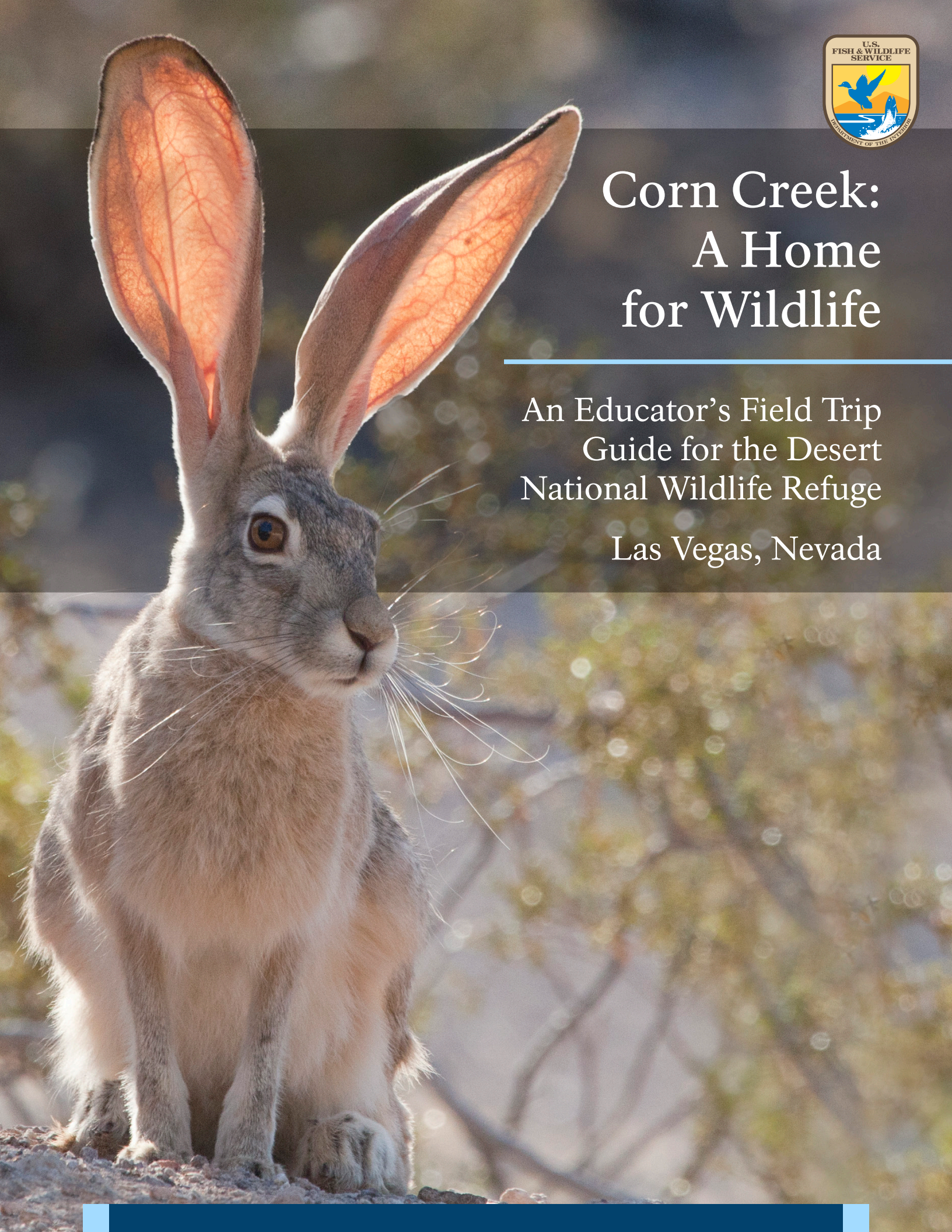

Corn Creek: A Home for Wildlife

An Educator's Field Trip Guide for the Desert National Wildlife Refuge

Las Vegas, Nevada

This Field Trip Guide updated: December 2024

Cover Image: (Sharon Shafer)

Accessibility Statement

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Purpose of the Guide

The purpose of this guide is to support teachers in conducting independent field trips onto public lands, specifically the Corn Creek Visitor Center for the Desert National Wildlife Refuge near Las Vegas, Nevada.

This guide provides detailed information about what to bring, who to contact at the agency, and required information to arrange a field trip. It also provides activities to conduct along the trails at Corn Creek, as well as complementary pre- and post-field trip activities for the classroom to enhance student knowledge about desert habitats and human efforts to protect wildlife and habitats. The classroom-based activities are encouraged but not required to successfully conduct the field trip and its accompanying lessons.

The developers of this guide would like to acknowledge that some of the activities have been adapted from the following sources: Project Wet Curriculum Guidebook 2.0; Discover a Watershed: The Colorado River; Windows on the Wild: Biodiversity Basics; and, Discovery Place Stay at Home Science.

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Section 1 – About this Guide

Figure 1. Refuge ranger shows two students a crayfish. (Phatismo "Lucky" Wendell)

Welcome

Welcome to the "Corn Creek: A Home for Wildlife" educator's field trip guide for the Desert National Wildlife Refuge (Desert NWR).

This is one of four field trip guides developed for educators to independently conduct field trips on public lands in Southern Nevada. The other guides are for Red Rock Canyon National Conservation Area (managed by the Bureau of Land Management), the Spring Mountains National Recreation Area (managed by the U.S. Forest Service), and Lake Mead National Recreation Area (managed by the National Park Service).

These guides were funded through an award from the Southern Nevada Public Lands Management Act (SNPLMA), which financially supports recreation, conservation, and education on public lands in Southern Nevada. The award was given to a team representing five different agencies who are part of the Southern Nevada Agency Partnership (SNAP): The Bureau of Land Management (BLM), the National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), the U.S. Forest Service (USFS), and the Bureau of Reclamation (BOR).

All of these agencies are members of Southern Nevada Agency Partnership, an interagency partnership established in 1999 to address shared and common land management issues in Southern Nevada, as well as to work with outside partners and community members to support education, interpretation, and research to advance conservation.

Thank you for your commitment to educating youth about our beautiful and unique natural areas in Southern Nevada. We hope you explore all of the Teacher Guides and enjoy your time at the Desert National Wildlife Refuge!

Sincerely,

U.S. Fish & Wildlife Service & the SNAP Team

Figure 2. A field biologist and a scientist study the plant life in Southern Nevada. (USFWS)

Desert National Wildlife Refuge Welcome

Welcome to Desert National Wildlife Refuge! This is an excellent field trip destination for students of all ages. Whether you want to focus on history, biology, botany, ecology, or geology, you've come to the right place.

Created in 1936, Desert National Wildlife Refuge teems with diversity over a vast landscape that spans 1.6 million acres. It boasts 320 bird species, 32 species of reptiles, 52 species of mammals, 500 plant species, 7 life zones, and 6 mountain ranges as it transitions from the Mojave to the Great Basin Desert. The rich tapestry of life across Desert has deep cultural ties, as this place is the ancestral homeland of the Newe (Western Shoshone) and Nuwu/Nuwuvi (Southern Paiute/Chemehuevi) peoples.

The Desert National Wildlife Refuge is part of the National Wildlife Refuge System, one of the largest systems of protected lands and waters in the world. There are nine national wildlife refuges in Nevada for you to explore. Each was established to protect habitat for wildlife, and most are open for public visitation. We hope that a visit to our refuge inspires you and your students to explore others.

To honor, conserve, and protect this unique place, please follow all rules and regulations and leave the refuge better than you found it. We hope that you enjoy your time at Desert National Wildlife Refuge!

How to Use This Guide

This guide is intended for use in conjunction with an educator-led field trip to the Corn Creek Visitor Center at the Desert National Wildlife Refuge. The guide contains field trip specific activities addressing habitats and refuge residents, as well as classroom pre- and post-field trip activities addressing endangered species and refuge management themes.

The guide has four sections: (1) About this Guide; (2) Field Trip Information and Onsite Activities; (3) Classroom Activities; and (4) Background Information.

About this Guide provides activities at-a-glance and the education standards met by the guide's activities. The Field Trip and Onsite Activities section explains how to conduct a school field trip to the Desert National Wildlife Refuge and contains all educator instructions and student handouts for the Corn Creek field trip. The Classroom Activities section contains classroom-based, pre- and post-field trip activities to prepare for, expand upon, and reinforce the field trip experience and content. Although complementary to each other, all activities can be implemented independently, allowing educators to pick and choose. The Background Information section provides content and context for the field trip experience and the classroom activities.

Science Content Standards

This program is intended for students in 3rd through 5th grade but can easily be adapted to higher or lower grades.

The field trip and activities in this guide connect to science, social studies, English language arts, physical education/health, and art. Students gain experience using fundamental skills and concepts such as observing patterns in nature; cause and effect; using systems and system models; analyzing stability and change in systems; and examining the structure and function of elements in the natural world.

Activities have been created for the cognitive, social, emotional, and academic development of the intended age group. The following are some connections to Nevada Academic Content Standards for Science.

Nevada Academic Content Standards for Science (NVACSS) Disciplinary Core Ideas

Grade 3

3-LS2-1. Construct an argument that some animals form groups that help members survive.

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Figure 3. A Northern Shrike perches at the top of a branch. (Sharon Shafer)

Grade 4

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Engineering Practice & Design

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Section 2 – Field Trip and Onsite Activities

Figure 4. Refuge ranger speaks to a group of students at the Desert NWR. (Get Outdoors Nevada)

Recreate Responsibly

Whether exploring desert spaces or mountain places, remember to #RecreateResponsibly and follow Leave No Trace principles when you visit.

Know before you go

Check the status of the place you want to visit for closures, fire restrictions, and weather. Learn the rules and regulations for the site.

Plan and prepare

Make sure to plan and prepare properly for the field trip. Each location and agency has different field trip and entrance requirements. At the Desert National Wildlife Refuge, you need to make a reservation and may need a permit depending on your group size. Make sure you have the gear you need (such as student medications, plenty of water and snacks, sunscreen, and clothing layers). Be sure to have a back-up plan in case of emergencies, weather, closures, and similar.

Build an inclusive outdoors

Be an active part of making the outdoors safe and welcoming for all identities and abilities.

Respect others

There is space for everyone and countless outdoor activities. Be kind to all who use the outdoors and nature differently. Teach students basic trail etiquette – like step aside and let people pass, stay on the trail, use quiet voices and play music only in headphones. Students should be informed that loud noises scare off wildlife and other people go outdoors to relax and find quiet.

Make it better

We all have a responsibility to sustain the places we love. Help clean up litter or think of another way to volunteer.

Leave no trace

Respect the land, water, wildlife, historic sites, and Native American communities. Follow Leave No Trace principles: stay on trails, pack out all waste, leave what you find (this includes rocks, plants, and historic remnants), minimize campfire impacts/determine if there are fire restrictions, never feed animals, control and clean-up after pets, and avoid wildlife during sensitive times.

Safety

Keep your distance from wildlife

Do not feed wildlife – it actually hurts them, either because human food can be toxic and/or animals become aggressive and have to be captured and removed or euthanized.

Be aware of your surrounding terrain

Stick to trails and stay on the safe side of barriers. Use extra caution on steep, loose, or rocky terrain. Stay away from ledges and drop-offs.

Wear hiking shoes or boots with sturdy soles

Bring water, food, medications, and clothing

A good rule of thumb is to bring one liter of water for every two hours (more when it's warmer). On a field trip, teachers and chaperones should carry a backpack with student medicines, extra food, extra water, and a first aid kit.

Be weather-aware

Avoid walking in washes when rain is nearby. (It can be raining in higher elevations miles away and water can flood the wash). Avoid hiking in high temperatures or exposed locations during lightning storms.

Make sure people know where you are and when you will return

Make sure cell phone batteries are charged and GPS locaters are on, which can provide a location to 911 in case of an emergency.

Southern Nevada Federal Public Lands Field Trips

Places And Teacher Guides

The Las Vegas Valley is surrounded by amazing public lands run by different federal agencies including the National Park Service (NPS), the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and the U.S. Fish and Wildlife Service (USFWS). Each of these agencies has developed specific activities to help you plan and implement a field trip that highlights unique experiences at each location and meets specific educational standards and topics.

Figure 5. An Antelope Ground Squirrel on the lookout for predators at Desert NWR. (Sharon Shafer)

Taking students on field trips to the public lands around the Las Vegas Valley is a very rewarding experience for students and teachers alike, but it takes planning to help the field trip go smoothly. Each land agency has different contacts and processes to make field trip arrangements. For example, some locations have entrance fees, so you will need to apply for a fee waiver; other locations are free, but have limited space, so you will need to obtain permission to visit with a group and know where and how to park the bus.

This document provides checklists and information you can use for field trips to any location, while subsequent pages provide specific steps, contact information, and links to forms (e.g., permit forms, if needed) for planning the field trip associated with this specific location (Corn Creek, Desert National Wildlife Refuge.)

The four federal agencies (BLM, USFWS, NPS, and USFS) developed detailed materials to help you conduct a field trip to a specific location/trail. Below is a summary of the field trip locations and their activities and topics.

Desert National Wildlife Refuge

U.S. Fish and Wildlife Service – free entrance, limited space, permit may be needed, coordinate with the agency ahead of time at 1-702-879-6110 and email desertcomplex@fws.gov.

- LOCATION: Desert National Wildlife Refuge Corn Creek Visitor Center
- FIELD TRIP ACTIVITY: *Habitats: Refuge Residents* – Students are assigned a desert animal living at Desert National Wildlife Refuge. As the class follows the Corn Creek trails, there are specific stops that highlight different habitats. At each stop students consider the availability of food, water, and shelter and record whether their assigned animal would live in that habitat.
- TOPICS: Habitats/animals and plants found in different parts along the trail

Lake Mead National Recreation Area

National Park Service – fee area, fee waiver needed, limited parking space, coordinate with the agency ahead of time via lake_education@nps.gov.

- LOCATION: Bluffs Trail, Las Vegas Bay Campground
- FIELD TRIP ACTIVITIES: *Geology: Erosion, Weathering, and Deposition and Colors in Stone* – The Bluffs Trail provides an incredible view of the mountains that surround the Las Vegas Valley and a front-row look at geological processes like erosion, deposition, and fault lines. Also, nearly every major category of rock is represented on this trail – volcanic, metamorphic, sedimentary, and conglomerate – which tells an amazing story about the geology of the Las Vegas Valley. Students stop at points along the Bluffs Trail to learn about these land-forming processes, then finish with a watercolor activity "Colors in Stone."
- Topics: Geology/erosion/land formation

Red Rock Canyon National Conservation Area

Bureau of Land Management – Teachers are required to have attended a pre-approved training to conduct self-guided field trips, fee area, waiver needed, limited space, coordinate with the agency ahead of time by calling (702) 515-5380 or get more information on their website at: https://www.redrockcanyonlv.org/educational-resources.

- LOCATION: Fire Ecology Loop Trail (Pine Creek pullout in the loop)
- FIELD TRIP ACTIVITY: *BioBlitz Inventory* – Students identify desert plants at specific stops along the Pine Creek Canyon trail on their way to the Fire Ecology Trail. At points along the trail students work in pairs to conduct a "bioblitz inventory" to see how many different leaf arrangements and leaf shapes they can find in a square meter. Students compare the areas and make decisions about biodiversity based upon the data they collected.
- TOPICS: Biodiversity/plant identification/data collection and analysis

The Spring Mountains National Recreation Area

U.S. Forest Service – free entrance, limited space, coordinate with the agency ahead of time by calling the Visitor Gateway at 702-872-5486.

- LOCATION: Spring Mountains Visitor Gateway
- FIELD TRIP ACTIVITY: *Nature Detective* – Nature Detective is an activity that connects students to their surroundings and allows them to practice observational skills. Students begin their observations on the ride up Kyle Canyon Road, learning about different life zones as they move from desert to pine trees. Once at the Spring Mountain Visitor Gateway, they explore the nearby trails and record observations of nature, including evidence of insect and animal life. Students then take their observations and craft them into a poem.
- TOPICS: Life zones/evidence of plants and animals in nature/recording observations using their senses

General Checklists and Planning

STEP 1: FIELD TRIP DATES & PAPERWORK (minimum 2 months prior)

All of the agencies featured in this field trip guide require schools to schedule the field trip ahead of time.

- Select a field trip date with at least 1 – 2 alternative dates. Some areas have limited space with schools competing for that space. The more optional dates you have the more likely you will easily be able to reserve your desired field trip spot. If your original field trip location is not available, consider going to one of the other three agency locations.
  - It is strongly recommended to plan at least 2 months out to allow time for the agency to process your paperwork. If your trip is less that one month away, be prepared that you may not be able to visit that location.
- Determine how the class will get to the location and, once a date is identified with the agency, reserve buses. Funds may be available to help pay for buses or to even rent a charter bus. Get Outdoors Nevada is a non-profit organization that may be able to connect schools to mini-grants for buses. NOTE: There are restrictions for chartered buses at certain field trip sites, either for size or certain agencies have contractual agreements with specific companies. If you use a charter bus that is not on the agency's approved list, you may have to pay additional fees. Agency details are included in the agency field trip section in the specific Teacher Guide (this guide is for the Desert National Wildlife Refuge).
- Complete all paperwork needed for your school and/or school district (including obtaining permission slips, ordering lunches and water ahead of time, etc.). Clark County School District requires a minimum of 30 days to process field trip paperwork. Your local school or district may have different deadlines.

STEP 2: CONTACT THE AGENCY (minimum 1 month prior, preferably several months prior)

- Refer to specific field trip activities for information about who to contact and the necessary forms required for the agency/location you are interested in visiting.
  - Read forms carefully and include all of the requested information. Missing information/documents will result in a delay. For example, in order to process fee waivers, some agencies require the teacher to complete and sign the form, provide proof of accreditation of the school, provide proof of non-profit status, and give a description of the educational activity and learning objectives for the activity. Just because you are using one of the lessons developed by the agency, do not expect the fees or front booth staff to know this information. Copy and paste descriptions and educational standards from the specific guide into specific paperwork or attachments as needed.

STEP 3: PLAN THE ITINERARY

Plan a detailed itinerary. A sample general itinerary is provided below. More example itineraries are provided with the specific field trip information.

Itineraries will vary depending on the following factors:

- Distance from the school to the site. Use online maps to estimate the time needed to travel from your school to the field trip location. Be sure to add in additional time for traffic and getting through fee booths.
- What time your school starts and ends.
- Whether you are using school buses or chartered buses. School buses often have to be back sooner.
- The number of students participating in the field trip and where you are going. If the group is large, your itinerary may need to include rotations and additional group leaders. Suggestions for student group size and rotation times are included with each specific agency/location field trip.

Sample Itinerary:

- 9:00 – 9:15 a.m.: Depart school
- 10:00 a.m.: Arrive at field trip location
- 10:00 – 10:15 a.m.: Restrooms (we highly recommend all students go to the bathroom before heading onto the trail)
- 10:15 – 10:20 a.m.: Introduction
- 10:20 a.m. – 12:00 p.m.: Trails and activities
- 12:00 – 12:15 p.m.: Restrooms and load buses
- 12:15: Depart
- 1:00 p.m.: Arrive back at school

STEP 4: DO A SITE VISIT (minimum of 1 week prior)

Visit the site ahead of time. This will significantly increase your comfort level with conducting the field trip. Scope out where the bus(es) will park, bathroom locations, as well as the most direct and/or safest way to get from the bus to the trail. Print out a copy of the field trip activity and accompanying maps and bring them with you. Try a test run by yourself or with friends or family, taking note of specific stopping points described in the activity.

Figure 6. Desert NWR landscape. (Sharon Shafer)

STEP 5: GATHER SUPPLIES FOR YOUR FIELD TRIP (1 week – 2 days prior)

- Bring permission slips as needed/required by school or agency. Make sure you are aware of medical concerns with students.
- Distribute field trip supplies lists for students – Each student needs to wear comfortable clothes, wear close-toed shoes like sneakers, bring a backpack, clothing layers/jacket per season, water bottle, snacks, pen/pencil, medicines.
- Prepare copies of activity handouts and any supplies for the field trip activity (e.g., photo print-outs, pens/pencils). Activity supplies are listed at the beginning of the specific field trip.
- Copy of approved Fee Waiver Form (if needed) – Print out a copy of your *agency-approved* field trip fee waiver and bring it with you on the bus to show the entrance station. Field trips that will need fee waivers are Lake Mead National Recreation Area and Red Rock Canyon National Conservation Area. Desert NWR and the Spring Mountains NRA do not currently need a fee waiver.
- Bring fully-charged cell phones – All adult chaperones on the trip should bring fully charged cell phones in case of an emergency. Emergency phone numbers for each agency are provided on the agency-specific field trip pages. These numbers will get you the fastest response. Not all locations will have a strong cell phone signal and reception is better for some carriers than others depending on the area (e.g., Verizon, AT&T, T-Mobile). Having a variety of phones and carriers will increase the likelihood of cell signal.
- (Optional) Emergency GPS locater/alert device – Emergency GPS locators are excellent safety devices to have on hand in case of an emergency when cell phones do not work. Common brands are SPOT and Garmin InReach. There are basic alert devices that do not require a subscription (no fee) and just send an alert and location to 911. Other devices allow texting-style communication with those on a contact list or, in an emergency, with the dispatch to

provide details about the emergency. The more sophisticated devices with texting require monthly or limited plans. Outdoor stores are a good place to learn more about these device options. If a school plans to do self-guided field trips to public lands, the school might consider purchasing a device and allowing teachers to check it out.

- Field trip teacher/chaperone backpack – Assemble one or more field trip backpacks for teacher(s), group leaders, or chaperones with the following supplies:
  - Field trip activity materials for each group leader (e.g., handouts, data sheets, background information, etc. per the specific field trip activity instructions)
  - Large and small trash bags – Help students practice Leave No Trace principles by bringing both large and small trash bags with you. Bring small trash bags for the trail and use large ones to pack out lunch trash. Some students really enjoy picking up trash found along the trail. You can give small trash bags (and possibly gloves) to students who get excited about contributing.
  - Gloves - Consider having disposable gloves for staff for medical emergencies and for students for litter pickup.
  - Hand sanitizer
  - Spare water and snacks
  - First aid kit
  - Sunscreen
  - Student emergency medicine (e.g., epipens, asthma inhalers, insulin, etc.)
  - 1-2 Wag bags - Wag bags are emergency bathroom kits in case someone needs "to go" while out on the trail and cannot make it to a standard bathroom facility. Most outdoor stores sell wag bag kits, or they can also be ordered online. These kits include instructions, toilet paper, hand wipe, anti-odor and absorbent materials, and multiple opaque bags to prevent spills or seeing the waste. NOTE: Students should not urinate in the bags; they are for feces.

STEP 6: CONFIRMATIONS (the day before)

Confirm bus(es), student lunches, permission slips, student checklists, and all above supplies, as needed.

STEP 7: HAVE FUN AND FOLLOW-UP WITH THE AGENCY!

- Celebrate the joy the students experience while being out in nature and on our public lands!
- Follow up with the agency and let them know how the field trip went for you and the students. If you have suggestions about the field trip activity or materials, let the agency know. They will take notes for future revisions.

Conducting a Field Trip to the Corn Creek Visitor Center

To conduct a self-guided field trip to Corn Creek contact the Desert National Wildlife Refuge at least two months in advance with your contact information, group size (maximum of 45 students), and preferred trip dates. Dates fill quickly, so be prepared with 1-2 backup dates in case your first choice is already reserved.

Note that larger group sizes may require a Special Use Permit issued by the Refuge. Permits are free for educational activities but do require a minimum of one month for staff to complete and issue. Refuge staff will determine if this is required for your group as part of the initial reservation process and, if it is, will provide you with the next steps.

The Corn Creek Visitor Center has two classrooms that can be used with prior reservation. Access to the visitor center exhibits when the building is closed may be possible but is dependent on staff availability and advanced reservation. Bathrooms, water, and the trails are accessible from sunrise to sunset, even if the visitor center is closed.

In addition, the Refuge has educator bins for check out. The bins are available for use during your field trip and must be returned at the end. They include most of the materials needed to run the Refuge Residents and Nature Inspirations activities, including laminated animal cards and stop-rotation cards, saving you time and materials in preparation of your visit. Educators will still need to provide the student handouts that they write on and can turn in.

To reserve your field trip, contact the refuge at least two months in advance. To reserve the educator bins, the classrooms, or access to visitor center exhibits, contact the refuge no later than one month in advance. Double check that the bins are available and complete (i.e. not missing materials) prior to your field trip and be prepared to bring all of your own materials if the bins are not available.

Refuge Contact

desertcomplex@fws.gov or 1-702-879-6110

Please reference “self-guided field trip reservations” in your communications.

Refuge Hours and Resources

Corn Creek Trails: Open sunrise to sunset

Visitor Center Hours: Thursday-Monday, 8:00 a.m. – 4:00 p.m. (September – May.) Summer hours vary.

The Visitor Center is a great starting point for visitors to become more familiar with the refuge and the wildlife that live here. Visitors can watch a 17-minute refuge orientation video, which is the same video used in the pre-field trip visit Refuge Puzzle activity, browse wildlife and human history exhibits, and obtain maps and brochures.

The Corn Creek trail system leaves from behind the visitor center, and its 1.5 miles of trail winds through different habitats and past cultural remnants. The trails are an excellent way to start your refuge experience! Along the trail, take a peek at the endangered Pahrump poolfish in our refugium, or make your way to the railroad tie cabin, which was built with railroad ties from the abandoned Las Vegas & Tonopah Railroad. Old scars from the railroad spikes still mark the walls of this 1920s historic home.

Facilities include restrooms, water, accessible trails, a covered patio, a picnic area with 6 tables, and bus parking.

School Field Trips

The Corn Creek Visitor Center and associated trails are popular for bird and wildlife watching and have limited space. A maximum of 45 students can come on a field trip, and they must be broken into three groups of 15. The specific field trip information provided in this guide describes how to break the students into groups. It also provides 2-hour and 3-hour field trip options.

Figure 7. Student visitors to Desert NWR complete Field Trip Activity handouts. (Get Outdoors Nevada)

Rules and Regulations: Desert National Wildlife Refuge

We have included common rules and regulations that are relevant for your field trip to the Corn Creek Visitor Center and trails. For a complete list of refuge rules and regulations, please visit https://www.fws.gov/refuge/desert.

- Corn Creek trails are open sunrise to sunset. Corn Creek Visitor Center hours vary. Please check with the refuge for schedule.
- All visitors must stay on marked trails at Corn Creek. Remind students to stay within the footprint of the trails.
- Organized groups, including school groups, may require a special use permit. Exemptions may apply as determined by refuge staff.
- Pack out what you take in, including all trash, materials, and supplies.
- No plant or mineral collection of any kind is allowed. This includes fruit from the historic orchard. Historic and archeologic artifacts cannot be moved or removed.
- No harassing or disturbing wildlife.

- Educational activities that require water sampling, specimen collection, or similar are not allowed. Exemptions might be permitted with prior approval of the of the Refuge Manager.
- At Corn Creek, pets are allowed on the trails, but never in the water, nor inside the Visitor Center. All pets must be restrained on a physical leash no longer than 6 feet (2 meters) in length. Pet owners must promptly and properly dispose of their pet's waste.
- No swimming, washing, wading, or fishing is permitted in refuge waters and springs.
- Bicycles are only permitted on designated roads. Bicycles are not allowed on Corn Creek trails.
- Use of drones or aerial devices (kites, balloons, etc.) is not permitted.
- Food must be kept in secure, wildlife-proof containers such as a cooler with latch or inside a vehicle. When food is outside of a secure container, a responsible adult is required to be with the food at all times and prevent animals' access to it.

Figure 8. Refuge volunteer exhibiting things to student visitors. (David Walker)

- Group activities will have no net impact on refuge facilities or resources. Leave it better than you found it!
- Share the space. Groups aren't permitted to informally reserve public facilities, and they must not restrict or prevent public access to public facilities, including but not limited to trails, benches, picnic tables, bathrooms, and covered shelters. If a facility is not in active use, such as a bench, it should be clear and available for use by the visiting public.
- It is illegal to dump animals and aquatic pets on the refuge. Domesticated animals are ill-adapted to survive on their own, can carry diseases fatal to their wild relatives, and may eat the native species that live here. Resources like https://www.dontletitloose.com can help you find an appropriate new home for your pet.

Reminder! All organized group activities, require a special use permit. Application should be submitted no less than 1 month in advance. For more information or to obtain a permit, please contact the Refuge Manager.

Refuge phone number: 1-702-879-6110
Interagency law enforcement dispatch (non-emergency): 702-293-8998
Emergency dispatch: 911

We hope you enjoy your time at Desert National Wildlife Refuge!

Activities at a Glance

Pre-Field Trip Activities

Refuge Puzzle

- Overview: Students assemble a puzzle of a map of the Desert National Wildlife Refuge and the trails at the Corn Creek Visitor Center. While assembling the puzzle, they learn about the habitats and history of the refuge. There is also a 17-minute introductory video about the Refuge.
- Location: Outside in schoolyard or field
- Time: 40-50 minutes

Note: In this guide, field trip activities are listed first, classroom (pre-field trip and post-field trip) follow.

Pahrump Poolfish Game

- Overview: Students play a game that simulates stressors impacting the endangered Pahrump Poolfish and things that can help.
- Location: Classroom
- Time: 20-30 minutes

Field Trip Activities

Onsite activities take place at the Corn Creek Visitor Center and the surrounding trails at the Desert National Wildlife Refuge. Hiking covers approximately 1 mile. All trails utilized on the field trip are accessible (Jackrabbit Loop, Coyote Loop, and Bighorn Loop). Make sure you, your chaperones, and your students are all prepared for outdoor weather and have what you need to conduct a successful and safe field trip.

Refuge Residents

- Overview: Groups use the marked trail map, stopping at designated stops along the Corn Creek Visitor Center trails to consider their resident animals in the context of the habitats at each stop.
- Location: The trail system behind the Corn Creek Visitor Center
- 75 minutes

Nature Inspirations

- Overview: Students use the natural world to engage with language and poetry. There are two poem templates to choose from: acrostic and cinquain.
- Location: On the Visitor Center patio or at the picnic tables on Coyote Loop
- Time: 15-20 minutes

Post-Field Trip Activities

Habitat Scramble

- Overview: Students are assigned a habitat and sort their habitats relative to water availability.
- Location: Classroom
- Time: 15-20 minutes

Design a Refuge

- Overview: Students work in groups to design a refuge which provides habitat for the Federally-threatened desert tortoise or another threatened or endangered species.
- Location: Classroom
- Time: 1 class period

Overview - Field Trip Itineraries

This section of the Desert National Wildlife Refuge Teacher's Guide contains itineraries for both a 2-hour and 3-hour field trip. The field trip activities are designed to be done in rotations to break larger groups of students into three smaller groups of no more than 15 students/group (maximum number of students for a self-guided field trip is 45.)

The Desert National Wildlife Refuge contains a variety of habitats both at the Corn Creek Visitor Center and beyond – along the dirt roads and up high in the Sheep Mountains. The field trip activities in this guide focus on the habitats near the visitor center that students can see and interact with on their visit to the Refuge.

Two-Hour Field Trip Itinerary (rotations for groups are in the table below)

Onsite Activities

- Introduction – 20 minutes
- Refuge Residents – 75 minutes
- Nature Inspirations – 25 minutes

Welcome and Orientation

Location

Visitor Center covered patio

Time

20 minutes

Overview

Orient students to the site and field trip

Procedure

- Walk students to the covered patio on the right side of the Visitor Center. Coolers with lunches can be left near the water fountains in front of the restrooms or in the classrooms inside of the Visitor Center (if prior reservations were made).

- Ask students to use the restrooms and wash their hands before returning to the covered patio area of the Visitor Center. Have students take a seat on the benches.
- **Get the students' attention, then tell them:**

Welcome to the Desert National Wildlife Refuge! National wildlife refuges are managed by the U.S. Fish and Wildlife Service. The goal of this agency is to conserve and protect wildlife and their habitats for the benefit of the people. Wildlife refuges give plants and animals a place to live and thrive and give people large outdoor spaces where they can enjoy the beauty of nature.

This is the largest wildlife refuge outside of Alaska. It protects the largest intact habitat for desert bighorn sheep, but it is also home to over 500 species of plants, 320 species of birds, 52 species of mammals, 32 species of reptiles, and so much more!

While we are here, we want to take care of the land so that plants and animals can stay healthy and so other people can enjoy the refuge, too. Here are some of the ways that we can do that:

- **Trash your trash**
- **Stay on the trail**
- **Leave what you find for others to enjoy (e.g., cool rocks, flowers, etc.)**
- **Respect wildlife (keep your distance, stay quiet, don't chase or feed wildlife)**
- **Respect other visitors**

Today, we are going to learn about the different habitats here at the refuge. We will split into smaller groups and rotate between activities. At the end, we will come back here and do a wrap-up activity before heading back onto the bus.

- Split students up into groups with their chaperones and begin rotations.

NOTE: Group sizes should be no more than 15 students. You will need to plan ahead to determine the number of student groups and how many chaperones will be needed to help conduct the activities and how you will do rotations to accommodate the number of students you have.

For the **Refuge Residents** activity, 45 students can be split into 3 groups of 15 students. Groups will be spread across the trails and rotation stops. The activity describes how to break the students into groups and where to begin the rotation.

The **Nature Inspirations** activity can be completed as a whole group outside of the Corn Creek Visitor Center as a closing activity. Another option is to keep students in smaller groups and find an open spot along the trail to do the activity (e.g., the picnic area, the grass near the orchard, or by the pond). If you want to use the classroom in the Visitor Center, that must be reserved ahead of time.

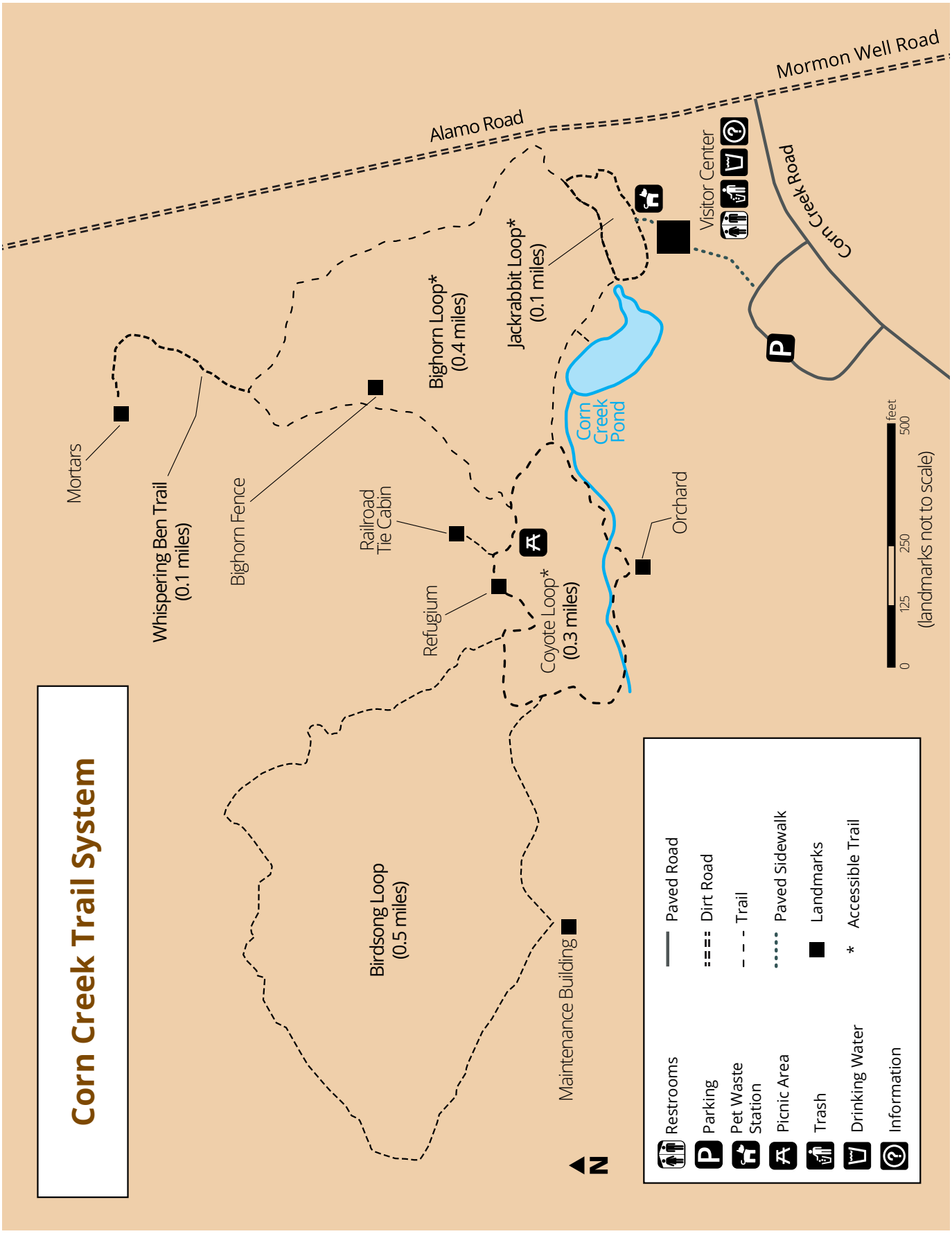


Figure 9. Corn Creek Trail System.

TWO-HOUR FIELD TRIP OPTIONS

Below are different rotation configurations based upon the number of groups.

Each group will need a chaperone that will lead each group and conduct the activities.

NOTE: Rows in the tables below in gray indicate simultaneous implementation.

Table 1. Two Groups of 15 each (30 people) – 2 hours

Time	Activity	Location	Group	Notes
20 minutes	Welcome and Orientation	Covered patio at the Visitor Center	Entire class	none
75 minutes	Refuge Residents	First Stop: Stop A Rotate counter-clockwise (Stop A to Stop E)	1	You will start this activity by exiting the covered patio of the Visitor Center. Then, you will take a **right** to follow Jackrabbit Loop. Take another right to turn onto Bighorn Loop. Your first stop will be Stop A. You will move counter-clockwise around the map (Stop A to Stop E).
75 minutes	Refuge Residents	First Stop: Stop E Rotate clockwise (Stop E to Stop A)	2	You will start this activity by exiting the covered patio of the Visitor Center. Then, you will take a **left** to follow Jackrabbit Loop. Stay left to continue onto Bighorn Loop. Stay left to reach Coyote Loop. Your first stop will be Stop E. You will move clockwise around the map (Stop E to Stop A).
25 minutes	Nature Inspirations	Covered patio at the Visitor Center	Entire class	This activity might be more inspirational if done near the Corn Creek Pond/on the trail/at the picnic area. Keep in mind the trails have a 15-person/group limit.

Table 2. Three Groups of 15 each (45 people) – 2 hours

Time	Activity	Location	Group	Notes
20 minutes	Orientation and Bathroom	Covered patio at the Visitor Center	Entire class	none
75 minutes	Refuge Residents	Rotate counter-clockwise (Stop A to Stop E)	1	You will start the Refuge Residents activity by exiting the covered patio of the Visitor Center. Then, you will take a **right** to follow Jackrabbit Loop. Take another right to turn onto Bighorn Loop. Your first stop will be Stop A. You will move counter-clockwise around the map (Stop A to Stop E).
75 minutes	Refuge Residents	Rotate clockwise (Stop E to Stop A)	2	You will start the Refuge Residents activity by exiting the covered patio of the Visitor Center. Then, you will take a **left** to follow Jackrabbit Loop. Stay left to continue onto Bighorn Loop. Stay left to reach Coyote Loop. Your first stop will be Stop E. You will move clockwise around the map (Stop E to Stop A).

Time	Activity	Location	Group	Notes
75 minutes	Refuge Residents	Cut across the center then rotate counter clockwise (Stop B towards Stop E towards Stop A)	3	You will start the Refuge Residents activity by exiting the covered patio of the Visitor Center. Then, you will take a **left** to follow Jackrabbit Loop. **Stay left to continue onto Bighorn Loop. Stay left to reach Coyote Loop. Your first stop will be Stop B.** You will move clockwise around the map (Stop B to Stop A). NOTE: This route will have some repeat sections of the trail and will take a little longer. Be sure to accommodate for this in your timing.
25 minutes	Nature Inspirations	Covered patio at the Visitor Center	Entire class	This activity might be more inspirational if done near the Corn Creek Pond/on the trail/at the picnic area. Keep in mind the trails have a 15-person/group limit.

Lunch Break: It is up to you how and when you want the students to eat lunch. If time allows, you can add lunch as a picnic area stop during the Refuge Residents activity; extend the Nature Inspiration activity to include lunch; or have a dedicated lunch rotation as part of the field trip. Students should bring lunch in their packs, and teachers/leaders should bring trash bags. Please take all of your field trip trash back to school with you. If you do not have time for a dedicated lunch break, the students could eat on the bus.

Lunch Locations: Students can eat at the picnic tables on the Coyote Loop Trail (limited to about 30 students) or the Visitor Center covered patio.

THREE-HOUR FIELD TRIP OPTION

Follow the two-hour schedule but add a lunch period and a rotation where students can explore the exhibits at the Corn Creek Visitor Center (please reserve in advance for Visitor Center closed days). You could do the Habitat Scramble activity instead of Nature Inspirations and the Visitor Center. It is recommended that Habitat Scramble be done after the Refuge Residents, as the experiences and background information gained from Refuge Residents help.

Example: Orientation/Bathrooms (20 min) → Refuge Residents (75 min) → Nature Inspirations (20 min) → Lunch (25 min) → Visitor Center (25 min)

Figure 10. A Red Racer snake navigates its way though a shrub. (Sharon Shafer)

General Materials

- Copies of student handouts (for each field trip activity you plan to do)
- Clipboards*
- Pencils
- Field trip teacher/chaperone backpack (see Gather Supplies for Your Field Trip for suggestions on what to pack)

*Clipboards are included in the Educator Kit, available for checkout a minimum of one month in advance through the Desert National Wildlife Refuge at desertcomplex@fws.gov or 1-702-879-6110.

Refuge Residents Activity

Overview

In the activity, students will extend their understanding of various animals that live on the refuge by learning about the animals' specific habitat needs and where on the refuge these needs can be fulfilled. Students will explore these concepts through the lens of an assigned animal. At each stop, students will observe, analyze, and record (or say) whether or not they believe their basic needs for food, water, shelter, and space are met by that habitat.

Location

Desert National Wildlife Refuge, Corn Creek Visitor Center

Materials

* Indicates materials found in the Educator Kit that can be checked out. The Desert National Wildlife Refuge has assembled Educator Kits with supplies and laminated materials for this activity. When you make your arrangements for the field trip, ask to reserve the kit. Availability of the kits will determine which supplies to bring. Educators are responsible for writing utensils and for making copies of handouts that students write on. If a kit is not available be prepared to bring all of the activity materials.

- Animal cards* - Classes will be broken into groups of no more than 15 students. All groups should have a set of animals cards. Each student will be given one animal card and will walk the trail as that animal. If a group is large enough, there should be two students representing each animal in a group to form a pair.
    - To ensure that each of the four habitats is represented by at least one student pair per group, you will need copies of the following animal cards: **tortoise, phainopepla, jackrabbit, and Pahrump poolfish**. (If you are making your own copies you will need 2 cards x # of groups = total copies needed of each.)
    - If you have more than 8 students per group, include one or more of the following animals: roadrunner, coyote, quail, dragonfly. You can add an additional animal for every two students (example: group of 8 students = four animals; group of 12 = six animals.)
    - Print a full set of the cards* for each person conducting the activity to refer to and hold up at the stops.
- Marked trail map* - 1 per leader/chaperone
- OPTIONAL: If using recording sheets during the activity, you will also need recording sheets - 1 per animal pair (NOTE: Copies of these sheets are NOT in the Educator Kit)

Time

75 minutes

Introduction

A refuge is a safe place for wildlife to live. Desert National Wildlife Refuge was created to protect the desert bighorn sheep, but many other animals also call this place home, like the desert tortoise and the mountain lion. Different kinds of animals need different habitats to live in.

An animal's habitat is the community in which it lives. A habitat can be likened to a home: a place in which food, water, shelter, and familiar space is found. A habitat or a home is where an animal has everything it needs to survive. A good habitat must suit an animal's physical needs, have a varied terrain, room to roam, and a dependable supply of food and water. It should also have safe places for an animal to feed, play, hide from predators, rest safely, be protected from the elements, and raise its young.

Figure 11. A desert bighorn sheep. (Sharon Shafer)

The landscape surrounding the Corn Creek Visitor Center can be divided into four distinct biological communities. **Communities** are biogeographical units that have formed in response to characteristics of the physical environment, such as elevation, precipitation, and temperature. In other words, a community is a group of plants and animals particularly well-adapted to living in a particular habitat. A **habitat** is a place that is "home" to an animal—where an animal can find everything it needs to survive. Some animals live their lives in one single biological community (e.g., the Pahrump Poolfish lives in the spring), while others use multiple biological communities (e.g., a coyote has a large range and uses resources in riparian, mesquite, saltbush, creosote communities, as well as beyond.)

Procedure

1. Determine how many groups you will need to divide the students into. There should be no more than 15 students per group. The maximum number is three groups at a time on the trail (45 students).
    a. Each group has its own map and stop order.
2. Before breaking into groups, provide the following information to the students (do this at the start of the trails under or near the covered patio at the Visitor Center.) Explain to students that:
    a. We will be following a trail and exploring different habitats and the animals that live in them.
    b. They will need to follow trail etiquette: leave plants and animals alone, do not take anything from the trail or environment, deposit trash in trash cans, step aside for others on the trail, using quiet voices increases the chance to see animals.

c. Explain that there are hundreds of species of animals and plants that reside on the refuge. Each animal is adapted to live here because the refuge provides all of its basic habitat needs.

d. Ask the students to define "**habitat**." Cue them as necessary and expand on their answers with the definition provided. Make sure they know the four basic needs, but concentrate on **food**, **water**, and **shelter** (the fourth need is **space**, which is abundant on the refuge – the Desert National Wildlife Refuge is the largest refuge in the contiguous United States. The amount of space an animal needs depends upon the species and environmental and habitat conditions).

e. Explain that, to help them better understand a particular resident animal, they will each take on the identity of one of the animals that lives on the refuge and decide which of the four habitats is a good place for their animal to live.

3. Break the students into groups and distribute the Animal Cards. There are eight different animals in the set (coyote, phainopepla, desert tortoise, roadrunner, quail, jackrabbit, dragonfly, and Pahrump poolfish). If two students have the same card, they can work together as a team. On each Animal Card is a picture of the animal and a description of their needs.

   OPTIONAL APPROACHES BASED UPON STUDENT READING LEVELS AND TIME

   The second student handout is the Recording Sheet (optional). There are three options for this:

   - **Option 1:** This Recording Sheet asks student to write out the habitat information/details at each stop. This option is good for older or more advanced students and/or for longer field trip times (e.g., 3+ hours).
   - **Option 2:** This Recording Sheet asks students to circle "yes" or "no" to each of the needs/habitat questions. This option is good for younger students, students with lower reading levels, and/or for shorter field trips.
   - **Option 3:** No handouts are printed, and students are asked to respond verbally. In this option, you will prompt the students with questions at each habitat stop. This option is ideal for shorter field trips, younger students, and for teachers that don't require a written assessment as part of the field trip.

4. Tell students to silently read their cards before starting the activity. Explain to the students that they should begin their walk from the perspective of the animal on their card, thinking about whether their animal could live in a given location. Tell them that they will be making several stops on their journey where they will consider the following questions:

   - What basic needs can be met at this stop? Food? Water? Shelter?
   - Is this a good habitat for your animal? Why or why not?

5. Have the students name their animal group. They can use colors, emotions, movements, attributes, etc. For example: Flaming Dragonflies, Paddling Poolfish, Yipping Coyotes, and Tired Tortoises. They can write their special name on their Recording Sheet (if applicable).

Corn Creek Trails Map with Refuge Residents Stops

You will start this activity by exiting the covered patio to the rear of the Visitor Center. Then, depending on the total number of groups on your field trip, you will either take a right or a left at the trail kiosk (see the field trip section of this guide for rotation details and examples).

Trail Stops:

Stop A: Bighorn Loop Lookout (Habitat: Creosote Bush Community)

Stop B: Railroad Tie Cabin (Habitat: Mesquite Bosque)

Stop C: Refugium (Note: This is Not a Habitat Stop)

Stop D: Coyote Loop Western Edge (Habitat: Saltbush Community)

Stop E: Coyote Loop near Orchard (Habitat: Desert Riparian Zone)

Note: It is possible that student groups may arrive at stops at the same time. If you come across another group that has already began discussing the stop you wish to visit, direct your group to keep their distance and stand on one side of the trail (to allow other visitors to pass). Wait until the other group has finished before approaching the stop. (This allows you to not exceed the maximum allowable number of 15 in a group.) Use this opportunity to engage the students with their surroundings. Ask them to look, listen, and smell using their senses. You can also ask students questions about the habitat they are next to, pulling from the information they have already explored.

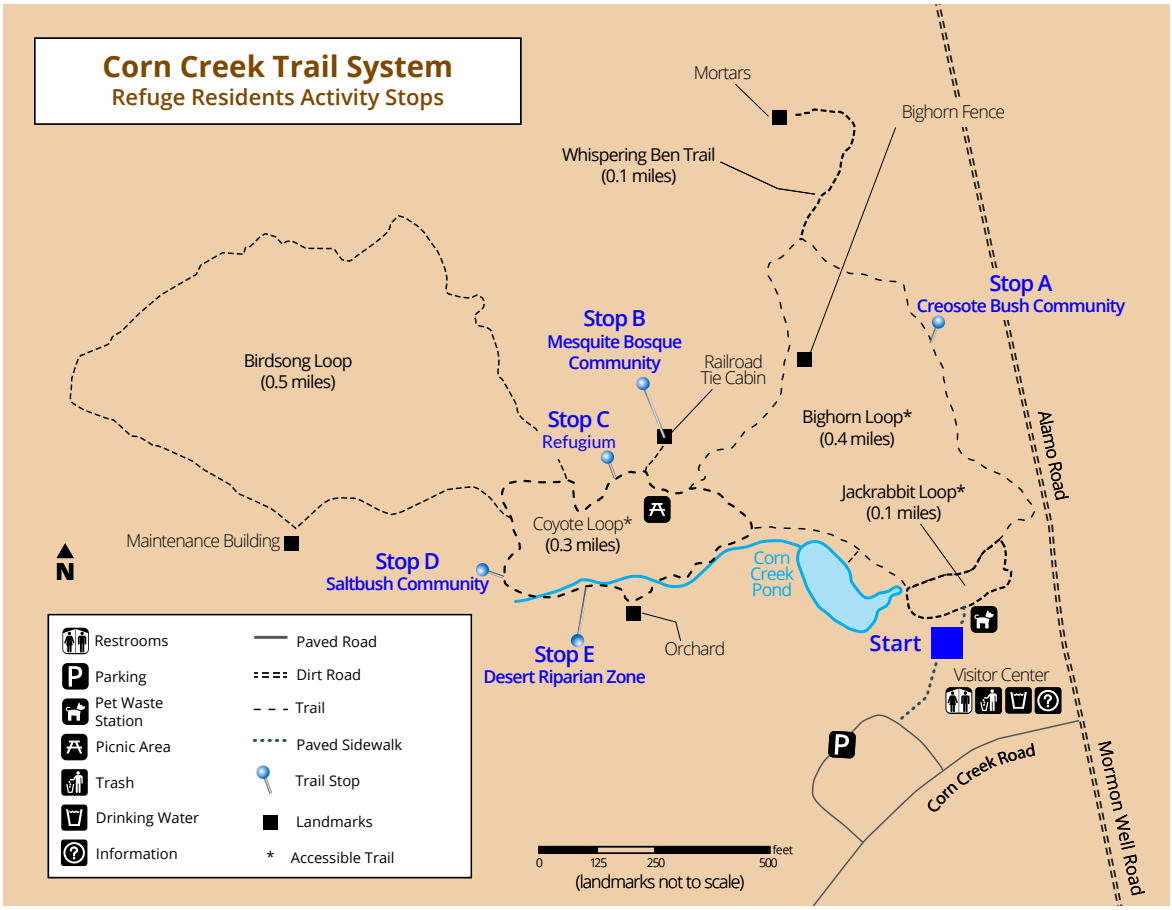


Figure 12. Refuge Residents activity stops on the Corn Creek trails.

Leader Handout

STOP A: Bighorn Loop Lookout – Creosote Bush Community

This stop is on the eastern edge of Bighorn Loop. There is a pergola, a bench, and three information panels. The stop is oriented east and provides an excellent view of the Sheep Range.

Figure 13. A view of the pergola, facing the Sheep Mountains. (R. Tressler/USFWS)

Ask: How many of you like the way Las Vegas smells after it rains? Does anyone know which plant is responsible for that "desert rain" smell?

Tell them: The creosote bush gives off the "desert rain" smell experienced in Las Vegas. In order to survive the extreme heat of the desert, creosote has waxy oils on its leaves which protect them from drying out. These oils become active in rain. If you cup the creosote leaves in your hands, exhale, and inhale, it will release the scent. ***(Demonstrate this with your group by inviting students to go up to a creosote bush, cup their hands around it, exhale, then inhale to smell. Invite them touch – not pull off – the leaves. Note the waxy feel and how tiny they are, which helps reduce water loss.)***

Tell them: Areas of the desert such as this, where creosote dominates, are called *Creosote Bush Communities*. Creosote may seem small to us, but it provides great cover for smaller animals trying to seek shelter from the hot sun. It's also a good place for them to hide from predators.

Ask: Does anyone remember which animal the Desert National Wildlife Refuge was made to protect? (***Answer***: desert bighorn sheep)

Tell them: From here, you can see the Sheep Mountains ***(point east)***, which is named for the roughly 450-900 bighorn sheep that call this refuge home. The mountains and foothills of the refuge

provide food, water, shelter, and, most importantly, lots of space for the desert bighorn sheep to escape from predators (mountain lions) and raise their young.

Ask the students to fill out their recording sheets (if applicable).

Ask Them/Tell Them:

Raise your hand if you think this is a good habitat for your animal!

> **Best answers:** jackrabbit, desert tortoise, roadrunner, quail, coyote
>
> **Bad habitat for:** dragonflies, Pahrump poolfish (they need the water!)

Raise your hand if the creosote bush provides food your animals?

> **Food answer:** Creosote provides food for jackrabbits, and it is occasionally eaten by desert tortoises. In turn, roadrunners, jackrabbits, and quails that live here are prey for coyotes.

Does creosote provide water for your animals? Can anyone explain how the creosote bush provides water?

> **Water Answer:** Have you eaten a watermelon or an orange? Think about how much juice there was! That juice is mostly water, and many animals get their water from the plants they eat, just like you do. Creosote provides water for the jackrabbit and desert tortoise, which they obtain by eating its leaves. The fruits and berries of cacti and mistletoe provide water for quail, phainopepla, and roadrunners.

Ask the students to raise their hands if the creosote bush provides shelter for their animals? Can anyone share how it provides shelter for their animal?

> **Shelter Answer:** Creosote provides shelter for the desert tortoise, roadrunner, quail, and jackrabbit. Some animals hang out under the branches (roadrunner, quail, jackrabbit), others dig holes and live amongst the roots (tortoise).

OPTIONAL: Encourage the groups with the **desert tortoise** and **roadrunner** to read their animal cards and share how/why this habitat fulfills the needs of their animals.

Leader Handout

STOP B: Railroad Tie Cabin – Mesquite Bosque (boss-kay)

Walk the students over to the Railroad Tie Cabin. On the right side of the cabin and behind it are thick patches of mesquite trees. This is known as a mesquite "bosque" (boss-kay) or forest. You are allowed to lead the students past the information panel so they can get a closer look at the mesquite trees.

Figure 14. A view of the historic Railroad Tie Cabin. (R. Tressler/USFWS)

Ask: This stop is an excellent place for humans. Which of the four basic needs did this cabin provide for humans? (**Answer:** *shelter*)

Tell them: This cabin was built in the 1920s by the Richardson family. There wasn't a lot of wood in the desert, so they used wood (ties) from the railroad that once ran from Las Vegas to Tonopah. The Richardsons were ranchers that kept livestock and planted the orchard here at Corn Creek.

Ask them: What are some difference you notice between this community and the last one?

Tell Them: (Student responses will vary) There are trees. There is a cabin. The plants are different and more dense.

Ask them: What essential need do you think the trees at this stop provide for animals? Food, water, shelter, or space?

Tell them: There is more shelter available for animals here. The mesquite trees grow in dense patches called bosques (boss-kays) which provide excellent cover for animals. Mesquite trees have seed pods that are very nutritious. *Nuwu/Nuwuvi* (Southern Paiute people) grind these seed pods into a flour for food. Both coyotes and jackrabbits like to eat the seed pods of mesquite trees. Coyote scat often contains undigested parts of the seeds.

Figure 15. A clump of desert mistletoe growing off of a mesquite tree branch. (A.Eowyn/USFWS)

Ask: Does anyone know what desert mistletoe looks like? Can anyone point it out to me?

Tell them: Mistletoe is a parasitic plant that grows on mesquite trees. The mistletoe steals precious water and nutrients from the mesquite it grows on. ***(Point to a bunch of mistletoe in the mesquite tree)***. Desert mistletoe berries are the preferred food of a bird called a phainopepla (fay-no-pep-lah). While phainopepla go to the bathroom, their gooey droppings stick to the tree branch, giving the mistletoe seeds a new place to grow. Look around you – the phainopepla has done this job well here!

> **NOTE:** Cutting or collecting live or dead plant material is prohibited on the Desert National Wildlife Refuge. Make sure the students do not pick or attempt to eat mistletoe berries or any other plants on the field trip.

Tell them: Mesquite trees grow where there is plenty of water available. They have deep roots which allow them to tap into the water stored underground. Water is hard to come by in the desert. Coyotes are known to dig "wells" near the base of mesquite trees to find water to drink. You don't see any evidence of this at Corn Creek because the coyotes can drink water from the Corn Creek pond and streams. This refuge is special because it helps protect the Corn Creek springs.

Ask the students to fill out their recording sheets (if applicable).

Ask Them/Tell them:

- Raise your hand if you think this is a good habitat for your animal!
  - **Best answers:** jackrabbit, phainopepla, and coyote
  - **Bad habitat for:** dragonflies, Pahrump poolfish (they need the water!)
- Raise your hand if the mesquite tree provides food their animals.
- Raise your hand if the mistletoe provides food their animals.
  - **Food Answer:** Coyotes and jackrabbits like to eat the bean pods of mesquite trees.
- Ask the students how this habitat provides water for any of their animals?
  - **Water Answer:** The berries of mistletoe provide water for phainopepla and quails. Coyotes dig wells at the bases of mesquite trees to tap into the groundwater beneath them.
- Ask the students to raise their hands if the mesquite provides shelter for their animals? Can anyone share how it provides shelter for their animal?
  - **Shelter Answer:** Mesquite trees provide shelter for the phainopepla and coyote. It can also provide cover for jackrabbits, roadrunners, and quail.

OPTIONAL: Encourage the groups with the **phainopepla** and **coyote** to read their animal cards and share how/why this habitat fulfills the needs of their animals.

Leader Handout

STOP C: Refugium (Pronounced Ruh-FYOO-jee-uhm)

(Note: This is not a habitat stop. This stop is connected to the Pahrump Poolfish game.)

Walk the students over to the information panel in front of the refugium. **Note: For best results, do not allow students to approach the refugium until after you have finished speaking.**

Figure 16. The refugium is a protected home for Pahrump Poolfish. (R.Tressler/ USFWS)

Tell them: This small building filled with water is called a refugium. The refugium is a protected home built specifically for the Pahrump poolfish. The Pahrump poolfish is an **endangered species**. This means that there aren't many of them left in the wild and they are in danger of dying out completely. There are many reasons why a species may become endangered. In the case of the Pahrump poolfish, their home was destroyed. The poolfish used to live in a spring in Pahrump, but the spring dried up in 1975 because humans overused the water.

Ask: If you can't take care of a pet goldfish anymore, do you think it is okay to bring it here and dump it into the creek? (***Answer:*** No! Of course not!)

Tell them: Sometimes, people dump their pets (like goldfish and crayfish) into Corn Creek when they can no longer take care of them. These pets eat the poolfish and compete with them for resources. The refugium is a protected place for the poolfish to live away from these non-native species that might harm them. (Goldfish and crayfish can eat the poolfish in the creek and pond, so this is an extra-protected place to safely live.)

Let the students take turns looking through the windows at the poolfish. Remind them that these fish are very small (only 2 to 3 inches long) and may be difficult to see unless they look closely!

Leader Handout

STOP D: Coyote Loop Western Edge (Saltbush Community)

After crossing the first bridge on Coyote Loop, you will come upon a saltbush scrub area. There will be wooden fencing on both sides of the path and a view of the maintenance building. Stop when you see the "Sensitive Wildlife Area" sign on the fence and have the students focus on the area with the saltbushes, directly opposite of the sign. **Make sure that the students are only standing on one side of the path so other visitors can pass them on the trail.**

Figure 17. Saltbush is one of the most widespread shrubs in Nevada. (A.Eowyn/USFWS)

Tell them: This habitat, known as the Saltbush Community, is dominated by the four-wing saltbush, one of the most widespread shrubs in Nevada. Saltbush grows in saline (salty) basins and playas, where the soil is sandy (point to the sandy soils). Like creosote, saltbush provides excellent cover for smaller animals. Wildlife have found many ways to hide from humans, including camouflage. The ability to go unnoticed is important for both predators and prey.

Ask: What is camouflage?

Tell them: The coats and coverings of many animals are designed to match their surroundings to make them almost impossible to see. The primary adaptive function of camouflage is to allow animals to hide from predators.

Ask: Raise your hand if your assigned animal has camouflage or a coat coloring that might help it to blend in with the Saltbush Community?

Tell them: Quails are birds that live most of their lives on land instead of in the sky. They build their nests on the ground and require dense shrubs like saltbush to protect their nests from predators and the elements. Some natural predators of quail eggs and chicks are the coyote and the roadrunner.

Ask the students to fill out their student recording sheets (if applicable).

Ask Them/Tell them:

- Raise your hand if you think this is a good habitat for your animal!
  - **Good habitat for:** jackrabbit, desert tortoise, roadrunner, quail, coyote
  - **Bad habitat for:** phainopepla, dragonflies, Pahrump poolfish
- Raise your hand if the saltbush provides food for your animal.
  - **Food Answer:** Saltbush provides food for the jackrabbit. It is occasionally eaten by desert tortoises. Jackrabbits and quails are prey for coyotes.
- Raise your hand if the saltbush provides water for your animal. Can anyone explain how the saltbush provides water?
  - **Water Answer:** Saltbush provides water for the jackrabbit and desert tortoise. Water is stored in the plant and the animals can extract water through their digestion.
- Raise your hand if the saltbush provides shelter for your animal. Can anyone share how it provides shelter for your animal?
  - **Shelter Answer:** Plants in the Saltbush Community provide shelter for the desert tortoise, roadrunner, quail, and jackrabbit. Some animals hang out under the branches, others dig holes and live amongst the roots.

OPTIONAL: Encourage the groups with the **jackrabbit** and **quail** to read their animal cards and share how/why this habitat fulfills the needs of their animals.

Leader Handout

STOP E: Coyote Loop Near Orchard (Desert Riparian Zone)

Stop near the pomegranate tree and an exhibit sign titled "Fruits of Labor." **Make sure that the students are only standing on one side of the path so other visitors can pass them on the trail.**

ASK: Let's take a minute to be quiet and to listen and look around us. Pay attention to the different things you can hear and see.

Figure 18. Bordering the riparian zone, the orchard makes a great bird habitat. (A.Eowyn/USFWS)

Figure 19. Coyote trail near the orchard. (A.Eowyn/USFWS)

Tell them: Did you see the leaves move? Or, hear the water? Water is important to all living things, but it is especially rare in the desert. Some desert animals drink water from natural springs like the one at Corn Creek, but most animals get the water they need from the food they eat, like succulent plants, seeds, or the bodies of their prey.

Tell them: A refuge is a protected place for wildlife to live. It is also important that the refuge be a healthy place to live. Habitats with flowing water and plants that like to grow near it are called **riparian** habitats. They are very rare in the desert and need extra protection.

Tell them: The orchard was originally planted by the Richardson family who ranched at Corn Creek in the 1920s. Using the water in Corn Creek for irrigation, they grew fruit and nut trees, like the pomegranate trees you can see here. The orchard and the riparian zone are a favorite stop for migratory birds. Other animals make use of the orchard and the water of Corn Creek Springs, including coyotes and rabbits.

Ask the students to fill out their recording sheets (if applicable).

Ask Them/Tell them:

- Raise your hand if you think this is a good habitat for your animal!
  - **Good habitat for:** All refuge residents!

Note: This habitat is particularly risky for the desert tortoise since its main predator, the raven, lives here. There is little cover for the tortoise to escape notice or blend into this environment.

- Ask the students to share how the riparian area provides food their animals?
  - **Food Answer:** As nymphs, dragonflies eat aquatic larvae, small fish, and tadpoles that are only found in riparian areas. As adults, dragonflies eat months, flies, and other soft-bodied insects which inhabit riparian habitats. Poolfish eat organic debris, insects, plants, algae, and snails, all of which live in the Corn Creek stream system. Insects and frogs are eaten by phainopepla, quail, roadrunners, and coyotes. The desert tortoise and jackrabbit eat clovers, alfalfa, and grasses which depend on wet or flooded soils to grow.
- Ask the students how the riparian area provides water for any of their animals?
  - **Water Answer:** All desert animals will drink water if it is readily available. Since the water in Corn Creek flows all year long, these waters are a reliable source of water for our refuge residents.
- Ask the students how the riparian area provides shelter for their animals?
  - **Shelter Answer:** The trees and plants around the Corn Creek Visitor Center use this water to grow. Many animals use the plants found in the desert riparian zone, such as cottonwood trees, Goodding's willow, saltgrass, and arrowweed as shelter, either temporarily while they are stopping by for a quick drink, or permanently as a full-time home.

OPTIONAL: Encourage the groups with the **Pahrump poolfish** and **dragonfly** to read their animal cards and share how/why this habitat fulfills the needs of their animals.

Leader Handout

Other Quick Stops

(Connected with the Refuge Puzzle Pre-Site Activity)

As you get started with the groups, stop along the way and ask them to look, smell, and listen to orient them to their environment. Below is some information that can be read to or shared with the students.

Corn Creek Pond: In 1971, a pond was created at Corn Creek from Corn Creek spring for the endangered Pahrump Poolfish. Twenty-nine poolfish were brought to live in the pond, and initially they thrived – finding all that they need to live (food, water, shelter, and space). Then people illegally introduced non-native species, including mosquitofish, crayfish, and bullfrogs, into the pond. These non-native animals competed with the poolfish for resources and even preyed upon the Pahrump poolfish and their eggs. When the poolfish population was in danger of disappearing due to this new threat, the U.S. Fish and Wildlife Service tried different solutions to save them. In 2003, they built the refugium [Stop C] to protect the fish.

Look close! Sometimes students can see the invasive crayfish in the creek as they cross over the bridges and in the pond.

Never release your pets or aquarium creatures into the wild! Most cannot survive and those that do can harm the animals that call this place home by eating there food, changing the habitat, or preying on them.

Figure 20. The Corn Creek Pond from the trail. (USFWS)

Figure 21. Crayfish.

Figure 22. Image of Bullfrog.

Bighorn Fence: In the 1950s and 1960s, biologists used to study a captive herd of bighorn sheep at Corn Creek. Starting in the 1970s, researchers began studying the sheep in their natural habitat. This fence is a remnant of the historic sheep enclosure - a reminder of changing management on the refuge.

- Ask the students why they think it might be better to study the sheep in a natural habitat versus in an enclosure?
  - Answers: The sheep will behave differently fenced in versus roaming; if studied in their natural habitat you can see how they eat, play, reproduce, and interact naturally.

Figure 23. Fence once used to enclose the bighorn sheep. It is noted as "Bighorn Fence" on the trail map. (USFWS)

Figure 24. Three Bighorn Sheep stand atop a large rock. (Sharon Shafer)

Group 1

Start by exiting the Visitor Center Patio to the rear. Take a right at the trail kiosk to continue onto Jackrabbit Loop. Then, take a right onto Bighorn Loop. Take short stops along the way, asking students to make observations about what they see, hear, or smell, connecting them with their surroundings. Your first stop will be Stop A (the Bighorn Loop Lookout). You will continue counterclockwise around the trails (excluding Birdsong Loop) until you reach your final stop, Stop E (the Orchard stop).

Your Route: Begin at Stop A → Stop B (point out bighorn fence from the Refuge Puzzle activity along the way) → Progress counter-clockwise to Stops C, D, E → After Stop E Point out the orchard from the Refuge Puzzle activity → Next point out the pond (there is an interpretive sign)

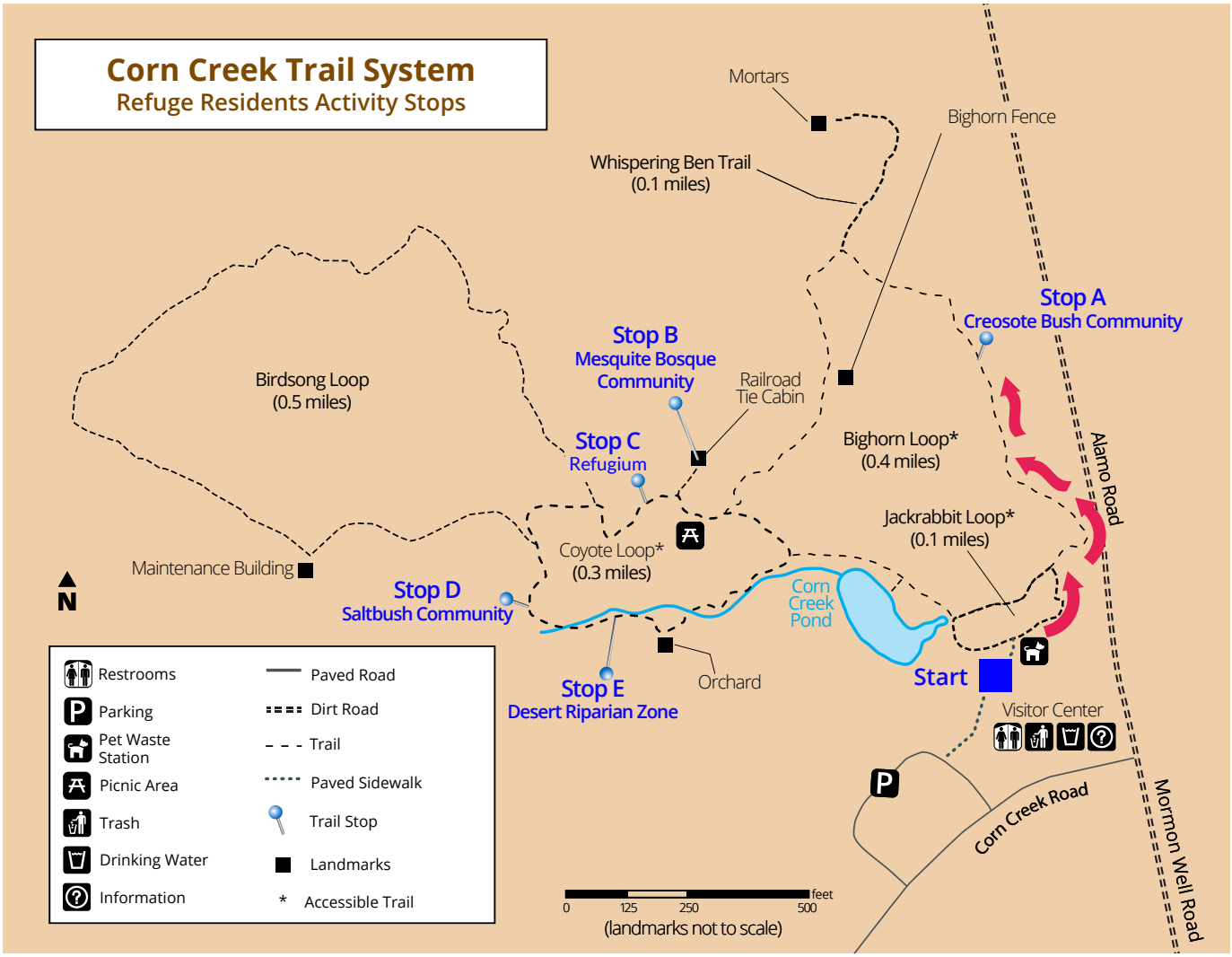


Figure 25. Corn Creek Trail System with Group 1 trail marked.

When you are finished, turn around and retrace your steps on the Bighorn Loop to return to the Visitor Center patio.

Group 2

Start by exiting the Visitor Center Patio to the rear. Take a left at the trail kiosk to continue onto Jackrabbit Loop. Stay left to continue onto Bighorn Loop and pass the Corn Creek Pond. Take short stops along the way, asking students to make observations about what they see, hear, or smell, connecting them with their surroundings. Stay left again to continue onto Coyote Loop. Your first stop will be Stop E (the Orchard stop). You will continue clockwise around the trails (excluding Birdsong Loop) until you reach your final stop, Stop A (the Bighorn Loop Lookout).

Your Route: As you begin your path, point out the pond (there is an interpretive sign) → Next point out the orchard from the Refuge Puzzle activity then stop at Stop E. Continue clockwise to stops D, C, B → On your way to Stop A, point out the bighorn fence from the Refuge Puzzle activity → Your last stop is A

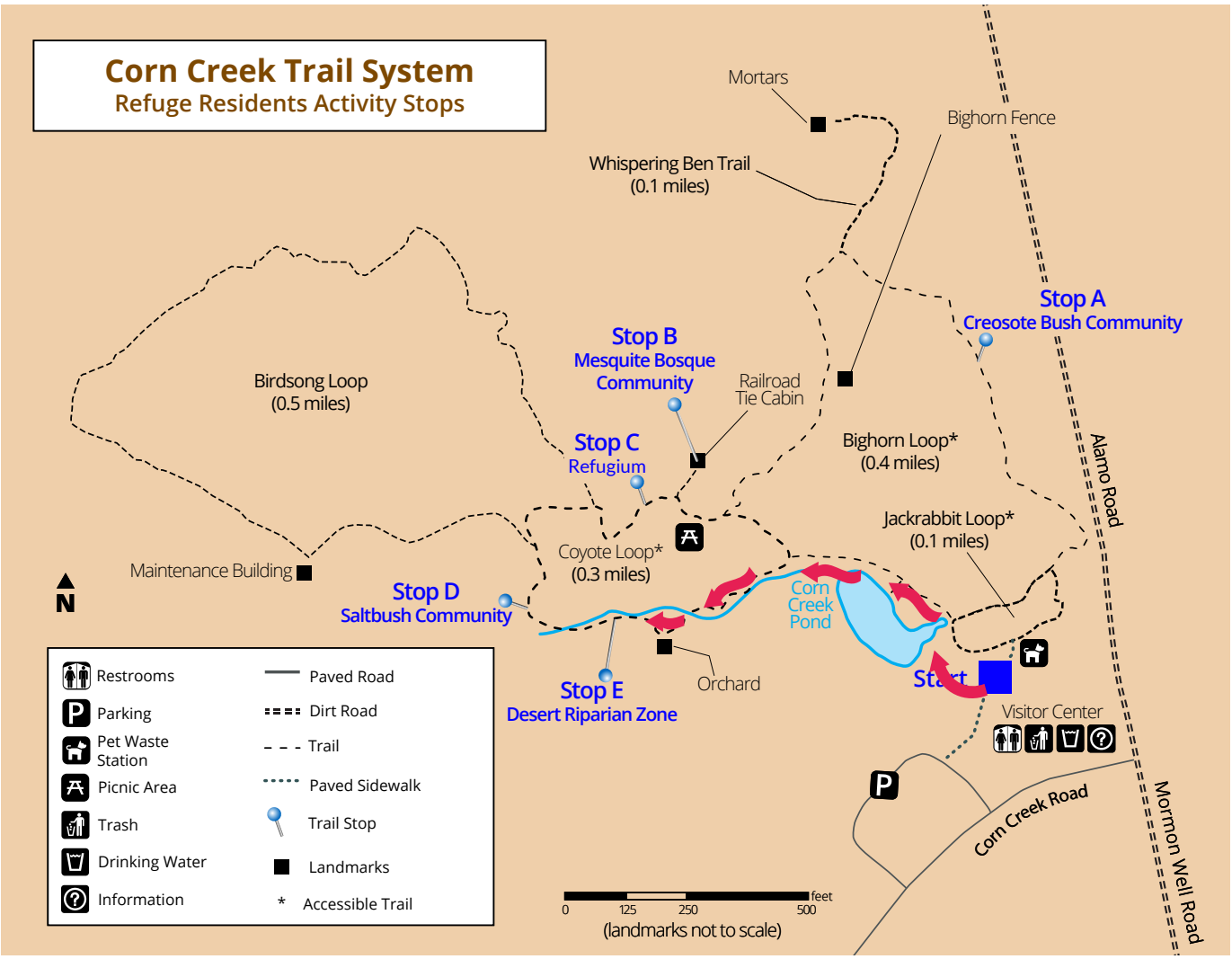


Figure 26. Corn Creek Trail System with Group 2 trail marked.

When you are finished, you can either turn around and follow Bighorn Loop and then take a right onto Coyote Loop to have lunch at the picnic area or continue straight to return to the Visitor Center Patio.

Group 3

Start by exiting the Visitor Center Patio to the rear. Take a left at the trail kiosk to continue onto Jackrabbit Loop. Stay left to continue onto Bighorn Loop and pass the Corn Creek Pond. Take short stops along the way, asking students to make observations about what they see, hear, or smell, connecting them with their surroundings. Take a right onto Coyote Loop, go PAST the second Bighorn Loop intersection veering left towards Stop B. Your first stop will be Stop B (the Railroad Tie Cabin). You will continue COUNTERCLOCKWISE around the Coyote Loop Trail trails until you reach the second intersection of the Bighorn Loop then go CLOCKWISE to your final stop, Stop A (the Refugium). NOTE: There will be a small overlap of the Coyote Loop trail (the section between the first and second intersection of the Bighorn Loop with Coyote Loop).

Your Route: As you begin your hike, point out the pond (there is an interpretive sign) and progress to Stop B. Continue counterclockwise to Stops C, D, and E. After Stop E, point out the orchard from the Refuge Puzzle activity → veer left past the first intersection of Bighorn Loop, stay on the Coyote Loop, then go right on the second intersection of Bighorn Loop heading towards the bighorn fence. Point out the bighorn fence from the Refuge Puzzle activity. Your final stop is A.

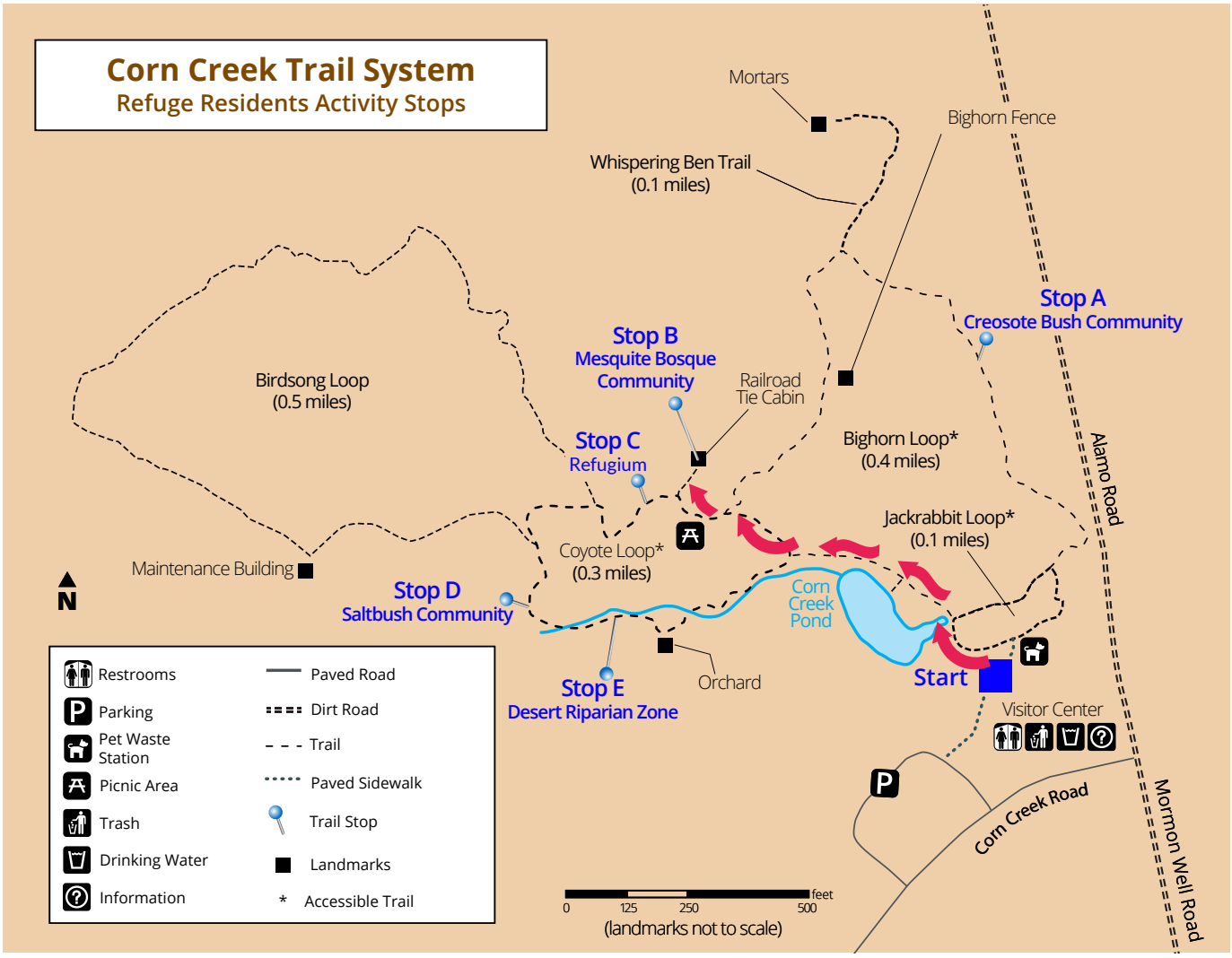


Figure 27. Corn Creek Trail System with Group 3 trail marked.

When you are finished, you can either continue to follow the Bighorn Loop to the Jackrabbit Loop to return to the Visitor Center Patio.

Student Recording Sheet – Option 1

Group Name:_____ Group Animal: _____

Student Name: _____

- Record if your animal would be able to call each stop "Home"!
- Does it meet the four Basic Needs of every animal? Food, Water, Shelter, and Space (room to roam and places to raise young)
- Space: The Desert National Wildlife Refuge is the largest refuge in the lower 48 United States. Space is abundant for animals here.

Stop A – Creosote (pronounced: kri-uh-sote) Bush Community:

1. What basic needs are available at this stop?

   Food:_____

   Water: _____

   Shelter: _____

2. Is this a good habitat for your animal? Why or why not?

Stop B – Mesquite Bosque (pronounced: muh·skeet boss-kay):

1. What basic needs are available at this stop?

   Food:_____

   Water: _____

   Shelter: _____

2. Is this a good habitat for your animal? Why or why not?

Stop D – Saltbush Community:

1. What basic needs are available at this stop?

   Food:_____

   Water: _____

   Shelter: _____

2. Is this a good habitat for your animal? Why or why not?

Stop E – Desert Riparian Zone:

1. What basic needs are available at this stop?

   Food:_____

   Water: _____

   Shelter: _____

2. Is this a good habitat for your animal? Why or why not?

Student Recording Sheet – Option 2

Group Name:_____ Group Animal: _____

Student Name: _____

- Circle the answers at each stop and decide if your animal can call that location Home! Consider if the habitat has Food, Water, Shelter, and Space (room to roam and places to raise young).
- Space: The Desert National Wildlife Refuge is the largest refuge in the lower 48 United States. Space is abundant for animals here.

Stop A – Creosote (pronounced kri-uh-sote) Bush Community:

1. Does this habitat have all of the basic needs for your animal? (circle your answer)

   Food: Yes No

   Water: Yes No

   Shelter: Yes No

2. Is this a good habitat (home) for your animal? Yes No

Stop B – Mesquite Bosque (pronounced muh·skeet boss-kay):

1. Does this habitat have all of the basic needs for your animal? (circle your answer)

   Food: Yes No

   Water: Yes No

   Shelter: Yes No

2. Is this a good habitat (home) for your animal? Yes No

Stop D – Saltbush Community:

1. Does this habitat have all of the basic needs for your animal? (circle your answer)

   Food: Yes No

   Water: Yes No

   Shelter: Yes No

2. Is this a good habitat (home) for your animal? Yes No

Stop E – Desert Riparian Zone:

1. Does this habitat have all of the basic needs for your animal? (circle your answer)

   Food: Yes No

   Water: Yes No

   Shelter: Yes No

2. Is this a good habitat (home) for your animal? Yes No

Coyote

Coyote. (USFWS)

Coyote

Food: You will eat any animal you can catch, including ground squirrels, jackrabbits, and roadrunners—you will also occasionally eat plant material, especially the nutritious bean pods of mesquite trees.

Water: You get most of the water you need from prey but won't pass up the opportunity to drink directly from a pond or stream.

Shelter: You prefer areas with protective cover, like mesquite bosques (pronounced boss-kays) or creosote bush communities. You will dig your den out of the soft dirt in these areas.

Habitat: Your appetite drives you to travel miles and miles in search of food, making your territory quite large and the habitats you hang out in quite varied!

Phainopepla

(Pronounced: fay-no-pap-lah)

The Phainopepla bird. (Sharon Shafer)

Mistletoe. (A. Eowyn/USFWS)

Phainopepla

Food: You are one smart bird, carrying and planting your favorite food—the desert mistletoe—everywhere you go! While you go to the bathroom, your gooey droppings stick to the branches of mesquite trees, giving the mistletoe seeds a new place to grow. You can eat up to 1,000 mistletoe berries in a single day! You also like to eat small insects like beetles, flies, and caterpillars.

NOTE: Do not pick or eat any plants on the refuge!

Water: Because of all the juicy mistletoe berries you eat, you rarely need to drink water.

Shelter: Using spider silk for reinforcement, you build your nest in a cluster of mistletoe, which offers excellent shade and protection for you and your young.

Habitat: You love to hang out in mesquite trees where the mistletoe berries grow.

Desert Tortoise

Desert Tortoise walking over rocky ground. (Sharon K. Shafer)

Desert Tortoise

Food: In the spring and fall, you can be found eating creosote, grasses, flowers, fruit, and cacti.

Water: Oddly, you drink water from your nose. This adaptation helps you to gather water from small areas, like rock crevices or leaves. Luckily for you, you get most of the water you need from the food you eat. You are also able to store water for long periods of time in your bladder and reabsorb it when needed. This comes in handy in the dry Mojave Desert!

Shelter: For shelter, you will dig a dome-shaped burrow in the wall of a wash or near the base of a creosote bush. Your burrow helps you to avoid predators and escape the hot desert sun or the cold winters.

Habitat: You like to hang out in desert scrub habitats where your brown and tan coloration helps you to blend in with the environment.

Roadrunner

A roadrunner stands in tall grass next to a road. (R. Tressler/USFWS)

Roadrunner

Food: You will eat pretty much anything you can catch—lizards, rattlesnakes, baby quails, and even small mammals like mice.

Water: When you can't find meat, you will eat plants, like the prickly pear cactus. These plants are high in water content, and, like the tortoise, you have adaptations which let you to go for long periods of time without drinking water.

Shelter and Habitat: You prefer to hang out in creosote bushes and other dense shrubs which provide cover from predators like the coyote. You build your nests near or on the ground in sturdy bushes or cacti using twigs, leaves, feathers, and manure.

Quail

A mother quail and her two chicks stand on a log. (Sharon K. Schafer)

Quail

Food: You spend most of the day eating mistletoe berries, cactus fruits, seeds, leaves, and insects.

Water: You will drink water if it is available, but you usually get enough from the juicy cactus fruits and mistletoe berries you eat.

NOTE: Do not pick or eat any plants on the refuge!

Shelter: You build your nest directly on the ground in dense stands of four-wing saltbush using dead grasses and leaves. Sometimes, you will reuse an abandoned roadrunner nest as a base, building your nest right on top!

Habitat: Your preferred habitats are brushy washes. You love to rest in the cool shade of a saltbush. You are frequently seen traveling in a group called a “covey” (pronounced kuh-vee), following each other around and foraging for food on the ground.

Jackrabbit

A jackrabbit sits on a desert rock. The sunlight shines through its thin ears, showing its veins. (Sharon K. Schafer)

Jackrabbit

Food: You like to eat grasses, cacti, four-wing saltbush, mesquite, and creosote.

Water: The plants you like to eat are rich in water, limiting your need to drink.

Shelter and Habitat: You love the open scrub desert and will outrun almost any predator. Coyotes are your worst enemy—especially when they team up and take turns trying to catch you—how unfair! Your big ears help you to listen for predators under the cover of thick vegetation like saltbushes. On hot summer days, you like to sit in the shade of a bush with your ears flattened against your back. This helps you to blend in with the desert vegetation and cools you down by allowing blood to flow away from your body and into your long, thin ears.

Dragonfly

A dragonfly sunning itself on a stick. (Sharon K. Schafer)

Dragonfly

Food: You love to eat insects, including moths, flies, ants, and mosquitos. You can eat up to 100 mosquitos in a single day!

Water: The insects you eat provide plenty of water, but sometimes you hover over the water's surface to take a drink. This can be risky, because predators, like birds and frogs, can see you and try to eat you. Luckily, your unique flying pattern makes it hard for them to catch you!

Shelter: Before you become an adult and grow wings, most of your life is spent as a ***nymph*** (a larval form which has gills and lives underwater). As a nymph, you hide under rocks and eat larvae, small fish, and tadpoles. When you are grown, you climb out of the water and go through a big change called a ***metamorphosis*** (like what a caterpillar goes through when it becomes a butterfly). Your skin dries and hardens to become like a shell. After three hours, you shed your old skin and emerge with wings! Now, you live in the air and shelter in riparian plants like cattails and willow trees.

Habitat: You like ponds and streams where there are lots of insects to eat.

Pahrump Poolfish

Pahrump Poolfish swimming. (S.Goodchild/USFWS)

Pahrump Poolfish

About You: You are a very special fish. You are an endangered species, meaning there aren't many of your kind left in the wild. Your biggest threats are pets like goldfish, crayfish, and mosquitofish. People illegally dump these pets into the waters where you live when they can no longer take care of them. These aquatic pets eat you and your eggs! Luckily, in 2003, refuge staff built you a refugium which acts as a safe haven for you to live away from these alien invaders.

Food: You like to eat aquatic insects, plant matter, and organic matter.

Water: As a fish, you live in the water, so it's all around you! You drink water by absorbing it into your body through your skin and gills.

Shelter/Habitat: Your original home, Manse Spring, dried up in 1975 because humans overused the water. Now, you live in a few isolated locations in Southern Nevada. The refuge is one of these places! You live in the shallow spring waters of Corn Creek and in the refugium.

Nature Inspirations Activity

Overview

In this activity, students spend time reflecting upon their field trip to Corn Creek and using the natural world as a platform to engage with language, art, or poetry. Ideally this will take place at the end of the field trip, when students can connect with their surroundings and have a closing, reflective activity for the field trip. Choose which activity (drawing, reflective journaling, or two poetry options) best suits your class.

Location

Picnic Area on the Coyote Loop Trail (no more than 30 students) or at the Corn Creek Visitor Center under the covered patio (up to 45 students).

Materials

- Pencils (optional: colored pencils)
- Blank paper, notebooks, and/or journaling or poem templates
- Clipboards

Time

20 minutes

Procedure

1. Have the students sit quietly and observe the landscape and their surroundings for a few moments. Invite them to reflect on or share what they see, smell, and hear. Invite them to think about the field trip they just completed.

   Based upon the time remaining in your field trip and your students' age, determine which type of reflection your class will do and distribute one of the following to your students:

   a. **Drawing reflection:** Distribute blank paper and pencils or colored pencils.

   b. **Reflective journaling:** Distribute the Field Trip Reflection Handout along with pencils and review the questions.

   c. **Poetry:** If you are having the students do a poem, distribute either the cinquain (pronounced sin cane) or acrostic poem template.

2. Tell:

   Artists and writers creatively describe or show nature in a way that gets emotional responses from audiences, such as excitement, sadness, thankfulness. These responses can inspire others to adopt behaviors and protect and preserve the natural world. Today you will have an opportunity to create works of art that can inspire others.

   a. **Drawing reflection:** Invite the students to draw their favorite part of the field trip or something exciting or pretty that they saw. Encourage them to add details.

b. **Reflective journaling:** Use the Field Trip Reflection questions below to help prompt students to write about their experience at Corn Creek.

   Field Trip Reflection

   1. What was your favorite part of the field trip?
   2. What was your animal and what did you learn about your animal?
   3. Do you think animals only live in one habitat or plant community? Why or why not?
   4. If you were to come back to Corn Creek with friends or your family where would you take them and what would you tell them about this place?

c. **Poetry Details:** Use the Field Trip Reflection Handout (below) to help students identify topics or develop content for their poems.

If the students do one of the poems, it is suggested they either have previous experience writing poems or enough time is given to discuss nouns, adjectives, and verbs, and provide poem examples to help them describe what they see. There are two choices of guided writing: acrostic poems or cinquain poems. For younger students, acrostic poetry is a better choice. For older students who are familiar with language and phonics, the cinquain poem can be a good choice.

The acrostic poem template provided in this activity has all of the students reflect upon water – which is very important in the desert and a unique feature at Corn Creek. More advanced students can select another feature of nature to use. If this is selected, it may be best to distribute blank paper, cross out the letters in the handout, or have them write on the back of the handout.

Poetry Introduction:

For the poetry - choose individual elements of the landscape such as a flower, the stream, a tree, etc. to focus on.

Ask: Think about the element. What feelings, emotions, or thoughts do you have when you see that element?

Tell: Instruct students to brainstorm a list of adjectives that describe the element.

Give examples of adjectives as needed: Adjectives describe nouns or pronouns. Examples: **Brown** fur; **curly** hair; **stiff** comb; **soft** petal. NOTE: By using adjectives and language to describe elements in nature, we often reveal emotions and feelings about that element.

Ask: Do you see any actions or interactions happening in the landscape? Ask students to brainstorm verbs that describe the actions or interactions.

Provide some examples: birds and trees – birds sit on the tree branch; plants and water – plants **absorb** the water through their roots; animals and plants – Animals **munch** on the leaves.

(Activity adapted from: Project Wet Curriculum & Activity Guide 2.0; Water Inspirations C 2011; Project Wet Foundation)

Acrostic Poem

An acrostic poem begins with a noun in which each letter of the noun is used to begin each line of the poem. Each line should be a word or group of words that reveal something about the noun.

The handout uses water as the natural element for students to reflect upon. More advanced students can choose an element of the landscape in the student's line of sight and write on a blank piece of paper or change out the letters in the template. Begin with a noun with just a few letters, i.e., Sky, Cloud, Leaf.

Acrostic Poem Example

Water

Wet drops fall quietly

Ample and full

Trickling down the edge of a leaf

Emptying onto the ground

Running between my toes

After students practice with this element together as a class, allow time for them to choose a new subject they observe at the site to write a unique acrostic poem about. Allow plenty of time to share at the site or on the bus back to school.

Cinquain (pronounced sin cane) Poem

A cinquain poem is a five-line poem that follows a very deliberate form:

Line 1: A one-word line, a noun which is the subject of your poem

Line 2: Two adjectives that describe the noun above

Line 3: Three action verbs that describe the noun in Line 1

Line 4: A phrase that indicates a feeling about Line 1

Line 5: A synonym for Line 1

Cinquain Poem Example

Stream
wet, cold
moving, flowing, carrying
sustaining life
water

Choose an element in the landscape to write a cinquain poem about. Begin with a noun which will serve as the subject of the poem.

Using the format above, students can use basic language phonics to create a beautiful poem about a stream.

After students practice with this element together as a class, allow time for them to choose a new subject they observe at the site to write a unique cinquain poem about. Allow plenty of time to share at the site or on the bus back to school.

Field Trip Reflection Handout

Name: _____

1. What was your favorite part of the field trip?

2. What was your animal and what did you learn about your animal?

3. Do you think animals only live in one habitat or plant community? Why or why not?

4. If you were to come back to Corn Creek with friends or your family where would you take them and what would you tell them about this place?

Poetry template for Cinquain (pronounced: sin cane) Poem

Name: _____

A cinquain poem is a five-line poem that follows a very deliberate form:

Line 1: A one-word line, a noun which is the subject of your poem

Line 2: Two adjectives that describe the noun above

Line 3: Three action verbs that describe the noun in

Line 4: A phrase that indicates a feeling about Line 1

Line 5: A synonym for Line 1

Example:

Stream
wet, cold
moving, flowing, carrying
sustaining life
water

Take a moment to observe the beauty around you, then write a poem on Lines 1-5 using the form described above.

Line 1: _____

Line 2: _____

Line 3: _____

Line 4: _____

Line 5: _____

Poetry template for an Acrostic Poem

Name: _____

An acrostic poem begins with a noun in which each letter of the noun is used to begin each line of the poem. Each line should be a word or group of words that reveal something about the noun.

In this example, the word “water” will be used. Water is a very important and rare resource in the desert that is conserved at the Desert National Wildlife Refuge. The refuge protects several natural springs that provide water for bighorn sheep and other wildlife that call the refuge home. The spring-fed pond at Corn Creek provides habitat for the endangered Pahrump poolfish.

Example:

Wet drops fall quietly

Ample and full

Trickling down the edge of a leaf

Emptying onto the ground

Running between my toes

Take a moment to observe the beauty around you, then write a poem on Lines 1-5 using the form described above.

W: _____

A: _____

T:_____

E: _____

R: _____

Section 3 – Classroom Activities

Figure 28. A U.S. Fish and Wildlife Service park ranger shows visitors highlights on the trail. (Phatismo "Lucky" Wendell)

Pre-Field Trip Classroom Activity

Refuge Puzzle

Location

Classroom

Overview

Students assemble a map puzzle of the Desert National Wildlife Refuge and the trails near the Corn Creek Visitor Center. While assembling the puzzle, students learn about the history and habitats of the refuge.

Materials

Map of Nevada and Las Vegas Valley/Southern Nevada (obtain either fold-out paper maps of the area or prepare a projected image or print out images of the maps provided).

Puzzle Pieces – 1 set per group of 2-3 students

Refuge Video Sheet (one per student)

Procedure

1. Prepare the puzzle pieces: Make a 2-sided copy with the descriptions on the back (be sure the proper corners are aligned so the information lines up correctly for each of the pieces). Cut out the puzzle pieces along the lines. Consider copying on heavy paper or laminating the individual pieces if you plan to reuse them. Make enough puzzles to break the students up into groups of 2 or 3 students. Place the puzzle pieces in a folder or bag.

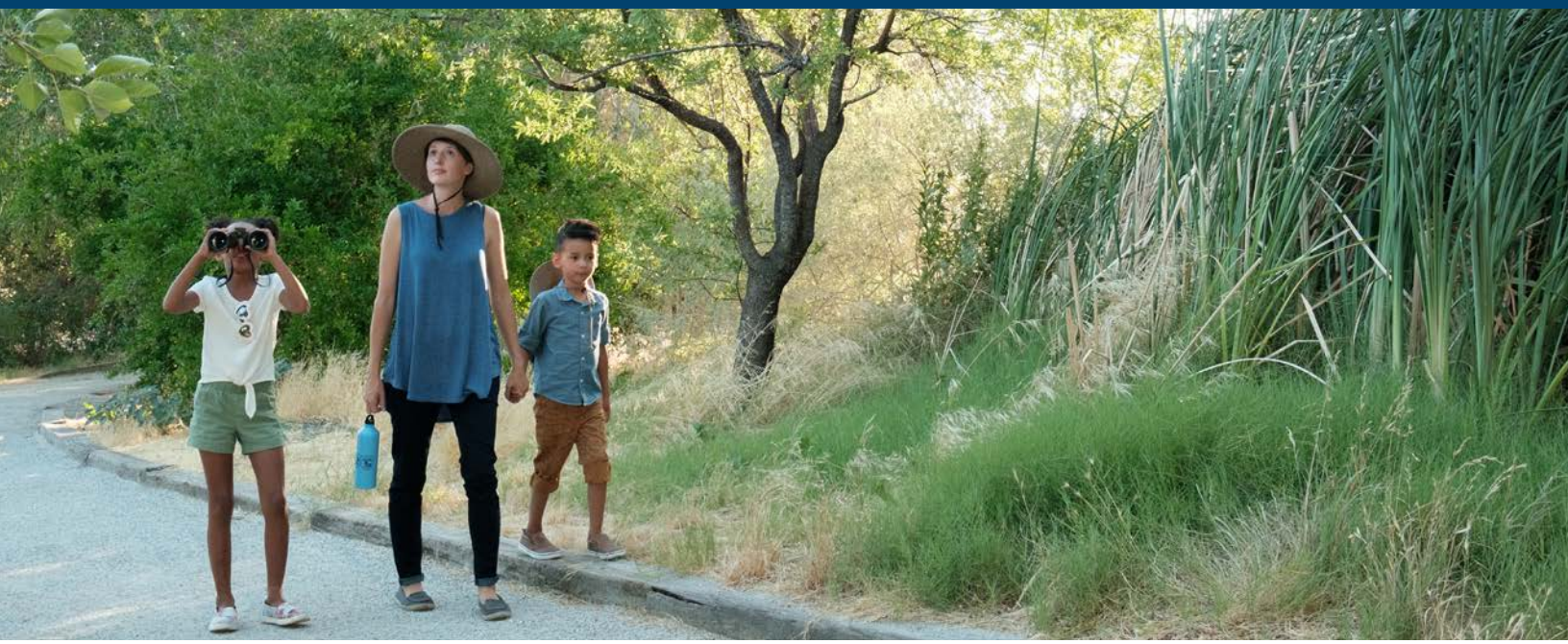


Figure 29. Taking a hike at Desert National Wildlife Refuge. (Phatismo "Lucky" Wendell)

2. Show the students a map of Nevada and a map of the Las Vegas Valley or Southern Nevada (foldout map, projected image, or print-out). Ask them if they know where they are currently located on that map. Point out your location. Then, show them where the Desert National Wildlife Refuge is located and the route the bus will take for the field trip.
3. Next, show the students a map of the Desert National Wildlife Refuge and share key points you feel would be important for the students to know from the background information provided in this guide. Example key points to highlight include:
    a. The refuge is 1.6 million acres (2,500 square miles)
        - If you want to add some math skills have the students calculate the square miles of the refuge. Or convert the square miles to acres (or vice versa).
    b. The refuge was established in 1936 with the goal of conserving the dwindling natural habitat of the desert bighorn sheep, the largest native mammal of the Mojave Desert.
    c. The sheep live in the mountain ranges across the refuge and Mojave Desert.
    d. The refuge is also home to over 500 species of plants, 320 species of birds, 52 species of mammals, and 35 species of reptiles.
    e. Species of concern include the federally threatened desert tortoise and the federally endangered Pahrump poolfish.
4. Inform the students that they will be going on a field trip to the Desert National Wildlife Refuge, specifically to the Corn Creek Visitor Center. Today, they will learn some fun facts about the Refuge and the Corn Creek area as they build a puzzle together in small groups. The puzzle is a map of the location they will be visiting.

5. Distribute the folder or ziplock bags of puzzle pieces so each group has a puzzle to assemble (groups of 2-3 students recommended).
6. Have the students take out the puzzle pieces and distribute them evenly (there are 10 puzzle pieces).
7. Students will take turns reading the backs of their puzzle pieces and placing them on the table. After each student reads, they will try to align the pieces to assemble the map. Some pieces might not connect until several pieces have already been laid down.
8. When the students are done with their puzzle, let them know that they are going to watch a video about the Desert National Wildlife Refuge. Invite them to look for locations they learned about while assembling their puzzles.
9. Distribute the Refuge Video Sheet (one per student). Review the questions on the sheet before the video so students can take notes and answer the questions during the video.
10. Play the video for the students: https://vimeo.com/86424950
11. After the video:
    a. **Ask**: Did you see any of the places, habitats, or animals from the puzzle in the video? Get a couple of examples.
    b. **Review** the questions from the Refuge Video Sheet. Ask students to raise their hands and share at least one answer per question.
    c. **Ask**: Is there anything you are particularly excited about seeing on the field trip? Note: The field trip will be limited to the Corn Creek Visitor Center, so the students will not get a chance to see desert bighorn sheep or the habitats higher up in elevation (e.g., pinyon-juniper woodlands, pine-fir forests, or bristlecone pines).

Desert National Wildlife Refuge - Film Worksheet

1) What was Desert National Wildlife Refuge established to protect?

2) What is the most abundant plant in the Mojave Desert?

3) Name two different animals you saw in the film:

4) What do you think is special about Desert National Wildlife Refuge?

5) What do you think a national wildlife refuge is?

6) What are you excited to see on your field trip to the refuge?

Desert National Wildlife Refuge

ACTIVITY HANDOUT - Desert National Wildlife Refuge map.

ACTIVITY HANDOUT - Federal Lands and Indian Reservations map. (USDOI and USGS)

nationalatlas.gov™
Where We Are

NEVADA

FEDERAL LANDS AND INDIAN RESERVATIONS

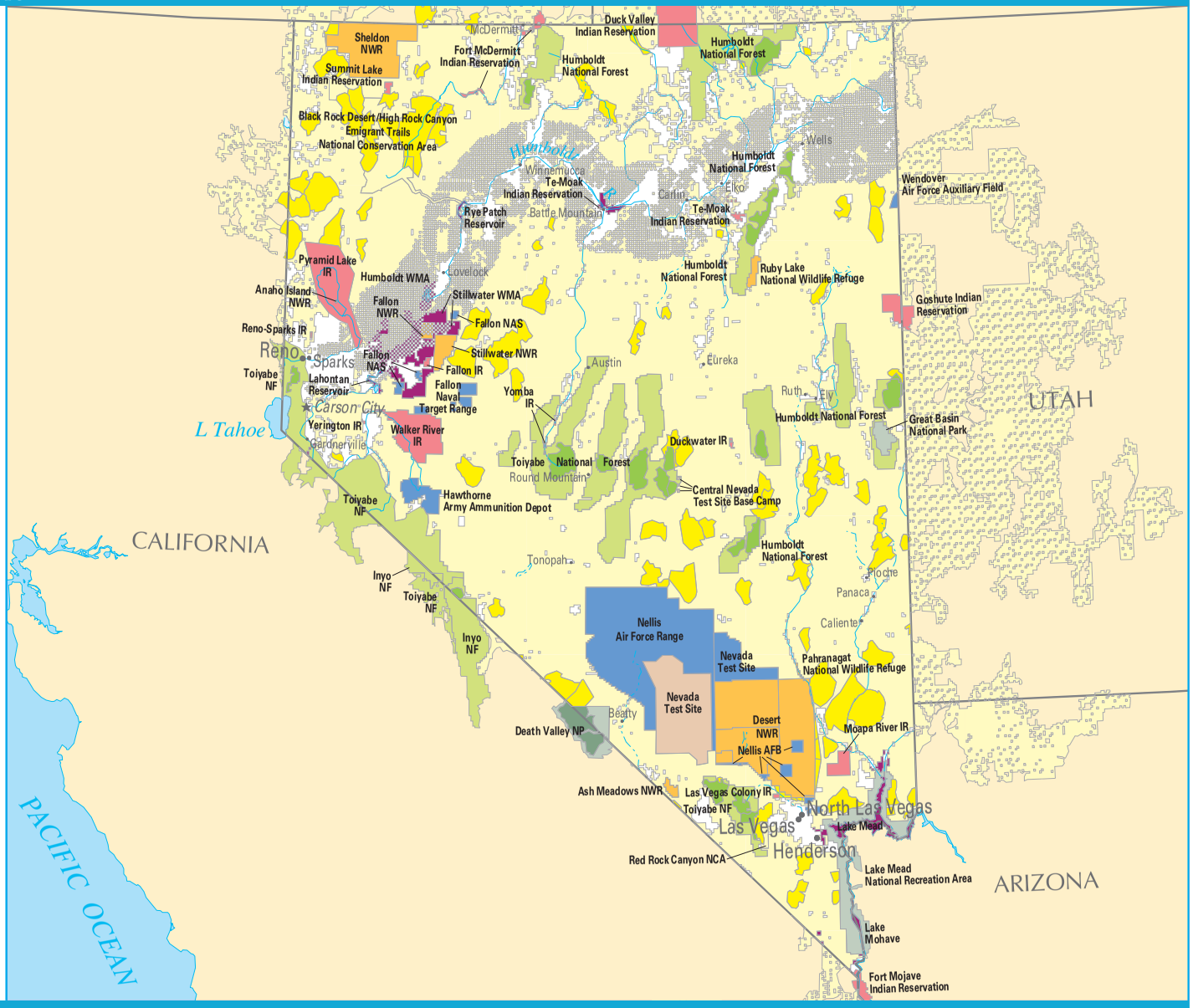
- Bureau of Indian Affairs
- Bureau of Land Management / Wilderness
- Bureau of Reclamation
- Department of Defense (includes Army Corps of Engineers lakes)
- Department of Energy
- Fish and Wildlife Service / Wilderness
- Forest Service / Wilderness
- National Park Service / Wilderness

Some small sites are not shown, especially in urban areas.

MILES
0 25 50 75 100
Albers equal area projection

Abbreviations

AFB	Air Force Base
IR	Indian Reservation
NAS	Naval Air Station
NCA	National Conservation Area
NF	National Forest
NP	National Park
NWR	National Wildlife Refuge
WMA	Wildlife Management Area



U.S. Department of the Interior
U.S. Geological Survey

The **National Atlas** of the United States of America®

pagefed_nv7.pdf INTERIOR-GEOLOGICAL SURVEY, RESTON, VIRGINIA-2003

Refuge Puzzle Map Side 1. (USFWS)

Refuge Puzzle Map Side 2. (USFWS)

Grinding Stone:
The *Nuwu* / *Nuwuvi* (Southern Paiutes) used the limestone mortar at the end of the Whispering Ben Trail to grind dried mesquite pods into flour. They used the flour to sweeten jerky and to make candy. More than 50,000 Nuwu/Nuwuvi live in Las Vegas today, and they continue to maintain their connections to Corn Creek, which they call *Pakonapanti*.

Saltbush Community:
The Saltbush community is found in saline basins and playas, particularly those with low nocturnal temperatures and high soil salinity. Common components of this community include the four-wing saltbush, shadscale saltbush, rabbitbrush, and white bursage.

Alamo Road and Mormon Well Road:
Following trails originally made by the *Nuwu* / *Nuwuvi* (Southern Paiutes), Mormon settlers arrived in Nevada in the mid-1850s. Mormon Well Road leads to a natural spring and an old corral that were used by Mormon ranchers in the 1920s. Mormons were the first population of non-natives to permanently settle in the area.

Railroad Tie Cabin:
The historic Railroad Tie Cabin was built by the Richardson family in the 1920s using old railroad ties from the abandoned Las Vegas & Tonopah Railroad. The Richardson family established the Corn Creek ranch and lived here from 1916 to 1936.

Mesquite Bosque (boss-kay):
Mesquite bosques are wooded areas dominated by mesquite trees, which depend on sufficient groundwater in order to grow tall enough to create a closed canopy. Because of this, they are usually found at the outer portions of riparian zones.

Bighorn Fence:
This fence is left behind from the days when refuge biologists studied desert bighorn sheep in an enclosure at Corn Creek. In the late 1970s, researchers began observing them in their natural habitat, leading to more accurate observations of their behavior.

Refugium:
The refugium is a safe haven for the endangered Pahrump poolfish, protecting them from invasive predators and habitat loss. The fish were transplanted to DNWR from a spring in Nye County that dried up in 1975 due to humans overusing its water.

Desert Riparian Habitat:
Corn Creek Springs encompasses most of the riparian habitat in the DNWR. The springs provide an abundant supply of insects for birds and fish, and lush, green vegetation for mammals. The spring-fed pond, wetlands, and streams give birds a critical source of water, food, and shelter.

Orchard:
The orchard was planted by the Richardson family who ranched at Corn Creek from 1916 to 1936. Using water from Corn Creek Springs for irrigation, they grew fruit and nut trees including peach, mulberry, pomegranate, apple, almond, and pecan.

Creosote Community:
Creosote is the most widely-distributed plant of the Mojave Desert. Creosote has a unique growing pattern, with individual plants evenly distributed over an area. It provides important habitat and cover for the desert tortoise and other wildlife.

Pre-Field Trip Classroom Activity

Pahrump Poolfish Game

Teacher Materials

Overview

This activity introduces students to the only animal at the refuge which is federally-listed as an endangered species – the Pahrump poolfish. (Note: this means that there aren't many Pahrump poolfish left in the wild and that the species is in danger of dying out). Students play a simulation game where they learn the threats facing the Pahrump poolfish and why their continued protection is so important. This activity can be conducted either as a pre- or post-field trip activity.

(This activity is adapted from Discover a Watershed: The Colorado River's Chillin with the Chubs activity.)

Location

Schoolyard or field

Materials

- Pahrump Poolfish Handout (number depends on if the students or teacher are reading the information)
- Stressor signs (low water levels, goldfish, crawfish/crayfish, bullfrogs, mosquitofish, koi, carp, mollies) - laminate the signs and hang them from yarn so the students can wear them.

Background

In this activity, students participate in a simulation which reveals the story of how people's overuse of water and the misguided release of aquarium pets, such as goldfish and koi, into natural water systems can threaten the survival of native fish populations. The activity simulates what happens to a protected fish population when non-native species are introduced into its habitat.

In the simulation, the majority of students represent the Pahrump poolfish living in their original habitat of Manse Spring near Pahrump, NV, in the 1960s. One or two students represent stressors (e.g., low water levels or non-native/invasive species). Gradually, the poolfish habitat changes. Water levels are low or invasive species are eating the poolfish, which puts tremendous stress on the fish. Students that represent low water levels or an invasive species (or other stressors) tag students that represent poolfish. Some of the fish do not make it and are out of the game. Tagged students can re-enter the game by drawing a new stressor card or as a new poolfish (representing re-population). Consider making count and wait cards to guide students when to re-enter the game. This process continues until very few, if any, poolfish remain.

A discussion follows that captures the events that have transpired in relation to the events and species involved. The discussion may also include dialogue on what may happen in the future, other stressors to the habitat, and/or the concept of an endangered species. An optional extension is

offered where each student can create their own educational ad campaign calling a stop to illegal pet dumping.

The story of the Pahrump poolfish reminds us of how seemingly unrelated human actions can have devastating effects on native plants and animals, and how the efforts of staff and partners of the U.S. Fish and Wildlife Service and the National Wildlife Refuge System can begin to mitigate those effects.

Figure 30. Two visitors looking into the poolfish refugium. (Get Outdoors Nevada)

Procedure

1. Students read the Pahrump Poolfish handout. For beginner readers, educator reads the handout out loud.
2. Discuss:
   - What is an example of a "stressor" that affects the Pahrump poolfish's ability to thrive? Describe and discuss a few of the stressors (low water levels, goldfish, crayfish, bullfrogs, mosquitofish, koi, carp, mollies).
   - How did the stressor get into the habitat? What caused the stressor?
   - Have there been any other stressors to the Pahrump poolfish?
3. Identify an open area where students will play the game (e.g., a playing field). The playing field needs to be wide enough where students can stand side-by-side in a line and run a defined distance in length. Use field markings or natural end points where students cannot run beyond.
4. Line the students up, side-by-side, at one end of the playing field. Explain that they are now going to assume the identity of the Pahrump poolfish. In front of them is their natural spring habitat. The object of this game is for the poolfish to get to the other side of their spring successfully (define the boundaries well – if they go outside of the boundaries then they leave the game). On your signal, have the students (the "fish") walk ("swim") to the other side of the playing field. Remind the students of the clearly identified spring boundary and instruct them to stay in the water. Once they have successfully reached the other side of the playing field, praise them for a job well done. Explain that they are going to swim back, only this time, a "stressor" will be added to their habitat.
5. Select one or two students to act as an introduced non-native species, such as a goldfish or crayfish. Have them wear their sign around their neck. Introduce these students as the "stressors." Remind students of the story of the Pahrump poolfish. When non-native fish entered their natural habitat, it stresses out the poolfish.

Ask the students to think of ways the introduction of non-native fish to the habitat might stress them out.

- They may become prey
- They may have to compete for food resources
- They may have a difficult time protecting their young from the new fish
- They may have to compete for habitat space

6. Explain that the poolfish need to swim to the other side of the playing field again, but this time the "stressors" will be able to stress them out by simply tagging the poolfish on their arm or shoulder. Tell the students that each stressor can only tag a certain number of fish. Consider adding a number to the back of each stressor card beforehand.

   If a poolfish gets tagged, it becomes stressed out of the game. Stressed out fish leave the playing field.

   On your signal, have the students walk to the other side (It is up to you whether or not you allow them to run and parameters you place on tagging).

   To keep "stressed out" students engaged, you can introduce new stressor cards and/or consider making new poolfish cards and count and wait cards. You can hand out these cards as students exit the "pond" or you can have students randomly pick a card to get re-engaged in the game.

7. Keep playing until your set time is up or you have just a few poolfish left. Together, count how many poolfish remain at the other end of the playing field. Discuss how the population is doing. Explain that the non-native fish are enjoying their new habitat and that their populations are doing very well. They have plenty of space and lots of food.

8. You can also add a stressor by decreasing the size of the "pool" (i.e. shrinking the boundaries). This simulates the loss of water through groundwater over-use. When you play a round with this new stressor, **Ask**: How does this stressor affected the native poolfish?

   Answer: It decreases the size of their home, which decreases the amount of food available. It also makes it easier for the non-native fish to "tag" the poolfish out of the game.

Optional Extension

Discuss what happened to the Pahrump poolfish. Discuss efforts to stop the illegal dumping of aquarium and classroom pets into these waters. Ask students to brainstorm other ideas for ending the illegal introduction of non-native fish into protected waters. Have students make posters or brochures with ad campaigns educating the public and calling for residents to stop illegal pet dumping. Have students share their posters and brochures.

Overview of Pahrump Poolfish

The Pahrump poolfish (*Empetrichthys latos*) are small fish with a maximum body length of about 3 inches. Females are often larger than males. Their bodies are green and brown with black spots. However, males can turn a silvery-blue color when breeding. Pahrump poolfish usually breed in the spring, but under ideal conditions, they are able to breed year-round.

Pahrump poolfish are omnivorous, meaning they eat both plants and animals, with a diet of mostly algae and insects. Male poolfish can live up to 7 years while the females can reach up to 10 years. The Pahrump poolfish were listed as an endangered species by the U.S. Fish and Wildlife Service in 1967 and are the last surviving species of their genus (*Empetrichthys*).

Figure 31. Artwork of a Pahrump Poolfish. (Joseph R. Tomelleri)

Pahrump poolfish are **endemic** to Nevada, which **means they exist nowhere else on Earth!** Their original native habitat was limited to Manse Spring, a small, isolated spring in Pahrump Valley, about 62 miles west of Las Vegas, which dried out in 1975 as a result of human's overuse of the water for agriculture.

Today, the Pahrump poolfish live in 4 locations in Southern Nevada. It is believed that the Pahrump poolfish (and their close splitfin relatives, the Ash Meadows killifish, the Raycraft Ranch springfish, and the Pahrump Ranch poolfish) evolved in isolation from each other ever since the Pleistocene Lakes receded from the area about 10,000 years ago.

When Euro-American settlers migrated to Southern Nevada in the late 19th century, they dramatically changed the desert landscape. Ranchers brought cattle and other livestock to the area, which required a steady supply of hay to survive. Alfalfa, the crop of choice, was a non-native species that needed more water than the desert soil could provide naturally. Settlers pumped water from springs to irrigate their crop fields. As the settler population increased, so did their water use. The springs that the native fish had called home for thousands of years grew smaller and smaller, and, eventually, dried out completely. All other species and subspecies of the *Empetrichthys* genus were declared extinct at various timepoints in the 1950s as their homes were lost.

The Pahrump poolfish were lucky. Their home, Manse Spring, was tucked away on a private ranch.

Figure 32. Two Pahrump Poolfish. (USFWS)

Figure 33. Two Pahrump Poolfish. (USFWS)

When all other springs in the area had dried out, the water at Manse Spring was still flowing. Researchers began studying the Pahrump poolfish in the 1960s and grew increasingly concerned about their long-term survival. Researchers determined that the spring was in danger of drying out.

Researchers also found non-native goldfish in the spring, which put additional stress on the Pahrump poolfish population. In an attempt to save this fragile species, staff from Federal and State agencies collected fish from Manse Spring and moved them to several refuge locations in Southern Nevada, including Corn Creek at the Desert National Wildlife Refuge. This action was critical, as the Pahrump poolfish ended up losing their home when Manse Spring dried out in 1975.

Pahrump Poolfish at the Desert National Wildlife Refuge

In 1971, Staff from Federal and State agencies collected 29 Pahrump poolfish from Manse Spring, placed them in buckets, and transplanted them to Corn Creek springs at the Desert National Wildlife Refuge. These 29 poolfish initially flourished in the Corn Creek Pond and streams, which had no natural predators or competing fish species. Unfortunately, in the mid-1970s, humans introduced non-native mosquitofish to the system which competed with the poolfish for food and ate smaller poolfish and poolfish eggs. Refuge staff drained the pond and removed the mosquitofish so the poolfish population could recover.

Following this intervention, Pahrump poolfish were reintroduced at Corn Creek and thrived once again. This success was short-lived, however, as humans illegally dumped non-native crayfish into the system in the late 1990s. The crayfish competed with the Pahrump poolfish for resources and ate adult poolfish and poolfish eggs. By 1998, only three Pahrump poolfish were left at Corn Creek.

Luckily, a separate population of Pahrump poolfish located at Harriet Lake was thriving. In 2002, the Desert National Wildlife Refuge built a large, aquarium-like setting, called a **refugium (pronounced Ruh-FYOO-jee-uhm)**, as a permanent, isolated home for the Pahrump poolfish. The refugium was designed to provide a safer habitat for the fish, protecting them from crayfish and other introduced species. Once the refugium was completed, several poolfish were relocated from Harriet Lake to the refugium at Desert National Wildlife Refuge.

In 2011, the main pond at Corn Creek was reconstructed with a cement bottom to prevent crayfish burrowing. The pond was also chemically treated to remove all non-native mosquitofish and guppies. In 2014, Pahrump poolfish were reintroduced to the springs for the third time. In 2019, non-native koi, carp, and mollies were found in the pond. These non-native species had decreased the Pahrump poolfish population to less than 200 individuals. The pond underwent two chemical treatments in 2021 to remove these non-native fish species. Following treatments, Pahrump poolfish were reintroduced to Corn Creek a fourth time and continue to thrive to this day.

Although the main pond has remained free of non-native fish species since 2021, crayfish continue to persist throughout the Corn Creek system. In 2023, the U.S. Fish and Wildlife Service estimated the numbers of Pahrump poolfish at the refuge. They found about 1,500 poolfish in the pond and 40 poolfish in the refugium. The refugium continues to provide protection for the Pahrump poolfish (i.e., acts as an educational tool for the public to view the fish and learn about their ongoing struggle for survival). It is the hope of land managers, scientists, ecologists and concerned citizens that the Pahrump poolfish can continue to thrive and that its fragile habitat can be kept free from non-native species.

Pahrump Poolfish at the Desert National Wildlife Refuge – A Timeline

1960s: Researchers begin studying the Pahrump poolfish in their natural habitat of Manse Spring

1970s:

- Non-native **goldfish** are introduced to Manse Spring and began eating the Pahrump poolfish
- Researchers are concerned that Manse Spring will dry out soon due to human use for agriculture

1971: 29 Pahrump poolfish are collected in buckets from Manse Spring and are relocated to the waters of Corn Creek at Desert National Wildlife Refuge

Mid-1970s:

- Non-native **mosquitofish** are illegally introduced to Corn Creek and kill off much of the Pahrump poolfish population
- The main pond at Corn Creek is drained and all mosquitofish are removed

1975: Manse Spring, the original habitat of the Pahrump poolfish, dries out completely

1976: Pahrump poolfish are reintroduced to Corn Creek

Early 1990s: Non-native **crayfish** and **bullfrogs** are illegally introduced to Corn Creek

1998: After suffering from predation and competition with crayfish and bullfrogs, only 3 Pahrump poolfish remain at Corn Creek

2002: A refugium is constructed at Corn Creek

2003: Pahrump poolfish are introduced to the refugium

2014: Pahrump poolfish are reintroduced to the Corn Creek Pond and streams

2018: Pahrump poolfish population is up to 2,000 individuals in the main pond at Corn Creek

2019:

- Non-native **koi**, **carp**, and **mollies** are found in the Corn Creek system
- The population of Pahrump poolfish at Corn Creek is estimated at less than 200 individuals

2021: The Corn Creek system is free of all non-native fish, but crayfish continue to persist

2023:

- Pahrump poolfish counts are conducted by the U.S. Fish and Wildlife Service
- Approximately 1,500 Pahrump poolfish are found in the Corn Creek Pond
- Approximately 40 Pahrump poolfish are found in the refugium

Cut Here

Stressor: Crayfish

Crayfish.

Cut Here

Stressor: Bullfrogs

Bullfrog.

Cut Here

Stressor: Carp

Koi, a type of carp, swimming.

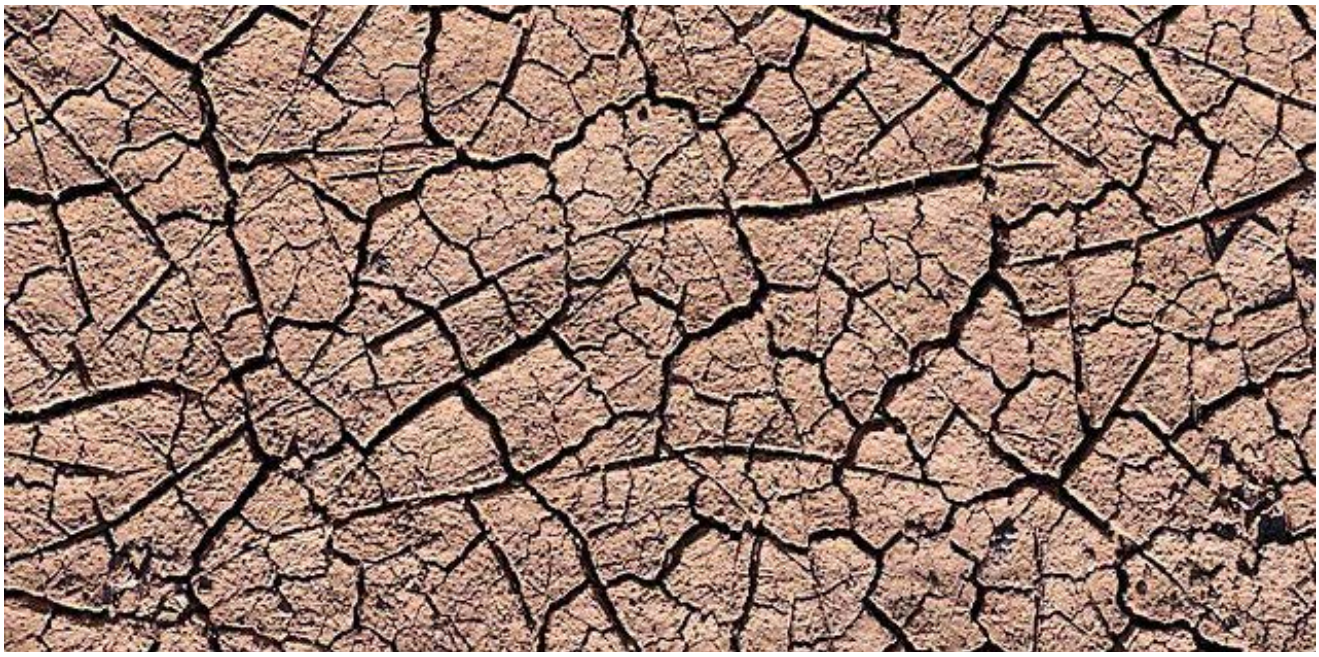
Cut Here

Stressor: Mollies

Mollies.

Cut Here

Stressor: Low Water Levels



Dry dirt from low water levels.

Cut Here

Stressor: Goldfish

Goldfish.

Cut Here

Stressor: Mosquitofish

Mosquitofish.

Post-Field Trip Classroom Activity

Habitat Scramble

Overview

This activity reviews the diversity of habitats students encountered at the Desert National Wildlife Refuge. Elevation, rainfall, water availability, soil type, and temperature are factors that define which habitats can be found on the refuge. Each habitat provides a unique area for different animal species to call home, providing them with food, shelter, space, and sometimes water. In this activity, students explore the characteristics of four habitats found near the Corn Creek Visitor Center and the species that inhabit them. Then, students "scramble" to order the 4 habitats by their proximity to a water source.

Location

Classroom post-fieldtrip or on-site (see 3-hour field trip itinerary)

Materials

- Map of the Desert National Wildlife Refuge
- Map of the Corn Creek Visitor Center Trail System
- Habitat Picture Cards - 1 set per group of 4 students
- Animal Cards - 1 set per group of 4 students

Time

(45-60 minutes)

Background

While Desert National Wildlife Refuge has been called home by people for thousands of years, from Nuwu/Nuwuvi (Southern Paiute) to ranch homesteaders, the Refuge still remains largely unchanged by human hands. Over 1.3 million acres of the Refuge is proposed wilderness and has been managed as de facto wilderness since 1974. The entire refuge encompasses almost 1.6 million acres. For reference, this land mass area is larger than the state of Delaware. Within the Refuge lie six major mountain ranges and seven distinct life zones. The Refuge supports a variety of wildlife including lizards, desert tortoises, mountain lions, the endangered Pahrump poolfish, and over 320 species of birds. It also forms one of the largest intact blocks of desert bighorn sheep habitat remaining in the Southwest.

Although the Refuge has seven life zones, we will primarily focus on a few different habitats that can be found around the Corn Creek Visitor Center. These different habitats include the creosote community, desert riparian zone, mesquite bosque, and the saltbush community. Each habitat provides a unique area for different animal species to call home, providing them with food, shelter, space, and sometimes water. Although several additional habitat types exist at Desert NWR, they occur only at higher elevations in the backcountry. For the purposes of this guide, we will focus

only on the handful of habitats found around the Corn Creek Visitor Center that are available for students to experience and interact with.

Desert Riparian Zone

Riparian habitats are adjacent to streams and water bodies. The spring-fed pond, wetlands, and streams of Corn Creek encompass most of the riparian habitat in the Desert National Wildlife Refuge, offering a rare source of water in the dry Mojave Desert. This habitat provides an abundant supply of insects, such as flies and mosquitoes, for birds, bats, fish, and lizards. The Corn Creek Pond, streams, and refugium are home to the endangered Pahrump poolfish and Woodhouse's toads. Riparian plants commonly found on the refuge include Fremont cottonwood, arrowweed, saltgrass, Goodding's Willow, and southern cattail.

Figure 34. A Yellow-backed Spiny Lizard warms itself in the sun. (Sharon Shafer)

Mesquite Bosque

Mesquite bosques are wooded areas dominated by mesquite trees, which depend on sufficient groundwater to grow tall enough to create a closed canopy. This habitat type is typically found near water, either in desert riparian corridors or washes. The seedpods of mesquite trees are a favorite food of coyotes. The thick growth pattern of mesquite makes them excellent nesting sites for birds. Phainopeplas (pronounced fay-no-pep-lah) have an interesting relationship with the **parasitic** desert mistletoe. A **parasite** is defined as an "organism that lives in or on an organism of another species (its host) and benefits by deriving nutrients at the other's expense" (Oxford). These birds get most of the nutrients and water they need from mistletoe berries. A single phainopepla can consume up to 1,000 desert mistletoe berries in one day! Only 12 minutes after eating, the phainopepla will release their waste and spread the mistletoe seeds all over the branches of mesquite trees. These seeds then germinate in the spring, growing in dense clusters directly out of the mesquite tree branches. The phainopeplas will then build their nests in the excellent cover of the mistletoe clusters.

Creosote Bush Community

This open scrubland is defined by the creosote bush, the most widely distributed plant of the Mojave Desert. Creosote has a unique growing pattern, with individual plants evenly distributed over an area and many individual plants living up to 100 years. Creosote can reproduce from seeds or cloning. Clones, which branch off the same plant in circular clusters, have the exact same genetic information as the original plant. This results in individuals whose DNA is thousands of years old.

Creosote is known for its "desert rain" smell. If you cup the creosote leaves in your hands, exhale, and then inhale, it will release the scent. Some people may confuse creosote with the creosote tar used to preserve railroad ties. Creosote tar is made from petroleum-oil, not the creosote plant. Creosote has important adaptations to the desert, including small, deep roots and waxy leaves to prevent water evaporation. The deep roots make an excellent home for burrowing animals and sometimes serve as a food source. Other associated species in the creosote bush community include white bursage, yucca, desert globemallow, and beavertail cactus. This habitat is found on the outer edges of or interspersed with mesquite bosques and receives less than 5 inches of rain per year. It provides important habitat and cover for the desert tortoise, antelope ground squirrel, black-tailed jackrabbit, roadrunner, and other wildlife.

Saltbush Community

The saltbush community is found in salt-filled basins and playas, particularly those with low nighttime temperatures and sandy soils. Common plants of this community include the four-wing saltbush, shadscale saltbush, rabbitbrush, and white bursage. Four-wing saltbush is one of the most widespread species in Nevada and is found at elevations between 300 and 3,000 feet. The saltbush community occurs in arid (dry) and semi-arid areas of the southwestern United States, ranging from 8 to 14 inches of rain per year. Plant cover is higher than that of the creosote community, with about 15-60% of the ground shaded by living plants. This community provides food and cover for many species of wildlife including quails, songbirds, and small mammals like the desert cottontail.

Procedure

1. Students are shown a map of Nevada with the Desert National Wildlife Refuge boundaries. They are also shown a map of the Corn Creek Visitor Center and its trail system. Remind students this is where the field trip took place. Have students locate the Corn Creek Pond. Ask students to look at the various vegetation types from a birds-eye-view.

   Discuss:

   - Do you notice any patterns regarding the vegetation types and their proximity to water?
   - Which plant type might require more water: trees or shrubs?

2. Divide the class into groups of 4 students. Distribute one set of Habitat Picture Cards to each group. Each student per group will represent 1 of the 4 habitats (Desert Riparian Zone, Mesquite Bosque, Creosote Community, or Saltbush Community). If there are fewer than 4 students in a group, one student can have two cards.

3. Instruct the students to take out their "MORE WATER: Corn Creek" and "LESS WATER: Arid Desert" cards. Place these cards on the table or ground with some distance between them.

4. Have the students recall their field trip visit and speculate if their habitat is close to or further away from a water source and why.

5. Have the students work together to put the cards in order of their distance to Corn Creek and the Arid Desert based on their habitat descriptions. Spread the habitats out on a tabletop or on the floor so all the teams can see the order. Have them examine their results and make any changes to their order that they might now observe.

6. Have each team present their habitat order to the class.

   As a class, discuss:

   - Are there any differences between the teams in the habitat order? If there are, have the teams explain their reasoning for the placement. Help the class with any mistakes until the picture cards are in the correct order.
   - **Correct Order:** More Water: Corn Creek → Desert Riparian Zone → Mesquite Bosque → Creosote Community → Saltbush Community → Less Water: Arid Desert
   - **Ask:** What do you notice about the changes in plant life in each life habitat?

7. Distribute a deck of Animal Cards to each group of four students. Each deck has 12 animals, and each deck is identical to the other decks. The animal cards contain the name of the animal, a picture or illustration and some biofacts to help students determine which habitat the animal might inhabit. Allow a few minutes for teams to explore their animal cards.

8. When prompted, have the teams put the animals with the correct Habitat Picture Card. It's okay if teams do not put their cards exactly where other teams put their cards. Discuss results:

   - Review each habitat and call on a team to list the animals they included in the habitat.
   - **Ask:** How did you make your decision about what habitat an animal inhabits?
   - Some animals are called generalists, which means they are able to inhabit more than one habitat, and may switch between habitats on a daily basis in order to meet their needs. Which animals do you think might exhibit this behavior and why?

   Answers:

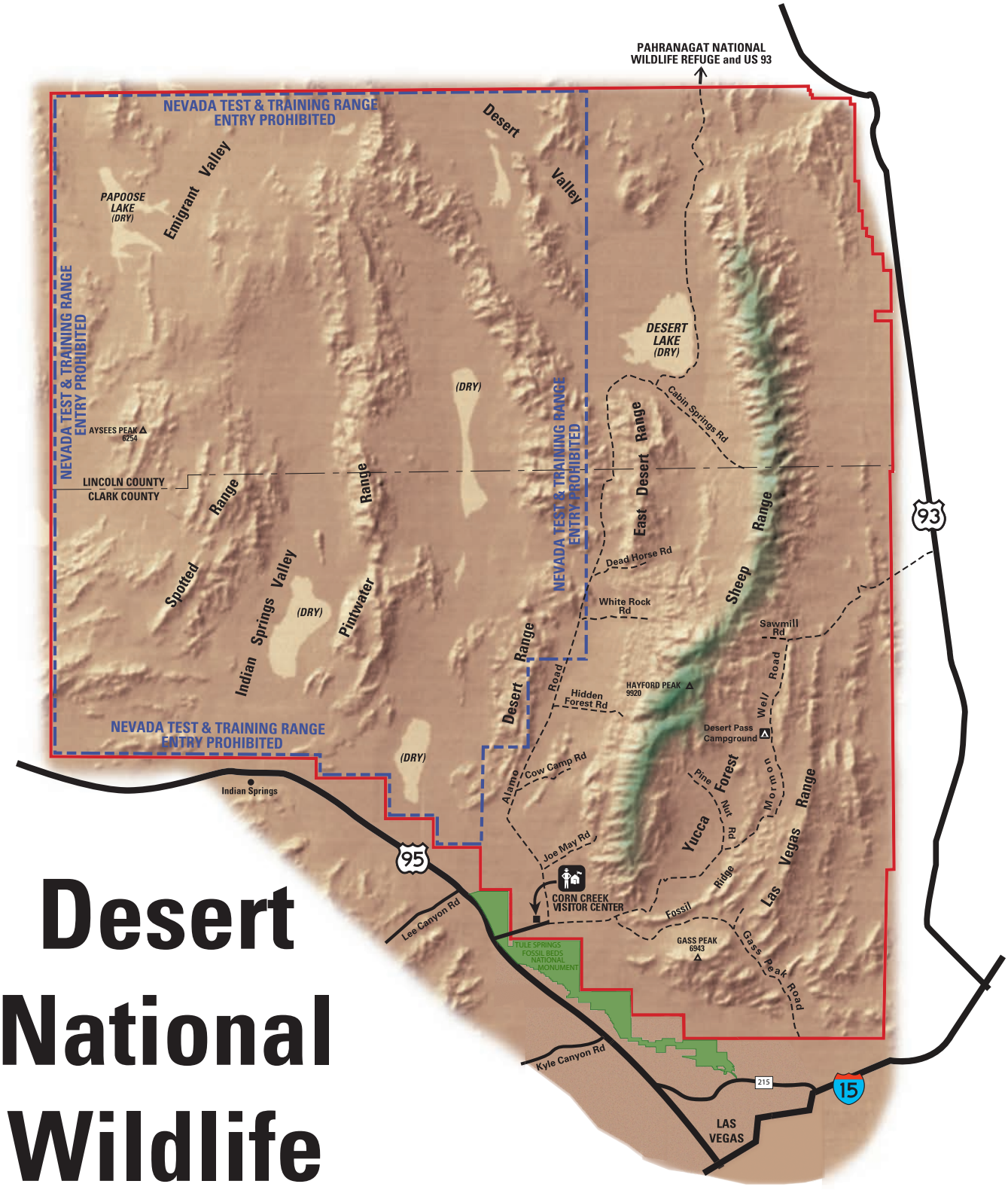
   Correct Ordering of Habitats:

   More Water: Corn Creek → Desert Riparian Zone → Mesquite Bosque → Creosote Community → Saltbush Community → Less Water: Arid Desert

Table 3: Habitats and Their Associated Animals

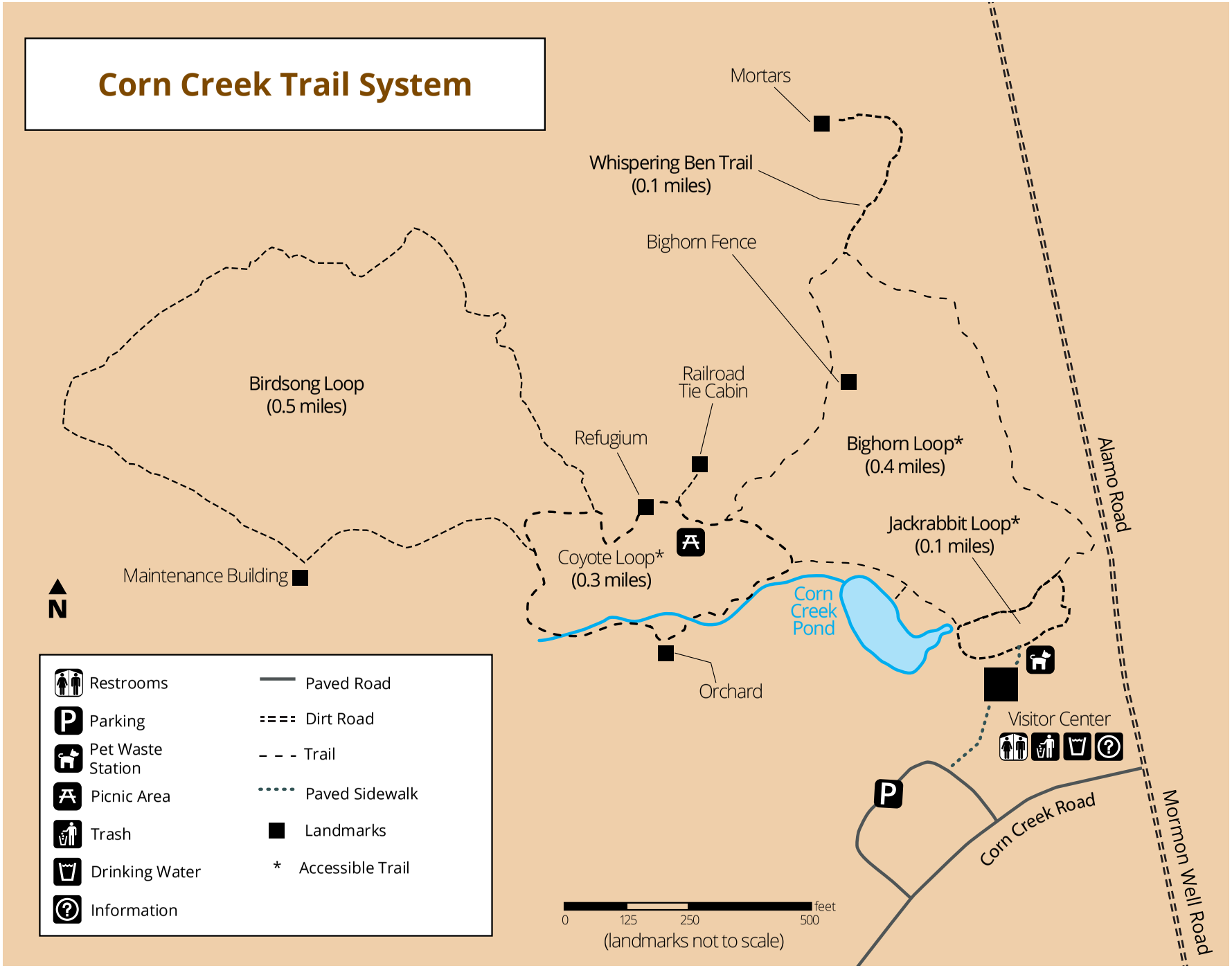
Habitat Type	Saltbush Community	Mesquite Bosque	Desert Riparian Zone	Creosote Bush Community	All Habitat Types (Generalist Species)
Associated Animals	Quail, Jackrabbit, Desert Cottontail, Mockingbird	Phainopepla, Coyote	Dragonfly, Pahrump poolfish, Desert Cottontail	Antelope Ground Squirrel, Desert Tortoise, Roadrunner, Desert Cottontail, Mockingbird	Spiny Lizard, Coyote

Desert National Wildlife Refuge



Desert Reguge map courtesy of the U.S. Fish and Wildlife Service. (USFWS)

Corn Creek Visitor Center Trail System Map. (USFWS Graphic)



A Spiny Lizard suns itself on a rock. (Sharon K. Schafer)

Spiny Lizard

Description: (reptile) may have blue or purple patches on their belly and throat or dark spots on their back, they are frequently seen doing push-ups

Diet: feeds on ants, beetles, flies, grasshoppers, other lizards, and plant material (carnivore/insectivore = eats meat or insects)

Habitat: prefers to stick close to water in riparian areas but also lives under rocks and in desert scrub

An Antelope Ground Squirrel suns itself on a rock. (Sharon K. Schafer)

Antelope Ground Squirrel

Description: (mammal) they have a white stripe up the side and frequently their tail is placed over their back

Diet: foliage, seeds, insects, lizards, and rodents (omnivore = eats plants and meat)

Habitat: prefers desert habitats that contain cacti and shrubs

Behavior: digs burrow systems near plant bases, uses tail for shade in hot sun

A Desert Cottontail with its ears perked up, watching for predators. (Sharon K. Schafer)

Desert Cottontail

Description: (mammal) they have large ears, white bellies, and a round tail that is dark on top and white on the bottom

Diet: mainly grasses, occasionally tree bark and other plant materials (herbivore = eats plants)

Habitat: prefers dry shrublands and riparian habitats

Predators: coyote, foxes, bobcats, hawks

A Mockingbird sits perched on a desert shrub. (Ed Norton)

Northern Mockingbird

Description: (bird) they are shades of gray with a dark beak and frequently stick their tail up when they perch

Diet: insects, earthworms, berries, fruits, seeds, and lizards
(omnivore = eats plants and meat)

Habitat: prefers desert scrub and urban landscapes

Behavior: avid singers and mimics, can learn up to 200 different songs

A coyote on the look out for prey. (Sharon Shafer)

Coyote

Description: (mammal) they have a thick coat in shades of gray, tans, and oranges with a bushy tail and pointy ears

Diet: eats whatever it can catch—rabbits, ground squirrels, rodents, and sometimes plant material, especially enjoys the nutritious bean pods of mesquite trees
(omnivore = eats plants and meat)

Behavior: travels in a pack to hunt, digs dens in soft soils

A Phainopepla sits perched on a desert plant. (Sharon K. Shafer)

Phainopepla

(pronounced fay-no-pep-lah)

Description: (mammal) (bird) this is a dark-feathered bird with with brownish or red eyes, some have large white patches on their wings that can be seen in flight

Diet: mainly mistletoe berries, also insects (omnivore = eats plants and meat)

Habitat: prefers desert riparian areas and mesquite bosques

A Desert Tortoise walks over rocky ground. (Sharon K. Shafer)

Desert Tortoise

Description: (reptile) they can vary in size, move slowly, and have large solid shells that they can go into for protection

Diet: desert shrubs, creosote, grasses, cactus fruits (herbivore = eats plants)

Habitat: prefers desert scrub with creosote bushes or in dry washes

Predators: ravens, kit foxes, coyotes, mountain lions

A roadrunner stands in tall grass next to a paved road. (R.Tressler/USFWS)

Roadrunner

Description: (bird) they have two slender legs for running fast, a pointy, sometimes colorful tail, and a long, pointed beak

Diet: lizards, small snakes, baby quails, small mammals, prickly pear cactus (omnivore = eats plants and meat)

Habitat: prefers desert scrub near water

Behavior: builds nests on the ground in sturdy bushes or cacti

A mother Quail with her two chicks stand on a dry log. (Sharon K. Schafer)

Quail

Description: (bird) they frequently travel in groups, can have white spots, have a topknot of feathers on their head and make a throaty chirp noise

Diet: mistletoe berries, cactus fruits, seeds, leaves, insects (herbivore = eats plants)

Habitat: brushy washes where they can use saltbush for cover

Predators: snakes, foxes, and coyotes

A Jackrabbit stands alert for predators in the desert. (Sharon K. Schafer)

Jackrabbit

Description: (mammal) they have long flat feet, large ears and long whiskers

Diet: grasses, leaves, twigs, sagebrush, cacti (herbivore = eats plants)

Habitat: prefers open areas with desert shrubs

Behavior: runs long distances to escape predators like coyotes

A Flame Skimmer Dragonfly has landed on a stick. (Sharon K. Schafer)

Flame Skimmer Dragonfly

Description: (insect) they have a beautiful orange or brownish and amber coloring with 4 wings and big eyes

Diet: insects, especially mosquitos, moths, flies, and ants (carnivore = eats meat)

Habitat: prefers ponds, streams, and springs

Behavior: lives underwater for several years during nymph stage

Predators: birds, frogs

A Pahrump Poolfish rests. (S.Goodchild)

Pahrump Poolfish

Description: (fish) They can reach 3 inches long, have greenish scales above and silvery scales below, sometimes they may appear bluish.

Diet: insects, plant matter, detritus (omnivore = eats plants and meat)

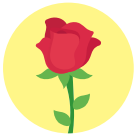
Habitat: alkaline mineral springs

Predators: crayfish, mosquitofish, goldfish

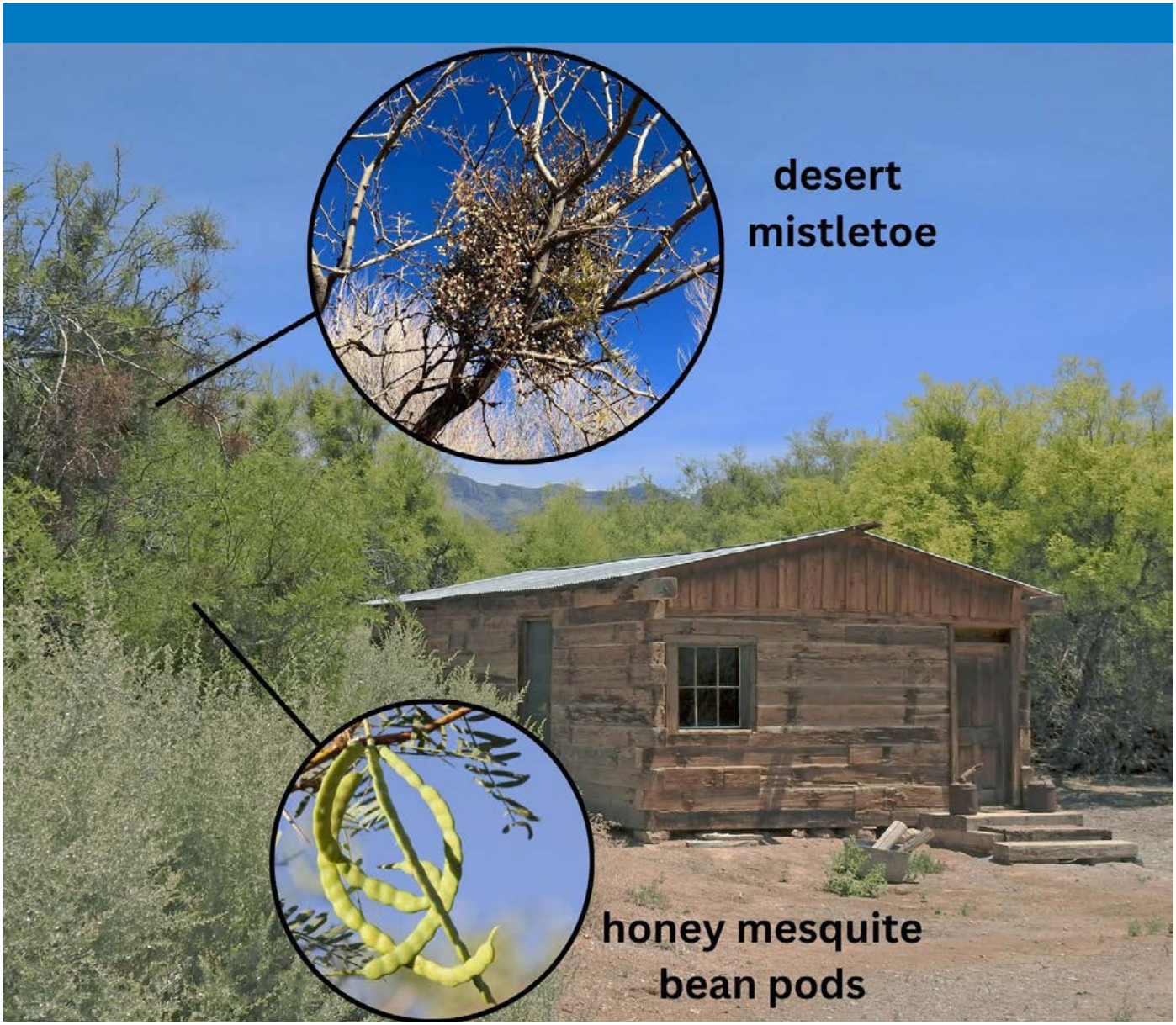
A Saltbush Community grows in the desert. (A.Eowyn/USFWS)

Saltbush Community

Common Plant Species: The four-wing saltbush, shadscale saltbush, rabbitbrush, and white bursage are all fund in abundance.



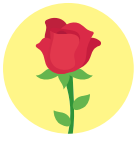
Unique Features: There is more plant cover in the saltbush community than that of the creosote community. The saltbush habitat provides food and cover for many species of wildlife including quails, songbirds, and small mammals like the desert cottontail.



A Mesquite Bosque with details of the desert mistletoe and honey mesquite bean pods. (A.Eowyn/USFWS, Thomas Farley, and Sharon K. Schafer)

Mesquite Bosque

Common Plant Species: Mesquite (pronounced mes-keet) bosques (pronounced bosk or boskay) are wooded areas made up of mostly mesquite trees. In order to grow, mesquite trees need groundwater that is located not too far from the surface.

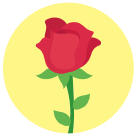


Unique Features: This habitat type is found near water, often close to desert riparian areas or washes. The mistletoe that grows on mesquite is a favorite food for the Phainopepla bird. The thick growth pattern of mesquite makes them excellent nesting sites for birds and homes for other animals.

Riparian forest along Corn Creek. (USFWS)

Desert Riparian Zone

Common Plant Species: Riparian plants found on the refuge include cottonwood, arrowweed, saltgrass, Goodding's willow, and southern cattail.

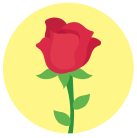


Unique Features: Riparian habitats are in or very close to streams and bodies of water. This habitat provides a supply of insects, such as flies and mosquitoes, for birds, bats, fish, and lizards to eat. The Corn Creek Pond and refugium are safe havens for the endangered Pahrump poolfish.

A Creosote Bush Community grows in the desert. (A.Eowyn/USFWS)

Creosote Bush Community

Common Plant Species: This open scrubland is defined by the creosote bush, the most widely distributed plant of the Mojave Desert. Other plant species in the creosote bush community include white bursage, yucca, desert globemallow, and beavertail cactus.



Unique Features: The deep roots make an excellent home for burrowing animals (animals that dig in the ground) and sometimes the roots serve as a food source for the animals. Examples of animals that call creosote home include the desert tortoise, antelope ground squirrel, black-tailed jackrabbit, and roadrunner.

A creek at Corn Creek. (A.Eowyn/USFWS)

More Water: Corn Creek

The desert landscape. (A.Sprunger/USFWS)

Less Water: Arid Desert

Post-Field Trip Classroom Activity

Design a Refuge

Overview

After visiting the Refuge, students use "design-thinking" to create a refuge for the desert tortoise. This activity can be adapted to allow the students to select a threatened or endangered species from the provided list. This requires additional time and student research to complete the activity. Students will practice empathizing with and understanding the animal's needs (habitat, food, and water), identifying problems, limitations, and competing elements, and brainstorming solutions. Students will learn about the many challenges desert tortoises (and other threatened and endangered species) face, such as lack of water or food resources and the threats of predators and invasive species, as well as potential ways to help threatened or endangered species through a refuge approach.

Location

Classroom (post-fieldtrip)

Materials

- Design a Refuge Questions handout (1 per group or per student)
- Design a Refuge Instructions
- Desert Tortoise Fact Sheet **OR** Threatened and Endangered Species List (1 per group or per student)
- Computers for research (if students are doing their own research)
- Large white paper (per group)
- Pencils, crayons, markers (per group)
- Habitat Scramble activity cards (plant community cards, per group)

Time

1 - 2 class periods (depending on whether students are doing their own research)

Procedure

1. Decide ahead of time whether you want your class to select their own threatened or endangered species from the list OR all focus on and use the desert tortoise materials provided.
2. Ask the students to reflect back on their field trip to the Desert National Wildlife Refuge.
    - What are some of the ways the refuge protects the home of its resident animals?

- How do managers ensure the refuge has adequate food, water and space for everything that lives there (plants, insects, animals, etc.)?
- What are ways animals can be protected from humans and other potential threats?
- What do you think are some of the wildlife refuge's challenges to protecting threatened or endangered species? (Recall that "endangered" means a species is in danger of extinction throughout all or a significant portion of its range and "threatened" means a species is likely to become endangered within the foreseeable future.)
- What are ways that humans help and hurt the protection of threatened or endangered species?

3. Have the students reflect on the definition of a wildlife refuge: **A wildlife refuge is land or waters set aside for conservation, management, and restoration of the fish, wildlife, plants, and their habitats for the benefit of present and future generations of Americans.** Wildlife refuges also foster understanding and instill appreciation of fish, wildlife, and plants and provide many opportunities for users including hunting, fishing, photography, wildlife observation, environmental education, and interpretation.
4. Ask the students if they recall the components in a habitat that animals need to survive? Provide prompts as needed. Definition of a habitat: **A habitat is a place where an organism makes its home. A habitat meets all the environmental conditions an organism needs to survive,** including **food, water, cover, and adequate space** for the animal to roam and raise its young.
5. Explain that today, students will work in groups to either:
   a. learn about the federally threatened desert tortoise and design a refuge to help protect the desert tortoise.
   b. pick an endangered or threatened Mojave Desert plant or animal species and do research to design a refuge to protect that species.

   Give one copy of the Design a Refuge Questions handout per group (or per student).

   Distribute the Desert Tortoise Fact Sheet OR the Threatened and Endangered Species List to each group or student. Instruct them to find the following information (either by reading the Desert Tortoise Fact Sheet OR conducting research on their selected species.)

   - What kind of climate does their plant or animal live in?
   - What habitat does their plant or animal live in? What kinds of plants and animals live in its environment?
   - What kind of food does their plant or animal need or eat? How does it get the food? If an animal, how far will it travel for food?
   - What are predators of their plant or animal?
   - How does their plant or animal stay safe from weather, predators, humans, etc.

- What are their plant or animal's biggest threats?
- How many of their plant or animal can live in an area?
- How does their plant or animal reproduce?

6. Give students a large sheet of paper to begin brainstorming their ideas for a refuge. Remind students that a refuge must include the animal's natural habitat and that the refuge should be able to **protect an animal population**, not just an individual animal. Therefore, the total amount of space and competition for resources from other plants and animals must be considered. There are human factors that also need to be considered. When people visit what will they do there (example: hiking, auto tours, bird watching)? Scientists will want to study the animals to learn more about how they live. Refuge staff will need space to work so they can take care of the refuge.

   Have students consider:

   - What size space do I need? PROMPTS: How much space does one plant or animal of the species need? How many plants or animals commonly live together for their species? How many plants or animals are needed to help the population grow? How many plants or animals will their habitat support? What about when they reproduce?)
   - How does my plant or animal eat? Where will it eat on my refuge?
   - Where will they sleep or seek shelter? (If applicable)
   - Where will they get water?
   - What other animals will naturally be in the habitat? How might those other animals impact their plant or animal?
   - Will humans use the refuge? If so, how? Will the refuge be near to or far from towns or cities? Why?
   - What things threaten or kill your plant or animal and how can those threats be decreased?
   - What recreation opportunities will be available?
   - What education and research will happen at the refuge?

7. After the class has had some time brainstorming and drawing their designs, have students pause and share their progress with the whole class or peer-to-peer. Encourage students to ask their classmates questions about their designs and to offer suggestions or solutions to their challenges. Have students finish their designs and present.

Design a Refuge: Questions Handout

Find the answers to and consider the following questions about your endangered or threatened Mojave desert plant or animal.

Endangered means a species is in danger of extinction throughout all or a significant portion of its range.

Threatened means a species is likely to become endangered within the foreseeable future.

Climate & Habitat

- What kind of climate does your plant or animal live in?
- What habitat does your plant or animal live in? What kinds of plants and animals live in its environment?
- What kind of food does your plant or animal need or eat? How does it get its food? If it's an animal, how far will it travel for food?
- How many of your plant or animal can live in an area?

Reproduction & Behaviors

- How does your plant or animal reproduce?
- What size space does your plant or animal need individually?
- How many plants or animals commonly live together for their species?
- How many plants or animals are needed to help the population grow?
- How many plants or animals will their habitat support?

Threats & Predators

- What are predators of your plant or animal?
- How does your plant or animal stay safe from weather, predators, humans, etc.
- What are your plant or animal's biggest threats?

Designing the Refuge

- Where/How will the plants or animals I am protecting eat?
- Where will your animal sleep or seek shelter? (If applicable)
- Where will your plant or animal get water?
- What other animals will naturally be in the habitat? How might those other animals impact your plant or animal?
- Will humans use the refuge? If so, how? Will the refuge be near to or far from towns or cities? Why?
- How can threats be decreased in your refuge?
- Will people be able to visit your refuge? Is so, what will they do? How will that help protect or harm the animal or plant?
- What education and research will happen at the refuge?

Design A Refuge: Instructions

Now that you have learned about your plant or animal, you will work in groups to design a refuge for a population. When designing your refuge, try to empathize with your plant or animal – understand what their needs and challenges are, then brainstorm solutions to solve some of the threats that your plant or animal face.

Consider the questions on **Design a Refuge: Questions Handout** and incorporate those factors into your refuge design. Be sure to consider food, water, cover, and adequate space.

Create drawings that show your animal's habitat and the refuge layout. Include things like:

- Maps with roads
- Distance from towns/cities
- Size of your refuge and why
- Elevations at the refuge (are there hills or mountains? Why or why not?), water sources, plant habitats/communities
- Buildings on the refuge and why
- Drawings of the plants/habitats your plants/animals will live in
- How many plants/animals will your refuge support & why?
- How will your plants/animals be protected from threats?

Threatened, Endangered, and Sensitive Species of the Mojave Desert

Mammals

- Amargosa southern pocket gopher, *Thomomys umbrinus amargosae*
- Desert bighorn sheep, *Ovis canadensis nelsoni*
- Mountain lion, *Felis concolor*
- Townsend's big-eared bat, *Plecotus townsendii*

Birds

- Bald eagle, *Haliaeetus leucocephalus*
- Least Bell's vireo, *Vireo bellii pusillus*
- Mexican spotted owl, *Strix occidentalis lucida*
- Yuma clapper rail, *Rallus longirostris yumanensis*

Reptiles

- Coachella Valley fringe-toed lizard, *Uma inornata*
- Desert tortoise, *Gopherus agassizii*

Amphibians

- Lowland leopard frog, *Rana yavapaiensis*

Fish

- Bonytail chub, *Gila elegans*
- Devil's Hole pupfish, *Cyprinodon diabolis*
- Pahrump poolfish, *Empetrichthys latos*
- Humpback chub, *Gila cypha*
- Razorback sucker, *Xyrauchen texanus*

Design A Refuge Activity – Desert Tortoise Fact Sheet

When the Desert National Wildlife Refuge was established in 1936, its main goal was to provide habitat and protection for the desert bighorn sheep (*Ovis canadensis nelsoni*), the state animal of Nevada. However, the refuge is also home to hundreds of other species, a few of which are either considered **threatened** or **endangered**.

One such species is the Mojave desert tortoise (Gopherus agassizii). The desert tortoise faces several threats including:

- Habitat loss from growing cities
- Humans interacting with them, which can cause the tortoise to pee out all the water it is saving. Without its stored water, the tortoise dies.
- Diseases
- Getting hit by cars when they try to cross the road
- Predators. Example: Ravens eat baby tortoises. The more human trash in an area, the more ravens live there, and the more baby tortoises are eaten.
- Balloons. When a balloon is released it can travel many miles before it returns to the ground. Tortoises mistake them for flowers, which they eat. Sadly, if they eat a balloon they will die.

Endangered means a type of plant or animal (a species) that is in danger of dying out (extinction) and there aren't many of them left in the wild.

Threatened means a species is close to becoming endangered. Threatened and endangered species receive special protections under the Endangered Species Act.

A **habitat** is a place where an organism makes its home—it meets all the environmental conditions an organism needs to survive, including food, water, cover, and adequate space for the animal to roam and raise its young.

Today, you will brainstorm some solutions to these threats and design a refuge (a protected area) that keeps desert tortoises safe and provides everything they need to thrive.

A refuge includes natural, protected habitat(s), but may also include other things like: scientists to do research, buildings and people to educate visitors, and trails, roads, or campgrounds to allow people to visit and enjoy nature (but in a way that doesn't hurt the animals.)

ENVIRONMENT/COVER

The desert tortoise is most often found in creosote (kri-uh-sote) bush communities, though they can also live in rocky foothills, washes, and canyons below 5,000 feet in elevation. Desert tortoises will build crescent-shaped burrows in the sides of washes or at the base of desert shrubs, like creosote. These shrubs provide cover which helps

Figure 35. Image of baby Mojave desert tortoise. (J. Kellam/BLM)

tortoises hide from predators and escape from the hot desert sun. Common plants in the creosote bush community include creosote, beavertail cactus, prickly pear cactus, desert marigold, desert globemallow, and white bursage.

Figure 36. A Creosote Bush Community at Desert NWR. (A.Eowyn/USFWS)

WATER

Desert tortoises have a mental map of places in their habitat where water collects. During rainstorms, tortoises will head to these places. Desert tortoises are also known to dig small catchment basins to collect water when it rains. Most of the water they get is from eating water-rich plant materials like green grasses, wildflowers, and cactus fruits. Desert tortoises can uptake water through their nostrils, an adaptation which helps them to "drink" water from small crevices. They are also able to store water in their bladders for long periods of time and reuse this stored water when needed. Unfortunately, tortoises are known to release all of the stored water from their bladders when startled. This is why we should never pick up or get too close to a desert tortoise in the wild. If they release all of their water, they could die.

SPACE/TERRITORY

A single desert tortoise will live in the same general area of less than one square mile (1 mile x 1 mile) during its lifespan of 50 to 100 years. Tortoises are considered solitary animals, meaning they will spend most of their lives alone, only meeting with other tortoises during spring breeding. Multiple tortoises may gather in areas with lots of food or water, though they usually won't be very social. When two male tortoises encounter one another, they may fight for dominance by trying to flip one another over.

REPRODUCTION

Desert tortoises are able to reproduce when they reach the ages of 15-20 years. Mating occurs in March and April and egg laying, which takes place at the entrance of burrows, takes place from May to July. Females lay about 1-14 eggs up to 3 times per year. The eggs are covered with soil and hatch after about 100 days. When baby tortoises emerge, they are fully-formed and able to live their lives independently. Unfortunately, the survival rate of young tortoises is very low. Ravens can puncture young tortoises' softer shells with their beaks until the tortoises reach about 10 years of age.

THREATS

The U.S. Fish and Wildlife Service considers the Mojave desert tortoise to be a "threatened" species, meaning it is likely to be at risk of extinction in the foreseeable future. This is because

Figure 37. An adult desert tortoise foraging. (J. Kellam/BLM)

desert tortoises face a variety of threats to their continued survival. One such threat is habitat loss and degradation due to human development. As more and more people move into the desert, the number of buildings increases, destroying what was once prime desert tortoise habitat. Development of the desert into towns and cities for humans means less space for tortoises to build their burrows or eat their food.

Where humans live—roads follow. Roads and highways are deadly for the slow-moving desert tortoise. Roads are also warm and tend to collect water, drawing tortoises towards them. Roads can also act as a barrier between tortoise habitat, making it difficult for a male desert tortoise to follow a female tortoise's scent and locate her for breeding.

Invasive species and climate change are additional threats facing the desert tortoise. Invasive plants are not part of the native environment, and some invasive plants can take over an environment changing the ecosystem – using water, increasing fire risk, and reducing space for other plants to grow. Animals in an ecosystem may not be adapted to eat the new invasive plants or the plants may be harmful to them. In the Mojave, invasive plant species are out-competing the plants that desert tortoise naturally eat, and the lack of food is impacting the health and size of the tortoise population and the amount of available habitat.

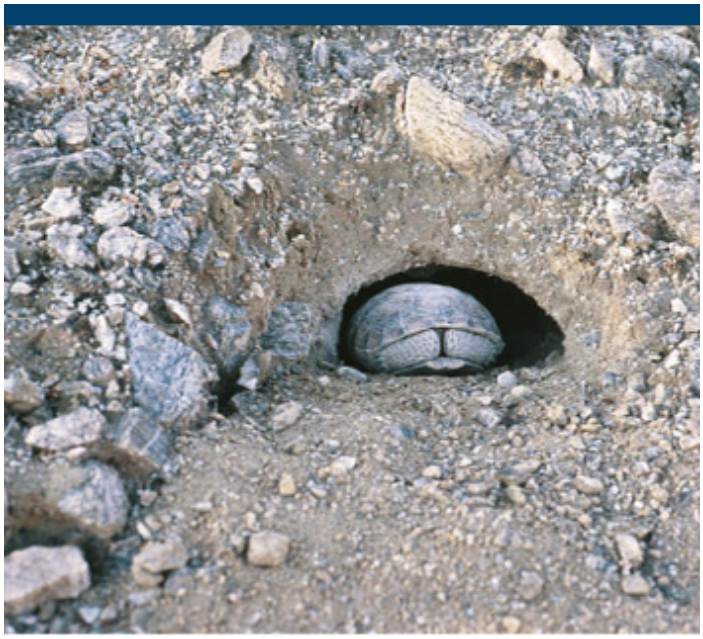


Figure 38. A desert tortoise hiding in its shell near burrow. (Pierre Fidenci)

Climate change increases temperatures during the summer, leading to drought and more frequent and intense wildfires. Wildfires not only burn animals and their homes; they also turn thriving desert landscapes into non-native grasslands. These disturbed habitats are easier for invasive plants to move into, creating a cycle of destruction. Desert tortoises struggle to survive in these new environments, since they are not adapted to live in them. Droughts and habitat degradation have also been shown to increase the chance of desert tortoises developing disease, which is considered an important threat.

Another major threat facing desert tortoises is **predation**. Predators are animals that eat other animals. Predators of the desert tortoise include ravens, roadrunners, kit foxes, and coyotes. Ravens do well in disturbed habitats and city environments and are attracted to areas where trash and food waste are not properly thrown away. Raven populations have increased alongside humans moving to the desert. Ravens are the main predator of young tortoises. It can take up to 10 years for a tortoise shell to harden enough to protect it from the hard beaks of ravens. This means that fewer tortoises can grow up and reproduce.

ADAPTATIONS

Desert tortoises are **reptiles** (aka cold-blooded animals) and are unable to regulate their body temperature internally (they have to use the outside temperatures to control their body temperature). Because of this, tortoises spend up to 98% of their lives underground where they can avoid the summer's heat and the winter's cold. Tortoises use their front legs to dig multiple burrows of varying depths. **Brumation** (hibernation for reptiles) occurs between the months of October and February. Desert tortoises will also hide in their summer burrows and enter a state of inactivity when it is too hot outside. The activity period for desert tortoises takes place between March and late October. During this time, tortoises emerge from their burrows to eat.

Desert tortoises stay safe from predators by fully retracting their heads and legs inside of their shell when disturbed. This protects the softer parts of their body from predators. Although mortality (death) rates are high for young tortoises that have not yet developed a hard shell, adult desert tortoises are rarely killed by predators. The only predator strong enough to puncture an adult tortoise shell is a mountain lion.

Section 4 – Additional Background Information and Resources

Figure 39. Retention pond at Corn Creek, Desert National Wildlife Refuge. (USFWS)

Public Lands

"Public lands" is a broad term used to describe the lands and waters that are owned collectively by the citizens of the United States. These areas are managed by either federal, state, or local governments. There are also other lands beyond "public lands" that are available for public use, such as private lands that are accessible by special conservation easements or hunting/fishing permits.

The majority of public lands are managed by four federal agencies: National Park Service (NPS), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), or Bureau of Land Management (BLM). The focus and mission of each of these agencies differ and subsequently affect the way they manage the lands. The Bureau of Reclamation manages land primarily along waterways for which it is responsible.

Bureau of Land Management – The Bureau of Land Management's mission is to sustain the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations.

National Park Service – To preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations.

U.S. Fish & Wildlife Service – To work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

U.S. Forest Service – To sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations.

Bureau of Reclamation – To manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

How lands are managed is dependent on the agency managing those lands, the mandates set for that land, and the type of land designation defining the scope and breadth of the use and protection. For example, some lands are preserved for wildlife (e.g. refuge or wilderness), while others may allow commercial activities such as mining or grazing.

The percentage of federal lands in each state varies, with the western states having higher percentages than eastern and midwestern states. Nevada has the highest percentage of federal land of all fifty states. Of Nevada's 70 million acres of land, 56 million acres or 80.1% of Nevada is federal lands.

For more information about our nation's public lands visit https://www.doi.gov/blog/americas-public-lands-explained.

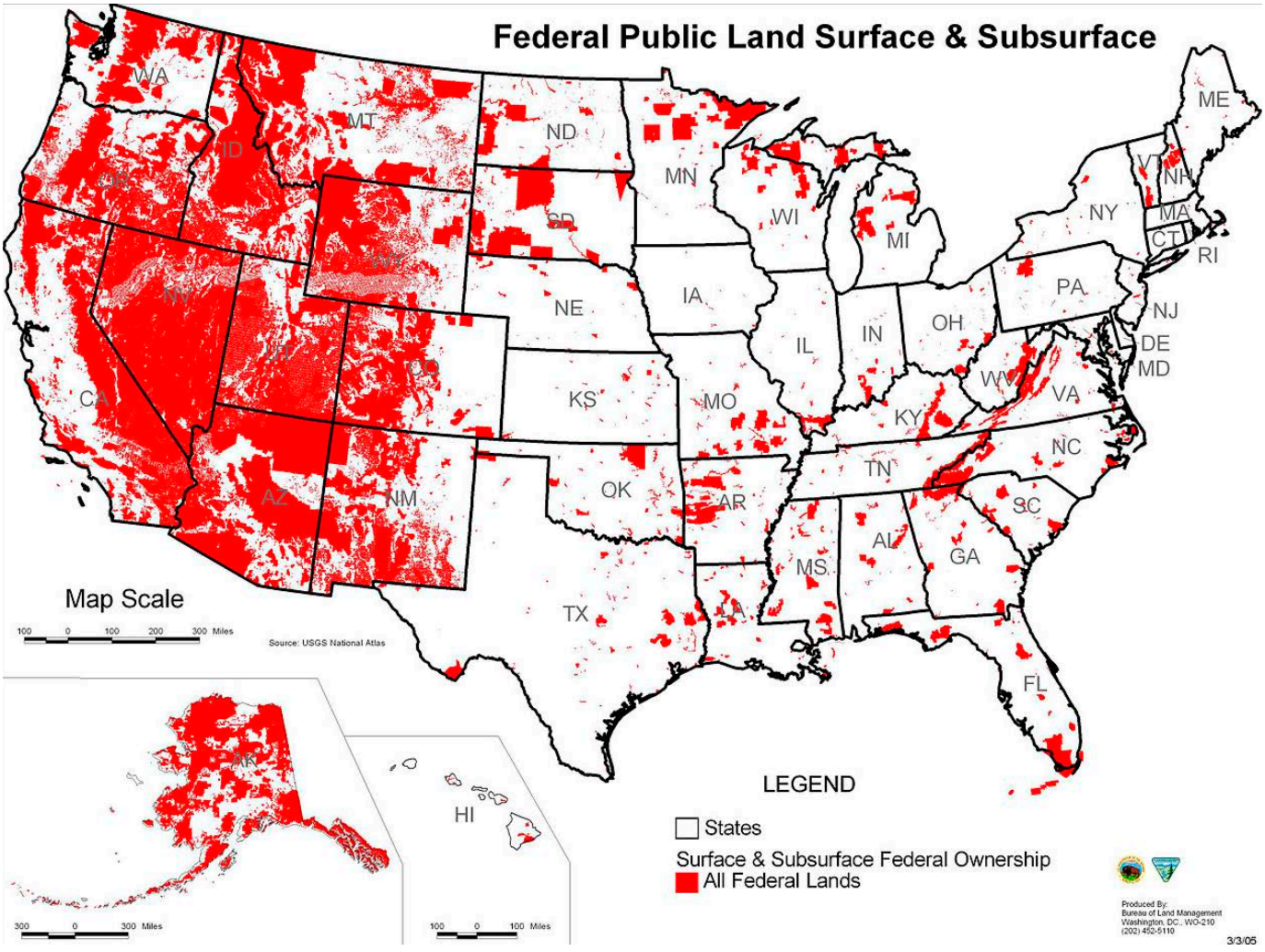


Figure 40. Map of the Federal Public Lands in the United States. (Image Courtesy of Bureau of Land Management – http://wilderness.org/blm-lands, Public Domain, https://commons.wikimedia.org/w/index.php?curid=26857120)

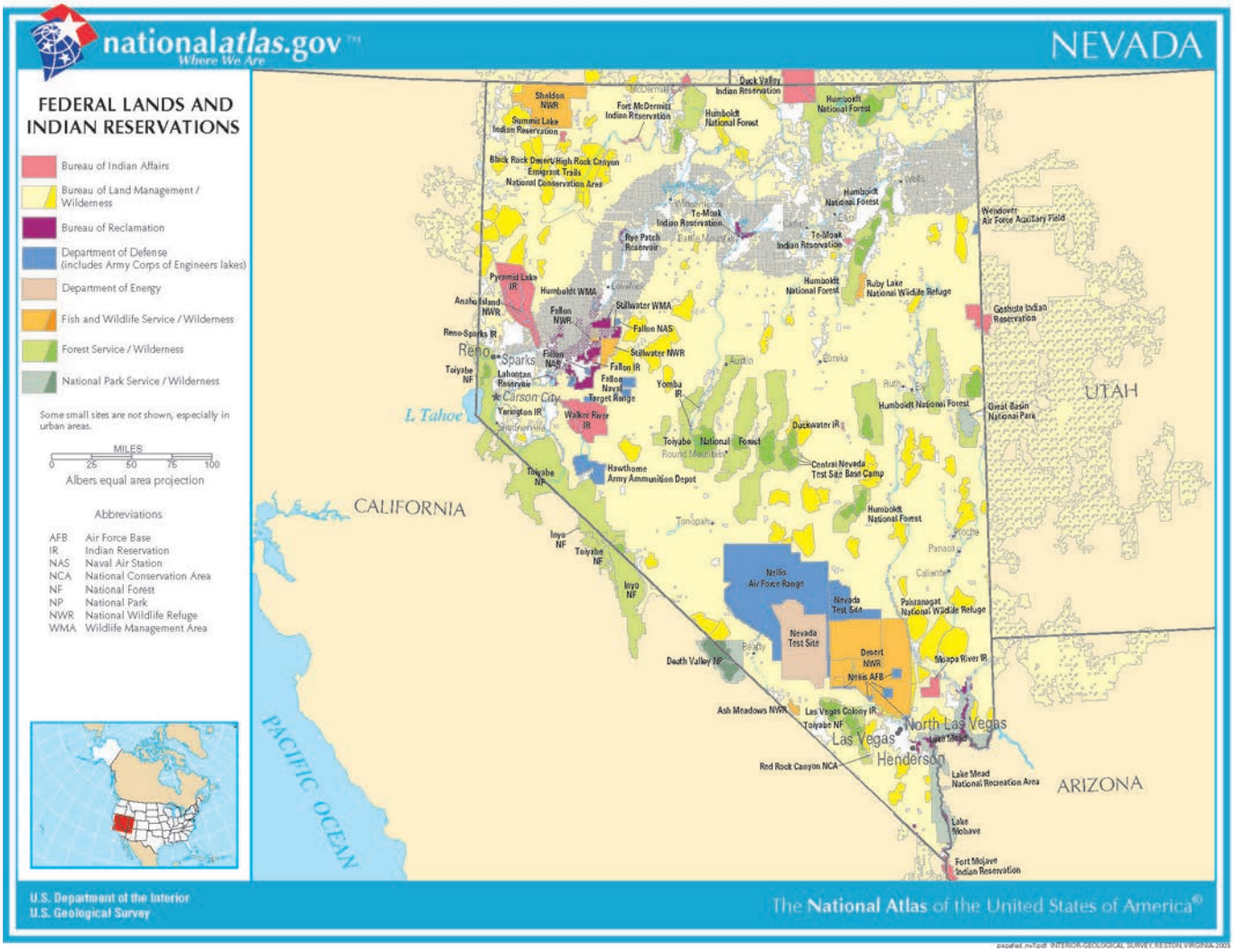


Figure 41. Map of the Federal Public Lands in Nevada. (nationalatlas.gov)

Introduction to the Desert National Wildlife Refuge

Every national wildlife refuge was created for a special purpose. Some were created to protect migratory birds, others to protect threatened or endangered species or unique habitats, while others fulfill another special purpose. All activities allowed on a refuge must be evaluated to make sure each activity will not conflict with the reason the refuge was founded. Managed by the U.S. Fish and Wildlife Service, this refuge is one of more than 570 in the National Wildlife Refuge System. This system protects iconic species that populate public lands and waters across the country and provides some of the best wildlife viewing opportunities on Earth.

Desert National Wildlife Refuge protects a wide variety of ecosystems across a diverse landscape of two deserts, six mountain ranges, and seven different life zones. The refuge was established in 1936 to provide habitat for the desert bighorn sheep and other desert wildlife. Today, it is the largest wildlife refuge outside of Alaska; at 1.6 million acres, the refuge can cover an area the size of Rhode Island twice and still have enough room left over for a quarter of a million football fields.

Figure 42. Blackbush. (USFWS)

Desert National Wildlife Refuge is home to more than 500 species of plants, over 320 species of birds, 52 species of mammals, 32 species of reptiles, and so much more. Species of concern include the threatened desert tortoise and the endangered Pahrump poolfish. It has been home to people for thousands of years, from Newe (Western Shoshone) and Nuwu/Nuwuvi (Southern Paiute/ Chemehuevi) to ranch homesteaders. All cultural and paleontological resources and sites on the refuge are protected. Don't touch or remove any artifacts - it prevents future visitors from being able to enjoy them, and it is a violation of federal law. Please enjoy the flora, fauna, fossils, and archeological sites throughout the refuge, but take only pictures.

The Desert National Wildlife Refuge headquarters and the surrounding area are known colloquially as "Corn Creek," a nod to the Corn Creek Springs, where water—a rare yet vital commodity in the desert—emerges from a deep carbonate aquifer system underground. There are more than 30 springs on the refuge, all of which are consistently maintained and improved upon by refuge staff. The Corn Creek trail system leaves from behind the Corn Creek Visitor Center, where about 1.5 miles of trails wind through different habitats. Along the trail, active habitat restoration is taking place. Refuge staff works hard to control non-native species and noxious weeds by utilizing an integrated vegetation management approach and planting native species that have been displaced.

Desert National Wildlife Refuge is managed as part of the Desert National Wildlife Refuge Complex. Refuges are grouped into a complex structure because they occur in a similar ecological region, such as a watershed or specific habitat type, and have a related purpose and management needs. Other refuges in the Desert National Wildlife Refuge Complex include Ash Meadows National Wildlife Refuge, a recognized wetland of international importance; Moapa Valley National Wildlife Refuge, home to an endangered fish called the Moapa dace; and Pahranagat National Wildlife Refuge, an essential stopover location for waterfowl and songbirds as they migrate along the Pacific Flyway.

More information about these refuges can be found online at: https://vimeo.com/87754158.

Desert National Wildlife Refuge (Desert NWR) Resource Guide

Public Lands

Department of Interior: https://www.doi.gov/blog/americas-public-lands-explained

Desert NWR Overview

Official U.S. Fish and Wildlife website: https://www.fws.gov

Official Desert National Wildlife Refuge website: https://www.fws.gov/refuge/desert

National Wildlife Refuge System: https://www.fws.gov/program/national-wildlife-refuge-system

Desert NWR Human History and Archaeology

Coyote Named This Place Pakonapanti by Heidi Roberts, Elizabeth von Till Warren, and Suzanne Eskenazi provides a comprehensive history of human habitation at Corn Creek. Available at UNLV's Lied Library Special Collections. https://unlv-primo.hosted.exlibrisgroup.com/permalink/f/ovttgp/01UNLV_ALMA21235198250004081

Excerpts from the book can be found here: https://corpora.tika.apache.org/base/docs/govdocs1/292/292636.pdf

https://www.yumpu.com/en/document/view/10705378/chapter-6-corn-creek-and-the-history-of-las-vegas-valley

Animals

The Nevada Department of Wildlife website has a searchable page about Nevada's native species. https://www.ndow.org/species-information

Birds

Red Rock Audubon's website has articles about local birds and bird-related news. https://www.redrockaudubon.com/blog

Fossils: The National Park Service Tule Springs Fossil Beds website has information about the prehistoric animals of the Las Vegas Valley. https://www.nps.gov/tusk/learn/index.htm

General

A Natural History of the Mojave Desert by Lawrence R. Walker and Fredrick H. Landau has information on local plants, animals, geology, water, human adaptions, and much more. Available at the Clark County Library. https://lvccld.bibliocommons.com/v2/record/S134C2131742

Explore Further Resources

The Friends of Nevada Wilderness and Nevada Division of Cultural Heritage both have excellent resources pages for both teachers and students. https://heritage.nv.gov/resources-for-teachers

Endangered Species Act

https://www.nevadawilderness.org/kids_corner

https://www.fisheries.noaa.gov/national/endangered-species-conservation/endangered-species-act

Acknowledgements

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Funding

SNPLMA Round 17: This project was funded due to the Southern Nevada Public Land Management Act, which authorized the sale of BLM-administered federal lands within a designated boundary in the Las Vegas Valley and required proceeds to be used on projects to fund federal, state and local projects that benefit communities and public lands.


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