard Matching Game

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Banded Gecko</td>
<td>Out at night. Hides under rocks in daytime.</td>
</tr>
<tr>
<td>2</td>
<td>Desert Iguana</td>
<td>Lives in low, sandy areas. Eats plants.</td>
</tr>
<tr>
<td>3</td>
<td>Tiger Whiptail</td>
<td>Lives and hunts insects in undergrowth.</td>
</tr>
<tr>
<td>4</td>
<td>Chuckwalla</td>
<td>Lives among rocks and boulders. Eats plants.</td>
</tr>
<tr>
<td>5</td>
<td>Gila Monster</td>
<td>Found in burrows. Hunts small mammals.</td>
</tr>
<tr>
<td>6</td>
<td>Desert Spiny Lizard</td>
<td>Found along rocky hillsides or in trees. Eats spiders and insects.</td>
</tr>
<tr>
<td>7</td>
<td>Zebra-tailed Lizard</td>
<td>Lives in washes. Eats small insects.</td>
</tr>
<tr>
<td>8</td>
<td>Regal Horned Lizard</td>
<td>Lives on the ground. Eats mostly ants.</td>
</tr>
<tr>
<td>9</td>
<td>Side-blotched Lizard</td>
<td>Lives on ground. Eats scorpions, spiders, and insects.</td>
</tr>
<tr>
<td>10</td>
<td>Long-tailed Brush Lizard</td>
<td>Lives in the branches of trees. Eats small insects.</td>
</tr>
<tr>
<td>11</td>
<td>Tree Lizard</td>
<td>Lives in the branches of the Mesquite.</td>
</tr>
</tbody>
</table>
1. Bandana Gecko
Out at night. Hides under rocks in daytime.

2. Desert Iguana
Lives in low, sandy areas. Eats plants.

3. Tiger Whiptail
Lives and hunts insects in undergrowth.

4. Chuckwalla

5. Gila Monster
Found in burrows. Hunts small mammals.

6. Desert Spiny Lizard
Found along rocky hillsides or in trees. Eats spiders and insects.

7. Zebra-tailed Lizard

8. Regal Horned Lizard
Lives on the ground. Eats mostly ants.

9. Side-blotched Lizard
Lives on ground. Eats scorpions, spiders, and insects.

10. Long-tailed Brush Lizard
Lives in the branches of trees. Eats insects.

11. Tree Lizard
Lives in the branches of the Mesquite.
Teacher Evaluation

Teacher, please circle the answer that most closely represents your feelings about the following statements. (Please note you have the right to refuse to answer any question.)

Key:  SA = Strongly Agree,  A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

1. The educational packet helped me teach my students about Sonoran Desert biodiversity.  SA A N D SD
2. The learning objectives for the educational packet were clear to me.  SA A N D SD
3. The information in the educational packet was age-appropriate for my students.  SA A N D SD
4. The amount of information in the educational packet was about right.  SA A N D SD
5. The activities in the educational packet were age-appropriate for my students.  SA A N D SD
6. The number of activities in the educational packet was about right.  SA A N D SD
7. The tour at the Center for Native and Urban Wildlife helped my students learn about Sonoran Desert biodiversity.  SA A N D SD
8. The information presented on the tour at the Center for Native and Urban Wildlife was age-appropriate for my students.  SA A N D SD
9. The length of the tour at the Center for Native and Urban Wildlife was about right.  SA A N D SD
10. The information presented by the Center for Native and Urban Wildlife supports the Scottsdale Unified District curriculum standards.  SA A N D SD
11. Which lessons in the educational packet did you teach? Which was most useful for teaching students about Sonoran Desert biodiversity?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

12. Which lesson in the educational packet was least useful for teaching students about Sonoran Desert biodiversity? Why?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

13. Which element of the tour was most beneficial in helping your students learn about Sonoran Desert biodiversity?

   A. Hall of Biodiversity Past	B. Toad Hall
   C. Liberty Wildlife

Why?_____________________________________________________________________
________________________________________________________________________
________________________________________________________________________

14. Which element of the tour was the least beneficial in helping your students learn about Sonoran Desert biodiversity?

   A. Hall of Biodiversity Past	B. Toad Hall
   C. Liberty Wildlife

Why?_____________________________________________________________________
________________________________________________________________________
________________________________________________________________________
15. Are you planning a field trip with your students to the McDowell Sonoran Preserve?
   Yes__________ No__________ Have already been__________

16. What grade do you teach? __________

17. How many years have you been teaching? __________

18. Is your educational background in science?
   Yes__________ No__________

19. What suggestions or recommendations do you have for improving the Center for Native and Urban Wildlife's educational program?

Thank you for taking the time to complete this survey. We really appreciate your feedback.

Please mail to: Ed Weigand, CNUW, 9000 E. Chaparral Rd., Scottsdale, AZ 85256
Optional Hike in the McDowell Sonoran Preserve  
(Sponsored by the city of Scottsdale)

The McDowell Sonoran Preserve in North Scottsdale is an area of more than 12,000 acres that has been set off limits to development. As a result, the Preserve offers an excellent opportunity for visitors to witness many of the plant and animal species maintained by the Center for Native and Urban Wildlife on the campus of Scottsdale Community College.

The City of Scottsdale sponsors hikes through the Preserve. Teachers interested in taking students on this hike can contact Yvonne Massman, Outdoor Recreation Specialist for the City of Scottsdale at (480) 312-7901 or 312-0990.

For further information about the McDowell Sonoran Preserve please contact the McDowell Sonoran Conservancy at (480) 998-7971, or visit their web site at:  
www.mcdowellsonoran.org
Enter by Parking lot C, entrance 1, go west then all the way north to Parking lot A. Go East along the tennis courts, turn South and pull alongside the curb facing south by the Student Center (SC). A CNUW docent will be there to greet you 😊