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Executive Summary

Highlights of the university’s focused efforts during the past three months include the following:

- Twenty-four people from the Summer and Fall 2008 cohorts have successfully graduated from the Nevada State Certification in Environmental and Interpretation Program.
- Planning continues for the mobile exhibit program to support and deliver SNAP messages.
- Fifty people have participated in each of two SNAP Families & Nature events, and will participate in an educational field trip to the Spring Mountains on June 20, 2009.
- Forever Earth was scheduled on 53 days involving 1985 individuals.
- Discover Mojave Outdoor World conducted 17 events for 329 participants.
- A successful partnership with Clark County School District has resulted in middle school physical education students participating in hiking, indoor rock climbing, and kayaking activities in the Outdoor World program.

Conservation Education and Interpretation

The following progress has been made toward CE&I project objectives in this quarter.

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Project 1 - Task 1. Assist CI teams in the implementation of at least three educational projects.

a. Identify at least one project each year to focus on from the following areas of strategic importance to SNAP: litter prevention, responsible OHV recreation, wilderness, and/or restoration. Agency personnel, including SNAP CI teams, will assist in the identification of these educational projects, providing necessary information and guidance. Project identification will be completed by August 31 of each year.

One project has been identified: educational outreach to promote responsible OHV recreation.
b. SNAP Executive Director and PLI staff will work with SNAP Board of Directors to determine focus areas and context of delivery of messages for these focus areas.

The Board supports the team’s proposal to proceed with northern Nevada/Idaho branding as the overall theme of their messaging outreach and then create a specified local message, while incorporating some of the existing interagency messages (i.e. Don’t Trash Nevada, Get Outdoors Nevada.)

c. PLI staff, appropriate agency staff, and other experts will determine the best set of delivery systems for each area of strategic importance. Possible delivery systems include brochures, kiosks, multi-media products, billboards, electronic devices such as MP3 players etc.

SNAP Agencies would like OHV Recreationists to always ride on designated routes, trails, and washes. To this end, SNAP will produce a Motorized Vehicle Zone map for Clark County, indicating what types of motorized vehicle operation is appropriate for each zone. This Zone map will also include general information, natural history information, tips for riding responsibly and safely, and stewardship messages, including messages about the importance of staying on trails.

d. Key user groups and best educational methodologies will be identified for each project, drawing upon the expertise of university faculty and staff. This will be completed by October 31 of each year.

Some people ride on trails all the time (compliers), while others do not (non-compliers). To be relevant and compelling, the messages included in the packet should incorporate what Clark County OHV recreationists believe about riding on trails. The most important message will take into account the difference between what compliers believe is important about riding on trails and what non-compliers believe about riding on trails. Targeting this difference in belief is key to creating the most compelling message (Ham et al, 2007: “Promoting Persuasion in Protected Areas”).

Process for Understanding what OHV users believe

1. Volunteers with Partners in Conservation used the attached Feedback Form to ask OHV users questions (March, April 2009). Fifteen respondents participated (see attachment: Feedback Form Responses: Asking OHV Users about Riding On and Off-trail) in the process.
2. The responses were grouped into common themes.
3. The most commonly held beliefs then become the basis for the second feedback questionnaire, which will determine which of these represents the strongest held belief (see attachment: Identifying Beliefs to Target with Persuasive Communication).
4. Volunteers from PIC and other OHV user groups will use this second feedback questionnaire to again gather input from another 25-50 OHV users, being sure to include responses from both compliers and non-compliers.
5. The results will indicate the message that should be most effective in targeting non-compliers and persuading them to ride on trails on Clark County public lands.

e. CE&I products and services for the focus project will be created and implemented by PI/Project Manager Allison Brody with assistance from the UNLV graduate student, Curriculum Development Personnel, Media Relations, and Web Communications. UNLV fiscal and clerical personnel will assist the PI/Project Manager with ordering, tracking, and documenting the purchase and delivery of required materials, supplies, and equipment. Agency
personnel will assist in product development, review, and execution within their agency educational programs. Examples of possible projects include brochures, interpretive signs, website content, multi-media products, curricula, and/or programs delivered by CE&I staff. Each project will be completed by May 31 of each year.

SNAP has not produced the Zone Map/Information Packet.

Accomplishments for Task 1 – Year 2

1. **Responsible OHV Recreation.** To be successful at communicating the message: "Stay on Trails," any outreach effort must include a map of where these trails are. Thus, this outreach effort depends on SNAP creating and producing a Motorized Vehicle Zone Map and Information Packet. While waiting for this to happen, Allison Brody is leading efforts to understanding what OHV users believe about Staying on Trails and target non-compliers with appropriate persuasive messaging.

2. **REV.** Three REV events (Restoration, Education, and Volunteerism) were held this year: two on Blackbrush reseeding and one on cattail removal/pupfish restoration.

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Project 1 – Task 2. Produce assessment proposals and reports for at least two CE&I products or services.

a. Identify data collection protocols for assessment of CE&I projects in priority focus areas: litter prevention, responsible OHV recreation, wilderness, and/or restoration. This activity for the selected focus area will be completed by November 30, 2007 and November 30, 2010.

   This task refers to subsequent years. No progress has been made this quarter.

b. Drawing upon the expertise of university faculty and staff, the PI/Project Manager will write assessment proposals to human-subject standards specified by UNLV’s Internal Review Board. These proposals will be completed by February 28, 2008 and February 2, 2011.

   Thirty-three people attended the two day Evaluation Workshop for February 26-27, 2009 facilitated by Chris Parsons, the principal of Word Craft, a firm that specializes in interpreting and communicating science and environment issues to the public.

c. Assessment end results will be cooperatively determined with the PLI staff, SNAP Executive Director, SNAP Board and appropriate agency staff.

   This task refers to subsequent years. No progress has been made this quarter.

d. Collect and analyze data, using UNLV faculty and research assistants as needed. PI/Project Manager, with assistance from the UNLV graduate student and hourly personnel, will produce a written report by May 31, 2008 and May 31, 2011.

   This task refers to subsequent years. No progress has been made this quarter.
Project 1 – Task 3. Document number of people reached by CE&I programs and services of the four federal agencies and cooperating partners.

a. Agency and PLI staff will identify data collection protocols for estimating the number of contacts reached by non-personal services offered by each of the four federal agencies during fiscal year 2008 – 2009 (October 2008-September 2009).

The data collection protocol and data collection forms are being utilized by all four agencies and the Red Rock Canyon Interpretive Association.

b. PI/Project Manager, with assistance from the UNLV graduate student and hourly personnel will collect and summarize data from fiscal year 2008-2009 (October 2008-September 2009) utilizing UNLV faculty expertise as needed. A written report will be completed by May 31, 2010.

Data will be submitted by the four federal agencies and the Red Rock Canyon Interpretive Association.

Accomplishments for Task 3 – Year 2
SNAP Agencies and their partners agreed on data collection protocols and a data collection form. Agency staff agreed to collect data using these methods for fiscal year 2009-2010.

Project 1 – Task 4. Work with at least one private sector group to implement at least two educational projects.

a. Identify two or more projects for delivering SNAP priority focus area messages to at least one private sector group. Examples of private sector groups interfacing with public lands include tour companies, concierge associations, and housing developers. Examples of projects that incorporate SNAP messages could be the development of a training program for a tour company or an interpretive plan for a trail system through a housing development. Agency personnel, including SNAP C I team members, will provide necessary information and guidance. SNAP Executive Director will work with PLI to develop concepts for private sector educational programs. At least one project will be identified by August 31, 2008, and an additional project will be identified by August 31, 2010.

The Public Lands Institute has partnered with the Las Vegas Springs Preserve to create an on-line media/podcast project featuring a series of graphic stories featuring animals found in the Mojave Desert surrounding the Las Vegas Valley. These animals are our neighbors, and for them -- and us -- the Mojave is Home.

The animals to be featured in these proposed graphic stories are currently either on display at the Springs Preserve, or can be found on-site at the Springs Preserve and elsewhere in the Las Vegas valley. Because children and their families can see the actual animals featured in the stories, they can make significant emotional and cognitive connections that can result in an active desire to understand and protect animals and wildlife in their natural habitat.

By connecting children to nature through these graphic stories, we expect to see an increased desire to explore the nearly seven million acres of public lands surrounding Las Vegas. Participants will be
more likely to take active advantage of the numerous natural areas and trails created by Clark County and the cities of Las Vegas, Henderson, and North Las Vegas. These graphic stories will be available as podcast installments and web-strips on a website created by the Public Lands Institute. This website will feature a rich, engaging environment especially appealing for children 8-11 years old. Children will be able to post stories and pictures about their experiences in nature, ask questions, and find ideas and information about near-by nature. Natural history information will be available in videos (featuring local experts) and PDF files. Family activity packets will be available for download that will convey natural and cultural history facts about the animals and their relationship to the Mojave desert, contain maps and ideas about places to explore, and include activities for families to engage in while in near-by nature. A teacher resource section will help teachers make curricular connections, provide supplemental activities, and include a calendar with training and other professional development opportunities related to the natural and cultural history of the Mojave.

The graphic stories will also be produced as full-color publications available for purchase at the Springs Preserve and other locations.

The four proposed graphic stories include: (1) the Story of Gill, the gila monster who found a new home; (2) the role of the damselfly in the Las Vegas water cycle; (3) the story of a young Gambel’s quail at the Springs Preserve; and (4) the role of the grey fox in the Mojave desert ecosystem.

The Springs Preserve, the School-Community Partnership Program (CCSD) and the Curriculum and Professional Development Center (CCSD) fully supports this project.

Objectives:
Children engaged by this project will:

Learn: The natural history of four Mojave Animals: gila monster, damselfly, Gambel’s quail, and grey fox. Understand that these animals want food and a safe place to live, just like us.

Feel: Excited to learn about the Mojave and a positive feeling towards these animals. Instill a desire to care for and protect animals living on public lands.

Do: Visit these animals at the Springs Preserve, look for information about other Mojave wildlife, seek out natural places, and care for our public lands.

b. CE&I products and services for the focus project will be created and implemented by PI/Project Manager, with assistance from the Curriculum Development Personnel, the UNLV graduate student, and Media Relations. UNLV fiscal and clerical personnel will assist the PI/Project Manager with ordering, tracking, and documenting the purchase and delivery of required materials, supplies, and equipment. Agency personnel will assist in project execution. Each project will be completed by May 31 of each year (2008 and 2010, respectively).

The first graphic novel, The Story of Gill, has been approved by Jennifer Haley of the SNAP Education group.

The Genre:

This style of novel appeared in the 1950s and 1960s. It was the collection of comic strips written into a longer story to be book length. There has been a recent revival in this media in the last decade. Increases in books went up 500% from 2001 to 2007, now making this a close to $4 million dollar
More importantly, kids are really reading these novels. They have an appeal that catches children’s attention and makes them take notice.

The Artists:
The Fillbach Brothers are well known in the comic book world and are currently the artists for the Star Wars graphic novel series. As residents of Las Vegas, they are willing to work on this project because of the educational messages this project will convey.

Gill is taken from the wild illegally. He is rescued from the poacher by state wildlife agents and given to the Barrick Museum of Natural History, where he is cared for by herpetologist Alex Heindl. Alex uses Gill in educational events all over the valley. The poacher that originally took Gill from the wild tries to steal him back from the Museum (this is the fiction part), but Gill escapes from the bad guy, who of course, goes to jail. Alex retires and Gill moves on to the Springs Preserve where he is today. There will be a graphic portion of the story followed by the natural history of the gila monster and information about the illegal trade in wildlife.

Project Assessment:
Success of this project can be measured in a variety of ways. Outputs that will be measured include the number of visitors to the website, the number of podcasts and webstrips downloaded, the number of family activity packets downloaded, and the number of books sold.

Outcomes can be measured by utilizing an assessment tool to quantify website participation, including submission of pictures, experiences, and questions.

We will also measure success by holding a variety of events centered on the graphic stories, including book signings by the artists, Family & Nature days, and interpretive hikes.

c. SNAP Executive Director will provide briefings to the SNAP Board of Directors on proposed private sector educational projects.

The project has been submitted to the SNAP Executive Director.
Canyon River Adventures, has completed the Nevada State Certification in Environmental Education and Interpretation Program this summer. Her internship project will be to develop and implement a training program for river guide staff. This training can incorporate SNAP messages. This project will be defined by August 31, 2009, and implemented during the 2009-2010 fiscal year.

An on-line media/podcast project has been initiated in partnership with the Las Vegas Springs Preserve, featuring a series of graphic stories featuring animals found in the Mojave Desert surrounding the Las Vegas Valley.

**Project 1 – Task 5. Work with the Hispanic community to implement at least two educational projects.**

a. PLI staff, in coordination with the appropriate agency staff, will identify at least one project for delivering SNAP priority focus area messages to Hispanic community. Examples of potential projects include interpretive projects and educational programs delivered at community events. Project identification will be completed by January 31, 2009.

The Hispanic Outreach Strategy (Figure 1) includes: (1) implementing targeted education programs; (2) developing communication tools; (3) communicating with community leaders; and (4) participating in community events (see attachment: Hispanic Communications Plan).

![Diagram](attachment: Hispanic Communications Plan.png)

**Figure 1: Graphic explaining the Hispanic Communications Strategy**
1. Implementing Targeted Education: the SNAP Families & Nature Multicultural Program for 2009

Allison Brody, Amanda Rowland (SNAP Education), Patricia Mynster (US FS), and Irma Wynants (Cultural Specialist for Clark County Winchester Cultural Center) planned and implemented three Families & Nature events this quarter, targeting families with the Michoacán Association.

Planning meetings were held April 2, April 16, and April 29 (notes and planning documents are posted at http://grovesite.com) to prepare for the events.

The first event incorporating “Families & Nature” activities was the Dia De Nino Festival held on April 25, 2009 at the Winchester Cultural Center. Nature Passports were developed (posted at http://grovesite.com) for the six SNAP activities at the Festival. As the children and their families completed each of the activities, their passport was stamped. Families with completed passports became eligible to participate in the remaining two 2009 Families & Nature events. Approximately 500 people attended the festival, with over 50 people participating in the SNAP Families & Nature activities.

These 50 people attended the second Families & Nature event, held on May 16 at Winchester Cultural Center. The purpose of this event to prepare the group for the culminating field trip to the Spring Mountains, understand logistical needs (especially pertaining to lunch), and participate in a variety of learning activities to introduce concepts related to the Spring Mountains field trip. The overall theme for the day was how climate affects plants, animals and people and comparing climatic conditions of the Spring Mountains with that of Las Vegas.

2. Communication Tools

Several communication tools have been approved and developed, including: comic books, Spanish language displays, and children’s activities to communicate various SNAP messages, including anti-litter, safety, and responsible use. Additionally, the SNAP Board is exploring the pros and cons of developing a Spanish language website for this audience.

3. Meeting Community Leaders

The success of SNAP’s Hispanic Outreach efforts will depend on community awareness and buy-in. Therefore, meetings have been scheduled with community leaders to make them aware of SNAP’s outreach efforts as it pertains to connecting people to the surrounding public lands and promoting responsible use. To date, Maria Marinch (President of Language Sources) and Allison Brody have met with: Mariano Lemus Gas, the Consul General de Mexico on October 14, 2008; with Eddie Escabedo, chairman and publisher of the El Mundo Newspaper; and Victoria Napoles-Laza, Senior Executive Vice President, and Otto Merida, President and CEO of the Latin Chamber of Commerce (March 13, 2009).

4. Participating in Community Events

Language Sources and Public Lands Institute represented SNAP at the Univision-sponsored Mexican Family Day on May 17, 2009. It was anticipated that 7,000 people would be in attendance.

Two children’s activities were piloted at this event: “Up and Down” (see attached) and Dunk the Trash, about litter in the environment.

b. CE&I products and services for the focus project will be created and implemented by PI/Project Manager, with assistance from the Curriculum Development Personnel, the UNLV
As described above.

c. PLI staff, in collaboration with agency staff, will identify additional potential projects or services suggested by follow-up stakeholder meetings. This will be done by November 30, 2009.

Meetings with community leaders have helped inform both products and activities. For example, Mariano Lemus Gas, the Consul General de Mexico, suggested the creation of comic books as a culturally appropriate way to communicate stewardship messages for both children and adults. Additionally, Otto Merida, President and CEO of the Latin Chamber of Commerce, appreciated the way that the Families & Nature programs were being planned with the community, and reinforced the importance of both asking the community to participate while at the same time responding to community needs.

d. PI/Project Manager, with assistance from the Curriculum Development Personnel, the UNLV graduate student, Media Relations, general clerical support, and agency personnel will create and implement one additional program or service for the Hispanic community, evaluating success and documenting milestones in a written report. This will be completed by January 31, 2011.

A different set of Families & Nature events, targeting a different segment of the population, will be planned for 2010.

e. PI/Project Manager will enlist the services of professional social researchers to create and implement a survey and monitoring program of the Hispanic community. Initial survey will focus on visitors to areas selected by the SNAP Board of Directors. Preliminary survey results will be provided to the SNAP Board of Directors as they become available. The results will be used to guide Hispanic messaging and outreach program development and implementation. The messaging and outreach program will be implemented by PI/Project Manager Allison Brody, with assistance from contracted marketing specialists, the UNLV graduate student, Media Relations, and Web Communications. UNLV fiscal and clerical personnel will assist the PI/Project Manager with ordering, tracking, and documenting the purchase and delivery of required materials, supplies, and equipment. Agency personnel will assist in product development, review, and execution within their agency educational programs. Agency personnel will assist in project development and implementation.

The SNAP Recreation team has provided final approval for the research project, which was submitted to OMB for review (the full OMB proposal is posted at http://grovesite.com).

a. A database will be created by contracted personnel, and the results of the survey and monitoring program will be entered into this database. A step-by-step resource guide for connecting with Hispanic communities will be completed based on this research by January 31, 2011.

This task refers to subsequent years. No progress has been made this quarter.
Accomplishments for Task 5 – Year 2

- A total of 500 people participated in activities featuring SNAP messages at the Michoacan Cultural Festival.
- A total of 11,000 people attended the Day of the Dead festival. SNAP created an Ofrenda for the festival to communicate a water safety message.
- More than 50 people have participated in two SNAP Families & Nature Multicultural events. A third event will bring these families on an educational field trip to the Spring Mountains on June 20, 2009.
- Several thousand people attended the Mexican Family Day festival. The SNAP booth at that festival featured children’s activities with anti-litter and other responsible-use messages.
- Communication tools have been created, including Spanish-language displays, activities, and comic books.
- Three meetings have been held with community leaders at El Mundo, the Mexican Consulate, and the Latin Chamber of Commerce.
- A research proposal has been submitted to OMB.


a. Administer educators’ listserv on a monthly basis, with assistance of Media Relations and Web Communications personnel and input from agency staff.

Listserv postings have been upgraded to a blog format. Postings and associated information can be viewed at www.enviroedexchange.org.

b. Facilitate bi-monthly meetings for Partners for Education about the Environment, a collaborative group of informal educators from more than 20 informal education organizations in the Las Vegas area, including representatives from each of the four federal agencies.

Subtasks (b) – (d) depended on the viability of the Partners for Education about the Environment. As time has passed, the Partners group has not proven to be a stable group. However, CHOLLA has been more active in regional educational efforts of importance to Partners for Education about the Environment. As a result, PLI has chosen to work with CHOLLA to assist in the implementation of two important focus areas: (1) implement a Field Trip Transportation Strategy with the CCSD Transportation office, which was successfully completed by December 2008; and (2) develop a Program Matrix for communicating to CCSD administrative staff the available expertise offered through the informal education sector (in process).

c. Appropriate agency staff will attend Partners for Education about the Environment meetings and work collaboratively to identify regional education focus and efforts.

A Program Matrix has been completed (posted at http://grovesite.com), and is pending approval by CHOLLA members at the June 16, 2009 meeting.

d. Implement stated goals (listed below) for Partners for Education about the Environment with assistance from Media Relations, general clerical support, agency personnel, and the UNLV graduate student.

See above.
Accomplishments for Task 6 – Year 2

- An EE&I blog has been created and maintained at www.enviroedexchange.org.
- An EE&I program matrix has been created, pending approval by CHOLLA members.
- A Field Trip Transportation Strategy has been implemented.
- A meeting was held on March 5, 2009 to investigate CE&I opportunities as they relate to the No Child Left Inside Act and Nevada’s Environmental Literacy Plan, being spear-headed by Richard Vineyard (Science Director, Nevada Department of Education). The No Child Left Inside legislation may ultimately be able to provide funding and sustainability to many of the SNAP field trip and teacher training programs.

Project 1 – Task 7. Develop Public Awareness Campaign to inform residents about the benefits of our public lands; encourage residents to learn about the plants, animals, rocks, and the natural and cultural history of Southern Nevada; and motivate people of all ages to responsibly explore outdoor recreational opportunities on public lands.

a. Conduct pre- and post-surveys to measure resident awareness levels. Pre-survey to be completed by August 31, 2008. Post-surveys to be completed by July 31, 2009 and April 30, 2010.

Due to the necessity of submitting this project through the OMB approval process, we have recommended developing the Public Awareness Campaign without first measuring resident awareness levels.

b. PLI and SNAP staff will participate in the development of a public awareness campaign, which includes but is not limited to creative strategy, production, distribution and evaluation. Campaign development will be completed by August 31, 2008 and implemented by January 5, 2009.

Progress on this task has been hindered by the following:

1. After evaluating this task, the Public Lands Institute made the decision not to assess public awareness. This decision was made primarily due to the constraints of the OMB process.
2. SNAP has not approved the over-arching themes and messages that a successful campaign requires.

However, a SNAP Messaging workshop, facilitated by Dr. Sam Ham, was held on March 25, 2009. Twenty-five people attended, including members of the SNAP Education, Anti-Litter, Wilderness, Recreation, Law Enforcement, and PAO teams.

SNAP Message workshop attendees (March 25, 2009):

A follow-up workgroup met on April 13, 2009 to finalize the work begun on March 25. Workgroup members included: Allison Brody, Jennifer Haley, Lori Headrick, Hillerie Patton, LaNelda Rolley, Angelina Yost.
The workgroup produced an overarching message and two sub-messages (one for OHV and one for Wilderness – see below). These messages have met the approval of the SNAP Board and various SNAP staff members. Angelina Yost will present the proposed messages at the SNAP Team Lead meeting on July 16, 2009.

Proposed Overarching Message

*Our public lands surrounding the Las Vegas Valley hold inspiring natural and historical treasures for us to enjoy today; create lasting memories for tomorrow; and take care of forever.*

The word “us” in this message can be changed according to the audience. For example, it can be substituted with “families”, “children”, and “communities.”

**Enjoy Today**
Public Lands are yours to explore and enjoy
(SNAP recreation map)

**Create Lasting Memories for Tomorrow**
This part of the message can be communicated through:

**Your Public Lands Bill of Rights (for Adults)**
- Camp under the stars
- Watch the sun set over the mountains
- Celebrate Nevada’s heritage
- Walk through a slot canyon
- Discover nature
- Have a picnic you will remember
- Play in the water
- Catch and release a fish
- Wonder at a petroglyph

**The Kids’ Public Lands Bill of Rights**
- Camp under the stars
- Celebrate Nevada’s heritage
- Discover nature
- Watch a lizard do push-ups
- Follow a trail
- Play in the dirt
- Splash in the water
- Have a picnic outdoors
- Catch and release a fish

**Take Care of It!**
- Volunteer and make the land your own (Get Outdoors Nevada)
- Stay on trails
- Don’t trash the neighborhood (Don’t Trash Nevada)
- Be careful with fires
- Don’t move non-native plants or animals -- Native nature only!
- Know before you go
Additional Messages

I. OHV
   You have the power to enjoy and take care of our public lands by staying on designated trails.

II. WILDERNESS
   Wilderness: Wild and wonderful opportunities are not far away - so enjoy, explore, and help take care of it.

c. PLI and SNAP staff will develop promotional vehicles to reach target audiences onsite by January 5, 2009.

   Progress on this task has been hindered by the fact that SNAP has not yet approved the over-arching themes and messages that a successful campaign requires.

d. PLI staff will produce a written assessment report of the effectiveness of the public awareness program. This will be completed by May 2010.

   Progress on this task has been hindered by the fact that SNAP has not approved the over-arching themes and messages that a successful campaign requires.

Accomplishments for Task 7 – Year 2
PLI has assisted SNAP in the development of messages.

Project 1 – Task 8. Develop Mobile Exhibit program to deliver SNAP messages.

a. PI/Project Manager will coordinate the development and construction of three-dimensional museum-quality exhibits with graphical elements and supporting educational materials, with assistance from the Curriculum Development Personnel, the UNLV graduate student, and Media Relations. SNAP and agency staff will assist in project development and implementation, message and graphic design development, and with the design of quality assurance protocols to ensure the consistent and effective use of the exhibit program. This will be completed by May 31, 2010.

   Planning documents (including budget, an implementation plan, an exhibit plan, and a training plan) are in process, including a way to understand what visitors understand about the messages we want to include in the exhibit.
SNAP Mobile Exhibit Project
Community reaches beyond the built environment

THEMATIC TITLE: Expand Horizons, Experience Community... Naturally

The Mobile Exhibit: With thoughtful planning and careful design this exhibit will deliver messages important to SNAP agencies in an unprecedented way for Southern Nevada. This exhibit will reach audiences where they are with a safe, provocative experience that will provide more than just information. It will connect current users of public lands to public lands in a deeper, more meaningful way. It will allow visitors to EXPERIENCE the importance of responsible use, exploration, and enjoyment of our Public Lands.

<table>
<thead>
<tr>
<th>Major Thematic Components</th>
<th>OBJECTIVES: By the end of the experience, visitors will:</th>
<th>Key Messages</th>
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| 1. Southern Nevada’s natural & cultural environment | - be able to list ways that the built environment connects with the local natural environment.  
- understand that a connection to the local natural environment is important to their quality of life.  
- show an interest in the natural and cultural history by seeking out local resources. | - This community reaches into the natural environment... Get to know your neighbors  
- Nevada’s natural environment is a living, dynamic landscape that quality of life depends on  
- Healthy communities depend on healthy environments |
| 2. Fostering sense of place | - feel connected to public lands.  
- recognize the variety of ways that community members connect with public lands. | - Our places tell your stories  
- Our Mojave, Our home, Your choice  
- The Mojave is where your life is happening. Make it personal, make it home |
| 3. The impacts of our actions | - be able to identify an invasive species and its consequences.  
- understand the aesthetic and health impacts of litter on public lands.  
- be able to identify the purpose of designated trails.  
- be able to list the consequences of recreating off-trail.  
- gain skills and knowledge for responsible recreation.  
- make decisions that reduce | - (CALL TO ACTION) The Mojave is yours, don’t desert it – Take it personally, value this place for future generations.  
- Choose your story – the choices you make matter to all of us. |
• learn ways in which they can get involved with local stewardship efforts.

**Accomplishments for Task 8 – Year 2**

The SNAP Mobile Exhibit Planning Committee has completed or are in process of completing the following planning:
- Exhibit Theme, goals, messages, objectives, and stories have been proposed
- Scheduling/Implementation Calendar
- Position descriptions/training plan
- Exhibit plan

**Project 1 – Task 9. Investigate potential delivery systems for integrating SNAP messages into the Clark County School District.**

Three focus groups were held with CCSD administrators and staff to discuss and understand potential delivery systems for integrating SNAP messages into the CCSD School District.

Administrators were invited in March 2009 (see attached Contacts and Desired Attendees and Focus Group Invitation). Thirteen administrators confirmed attendance, and eleven were able to actually attend the first focus group, held May 2, 2009 (see attached attendance sheet). Allison Brody (PLI) and Amy Page (PLI) facilitated the focus group discussion sessions and related activities. Amanda Rowland (SNAP Education) recorded responses. The overall agenda and compiled responses are posted at [http://grovesite.com](http://grovesite.com).

Teachers were also invited beginning March 2009. Attendance was cut off when more than forty teachers confirmed attendance. Two sessions were scheduled: one for the afternoon of May 2, and one for the evening of May 12, 2009 (see attached attendance sheet). Allison Brody (PLI) and Amy Page (PLI) facilitated the focus group discussion sessions and related activities. Amanda Rowland (SNAP Education) and Allyson Butler (PLI) recorded responses. The overall agenda and compiled responses are posted at [http://grovesite.com](http://grovesite.com).

The results from these three focus groups have been analyzed, resulting in the development of “SNAP CE&I: Recommendations for Creating and Delivering Programs to the Clark County School District,” posted at [http://grovesite.com](http://grovesite.com).

**Accomplishments for Task 9 – Year 2**

Three focus groups were held with CCSD administrators and teachers, resulting in the development of recommendations for creating and delivering programs to the Clark County School District.

a. PI/Project Manager, in cooperation with the Nevada Natural Resource Education Council, will facilitate the implementation of the Nevada State Certification Program for Environmental Education and Interpretation (NEE&I). Certification program components will include: recruitment and registration of Certificate Program participants; four workshops for Certification program participants; mentor-training workshops; and supervised internships for Certification program participants. SNAP and agency staff will provide review of certificate standards. Curriculum will be developed for the pilot program by May 31, 2008.

Twenty four people from both the summer 2008 and fall 2008 cohorts successfully completed all requirements and received Certificates in Environmental Education & Interpretation from NEEI during a graduation ceremony held May 14, 2009.

b. PI/Project Manager will facilitate the planning and implementation Our Places Tell Stories conference. Conference components will include: identification and invitation of speakers, including a keynote; recruitment and registration of participants; creation of conference program; and facility logistics (food, rooms, set-up, etc.). The conference will be held on March 4-6, 2008. If sufficient sponsorships are procured, it will be possible to hold an additional conference before May 2010.

The current economic climate and budget restraints are impacting many agencies, and it was found that projected participation in the June conference was well below the level necessary for success. The conference planning committee therefore made the decision to honor peoples’ circumstances and concerns and reschedule the conference for spring 2010.

An exploratory conference committee planning meeting will be scheduled for June 2009 to consider options for a 2010 OPTS conference.

Accomplishments for Task 7 – Year 2

- Twenty-four people have completed 45 hours of coursework and an internship to become certified Nevada State Environmental Educators & Interpreters
- Sierra Nevada Journeys took the lead in planning an OPTS conference for Lake Tahoe in June 2009; due to lack of attendance, it has been proposed that this conference be rescheduled for spring 2010.
### SUMMARY OF YEAR 2 (ROUND 6) DELIVERABLES – CE&I

<table>
<thead>
<tr>
<th>Year Two Deliverables (June 2008 – May 2009)</th>
<th>Percent Complete as of August 31, 2008</th>
<th>Plan for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project 1 – Task 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Identify at least one project each year to focus efforts.</td>
<td>100% for Year 2</td>
<td>One project has been identified: responsible OHV recreation.</td>
</tr>
<tr>
<td>b. SNAP Executive Director and PLI staff will work with SNAP Board of Directors to determine focus areas and context of delivery of messages for these focus areas.</td>
<td>100% for Year 2</td>
<td>Complete</td>
</tr>
<tr>
<td>c. Determine the best set of delivery systems for each project.</td>
<td>100% for Year 2</td>
<td>A Zone Map /Information Packet.</td>
</tr>
<tr>
<td>d. Key user groups and best educational methodologies will be identified for each project.</td>
<td>80% for Year 2</td>
<td>Zone Map and Promoting Persuasion in Protected Areas will be implemented.</td>
</tr>
<tr>
<td>e. CE&amp;I products and services for the focus project will be created and implemented.</td>
<td>0% for Year 2</td>
<td>SNAP has not created or produced the Zone Map / Information Packet.</td>
</tr>
<tr>
<td><strong>Project 1 – Task 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Produce assessment proposals and reports for at least two CE&amp;I products or services.</td>
<td>This refers to subsequent years</td>
<td>An evaluation workshop was held February 26-27, 2009.</td>
</tr>
<tr>
<td><strong>Project 1 – Task 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document number of people reached by CE&amp;I programs and services of the four federal agencies and cooperating partners.</td>
<td>100% for Year 2</td>
<td>Individual agencies are responsible for using data collection forms and protocols.</td>
</tr>
<tr>
<td><strong>Project 1—Task 4</strong></td>
<td>Complete for Year 1</td>
<td>Will identify and implement additional project beginning in August 2009.</td>
</tr>
<tr>
<td><strong>Project 1 – Task 5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Identify project for delivering SNAP priority focus area messages to Hispanic community.</td>
<td>100%</td>
<td>One project has been identified: to plan and deliver a series of events around the theme of “Families in Nature” with the Clark County Winchester Cultural Center.</td>
</tr>
<tr>
<td>b. Create and implement project.</td>
<td>100%</td>
<td>Two Families &amp; Nature events have been held. Communication tools have been created and implemented. Three meetings with community leaders have been held.</td>
</tr>
<tr>
<td><strong>Project 1 – Task 6</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>a. Administer educators’ listserv.</td>
<td>Continuous</td>
<td>Listserv postings and associated website updates/blog have been completed.</td>
</tr>
<tr>
<td>b. Facilitate Partners for Education about the Environment meetings.</td>
<td>Continuous</td>
<td>Environmental Literacy Planning, Conference Planning, CHOLLA</td>
</tr>
<tr>
<td>c. Appropriate agency staff will attend Partners for Education about the Environment meetings.</td>
<td>Continuous</td>
<td>SNAP CE staff is involved with Environmental Literacy planning and CHOLLA</td>
</tr>
</tbody>
</table>
| d. Implement stated goals (see overview section) for Partners for Education about the Environment. | Continuous | 1. Two NEE&I cohorts on schedule for completion  
2. CHOLLA Transportation strategy implemented  
3. CHOLLA matrix of program offerings completed |

**Project 1 – Task 7**

Develop a media plan and budget for the implementation of the public awareness campaign.  
15% | SNAP will agree on proposed messages by the July 16 team leader meeting |

**Project 1 – Task 8**

Coordinate the development and construction of three-dimensional museum-quality exhibits with graphical elements and supporting educational materials.  
35% | SNAP Board approval has been obtained, planning documents are in process. |

**Project 1 – Task 9**

Investigate potential delivery systems for integrating SNAP messages into the Clark County School District.  
100% | SNAP CE&I: Recommendations for Creating and Delivering Programs to the Clark County School District,” posted at http://grovesite.com. |

**Project 1 – Task 10**

Develop a Nevada State EE&I Certificate Program and conduct an Our Places Tell Stories Conference.  
100% | Two cohorts near completion. OPTS successfully held March 2008. |
FOREVER EARTH PROGRAM

The following progress has been made toward Forever Earth project objectives in this quarter.

Project 2 – Task 1. Coordinate and schedule Forever Earth uses.

a. Revise Forever Earth Standard Operating Procedures (SOPs; Sewing et. al., 2006) and produce revised SOP edition.

This task was completed in the first quarter for Year 2.

b. Provide training on revised SOPs for boat captains and deckhands. This activity will be completed by September 30 of each year.

This task was completed in the second quarter for Year 2.

c. Maintain Forever Earth website and update content.

Changes made this quarter to the Forever Earth website included adding pre- and post-trip activities for each grade level curriculum and minor updates. Additionally, REI and Outside Las Vegas Foundation were recognized on the home page for the $10,000 grant award for bus transportation expenses for schools participating in Forever Earth field trips.

Accomplishments for Task 1 – Year 2

1. Forever Earth Standard Operating Procedures (SOPs). The Forever Earth SOPs were updated and revised during the first quarter of Year 2. Minor changes reflected new information or safety considerations. A copy of the SOPs is located in the main cabin of Forever Earth.

2. Training for Forever Earth crew and staff. Training for all boat crew and program facilitators from the Public Lands Institute and the National Park Service was conducted on October 7, 2008. Man overboard and fire drills were conducted as well as training on the standard operating procedures. The station bill was reviewed by all staff.

3. Website updates. Minor changes to the website were made throughout the year and finalized by May 31, 2009.

Project 2 – Task 2. Schedule and deliver educational programming for a minimum of 25 trips.

a. Coordinate with Clark County School District teachers as well as private school teachers and home school educators to schedule a minimum of 25 educational trips on Forever Earth. This will be completed by May 31 of each year.

In the fourth quarter, 1953 passengers benefited from educational programming during 51 trips aboard Forever Earth. These are detailed in the following table. Highlights of Forever Earth educational use included:

- Fourth-graders from Cumorah Academy, Vanderburg Elementary School, and Vail Pittman Elementary School learned about Lake Mead’s water use cycle.
• Fifth-grade students from Lummis, Paradise, Twitchell, Martha P. King, Betsy Rhodes, Robert Taylor, Reedom, Rose Warren, and Bendorf Elementary Schools learned about the suitability of Lake Mead’s habitat for razorback suckers.

• GATE (Gifted and Talented) students from Wright, Marc Kahre, and Hollingsworth Elementary Schools participated in the Alien Invaders activities to investigate quagga mussels and their impacts on Lake Mead’s environment.

• Personnel from the Las Vegas Wash Coordinating Committee facilitated activities for fifth-grade students from three elementary schools.

• Sixth-grade students from Cumorah Academy, Garrett Junior High School, Grant Sawyer and Hyde Park Middle Schools participated in the Alien Invaders activities to investigate quagga mussels and their impacts on Lake Mead’s environment.

• Training for Public Lands Institute facilitators was conducted on March 9, 2009.

• The National Park Service conducted a familiarization trip for law enforcement personnel on March 25, 2009.

• A teacher workshop, Science through Sketching, conducted by Clark County School District personnel was held on May 9, 2009.

• “Listening” sessions hosted by the Public Lands Institute on May 2 and May 12, 2009. Participants included teachers and administrators from Clark County School District.

(NOTE: See attached for listings of all Forever Earth trips conducted during the 4th Quarter and during Year 2.)

### Forever Earth Education Trips – Year 2 (Round 6), 4th Quarter

<table>
<thead>
<tr>
<th>Date(s)</th>
<th>Group</th>
<th>Group Type</th>
<th>Trip Purpose</th>
<th>Length of Trip</th>
<th># of Adults</th>
<th># of Students</th>
<th>Total Pass.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Mar</td>
<td>Wright ES GATE (4th and 5th grades)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>19</td>
<td>26</td>
<td>45</td>
</tr>
<tr>
<td>3-Mar</td>
<td>Cumorah Academy (6th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>11</td>
<td>23</td>
<td>34</td>
</tr>
<tr>
<td>4-Mar</td>
<td>Wright ES GATE (4th and 5th grades)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>4</td>
<td>19</td>
<td>23</td>
</tr>
<tr>
<td>6-Mar</td>
<td>Mabel Hoggard Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>23</td>
<td>31</td>
</tr>
<tr>
<td>9-Mar</td>
<td>Public Lands Institute</td>
<td>Education</td>
<td>Staff Training</td>
<td>3.5 hrs.</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>12-Mar</td>
<td>Mabel Hoggard Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>25</td>
<td>33</td>
</tr>
<tr>
<td>16-Mar</td>
<td>Lummis Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>20</td>
<td>31</td>
<td>51</td>
</tr>
<tr>
<td>17-Mar</td>
<td>Bridger MS (7th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4.25 hrs. (2 trips)</td>
<td>9</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>18-Mar</td>
<td>Bridger MS (7th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4.25 hrs. (2 trips)</td>
<td>4</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td>19-Mar</td>
<td>Bridger MS (7th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4.5 hrs. (2 trips)</td>
<td>7</td>
<td>37</td>
<td>45</td>
</tr>
<tr>
<td>20-Mar</td>
<td>Paradise ES</td>
<td>Education</td>
<td>Student Field</td>
<td>3.5 hrs.</td>
<td>8</td>
<td>37</td>
<td>45</td>
</tr>
<tr>
<td>Date</td>
<td>School</td>
<td>Grade</td>
<td>Trip Type</td>
<td>Duration (hrs)</td>
<td>Hours</td>
<td>Minutes</td>
<td>Total Minutes</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------</td>
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<td>----------------------------------</td>
<td>----------------</td>
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</tr>
<tr>
<td>26-Mar</td>
<td>Twitchell ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>17</td>
<td>32</td>
<td>49</td>
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<tr>
<td>27-Mar</td>
<td>Paradise ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>3.5</td>
<td>7</td>
<td>47</td>
<td>54</td>
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<tr>
<td>30-Mar</td>
<td>Haikal Islamic Academy</td>
<td>7th grade</td>
<td>Student Field Trip</td>
<td>3.5</td>
<td>5</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>31-Mar</td>
<td>Marc Kahre ES</td>
<td>4th and 5th grade GATE</td>
<td>Student Field Trip</td>
<td>4.5</td>
<td>21</td>
<td>36</td>
<td>57</td>
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<tr>
<td>1-Apr</td>
<td>M.P. King ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>6</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>2-Apr</td>
<td>Betsy Rhodes ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4.5</td>
<td>10</td>
<td>23</td>
<td>33</td>
</tr>
<tr>
<td>13-Apr</td>
<td>Cumorah Academy (4th grade)</td>
<td></td>
<td>Student Field Trip</td>
<td>4</td>
<td>6</td>
<td>19</td>
<td>25</td>
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<tr>
<td>14-Apr</td>
<td>Reedem ES</td>
<td>4th/5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>10</td>
<td>24</td>
<td>34</td>
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<tr>
<td>15-Apr</td>
<td>Robert Taylor Elementary</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>4</td>
<td>23</td>
<td>27</td>
</tr>
<tr>
<td>16-Apr</td>
<td>Robert Taylor Elementary</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>4</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>17-Apr</td>
<td>Robert Taylor Elementary</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>4</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>20-Apr</td>
<td>Garrett JHS</td>
<td>7th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>6</td>
<td>21</td>
<td>27</td>
</tr>
<tr>
<td>22-Apr</td>
<td>Martha P. King ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>3.5</td>
<td>6</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>23-Apr</td>
<td>Garrett JHS</td>
<td>7th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>6</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>24-Apr</td>
<td>Garrett JHS</td>
<td>7th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>7</td>
<td>39</td>
<td>46</td>
</tr>
<tr>
<td>27-Apr</td>
<td>Rose Warren ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>3.75</td>
<td>13</td>
<td>44</td>
<td>57</td>
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<tr>
<td>28-Apr</td>
<td>Martha P. King ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>11</td>
<td>27</td>
<td>38</td>
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<tr>
<td>29-Apr</td>
<td>Martha P. King ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>11</td>
<td>29</td>
<td>40</td>
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<tr>
<td>30-Apr</td>
<td>Grant Sawyer Middle School</td>
<td>6th grade</td>
<td>Student Field Trip</td>
<td>3.5</td>
<td>13</td>
<td>49</td>
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</tr>
<tr>
<td>1-May</td>
<td>Rose Warren ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>10</td>
<td>43</td>
<td>53</td>
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<tr>
<td>2-May</td>
<td>Public Lands Institute</td>
<td></td>
<td>CCSD Focus Groups</td>
<td>6</td>
<td>27</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>4-May</td>
<td>Rose Warren ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>3.75</td>
<td>12</td>
<td>46</td>
<td>58</td>
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<tr>
<td>5-May</td>
<td>Martha P. King ES</td>
<td>5th grade</td>
<td>Student Field Trip</td>
<td>4</td>
<td>13</td>
<td>27</td>
<td>40</td>
</tr>
<tr>
<td>6-May</td>
<td>Hyde Park Middle School</td>
<td></td>
<td>Education</td>
<td>4</td>
<td>12</td>
<td>36</td>
<td>48</td>
</tr>
<tr>
<td>Date</td>
<td>School (6th grade)</td>
<td>Trip</td>
<td>(2 trips)</td>
<td>Hours</td>
<td>52</td>
<td></td>
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<td>--------</td>
<td>--------------------------------------------------------</td>
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</tr>
<tr>
<td>7-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education Student Field Trip</td>
<td>4 hrs.</td>
<td>12</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education Student Field Trip</td>
<td>4 hrs.</td>
<td>15</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-May</td>
<td>RPDP Teachers -- CCSD</td>
<td>Education Teacher Workshop</td>
<td>6.5 hrs.</td>
<td>16</td>
<td>0</td>
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</tr>
<tr>
<td>11-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education Student Field Trip</td>
<td>4.75 hrs.</td>
<td>9</td>
<td>51</td>
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</tr>
<tr>
<td>12-May</td>
<td>Hollingsworth ES GATE Grades 4 &amp; 5</td>
<td>Education Student Field Trip</td>
<td>3.75 hrs.</td>
<td>4</td>
<td>23</td>
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<td></td>
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<tr>
<td>12-May</td>
<td>Public Lands Institute</td>
<td>Education CCSD Focus Groups</td>
<td>3.75 hrs.</td>
<td>15</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-May</td>
<td>Bendorf ES (5th grade)</td>
<td>Education Student Field Trip</td>
<td>4 hrs.</td>
<td>12</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14-May</td>
<td>Bendorf ES (5th grade)</td>
<td>Education Student Field Trip</td>
<td>4 hrs.</td>
<td>8</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-May</td>
<td>Vanderburg ES (4th grade)</td>
<td>Education Student Field Trip</td>
<td>4.5 hrs.</td>
<td>12</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education Student Field Trip</td>
<td>5 hrs.</td>
<td>7</td>
<td>41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education Student Field Trip</td>
<td>5 hrs.</td>
<td>7</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education Student Field Trip</td>
<td>5 hrs.</td>
<td>7</td>
<td>33</td>
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</tr>
<tr>
<td>21-May</td>
<td>Vail Pittman ES (4th grade)</td>
<td>Education Student Field Trip</td>
<td>4 hrs.</td>
<td>4</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27-May</td>
<td>Twitchell ES (5th grade)</td>
<td>Education Student Field Trip</td>
<td>4 hrs.</td>
<td>8</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28-May</td>
<td>Twitchell ES (5th grade)</td>
<td>Education Student Field Trip</td>
<td>4 hrs.</td>
<td>17</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29-May</td>
<td>Twitchell ES (5th grade)</td>
<td>Education Student Field Trip</td>
<td>4 hrs.</td>
<td>8</td>
<td>30</td>
<td></td>
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</tr>
<tr>
<td><strong>TOTALS for 4th quarter</strong></td>
<td><strong>51 groups</strong></td>
<td><strong>Education -- 51 groups</strong></td>
<td><strong>Education -- 210.75 hrs.</strong></td>
<td><strong>507</strong></td>
<td><strong>1446</strong></td>
<td><strong>1953</strong></td>
<td></td>
</tr>
</tbody>
</table>

b. Review and revise existing Forever Earth curricula (Sewing et. al, 2006) and produce 2007-2008 Edition. This will be completed by May 31 of each year, beginning in 2008.

The 2007-2008 Edition was completed by May 31, 2008.

Revisions were made to the curricula and the 2008-2009 Edition was completed on time (posted at http://grovesite.com). New activities were added.
c. Drawing upon the expertise of university faculty and staff, develop and produce one additional curriculum module for sixth-grade students.

This activity was completed in Year 1.

d. Identify and purchase any needed program materials, supplies, equipment, and/or visual aids required for delivering the curriculum. This will be completed by May 31, 2008.

This activity was completed in Year 1.

e. Develop a partnership with one of the agencies responsible for water quality monitoring for integrating data collection performed by high school students into an ongoing research database.

Over the past four years of operation, Forever Earth has not been used consistently by high school groups. The need for this activity does not exist. Each year this task will be re-evaluated to determine its need for development.

f. Develop one additional curriculum module for fifth-grade students.

A new activity was developed for the fifth-grade curriculum (Forever Earth Curriculum, 2008-2009 edition, is posted at http://grovesite.com).

g. Identify and purchase any needed program materials, supplies, equipment, and/or visual aids required for delivering the curriculum.

Visual aids, program supplies, and needed equipment were purchased throughout the quarter and year as needed.

h. Develop one additional curriculum module for fourth grade students.

This will be completed by February 28, 2010.

i. Identify and purchase any needed program materials, supplies, equipment, and/or visual aids required for delivering the curriculum.

This will be completed May 31, 2010.

j. Working with agency personnel and drawing upon the expertise of university faculty and staff, produce a written assessment report that summarizes changes in student and teacher knowledge, attitudes, and performance and includes recommendations for program improvement. Utilize UNLV research assistants and faculty as needed to collect and analyze data.

This task was completed in the first quarter for Year 1. The assessment report for Year 2 is on task for completion by August 31, 2009.
Accomplishments for Task 2 – Year 2

1. **Scheduled educational trips on Forever Earth.** During Year 2, 109 educational trips were conducted aboard Forever Earth benefiting 2785 students and 1102 adults (3887 total passengers).

2. **2008-2009 Forever Earth Curriculum.** A new activity was created and field tested for the 5th grade curriculum. Other minor revisions were made, and the 2008-2009 Curriculum Edition was completed on time.

3. **Program supplies and equipment.** Throughout the year, additional supplies, equipment, and visual aids were acquired as needed for delivering the curriculum.

4. **Program assessment.** Throughout Year 1, a random sample of students were administered assessment instruments to assist in determining if learning objectives for each grade level were achieved. With the assistance of a UNLV graduate student, data were collected and analyzed. A report was written by Dr. Lori Olafson, Dr. Gregory Schraw, and Michelle Weibel, UNLV College of Education. This was accomplished during the first quarter of Year 2. Modifications and adjustments to program delivery were based on this assessment report.

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**Project 2 – Task 3. Schedule a minimum of three trips per year for research purposes.**

a. Develop and distribute a letter of introduction and a program brochure to university, state, and federal researchers in Nevada, Arizona, and Utah to inform them of Forever Earth and its purpose. This will be completed by August 31, 2007.

This activity was completed during Year 1.

b. Coordinate with university, state, and federal researchers to schedule Forever Earth for a minimum of three scientific research trips.

No progress was made on this activity in Year 2.

c. Identify and purchase any needed research supplies and/or equipment.

No progress was made on this activity in Year 2.

d. Revise Forever Earth program brochure (Sewing and Miller, 2006) as necessary. Distribute a letter of introduction and program brochure to university, state, and federal researchers in Nevada, Arizona, and Utah to inform them of Forever Earth and its purpose.

This activity was completed for Year 1.

No revisions to the program brochure were necessary during Year 2.

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Accomplishments for Task 3 – Year 2

1. **Market Forever Earth to Researchers.** Daphne Sewing, Project Manager, made a presentation about Forever Earth's availability to researchers to participants of the Lake Mead Science Symposium on January 18, 2009.

---

**Project 2 – Task 4. Schedule Forever Earth as a mobile visitor center.**
a. Coordinate with the Interpretive Division at Lake Mead National Recreation Area on a continuous basis to schedule Forever Earth at least twice per month during peak visitation (June, July, August of each year).

This task was completed in the first quarter.

### Accomplishments for Task 4 – Year 2

1. **Mobile Visitor Center.** The National Park Service used Forever Earth as a mobile visitor center on five occasions during Year 2. During the five scheduled trips, interpreters made over 1000 visitor contacts, conducted interpretive programs, and hosted visitors aboard the mobile visitor center.

*Project 2 – Task 5. Provide Forever Earth for agency purposes for a minimum of six trips per year.*

a. Coordinate on a continuous basis with local, state, and federal agencies to schedule Forever Earth for a minimum of six trips per year. This will be completed by May 31 of each year.

On March 25, 2009 Forever Earth hosted two agency groups, the Las Vegas Wash Coordinating Committee and the National Park Service.

#### Forever Earth Agency Trips – Year 2 (Round 6), 4th Quarter

<table>
<thead>
<tr>
<th>Date(s)</th>
<th>Group Type</th>
<th>Trip Purpose</th>
<th>Length of Trip</th>
<th># of Adults</th>
<th># of Students</th>
<th>Total Pass.</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-Mar</td>
<td>Agency</td>
<td>Team Meeting</td>
<td>4 hrs.</td>
<td>18</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>25-Mar</td>
<td>Agency</td>
<td>Law Enforcement Group - Familiarization Trip</td>
<td>2.25 hrs.</td>
<td>14</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>TOTALS for 4th quarter</td>
<td>Agency - 2 groups</td>
<td>Agency - 6.25 hrs.</td>
<td>32</td>
<td>0</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

### Accomplishments for Task 5 – Year 2

1. **Agency trips aboard Forever Earth.** During Year 2, a total of 16 trips were scheduled for agency purposes.

*Project 2 – Task 6. Provide funding for student field trips to public land sites.*

PI/Project Manager Daphne Sewing, with the assistance from the UNLV graduate student, will coordinate and disburse transportation funding for field trips to public lands by Clark County School District students.

a. Produce a written report on Transporting Students to Public Land Sites for Field Trips. The report will include recommendations for future implementation.
This activity was completed during Year 1.

b. During the 2007-2008 school year, provide transportation funding for a minimum of 15 field trips to public lands.

This activity was completed during Year 1.

c. During the 2008-2009 school year, provide transportation funding for a minimum of 35 field trips to public lands.

In the fourth quarter, transportation funding was provided for 30 field trips.

d. During the 2009-2010 school year, provide transportation funding for a minimum of 35 field trips to public lands.

This will be done by May 31, 2010.

Accomplishments for Task 6 – Year 2

1. Transportation Funding for Field Trips. During Year 2, transportation funding was provided for 69 field trips.

Project 2 – Task 7. Implement additional program assistance.
PI/Project Manager Daphne Sewing, with assistance from the UNLV graduate student, will evaluate, and to the extent possible, implement a volunteer or other workforce structure to increase the scope of delivery and impact of the program.

a. Determine and, to the extent possible, implement the most efficient, high quality delivery structure for the Forever Earth program.

Four part-time instructors were hired during the second quarter. This structure and other possible delivery systems will be evaluated by May 31, 2010.

Accomplishments for Task 7 – Year 2

1. Delivery system for Forever Earth Program. Hiring four part-time instructors allowed delivery of additional field trips. The number of field trips increased by 30% from Year 1.
DISCOVER MOJAVE OUTDOOR WORLD

The following progress has been made toward Outdoor World project objectives in this quarter.

a. Coordinate and develop a schedule of events for the year. This will be completed by September 30 of each year.

A schedule of activities for Year 2 (Round 6) has been developed (see attached).

A draft schedule of activities for Year 3 (Round 6) has been developed (see attached). Interest from recreation and community centers and other groups to schedule additional activities will be reflected in subsequent revisions of this schedule.

b. Utilize UNLV students and staff, volunteers, and federal agency personnel to conduct a minimum of 25 events. This will be completed by May 31 of each year.

In this quarter, 17 events were conducted for 329 participants (see table below).

Discover Mojave Outdoor World Schedule – 4th Quarter, Year 2 (Round 6)

<table>
<thead>
<tr>
<th>DATE</th>
<th>GROUP</th>
<th>ACTIVITY</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon., Mar 23</td>
<td>CCSD – JD Smith MS Physical Education</td>
<td>24 Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Mon., Mar 23</td>
<td>JD Smith MS Afternoon All Stars</td>
<td>20 Intro to Orienteering</td>
<td>JD Smith MS campus</td>
</tr>
<tr>
<td>Tues., March 24</td>
<td>Orr MS Afternoon All Stars</td>
<td>20 Intro to Orienteering (Maps)</td>
<td>Orr MS campus</td>
</tr>
<tr>
<td>Wed., Mar 25</td>
<td>JD Smith Afternoon All Stars</td>
<td>16 Orienteering</td>
<td>JD Smith campus</td>
</tr>
<tr>
<td>Thurs., Mar 26</td>
<td>Orr MS Afternoon All Stars</td>
<td>21 Intro to Orienteering (Compass)</td>
<td>Orr MS campus</td>
</tr>
<tr>
<td>Tues., Mar 31</td>
<td>Orr MS Afternoon All Stars</td>
<td>18 Orienteering</td>
<td>Orr MS campus</td>
</tr>
<tr>
<td>Tues., April 14</td>
<td>CCSD – Mack MS Physical Education</td>
<td>26 Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Wed., April 29</td>
<td>Paradise Environmental Science Club</td>
<td>12 Geocaching</td>
<td>Sunset Park</td>
</tr>
<tr>
<td>Wed., May 6</td>
<td>Paradise Environmental Science Club</td>
<td>9 Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Tues., May 12</td>
<td>CCSD – Keller MS Physical Education</td>
<td>38 Kayaking</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Wed., May 13</td>
<td>Paradise Environmental Science Club</td>
<td>10 Kayaking</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Sat., May 16</td>
<td>Families in Nature</td>
<td>51 Bird Watching I</td>
<td>Winchester Cultural Center</td>
</tr>
</tbody>
</table>
c. Draw upon the expertise of university faculty and staff to produce a written assessment report that summarizes changes in participant knowledge, attitudes, and performance and includes recommendations for program improvement. Utilize UNLV research assistants as needed to collect and analyze data.

This task was completed during the first quarter. The assessment report for Year 2 is on track for completion by August 31, 2009.

d. Maintain website to highlight program activities and partner contributions and update content as necessary. Website content will be evaluated regularly by agency staff.

Minor revisions have been made to the website throughout Year 2.

**Accomplishments for Task 1 - Year 2**

1. **Conducted Events.** During Year 2, 62 events were conducted for 1320 participants. Seventeen different groups were targeted for these events.

2. **Program Assessment.** Throughout Year 1, participants were administered assessment instruments to assist in determining if activity objectives were achieved. With the assistance of a UNLV graduate student, data were collected and analyzed. A report was written by Dr. Lori Olafson, Dr. Gregory Schraw, and Michelle Weibel, UNLV College of Education. This was accomplished during the first quarter of Year 2. Modifications and adjustments to program delivery were based on this assessment report.

3. **Website Revisions.** Minor revisions were made to the website throughout the year.

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**Project 3 - Task 2. Develop a minimum of one new Outdoor World activity each year.**

a. UNLV and agency staff will work together to identify the type of recreational activity to develop into an additional event for targeted youth audience. This will be completed by August 31 of each year.

In the fourth quarter, two new activities were added to the Outdoor World program:
• An outdoor rock climbing experience in the Spring Mountains National Recreation was field tested with seven participants. An indoor introductory experience was provided first.

• A geocaching activity utilizing GPS technology was field tested with 12 participants at Sunset Park.

b. Develop curriculum (goals, objectives, programs, activities, locations, etc.) for the selected recreational activity.

Activity outlines for the outdoor rock climbing experience and for the geocaching activity have been completed (see attached).

c. Field test new event curriculum, make changes, and finalize curriculum. This will be completed by May 31 of each year.

The geocaching activity was field tested with 12 participants on April 29, 2009 at Sunset Park.

The outdoor rock climbing experience was field tested with seven participants on May 16, 2009 at a site in the Spring Mountains National Recreation Area.

**Accomplishments for Task 2 – Year 2**

1. **New activities added to program.** Two new activities were added to the program during Year 2. An outdoor rock climbing activity and a geocaching activity were field tested during the fourth quarter with fifth-grade students from Paradise Elementary participating in an after-school science program. Curricula for these activities were completed.

---

Project 3 – Task 3. Develop a minimum of two partnerships that increase the impact of the program each year to assist in conducting Outdoor World events, providing financial assistance, or supplying the desired target audience of economically disadvantaged youth, ages 8-12.

a. UNLV, SNAP Executive Director, and SNAP Board of Directors work together to identify potential new partners.

No work was completed on this task during this quarter.

b. UNLV and appropriate agency staff, including the SNAP Board of Directors, will contact potential partners for intended purposes. This will be completed by October 31 of each year.

No work was completed on this task during this quarter.

c. Formulate a minimum of one partnership. This will be completed by January 31 of each year.

No work was completed on this task during this quarter.

d. Highlight partner contributions on website.
A video clip was added to the website to highlight the partnership established with Clark County School District to provide hiking, indoor rock climbing, and kayaking activities for middle school physical education students.

Accomplishments for Task 3 – Year 2

1. **New partnerships.** Five new partnerships were established during Year 2. Activities were conducted for Westcare, Sunrise Community Center, Desert Breeze Community Center, various Boys and Girls Club units, and Clark County School District.

   Several activities were conducted for middle school physical education students. A grant awarded from the Michael Jordan Foundation to Clark County School District provided funds for equipment rental and bus transportation. Kayaking, hiking, and indoor rock climbing activities complemented the Project Adventure curriculum used in physical education programs at the middle school level. Volunteers from Niketown assisted with the activities. Plans are being made to expand this partnership next school year.

*Project 3 – Task 4. Implement additional program assistance.*

PI/Project Manager Daphne Sewing, with assistance from the UNLV graduate student, will evaluate and, to the extent possible, implement a volunteer or other workforce structure to increase the scope of delivery and impact of the program.

a. **Determine and, to the extent possible, implement the most efficient, high quality delivery structure for the Outdoor World program.**

This will be done by May 31, 2010.

Accomplishments for Task 4 – Year 2

1. **Delivery system for Outdoor World Program.** Hiring three part-time instructors allowed delivery of additional activities. The number of activities increased by 121% and the number of participants by 166% from Year 1.
<table>
<thead>
<tr>
<th>Year Two Deliverables (June 2008 – May 2009)</th>
<th>Percent Complete as of February 28, 2009</th>
<th>Plan for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOREVER EARTH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Project 2 – Task 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Revise SOP.</td>
<td>100%</td>
<td>Operational changes will be identified during scheduled boat training and facilitators training and incorporated into the SOP.</td>
</tr>
<tr>
<td>b. Provide training on SOP for boat crew.</td>
<td>100%</td>
<td>Training was held on October 7, 2008.</td>
</tr>
<tr>
<td>c. Update and maintain website.</td>
<td>100%</td>
<td>Minor changes made and finalized this year.</td>
</tr>
<tr>
<td><strong>Project 2 – Task 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Schedule a minimum of 25 educational trips</td>
<td>436%</td>
<td>Additional reservations will occur throughout the school year.</td>
</tr>
<tr>
<td>b. Produce 2008/2009 edition of FE curriculum.</td>
<td>100%</td>
<td>This is scheduled for completion by May 31, 2009.</td>
</tr>
<tr>
<td>c. Develop additional 5th grade curriculum.</td>
<td>100%</td>
<td>This will be completed during the 3rd quarter.</td>
</tr>
<tr>
<td>d. Purchase program materials, supplies, and visual aids.</td>
<td>100%</td>
<td>Visual aid and equipment needs have been identified for the 2008/2009 school year.</td>
</tr>
<tr>
<td>e. Develop partnership for integrating data collected by high school students into existing research data base.</td>
<td>0%</td>
<td>Lack of participation by high schools make this task unnecessary.</td>
</tr>
<tr>
<td>j. Produce written assessment report of participants in Forever Earth curricula.</td>
<td>100%</td>
<td>A report was completed during the first quarter.</td>
</tr>
<tr>
<td><strong>Project 2 – Task 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Distribute information about Forever Earth to researchers in regional area.</td>
<td>100%</td>
<td>Completed.</td>
</tr>
<tr>
<td>b. Schedule 3 scientific research trips on Forever Earth.</td>
<td>0%</td>
<td>None of the inquiries by scientists resulted in trips being scheduled.</td>
</tr>
<tr>
<td>c. Purchase needed research supplies and equipment.</td>
<td>0%</td>
<td>No purchases were made since no trips were scheduled.</td>
</tr>
<tr>
<td><strong>Project 2 – Task 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Schedule Forever Earth as a mobile visitor center twice per month during June, July, and August.</td>
<td>83%</td>
<td>NPS scheduled five trips during the first quarter.</td>
</tr>
<tr>
<td><strong>Project 2 – Task 5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Schedule a minimum of 6 trips for agency purposes.</td>
<td>267%</td>
<td>Completed.</td>
</tr>
<tr>
<td><strong>Project 2 – Task 6</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Produce report “Transporting Students to Public Lands for Field Trips.”</td>
<td>100%</td>
<td>This task was completed during Year 1.</td>
</tr>
<tr>
<td>b. Provide bus transportation funds for 35 student field trips.</td>
<td>197%</td>
<td>This will occur as the school year progresses.</td>
</tr>
<tr>
<td><strong>Project 2 – Task 7</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Determine delivery system.</td>
<td>30%</td>
<td>This task will be completed during Year 3.</td>
</tr>
<tr>
<td><strong>OUTDOOR WORLD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Project 3 – Task 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Develop a schedule of events for the year.</td>
<td>100%</td>
<td>Draft schedule will be modified as more events are scheduled by partners.</td>
</tr>
<tr>
<td>b. Conduct a minimum of 25 events.</td>
<td>248%</td>
<td>Current partners indicated they will schedule more events throughout the year.</td>
</tr>
</tbody>
</table>
c. Produce written assessment report of participants in Outdoor World program. 100% A report was completed during the first quarter.

d. Update and maintain website. 50% Continuous.

**Project 3 – Task 2**
a. Identify a new recreational event to be developed. 100% Two activities were identified: an outdoor rock climbing experience and a geocaching activity.

b. Develop curriculum for the selected recreational event. 100% Completed.

c. Field test new event curriculum. 200% Two activities were field tested during the fourth quarter.

**Project 3 – Task 3**
a. Identify potential new partners. 100% Completed.

b. Contact potential partners. 100% Completed.

c. Formulate a minimum of one new partnership. 600% Completed.

d. Highlight partner contributions on website. 100% New partners will be highlighted on website. This is expected to occur during the fourth quarter.

**Project 3 – Task 4**
a. Determine delivery system to increase scope of program. 30% This will be completed by May 31, 2010.

Submitted by:

__________________________________________  May 31, 2009
Margaret M. Rees  Date
ATTACHMENTS
Feedback Form Responses: Asking OHV Users about Riding On and Off-trail
Feedback Form: Asking OHV Users about Riding On and Off-trail

Hi, my name is _____ and I am working with the Southern Nevada Agency Partnership to develop an OHV Zone Map to show where and how to ride in Clark County.

We know there are a number of reasons that people either stay on marked trails or ride off of marked routes and trails. We'd like to understand which reasons are the most important. Would you be willing to help us by answering these few questions?

YES – go on. NO – thank them for their time.

1. What do you see as the advantages or good things that could occur by riding on a marked trail today? [RECORD ANSWERS PRECISELY AND ACCURATELY, AND THEN PROBE: ANYTHING ELSE?]

2. What do you see as the disadvantages or bad things that could occur by riding on a marked trail today? [RECORD ANSWERS PRECISELY AND ACCURATELY, AND THEN PROBE: ANYTHING ELSE?]

3. Who (individuals or groups whose opinions you consider personally influential) do you think would support or approve of you riding on a marked trail today? [RECORD ANSWERS PRECISELY AND ACCURATELY, AND THEN PROBE: ANYTHING ELSE?]
4. Who (individuals or groups whose opinions you consider personally influential) do you think would object or disapprove of you riding on a marked trail today? [RECORD ANSWERS PRECISELY AND ACCURATELY, AND THEN PROBE: ANYTHING ELSE?]


ANYTHING ELSE?

5. What things make it easy for you to ride on marked trails? [RECORD ANSWERS PRECISELY AND ACCURATELY, AND THEN PROBE: ANYTHING ELSE?]


ANYTHING ELSE?

6. What things make it difficult for you to ride on marked trails? [RECORD ANSWERS PRECISELY AND ACCURATELY, AND THEN PROBE: ANYTHING ELSE?]


ANYTHING ELSE?
**Feedback Form Responses: Asking OHV Users about Riding On and Off-trail**
(collected by PIC March-April 2009)

**BEHAVIORAL BELIEF RESPONSES**

<table>
<thead>
<tr>
<th>Respondent #</th>
<th>Q. 1 What do you see as the advantages or good things that could occur by riding on a market trail today?</th>
<th>Q. 2 What do you see as the disadvantages or bad things that could occur by riding on a market trail today?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It keeps you from getting lost. Gives you confidence to know where you are - eliminates reasons for climbing a hill to see where you are</td>
<td>nothing</td>
</tr>
</tbody>
</table>
| 2            | • Keeps BLM happy.  
• Well, it's really the right thing to do. | No disadvantages. |
| 3            | You know where you are | Maybe some people might think it is boring - especially if the trail isn't challenging. That is why some go off-trail - it's more challenging and not so boring. |
| 4            | • Not getting lost.  
• You are not so likely to get in trouble (lost; washed-out road; OHV breakdown and no one knows where you are). | It takes away from the adventure – the fun. It is fun to go exploring and to make your own trail. |
| 5            | • I know it's a good, safe trail.  
• I feel comfortable taking my family because of safety issues. | Too many on trails – everyone is in the same place. |
| 6            | • It's the right thing to do now-adays.  
• There are too many people to just let people go everywhere. | If there aren't many trails – then it gets boring – if there are plenty of interesting trails, there is no problem. |
| 7            | You don't get lost. | It concentrates use – especially if there isn't enough trails. |
| 8            | Easier for groups to stay together | • Trails aren't as much fun as just going where you want.  
• It's funner to go fast – climb hills – go over natural terrain. We need areas set aside to do this and we need them everywhere. |
| 9            | • The scenery is more beautiful.  
• Tracks off-road are not attractive.  
• Unloading or leaving a campsite shouldn't count as off-road. | • Maybe you can't get to a place you want to go (no specifics) but usually there are plenty of roads.  
• When they close roads I still want to go on them. |
| 10           | Not getting lost. | Crowds |
| 11           | Keeps me in my comfort zone. I feel like I won't get lost or end up somewhere different than what I thought | • No disadvantages.  
• But there is never enough information – like plants, history – I want to know more so besides directional signs we need information signs. |
| 12           | You can just enjoy the ride – the day because the trail is there – you just follow it | Not enough signs so you get confused on the side roads or at intersections or you have to go back and check the signs. |
and don't have to worry about anything | don't know where the trail ends up.
---|---
13 | - People don't get lost.  
    - Some trails to neat places. | - Well, trails can be slower and more boring.  
    - We need OHV motorcycle areas were we can [tear?] it up
14 | It's the law – or at least it's what we are supposed to do | Kids won't more unstructured areas to ride – to play – they want challenges – and to go fast – trails aren't set up for that
15 | Since it's marked – if we had maps – we could plan ahead – if you can plan ahead, you can tell people where you'll be | User conflict if trails are heavily used

### NORMATIVE BELIEF RESPONSES

<table>
<thead>
<tr>
<th>ID</th>
<th>Q. 3 Who (individuals or groups whose opinions you consider personally influential) do you think would support or approve of you riding on a marked trail today?</th>
<th>Q. 4 Who (individuals or groups whose opinions you consider personally influential) do you think would object or disapprove of you riding on a marked trail today?</th>
</tr>
</thead>
</table>
| 1  | - Everybody should –  
    - but they (trails) must be marked – signs should be at every intersection | People who don't believe in multiple use. People who want everywhere to be wilderness. |
| 2  | The BLM | Wilderness people, they want us to screw up and ride off the trails so that they can lock up more land. |
| 3  | Well, it should make the BLM happy | Why would anyone object to staying on trails. |
| 4  | Shouldn't everybody | Tree huggers—they want to go off-road so they can use that to close a place down |
| 5  | Everyone should because staying on trails is what good land stewards do. | People that don't understand the need to be good land stewards. |
| 6  | Everyone in their right mind. | No one – in their right mind. |
| 7  | SNRTP – Southern Nevada Trails Partnership | The Sierra Club – they don’t like trails because of the impact all that use in one place creates. |
| 8  | - Adults;  
    - the government. | No one really – just because we would rather go anywhere doesn’t mean anyone would object to riding on trails. |
| 9  | - Most people, especially environmentalists.  
    - I do it because it is right – I don’t particularly care what others think – I mean I wouldn’t do it just to impress others. | Who would think that? |
| 10 | Normal Americans | City slickers – they don’t want anybody enjoying the land |
| 11 | OHV club – DAT only rides on approved trails. | Old-timers who think trails make the desert too urban |
| 12 | Everyone | People who hate ATVs, motorcycles |
| 13 | - The BLM –  
    - everyone | Environmentalists – that don’t want us riding at all |
| 14 | - Everyone –  
    - rangers –  
    - the land managers | Extreme environmentalists who want motorized recreation banned |
| 15 | n/a | The people that disapprove – that’s who the BLM should go after |
## CONTROL BELIEF RESPONSES

<table>
<thead>
<tr>
<th>ID</th>
<th>Q. 5 What things make it easy for you to ride on marked trails?</th>
<th>Q. 6 What things make it difficult for you to ride on marked trails?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Signs. Signs, signs, signs.</td>
<td>• Nothing makes it —</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• not enough signs or signs improperly placed would make it difficult.</td>
</tr>
<tr>
<td>2</td>
<td>Parking lots where trails are. Big parking lots so trailers can turn around.</td>
<td>• Not enough signs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Trails that are washed out.</td>
</tr>
<tr>
<td>3</td>
<td>• Information – kiosks – information about what is at the end of a trail.</td>
<td>No information – where am I?</td>
</tr>
<tr>
<td></td>
<td>• Maps, of course – and signs – positive signs.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Signs and maps</td>
<td>Other people going off the trails. I want to follow them – or go off the trail myself.</td>
</tr>
<tr>
<td>5</td>
<td>Maps – why are there no maps – it drives me crazy.</td>
<td>Nothing – except no maps.</td>
</tr>
<tr>
<td>6</td>
<td>• Trail systems are great with looped trails</td>
<td>Not knowing where trails go</td>
</tr>
<tr>
<td></td>
<td>• and all the information for you</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Signs and maps. Maps and signs.</td>
<td>• A very limited number of trails.</td>
</tr>
<tr>
<td></td>
<td>• All the trails are in the same terrain – scenery.</td>
<td>• All the trails are in the same terrain – scenery.</td>
</tr>
<tr>
<td>8</td>
<td>• Places to unload motorcycles.</td>
<td>Too many people</td>
</tr>
<tr>
<td></td>
<td>• Places to turn around at the end of the trail.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>• Signs – maps –</td>
<td>No maps, no signs – how do I know?</td>
</tr>
<tr>
<td></td>
<td>• enough roads and trails so that there is a lot of variety</td>
<td>Sometimes I don’t know . . . It is sometimes hard to tell where a road or trail really ends because maybe someone has driven farther – how do I know – so is it OK to go farther or not?</td>
</tr>
<tr>
<td>10</td>
<td>Knowing what’s ahead</td>
<td>Not knowing what’s ahead</td>
</tr>
<tr>
<td>11</td>
<td>• Kiosks –</td>
<td>Not enough information – we also need maps – maps that you can take with you, not too big.</td>
</tr>
<tr>
<td></td>
<td>• parking areas,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• picnic areas,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• places for groups to shop along the way</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• and hike around a bit –</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• room to park and turn around at the end of a trail –</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• but looped trails are much better.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>• Lots of trails for variety</td>
<td>Not having lots of trails. No variety – trails are boring – they need to go over interesting land – not flat – straight and not a bunch of dust.</td>
</tr>
<tr>
<td></td>
<td>• and so it doesn’t feel like you are riding on a sidewalk.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Places to turn around at the end</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• and to park at the beginning</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Knowing where the trail goes. What’s at the end of the trail.</td>
<td>• It (trails) are boring – straight.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sometimes I just hate doing something because it is the right thing to do even though I know it is the right thing to do.</td>
</tr>
<tr>
<td>14</td>
<td>Signs – information maps</td>
<td>More people using trails means some people leave their trash and I hate seeing trash.</td>
</tr>
<tr>
<td>15</td>
<td>Maps and signs</td>
<td>• No maps, no signs. I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• t’s no fun to feel like you’re lost – or at least confused.</td>
</tr>
</tbody>
</table>
Summary of Responses

Question 1: What do you see as the advantages or good things that could occur by riding on a market trail today?

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keeps me from getting lost/ It keeps me safe/from getting into trouble/comfortable</td>
<td>10</td>
</tr>
<tr>
<td>It is the right thing to do</td>
<td>3</td>
</tr>
<tr>
<td>It will keep BLM Happy/it's the law/supposed to do it</td>
<td>2</td>
</tr>
<tr>
<td>Beautiful scenery/will take me to neat places</td>
<td>2</td>
</tr>
<tr>
<td>Off-road tracks are not attractive</td>
<td>1</td>
</tr>
<tr>
<td>There are too many people to go everywhere</td>
<td>1</td>
</tr>
<tr>
<td>Easier for groups to stay together</td>
<td>1</td>
</tr>
</tbody>
</table>

Questions 2: What do you see as the disadvantages or bad things that could occur by riding on a market trail today?

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trails are boring/takes away from the adventure, fun/trails aren't as challenging</td>
<td>6</td>
</tr>
<tr>
<td>It concentrates use/there aren't enough trails/crowds/user conflicts</td>
<td>4</td>
</tr>
<tr>
<td>Nothing/there are no disadvantages</td>
<td>3</td>
</tr>
<tr>
<td>There isn't enough informational signs</td>
<td>1</td>
</tr>
<tr>
<td>Trails may not take you where you want to go</td>
<td>1</td>
</tr>
<tr>
<td>Trails that don't have enough signs can be confusing – don't know where you will end up</td>
<td>1</td>
</tr>
<tr>
<td>It is what good land stewards do</td>
<td>1</td>
</tr>
</tbody>
</table>

Questions 3: Who (individuals or groups whose opinions you consider personally influential) do you think would support or approve of you riding on a marked trail today?

<table>
<thead>
<tr>
<th>Group</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everybody/most people/adults</td>
<td>10</td>
</tr>
<tr>
<td>The BLM/rangers/land managers BLM/the government</td>
<td>5</td>
</tr>
<tr>
<td>Southern Nevada Trails Partnership</td>
<td>1</td>
</tr>
<tr>
<td>Environmentalists</td>
<td>1</td>
</tr>
<tr>
<td>OHV club</td>
<td>1</td>
</tr>
</tbody>
</table>

Q.4: Who (individuals or groups whose opinions you consider personally influential) do you think would object or disapprove of you riding on a marked trail today?

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmentalists/want wilderness everywhere/don't want people enjoying the land / want a reason to ban OHV/don't believe in multiple use/people that hate OHV</td>
<td>8</td>
</tr>
<tr>
<td>No one</td>
<td>4</td>
</tr>
<tr>
<td>People that don't understand that need to be good land stewards</td>
<td>1</td>
</tr>
<tr>
<td>Old-timers that think that trails make the desert too urban</td>
<td>1</td>
</tr>
</tbody>
</table>

Q.5: What things make it easy for you to ride on marked trails?

<table>
<thead>
<tr>
<th>Feature</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs and maps</td>
<td>12</td>
</tr>
<tr>
<td>Parking areas/parking lots where you can turn around/places to unload</td>
<td>4</td>
</tr>
<tr>
<td>Room to turn around at the end of a trail</td>
<td>3</td>
</tr>
<tr>
<td>Trails that have loops</td>
<td>2</td>
</tr>
<tr>
<td>Variety/lots of trails/don't feel like you are on a sidewalk</td>
<td>1</td>
</tr>
<tr>
<td>Picnic areas</td>
<td>1</td>
</tr>
</tbody>
</table>
Hiking | 1
shopping | 1

Q.6: What things make it difficult for you to ride on marked trails?

<table>
<thead>
<tr>
<th>Reason</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not enough signs/not knowing what’s ahead/not enough information/feeling like you are lost</td>
<td>9</td>
</tr>
<tr>
<td>Lack of variety/not having enough trails</td>
<td>3</td>
</tr>
<tr>
<td>Nothing</td>
<td>2</td>
</tr>
<tr>
<td>Trails that are washed out</td>
<td>1</td>
</tr>
<tr>
<td>Not wanting to do the right thing</td>
<td>1</td>
</tr>
<tr>
<td>Too many people</td>
<td>1</td>
</tr>
<tr>
<td>Too much trash</td>
<td>1</td>
</tr>
<tr>
<td>I want to follow people that have gone off-trail</td>
<td>1</td>
</tr>
</tbody>
</table>
Identifying Beliefs to Target with Persuasive Communication
IDENTIFYING BELIEFS TO TARGET WITH PERSUASIVE COMMUNICATION

The following questions focus on how OHV riders use marked trails on public lands in Clark County.

When questions refer to your use of OHV trails, please think only of your experience here today.

Please know that there are no right or wrong answers to the following questions, nor are some responses better or worse than others. Land managers simply want to know your honest opinions about riding on marked trails.

The purpose of this series of questions is to find out what you believe about riding on marked trails while on public lands in Clark County. Place an X on the line that represents how strongly you believe the statement.

1. If I always stay on marked trails, I will be less likely to get lost.
   - EXTREMELY UNLIKELY __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ ____
8. When it comes to riding on marked trails, doing what other people think I should do is:

<table>
<thead>
<tr>
<th>NOT AT ALL important to me</th>
<th>VERY important to me</th>
</tr>
</thead>
<tbody>
<tr>
<td>..........................</td>
<td>.....................</td>
</tr>
</tbody>
</table>

9. I believe that BLM rangers and land managers think:

<table>
<thead>
<tr>
<th>I should NOT always ride on marked trails in Clark County</th>
<th>I SHOULD always ride on marked trails</th>
</tr>
</thead>
<tbody>
<tr>
<td>.........................................................</td>
<td>.........................................</td>
</tr>
</tbody>
</table>

10. When it comes to riding on marked trails, doing what BLM rangers think I should do is:

<table>
<thead>
<tr>
<th>NOT AT ALL important to me</th>
<th>VERY important to me</th>
</tr>
</thead>
<tbody>
<tr>
<td>..........................</td>
<td>.....................</td>
</tr>
</tbody>
</table>

The next series of questions have to do with the ease or difficulty of riding on marked trails.

11. The lack of signs and maps could influence whether I always ride on the trails

<table>
<thead>
<tr>
<th>FALSE</th>
<th>TRUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>..........................</td>
<td>.....................</td>
</tr>
</tbody>
</table>

12. The lack of signs and maps makes staying on trails

<table>
<thead>
<tr>
<th>MORE DIFFICULT FOR ME</th>
<th>EASIER FOR ME</th>
</tr>
</thead>
<tbody>
<tr>
<td>..........................</td>
<td>...............</td>
</tr>
</tbody>
</table>
Hispanic Communications Plan
Introduction

The Public Lands Institute (PLI) at the University of Las Vegas, Nevada is a proactive institution tasked with educating, researching and engaging communities in relation to public land management and stewardship. The PLI works closely with the Southern Nevada Agency Partnership (SNAP) to address the partnership's conservation initiatives including litter clean-up, volunteerism, resource protection, recreation, science, research, and education. SNAP is comprised of the Bureau of Land Management, the National Park Service, the U.S. Fish and Wildlife Service and the U.S. Forest Service.

In 2007, the PLI contracted Language Sources, a multilingual language services, diversity outreach, specialty marketing and public relations firm in Nevada, to help guide their Hispanic communications, research and outreach activities. As part of the collaborative effort put forth by the SNAP agencies, the PLI has directed Language Sources to take a series of steps to achieve a variety of goals that include 1) understanding reasons why the Las Vegas Hispanic community visit public lands sites, 2) identify how to communicate information about the natural world in a way that appeals to the Hispanic community and ensures them to become actively involved in public lands sites— to recreate, to discover and to protect, 3) to identify practices that will make public lands sites more welcoming to the Las Vegas Hispanic community, and 4) to understand the barriers that prevent Las Vegas Hispanics from visiting public lands sites. To this end, the PLI is currently developing quantitative and qualitative research projects that will help profile the specific audiences within the Hispanic community that the partners need to reach. While the research is being designed and conducted, the partners are proactively initiating a community outreach and communications campaign that will be adapted as new information about Hispanic users and non-users of Nevada’s public lands is uncovered.

In order to further the general goals, Language Sources is glad to present the following DRAFT communications plan for 2009-2010 that will be implemented while research is underway. The efforts detailed in this plan for 2009-2010 will be primarily addressed toward the Spanish-dominant population of Southern Nevada and will consider the overall current understanding of the Hispanic target audience.

Goals

The following represent the specific goals related to the 2009-2010 communications plan:

• Communicate the importance of the natural world and inspire Hispanics, primarily Spanish-dominant, to become actively involved in public lands sites— to recreate, to discover and to protect.
• Increase public awareness among Hispanics, primarily Spanish-dominant, about issues that affect the environment and the natural balance in public lands, including dumping/littering, illegal fire, etc.
• Begin creating volunteer networks among Hispanics and increase volunteer participation.
• Overtime, modify impacting behaviors (e.g. littering), build stewardship and knowledge of the natural world and Nevada’s public lands among Hispanics.
Objectives

The following represent the specific objectives related to the 2009 communications plan:

• Design and implement a series of communications tools, including a Spanish-language website and Spanish-language print materials, which will pursue the established goals and will emphasize the plan’s messaging.
• Drive traffic to website and increase engaging use of plan tools.
• Build a collaborative network within the Hispanic community by engaging leaders and the public through established outreach that will include meetings and event participation.
• Conduct media relations activities that further the established goals using both controlled and uncontrolled media.

Messages

The following represent some of the primary and secondary messages to be communicated through a variety of tools and activities to accomplish the set goals and objectives:

Primary Messages

• Public lands offer learning opportunities, adventure, physical activity and the chance to reconnect with nature.
• We have the power to enjoy and protect our natural treasures by keeping in mind a few simple things.
• Southern Nevada has beautiful natural treasures that belong to all of us.

Secondary Messages

• The environment holds a delicate balance that can be easily disrupted by human action.
• Agencies entrusted to guide our care of the land are our partners in the protection of our lands and our safety.

Tools and Activities

The PLI and Language Sources will use a variety of tools and implement a series of activities to achieve the established plan goals and objectives and to communicate the appropriate messages. All tools and activities will be coordinated accordingly to have synergy and continuity.
Tools to be developed during 2009 include:

**Website**

A site in Spanish will be developed with an original domain name and will cover three areas for active engagement established as goals for this plan – to recreate, to discover and to protect. Language Sources has benchmarked a series of Spanish-language websites, including some with environmental topics, and has prepared a proposed web map (attached) for the creation of the Spanish-language site.

The agency proposes a visually-attractive site with abundant images of public lands and original copy in Spanish. The Spanish webpage proposed includes four main areas and four secondary levels. The areas and levels have connected content that lead the visitor to specifying key messaging. Please refer to the attachment for details.

A series of activities, also detailed in this proposal, will be conducted to drive traffic to the site and information flow should be tracked to measure success. The agency will also work on modifying and perfecting the site as research and user knowledge develops.

In order to increase traffic to the site, Language Sources recommends the use of an original domain name in Spanish that is easily remembered and can be retained by the targeted audience. Two suggested Spanish domain names include:

**nverde**

"NVerde" uses the initials of Nevada and the word green in Spanish, this domain name combines the environment and natural world. Most campaigns related to the environment, preservation and stewardship of the land use the "green" reference. Phonetically, the word can be read as "In green" – or "Into green" which can have associative qualities of involvement and integration.

**vivenevada**

"Vive Nevada" is translated as "Live Nevada." This can be associated with an active call that includes the enjoyment of public land and the "call to life" of the public to take care of the "living land."

Language Sources will conduct a survey of the two domain names to verify potential user preferences, name retention and association with environmental and general images, messages, etc. Findings of such research will be issued with a recommendation by March 2009.
Once the site map is completed and approved and the domain name is selected, Language Sources will work with the PLI and its specific agents to develop the site. A late-summer launch will be conducive to building an event around the site and other community programs.

Illustrated Booklets

Language Sources recommends the creation and production of four (4) booklets in 2009-2010 driving key messages in a comic/coloring book format that engages both adults and children. The booklets will feature animated characters, lead by Héctor a ram superhero, and will contain the following elements:

- Booklets are fun, interactive and also informative with banner at bottom carrying statistics and facts.
- Back cover will include tips and the SNAP, partner agencies and PLI web addresses.
- Front and back cover will be full color, while inside is black and white to allow for coloring.
- Booklets use branded animated characters that can be used for the website, promotional, advertising and other campaigns (acquisition of rights pending).
- Booklets can be collected and can be published as series with several topics including:
  - Anti-littering message (La Invasión del Basurón)
  - Wild fire prevention (La Amenaza del Fuego Feroz)
  - Boat and water safety
  - Proper use of trails and picnic areas
  - Hiking safety
  - Biking safety
  - Removal of protected species
  - Heroes of the public lands

The first three booklets will be developed from the topics above, while the fourth booklet will be created from storyline ideas presented through a student contest which will be designed in conjunction with the Clark County School District. This collaboration will increase public participation and visibility of the SNAP communication outreach.

The Spanish-language site will be prominently featured in the booklets to drive traffic and to obtain additional information about the contest and other SNAP and PLI programs and messages.

Promotional Items

A variety of promotional items will be created for distribution at community events. Items will be eco-friendly and will be representative of outdoor activities or will be used as engagement tools. Some suggestions may include:

- Eco-friendly shirts (Potentially collectable with different booklet characters)
Promotional Items (Continued)

- Family-friendly games or items. One concept is to develop a “board game” based on the traditional “Serpientes y Escaleras” or “Snakes and Ladders” game where players go up the board with positive messaging (e.g. placing the trash in the appropriate container) and go down with negative behavior (e.g. feeding wild animals).
- Eco-friendly bookmarks portraying booklet characters and messaging
- Eco-friendly “Super Héctor” cape and mask for children

Displays

Two 33” x 4 ½” pop up displays will be created to be used at meetings and events to reinforce messages through visually-attractive means. One display will contain information about SNAP, its partners and programs, while the other will contain plan messages utilizing animated characters. The Spanish-language website will be promoted in both displays.

As part of this overall plan, activities to be carried out during 2009 include:

Meetings with Leadership

Meetings with leaders and key members of the Hispanic community will continued to be held during 2009 to establish collaborative networks and generate engagement. There will be three to six meetings held per semester depending on availability. Special materials, including one-sheet informational handout, as well as other available promotional and print items, will be distributed during the meetings. A description of organizations with meetings in progress is attached for reference.

Special Launch Event

Language Sources will design and implement a special event at a public land to 1) launch the Spanish-language site and materials, 2) showcase the efforts of SNAP and its partners to date, and 3) drive specific key messages. The event should be held mid-spring or late-summer to allow for outdoor activities, but the specific date and location will depend on the readiness of the Spanish-language materials.

The agency will engage media and other community leaders and will help coordinate overall logistics. In addition to the news conference, the event should include an educational family trip to the public lands and a volunteer clean-up or recruitment effort.

Language Sources will work with the local city/county recreation departments and/or school district to ensure participation and public traffic.
Community Engagement

Participation at a minimum of four Hispanic-targeted events will be scheduled during 2009. A calendar of potential events with recommendations is attached for reference. Language Sources will staff the events, coordinate activities, distribute materials, promote the website, collect information and establish relationships for volunteering and other programs (Families in Nature).

Some activities may include interactive displays such as “Dunk the Trash”, where children can throw the “trash” pasted to a natural scenery background and throw it to a hoop to see the scenery restored and clean. This will have a visual impact and involves the participation of the community. Promotional items will be given for participation.

Language Sources will work with the SNAP and PLI to target and implement the Families in Nature program currently under development and integrate it to the goals, objectives and messages contained in this plan.

Earned Media and Partnerships

Language Sources will seek opportunities to publicize key messages and activities in earned media. Media advisories, news releases and other materials will be prepared as needed and will be sent to the PLI for SNAP proper approval prior to distribution. Overall media outreach will be coordinated with the PLI according to their agency of record plan and their particular general market strategies. Language Sources will target television, print, radio and other social media. Efforts will primarily focus on Spanish-language media, but will include general media when the contact is deemed strategic (e.g. launch event).

The agency will also seek collaboration with local print media to create a special edition on the environment and public lands that coincides with the launch event. Most earned media efforts will begin with launch event.

Public relations efforts for the Families in Nature program will be determined once the program is fully developed.

Paid Media and Advertising

Language Sources will assist the PLI with the development of appropriately targeted paid media and advertising as required by their overall communication strategy and their work with the general agency of record. Language Sources will also issue specific recommendations on media and advertising strategies once the research currently under development is conducted and published.
Language Sources encourages the use of the messages established in this plan specifically for Hispanic audiences and the use of the characters and creative to be developed in the booklet to maximize investment, maintain consistency, increase brand awareness and accomplish Hispanic plan goals.

**Timeline**

Please see attached timeline. (Under development pending final plan approval)

**Measurements**

Please see attached measurement table. (Under development pending final plan approval)

**Budget**

A detailed tentative budget is attached for your reference. Language Sources is developing a strategic plan to find partner agencies and corporations that will participate to leverage SNAP and PLI funding through sponsorships at several levels.

**Contact Information**

For any questions regarding this plan, please contact:

Maria Marinch, President  
1489 W. Warm Springs Road, Suite 110  
Henderson, NV 89014  
Phone: (702) 617-7845  
Fax: (702) 617-7846  
Cell: (702) 812-8663  
mmarinch@languagesources.com
"Up and Down" Children's Activity
Forever Earth Trip Schedule
Year 2, 4th Quarter
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<th>Date</th>
<th>Group</th>
<th>Group Type</th>
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<th># of Students</th>
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<td>Twitchell ES (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>8</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

**Totals for 4th quarter**

- 53 groups
- Education – 51 groups
- Agency – 2 groups
- Education – 210.75 hrs.
- Agency – 6.25 hrs.
- Totals: 539, 1446, 1985

**Totals for Year 2**

- 125 groups
- Education – 109 groups
- Agency – 16 groups
- Education – 452.25 hrs.
- Agency – 152.25 hrs.
- Totals: 1272, 2801, 4073

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Forever Earth Trip Schedule
Year 2
## Forever Earth Trip Schedule
### Year 2, Round 6 (June 1, 2008 - May 31, 2009)

<table>
<thead>
<tr>
<th>Date(s)</th>
<th>Group</th>
<th>Group Type</th>
<th>Trip Purpose</th>
<th>Length of Trip</th>
<th># of Adults</th>
<th># of Students</th>
<th>Total Pass.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Jun</td>
<td>Jeffers Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>5.5 hrs. (2 trips)</td>
<td>7</td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td>3-Jun</td>
<td>Brookman Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>12</td>
<td>30</td>
<td>42</td>
</tr>
<tr>
<td>4-Jun</td>
<td>Hollingsworth ES GATE Gr. 4&amp;5</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>5 hrs.</td>
<td>4</td>
<td>21</td>
<td>25</td>
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<tr>
<td>5-Jun</td>
<td>National Park Service</td>
<td>Agency</td>
<td>Familiarization Trip for NPS Tourism Group</td>
<td>3 hrs.</td>
<td>13</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>9-Jun</td>
<td>Miley Achievement Center (High School)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>3 hrs.</td>
<td>5</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>13-Jun</td>
<td>Bendorf Ele. (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>10</td>
<td>28</td>
<td>38</td>
</tr>
<tr>
<td>16-Jun</td>
<td>Bendorf Ele. (4th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>9</td>
<td>27</td>
<td>36</td>
</tr>
<tr>
<td>18-Jun</td>
<td>Bendorf Ele. (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>27</td>
<td>35</td>
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<tr>
<td>23-Jun</td>
<td>Westcare</td>
<td>Education</td>
<td>Outdoor World event</td>
<td>4 hrs.</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>24-Jun</td>
<td>Bendorf Ele. (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>11</td>
<td>24</td>
<td>35</td>
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<tr>
<td>25-Jun</td>
<td>Bendorf Ele. (4th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
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<td>27</td>
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<tr>
<td>28-Jun</td>
<td>National Park Service</td>
<td>Agency</td>
<td>Mobile Visitor Center</td>
<td>7 hrs.</td>
<td>2</td>
<td>0</td>
<td>2</td>
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<tr>
<td>5-Jul</td>
<td>National Park Service</td>
<td>Agency</td>
<td>Mobile Visitor Center</td>
<td>7 hrs.</td>
<td>3</td>
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<tr>
<td>12-Jul</td>
<td>RecMobile</td>
<td>Education</td>
<td>Outdoor World event</td>
<td>4 hrs.</td>
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<td>7</td>
<td>12</td>
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<tr>
<td>15-Jul</td>
<td>SAME - National Park Service</td>
<td>Agency</td>
<td>Familiarization Trip for Engineers Group</td>
<td>3 hrs.</td>
<td>17</td>
<td>0</td>
<td>17</td>
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<tr>
<td>19-Jul</td>
<td>National Park Service</td>
<td>Agency</td>
<td>Mobile Visitor Center</td>
<td>7.5 hrs.</td>
<td>2</td>
<td>0</td>
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<tr>
<td>2-Aug</td>
<td>National Park Service</td>
<td>Agency</td>
<td>Mobile Visitor Center</td>
<td>5.5 hrs.</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>11-Aug</td>
<td>Southern Nevada Water Authority</td>
<td>Agency</td>
<td>Standardize water quality instruments</td>
<td>6 hrs.</td>
<td>20</td>
<td>0</td>
<td>20</td>
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<tr>
<td>16-Aug</td>
<td>National Park Service</td>
<td>Agency</td>
<td>Mobile Visitor Center</td>
<td>7.5 hrs.</td>
<td>3</td>
<td>0</td>
<td>3</td>
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<tr>
<td>Aug. 18-26</td>
<td>National Park Service</td>
<td>Agency</td>
<td>Filming for Centennial Project</td>
<td>86 hrs.</td>
<td>35</td>
<td>16</td>
<td>51</td>
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<tr>
<td>20-Aug</td>
<td>National Park Service</td>
<td>Agency</td>
<td>Familiarization Trip</td>
<td>2.5 hrs.</td>
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<td>0</td>
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<td>Agency</td>
<td>Education/Activity</td>
<td>Trip Length</td>
<td>Education for 45 hrs.</td>
<td>Agency for 45 hrs.</td>
<td>Totals for 1st quarter</td>
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<td>------------------------</td>
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<tr>
<td>21-Aug</td>
<td>National Park Service</td>
<td>Agency</td>
<td>3 hrs.</td>
<td>5</td>
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<td>5</td>
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<tr>
<td>24-Sep</td>
<td>Goldfarb Elementary (4th grade)</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>9</td>
<td>28</td>
<td>37</td>
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<tr>
<td>26-Sep</td>
<td>Goldfarb Elementary (4th grade)</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>10</td>
<td>27</td>
<td>37</td>
<td></td>
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<tr>
<td>27-Sep</td>
<td>NV Council for History Education</td>
<td>Education</td>
<td>4 hrs.</td>
<td>21</td>
<td>0</td>
<td>21</td>
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<tr>
<td>3-Oct</td>
<td>Cumorah Academy</td>
<td>Education</td>
<td>5 hrs.</td>
<td>12</td>
<td>0</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>7-Oct</td>
<td>Public Lands Institute</td>
<td>Agency</td>
<td>3.5 hrs.</td>
<td>11</td>
<td>0</td>
<td>11</td>
<td></td>
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<tr>
<td>10-Oct</td>
<td>Goldfarb Elementary (5th grade)</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>28</td>
<td>36</td>
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</tr>
<tr>
<td>11-Oct</td>
<td>UNLV Education Outreach</td>
<td>Education</td>
<td>7 hrs.</td>
<td>19</td>
<td>0</td>
<td>19</td>
<td></td>
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<tr>
<td>14-Oct</td>
<td>Forever Resorts/NPS event</td>
<td>Agency</td>
<td>2 hrs.</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>16-Oct</td>
<td>Burk Horizon High School</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>36</td>
<td>44</td>
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<tr>
<td>17-Oct</td>
<td>Goldfarb Elementary (4th grade)</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>9</td>
<td>29</td>
<td>38</td>
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<tr>
<td>20-Oct</td>
<td>UNLV Education Outreach</td>
<td>Education</td>
<td>5 hrs.</td>
<td>25</td>
<td>0</td>
<td>25</td>
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</tr>
<tr>
<td>21-Oct</td>
<td>Gene Ward Elementary (4th grade)</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>19</td>
<td>31</td>
<td>50</td>
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<td>Gene Ward Elementary (4th grade)</td>
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<td>3.5 hrs. (2 trips)</td>
<td>14</td>
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<td>Gene Ward Elementary (4th grade)</td>
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<td>4 hrs. (2 trips)</td>
<td>14</td>
<td>38</td>
<td>52</td>
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<td>27-Oct</td>
<td>Goldfarb Elementary (5th grade)</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>27</td>
<td>35</td>
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</tr>
<tr>
<td>28-Oct</td>
<td>Cumorah Academy (7th grade)</td>
<td>Education</td>
<td>4.5 hrs.</td>
<td>7</td>
<td>16</td>
<td>23</td>
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<tr>
<td>29-Oct</td>
<td>Goldfarb Elementary (5th grade)</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>30</td>
<td>38</td>
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</tr>
<tr>
<td>30-Oct</td>
<td>Cumorah Academy (5th grade)</td>
<td>Education</td>
<td>4.5 hrs.</td>
<td>6</td>
<td>20</td>
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<tr>
<td>3-Nov</td>
<td>Reedom Elementary (5th grade)</td>
<td>Education</td>
<td>4 hrs. (2 trips)</td>
<td>9</td>
<td>27</td>
<td>36</td>
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<tr>
<td>Date</td>
<td>School Name</td>
<td>Grade</td>
<td>Type</td>
<td>Duration</td>
<td>Education</td>
<td>Agency</td>
<td>Total</td>
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<tr>
<td>5-Nov</td>
<td>Goldfarb Elementary (4th/5th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>28</td>
<td>36</td>
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<tr>
<td>6-Nov</td>
<td>Mabel Hoggard Elementary (5th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>7</td>
<td>27</td>
<td>34</td>
</tr>
<tr>
<td>7-Nov</td>
<td>Legacy High School</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>3.5 hrs. (2 trips)</td>
<td>11</td>
<td>23</td>
<td>34</td>
</tr>
<tr>
<td>8-Nov</td>
<td>Public Lands Institute</td>
<td>Education</td>
<td>Outdoor World Event</td>
<td>5 hrs.</td>
<td>5</td>
<td>4</td>
<td>9</td>
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<tr>
<td>12-Nov</td>
<td>Reedom Elementary (5th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>3 hrs. (2 trips)</td>
<td>9</td>
<td>30</td>
<td>39</td>
</tr>
<tr>
<td>13-Nov</td>
<td>Guy Elementary (4th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (3 trips)</td>
<td>20</td>
<td>54</td>
<td>74</td>
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<tr>
<td>14-Nov</td>
<td>Goldfarb Elementary (4th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>13</td>
<td>22</td>
<td>35</td>
</tr>
<tr>
<td>15-Nov</td>
<td>Greenspun JHS (7th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>36</td>
<td>44</td>
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<tr>
<td>17-Nov</td>
<td>Guy Elementary (4th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (3 trips)</td>
<td>14</td>
<td>63</td>
<td>77</td>
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<td>Reedom Elementary (4th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>13</td>
<td>28</td>
<td>41</td>
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<tr>
<td>21-Nov</td>
<td>Goldfarb Elementary (5th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>22-Nov</td>
<td>Westcare Girls</td>
<td>Education</td>
<td>Outdoor World Event</td>
<td>5 hrs.</td>
<td>4</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>24-Nov</td>
<td>Westcare Boys</td>
<td>Education</td>
<td>Outdoor World Event</td>
<td>4.5 hrs.</td>
<td>5</td>
<td>13</td>
<td>18</td>
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<tr>
<td></td>
<td><strong>Totals for 2nd quarter</strong></td>
<td><strong>32 groups</strong></td>
<td><strong>Education – 30 groups</strong></td>
<td><strong>342</strong></td>
<td><strong>735</strong></td>
<td><strong>1077</strong></td>
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<td>2-Dec</td>
<td>JD Smith Middle School Afternoon</td>
<td>Education</td>
<td>Outdoor World Event</td>
<td>5 hrs.</td>
<td>5</td>
<td>21</td>
<td>26</td>
</tr>
<tr>
<td>3-Dec</td>
<td>Guy Elementary (4th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>3 hrs. (2 trips)</td>
<td>12</td>
<td>27</td>
<td>39</td>
</tr>
<tr>
<td>4-Dec</td>
<td>Reedom Elementary (5th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>10</td>
<td>24</td>
<td>34</td>
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<td>5-Dec</td>
<td>Reedom Elementary (4th)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>9</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>6-Dec</td>
<td>Jackie Gaughan Boys and Girls</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4.5 hrs.</td>
<td>6</td>
<td>5</td>
<td>11</td>
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<tr>
<td>6-Dec</td>
<td>Las Vegas Boatowners Association</td>
<td>Education</td>
<td>Community Outreach</td>
<td>5 hrs.</td>
<td>13</td>
<td>2</td>
<td>15</td>
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<tr>
<td>9-Dec</td>
<td>Orr Middle School Afternoon All</td>
<td>Education</td>
<td>Outdoor World Event</td>
<td>5 hrs.</td>
<td>6</td>
<td>22</td>
<td>28</td>
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<table>
<thead>
<tr>
<th>Date</th>
<th>Name and Location</th>
<th>Field Category</th>
<th>Activity Description</th>
<th>Hours (2 trips)</th>
<th>Total Groups</th>
<th>Total Education Hours</th>
<th>Total Agency Hours</th>
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<tr>
<td>10-Dec</td>
<td>William Wright Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>9</td>
<td>27</td>
<td>36</td>
</tr>
<tr>
<td>11-Dec</td>
<td>Goldfarb Elementary (4th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>12</td>
<td>31</td>
<td>43</td>
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<tr>
<td>22-Jan</td>
<td>Mabel Hoggard Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>12</td>
<td>27</td>
<td>39</td>
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<tr>
<td>12-Feb</td>
<td>Southern Nevada Water Authority</td>
<td>Agency</td>
<td>Standardize water quality instruments</td>
<td>3 hrs.</td>
<td>17</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>18-Feb</td>
<td>Lunt Elementary (4th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>8</td>
<td>25</td>
<td>33</td>
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<tr>
<td>19-Feb</td>
<td>Lunt Elementary (4th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>8</td>
<td>30</td>
<td>38</td>
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<tr>
<td>20-Feb</td>
<td>Lunt Elementary (4th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>10</td>
<td>26</td>
<td>36</td>
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<td>UNLV Education Outreach</td>
<td>Education</td>
<td>Elderhostel Program</td>
<td>4.5 hrs.</td>
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<td>0</td>
<td>18</td>
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<td>Lummis Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>12</td>
<td>31</td>
<td>43</td>
</tr>
<tr>
<td>25-Feb</td>
<td>Lummis Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>10</td>
<td>30</td>
<td>40</td>
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<tr>
<td>26-Feb</td>
<td>Lummis Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>18</td>
<td>29</td>
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<td>Education - 17 groups Agency - 1 group</td>
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<td>195</td>
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<td>572</td>
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<td>2-Mar</td>
<td>Wright ES GATE (4th and 5th grades)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>19</td>
<td>26</td>
<td>45</td>
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<tr>
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<td>Cumorah Academy (6th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>11</td>
<td>23</td>
<td>34</td>
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<tr>
<td>4-Mar</td>
<td>Wright ES GATE (4th and 5th grades)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>4</td>
<td>19</td>
<td>23</td>
</tr>
<tr>
<td>6-Mar</td>
<td>Mabel Hoggard Elementary (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>8</td>
<td>23</td>
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<tr>
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<td>3.5 hrs.</td>
<td>7</td>
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<tr>
<td>12-Mar</td>
<td>Mabel Hoggard Elementary (5th grade)</td>
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<td>4 hrs.</td>
<td>8</td>
<td>25</td>
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<td>4 hrs.</td>
<td>20</td>
<td>31</td>
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<td>Bridger MS (7th grade)</td>
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<td>4.25 hrs</td>
<td>9</td>
<td>28</td>
<td>36</td>
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<tr>
<td>18-Mar</td>
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<td>Education</td>
<td>Student Field Trip</td>
<td>4.25 hrs</td>
<td>4</td>
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<td>Date</td>
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<td>Grade</td>
<td>Activity</td>
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<td>Bridger MS</td>
<td>7th</td>
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<td>hrs.</td>
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<td>Paradise ES</td>
<td>5th</td>
<td>Student Field Trip</td>
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<td>hrs.</td>
<td>2 trips</td>
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<td>Law Enforcement Group - Familiarization Trip</td>
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<td>hrs.</td>
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<td>hrs.</td>
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<td>Student Field Trip</td>
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<td>hrs.</td>
<td>2 trips</td>
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<td>Haikal Islamic Academy</td>
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<td>Student Field Trip</td>
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<td>hrs.</td>
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<td>31-Mar</td>
<td>Marc Kahre ES</td>
<td>4th and 5th</td>
<td>GATE</td>
<td>Student Field Trip</td>
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<td>hrs.</td>
<td>2 trips</td>
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<td>M.P. King ES</td>
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<td>hrs.</td>
<td>2 trips</td>
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<td>Betsy Rhodes ES</td>
<td>5th</td>
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<td>hrs.</td>
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<td>Cumorah Academy</td>
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<td>Student Field Trip</td>
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<td>14-Apr</td>
<td>Reedom ES</td>
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<td>Student Field Trip</td>
<td>4</td>
<td>hrs.</td>
<td>2 trips</td>
<td>10</td>
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<td>15-Apr</td>
<td>Robert Taylor Elementary</td>
<td>5th</td>
<td>Student Field Trip</td>
<td>4</td>
<td>hrs.</td>
<td></td>
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<td>16-Apr</td>
<td>Robert Taylor Elementary</td>
<td>6th</td>
<td>Student Field Trip</td>
<td>4</td>
<td>hrs.</td>
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<td>17-Apr</td>
<td>Robert Taylor Elementary</td>
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<td>Student Field Trip</td>
<td>4</td>
<td>hrs.</td>
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<td>Garrett JHS</td>
<td>7th</td>
<td>Student Field Trip</td>
<td>4</td>
<td>hrs.</td>
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<td>hrs.</td>
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<td>Garrett JHS</td>
<td>7th</td>
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<td>hrs.</td>
<td>2 trips</td>
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<td>hrs.</td>
<td>2 trips</td>
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<td>27-Apr</td>
<td>Rose Warren ES</td>
<td>5th</td>
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<td>Student Field Trip</td>
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<td>hrs.</td>
<td>2 trips</td>
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<td>hrs.</td>
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<td>Date</td>
<td>Location</td>
<td>Education</td>
<td>Activity</td>
<td>Duration (hrs)</td>
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<td>Rose Warren ES (5th grade)</td>
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<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
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<td>43</td>
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<td>2-May</td>
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<td>Rose Warren ES (5th grade)</td>
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<td>3.75 hrs. (3 trips)</td>
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<td>Martha P. King ES (5th grade)</td>
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<td>27</td>
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<td>Hyde Park Middle School (6th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>12</td>
<td>36</td>
<td>48</td>
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<td>7-May</td>
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<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>12</td>
<td>40</td>
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<td>8-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>15</td>
<td>38</td>
<td>53</td>
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<tr>
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<td>Student Field Trip</td>
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<td>27</td>
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<td>Education</td>
<td>CCSD Focus Groups</td>
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<td>15</td>
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<td>15</td>
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<tr>
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<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>12</td>
<td>30</td>
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<td>14-May</td>
<td>Bendorf ES (5th grade)</td>
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<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
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<td>Vanderburg ES (4th grade)</td>
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<td>12</td>
<td>29</td>
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<td>Hyde Park Middle School (6th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>5 hrs. (2 trips)</td>
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<td>41</td>
<td>48</td>
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<tr>
<td>19-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>5 hrs. (2 trips)</td>
<td>7</td>
<td>35</td>
<td>42</td>
</tr>
<tr>
<td>20-May</td>
<td>Hyde Park Middle School (6th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>5 hrs. (2 trips)</td>
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<td>33</td>
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<tr>
<td>21-May</td>
<td>Vail Pittman ES (4th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs.</td>
<td>4</td>
<td>17</td>
<td>21</td>
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<tr>
<td>27-May</td>
<td>Twitchell ES (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>33</td>
<td>41</td>
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<tr>
<td>28-May</td>
<td>Twitchell ES (5th grade)</td>
<td>Education</td>
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<td>4 hrs. (2 trips)</td>
<td>17</td>
<td>29</td>
<td>46</td>
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<td>29-May</td>
<td>Twitchell ES (5th grade)</td>
<td>Education</td>
<td>Student Field Trip</td>
<td>4 hrs. (2 trips)</td>
<td>8</td>
<td>30</td>
<td>38</td>
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**Totals for 4th quarter**: 53 groups
<table>
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<tr>
<th>Totals for Year 2</th>
<th>125 groups</th>
<th>Education – 109 groups Agency – 16 groups</th>
<th>Education – 452.25 hrs. Agency – 162.25 hrs.</th>
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Discover Mojave
Outdoor World Schedule
Year 2
## Discover Mojave Outdoor World Schedule
### Year 2, Round 6 (June 1, 2008 – May 31, 2009)

<table>
<thead>
<tr>
<th>DATE</th>
<th>GROUP</th>
<th># of PARTICIPANTS</th>
<th>ACTIVITY</th>
<th>LOCATION</th>
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<tr>
<td>Thurs., June 12</td>
<td>Valley View Recreation Center</td>
<td>27</td>
<td>Intro. to Photography</td>
<td>Valley View Recreation Center</td>
</tr>
<tr>
<td>Sat., June 14</td>
<td>General Public</td>
<td>184</td>
<td>Fishing, Art Adventure</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tues., June 17</td>
<td>Las Vegas City Parks and Recreation Department</td>
<td>48</td>
<td>Intro to Bird Watching</td>
<td>Floyd Lamb Park</td>
</tr>
<tr>
<td>Mon., June 23</td>
<td>Westcare</td>
<td>6</td>
<td>Science and Art Adventure</td>
<td>Forever Earth, Lake Mead NRA</td>
</tr>
<tr>
<td>Wed., June 25</td>
<td>Valley View Recreation Center</td>
<td>31</td>
<td>Intro to Kayaking</td>
<td>Wells Pool, Henderson</td>
</tr>
<tr>
<td>Fri., June 27</td>
<td>Valley View Recreation Center</td>
<td>23</td>
<td>Kayaking</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Wed., July 2</td>
<td>Valley View Recreation Center</td>
<td>20</td>
<td>Hiking, Intro to Camping Skills</td>
<td>Spring Mountains NRA</td>
</tr>
<tr>
<td>Thurs., July 10</td>
<td>Valley View Recreation Center</td>
<td>21</td>
<td>Intro to Fishing</td>
<td>Valley View Recreation Center</td>
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<td>Floyd Lamb Park</td>
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<td>RecMobile</td>
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<td>Science and Art Activities</td>
<td>Forever Earth, Lake Mead NRA</td>
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<tr>
<td>Tues., July 15</td>
<td>Sunrise Community Center</td>
<td>8</td>
<td>Rock Climbing</td>
<td>Nevada Indoor Climbing Center</td>
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<tr>
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<td>Westcare</td>
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<td>Kayaking</td>
<td>Lake Mead NRA</td>
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<tr>
<td>Mon., July 21</td>
<td>Desert Breeze Community Center</td>
<td>21</td>
<td>Kayaking</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Fri., July 25</td>
<td>Valley View Recreation Center</td>
<td>26</td>
<td>Rock Climbing</td>
<td>Nevada Indoor Climbing Center</td>
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<tr>
<td>Wed., July 30</td>
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<td>Mon., Aug. 4</td>
<td>Desert Breeze Community Center</td>
<td>16</td>
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<td>Nevada Indoor Climbing Center</td>
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<td>Sat., Aug. 9</td>
<td>Sunrise Community Center</td>
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<td>Lake Mead NRA</td>
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<tr>
<td>Fri., Aug. 15</td>
<td>Desert Breeze Community Center</td>
<td>16</td>
<td>Hiking</td>
<td>Spring Mountains NRA</td>
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<td>Tues., Aug. 19</td>
<td>Sunrise Community Center</td>
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<td>Lake Mead NRA</td>
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<td><strong>TOTALS for 1st Quarter</strong></td>
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<td><strong>22 Events</strong></td>
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<td><strong>Wed., Sept.</strong></td>
<td>Environmental</td>
<td>11</td>
<td>Kayaking</td>
<td>Lake Mead NRA</td>
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<tr>
<td>Date</td>
<td>Event Description</td>
<td>Participants</td>
<td>Location</td>
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<tr>
<td>Wed., Oct. 1</td>
<td>Environmental Science Club, Paradise Elementary</td>
<td>11</td>
<td>Fishing I</td>
<td>Sunset Park</td>
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<tr>
<td>Wed., Oct. 8</td>
<td>Environmental Science Club, Paradise Elementary</td>
<td>12 x 2 = 24</td>
<td>Fishing II Art Adventure</td>
<td>Sunset Park</td>
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<td>Thurs., Oct. 9</td>
<td>Jackie Gaughan and Al Snyder Girls and Boys Clubs</td>
<td>23</td>
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<td>Nevada Indoor Climbing Center</td>
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<tr>
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<td>Environmental Science Club, Paradise Elementary</td>
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<td>Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
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<tr>
<td>Sat.-Sun., Oct. 25-26</td>
<td>Environmental Science Club, Paradise Elementary</td>
<td>7</td>
<td>Camping I</td>
<td>Red Rock Canyon National Conservation Area</td>
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<td>Wed., Oct. 29</td>
<td>Environmental Science Club, Paradise Elementary</td>
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<td>Bird Watching I</td>
<td>Sunset Park</td>
</tr>
<tr>
<td>Thurs., Nov. 6</td>
<td>Westcare Girls</td>
<td>9</td>
<td>Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Sat., Nov. 8</td>
<td>Environmental Science Club, Paradise Elementary</td>
<td>4</td>
<td>Science and Art Adventure</td>
<td>Forever Earth, Lake Mead NRA</td>
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<tr>
<td>Fri., Nov. 14</td>
<td>Paradise Elementary 2nd and 4th graders</td>
<td>59</td>
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<td>Sunset Park</td>
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<tr>
<td>Fri., Nov. 14</td>
<td>Westcare Boys</td>
<td>9</td>
<td>Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
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<tr>
<td>Thurs., Nov. 20</td>
<td>Jackie Gaughan Boys and Girls Club</td>
<td>16</td>
<td>Outdoor Education Obstacle Course</td>
<td>UNLV Campus</td>
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<td>Sat., Nov. 22</td>
<td>Westcare Girls</td>
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<td>Science and Art Adventure</td>
<td>Forever Earth, Lake Mead NRA</td>
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<tr>
<td>Mon., Nov. 24</td>
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<td>Tues., Nov. 25</td>
<td>CCSD – JD Smith MS Physical Education</td>
<td>25</td>
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<td>Nevada Indoor Climbing Center</td>
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**TOTALS for 2nd Quarter**: 5 Groups, 266 Events
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<th>Date</th>
<th>Participant(s)</th>
<th>Action</th>
<th>Location</th>
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<td>JD Smith MS Afternoon All Stars</td>
<td>Science and Art Adventure</td>
<td>Forever Earth Lake Mead NRA</td>
</tr>
<tr>
<td>Wed., Dec. 3</td>
<td>Westcare Boys</td>
<td>Fishing I</td>
<td>Floyd Lamb Park</td>
</tr>
<tr>
<td>Sat., Dec. 6</td>
<td>Jackie Gaughan Boys and Girls Club</td>
<td>Science and Art Adventure</td>
<td>Forever Earth Lake Mead NRA</td>
</tr>
<tr>
<td>Mon., Dec. 8</td>
<td>Ober ES 5th grade students</td>
<td>Birdwatching I</td>
<td>Ober ES campus</td>
</tr>
<tr>
<td>Tues., Dec. 9</td>
<td>Orr MS Afternoon All Stars</td>
<td>Science and Art Adventure</td>
<td>Forever Earth Lake Mead NRA</td>
</tr>
<tr>
<td>Sat., Feb. 7</td>
<td>JD Smith and Orr MS Afternoon All Stars</td>
<td>Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Tues., Feb. 10</td>
<td>CCSD - Miller MS Physical Education</td>
<td>Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
</tbody>
</table>

**TOTALS for 3rd Quarter**

<table>
<thead>
<tr>
<th>Date</th>
<th>Participant(s)</th>
<th>Action</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon., Mar. 23</td>
<td>CCSD - JD Smith MS Physical Education</td>
<td>Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Mon., Mar. 23</td>
<td>JD Smith MS Afternoon All Stars</td>
<td>Intro to Orienteering</td>
<td>JD Smith MS campus</td>
</tr>
<tr>
<td>Tues., March 24</td>
<td>Orr MS Afternoon All Stars</td>
<td>Intro to Orienteering (Maps)</td>
<td>Orr MS campus</td>
</tr>
<tr>
<td>Wed., Mar 25</td>
<td>JD Smith Afternoon All Stars</td>
<td>Orienteering</td>
<td>JD Smith campus</td>
</tr>
<tr>
<td>Thurs., Mar 26</td>
<td>Orr MS Afternoon All Stars</td>
<td>Intro to Orienteering (Compass)</td>
<td>Orr MS campus</td>
</tr>
<tr>
<td>Tues., Mar 31</td>
<td>Orr MS Afternoon All Stars</td>
<td>Orienteering</td>
<td>Orr MS campus</td>
</tr>
<tr>
<td>Tues., April 14</td>
<td>CCSD - Mack MS Physical Education</td>
<td>Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Wed., April 29</td>
<td>Paradise Environmental Science Club</td>
<td>Geocaching</td>
<td>Sunset Park</td>
</tr>
<tr>
<td>Wed., May 6</td>
<td>Paradise Environmental Science Club</td>
<td>Rock Climbing I</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Tues., May 12</td>
<td>CCSD - Keller MS Physical Education</td>
<td>Kayaking</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Wed., May 13</td>
<td>Paradise Environmental Science Club</td>
<td>Kayaking</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Sat., May 16</td>
<td>Families in Nature</td>
<td>Bird Watching I</td>
<td>Winchester Cultural Center</td>
</tr>
<tr>
<td>Sat.-Sun., May 16-17</td>
<td>Paradise Environmental Science Club</td>
<td>7 x 3 activities = 21</td>
<td>Spring Mtns. NRA</td>
</tr>
<tr>
<td>Tues., May 19</td>
<td>CCSD - Mack MS Physical Education</td>
<td>Kayaking</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Wed., May 20</td>
<td>Paradise</td>
<td>Bird Watching I</td>
<td>Sunset Park</td>
</tr>
<tr>
<td>Environmental Science Club</td>
<td>6 Groups</td>
<td>329 participants</td>
<td>17 Events</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------</td>
<td>------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>TOTALS for 4th Quarter</td>
<td>17 Groups</td>
<td>1320 participants</td>
<td>62 Events</td>
</tr>
<tr>
<td>TOTALS for Year 2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discover Mojave
Outdoor World Schedule (DRAFT)
Year 3
### Discover Mojave Outdoor World Schedule

**Year 3 (June 1, 2009 – May 31, 2010)**

(last updated 5/20/09)

<table>
<thead>
<tr>
<th>DATE</th>
<th>GROUP</th>
<th># of PARTICIPANTS</th>
<th>ACTIVITY</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sat., June 13</td>
<td>General Public - Free Fishing Day</td>
<td></td>
<td>Fishing Art</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Thurs., June 18</td>
<td>John Kish Unit, Henderson Boys and Girls Club</td>
<td></td>
<td>Kayaking 1</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Fri., June 19</td>
<td>Valley View Recreation Center</td>
<td></td>
<td>Kayaking 1</td>
<td>Lake Mead NRA</td>
</tr>
<tr>
<td>Thurs., June 25</td>
<td>John Kish Unit, Henderson Boys and Girls Club</td>
<td></td>
<td>Geocaching</td>
<td>Sunset Park</td>
</tr>
<tr>
<td>Thurs., July 9</td>
<td>John Kish Unit, Henderson Boys and Girls Club</td>
<td></td>
<td>Hiking</td>
<td>Spring Mountains NRA</td>
</tr>
<tr>
<td>Fri., July 10</td>
<td>Valley View Recreation Center</td>
<td></td>
<td>Geocaching</td>
<td>Sunset Park</td>
</tr>
<tr>
<td>Thurs., July 16</td>
<td>John Kish Unit, Henderson Boys and Girls Club</td>
<td></td>
<td>Rock Climbing 1</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Mon., July 20</td>
<td>Camp Lee</td>
<td></td>
<td>Geocaching</td>
<td>Spring Mountains NRA</td>
</tr>
<tr>
<td>Fri., July 24</td>
<td>Valley View Recreation Center</td>
<td></td>
<td>Rock Climbing 1</td>
<td>Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td>Thurs., July 30</td>
<td>Camp Lee</td>
<td></td>
<td>Bird Watching 1</td>
<td>Spring Mountains NRA</td>
</tr>
<tr>
<td>Fri., Aug. 7</td>
<td>Valley View Recreation Center</td>
<td></td>
<td>Hiking 1</td>
<td>Spring Mountains NRA</td>
</tr>
</tbody>
</table>

**TOTALS for 1st Quarter (to date)**
- 4 Groups
- 12 Events

**TOTALS for 2nd Quarter (to date)**
- Groups
- Events

**TOTALS for 3rd Quarter (to date)**
- Groups
- Events

**TOTALS for 4th Quarter (to date)**
- Groups
- Events

**TOTALS for Year 3 (to date)**
- Groups
- Events
Discover Mojave Outdoor World
Activity Outlines:
Geocaching
Rock Climbing (Adventurer Level)
GEOCACHING ACTIVITY

OVERVIEW

Geocaching is a high-tech treasure hunting game played throughout the world by adventure seekers equipped with Global Positioning Satellite (GPS) receivers. The basic idea is to locate hidden containers, called geocaches, in the outdoors.

This geocaching activity is set up as a friendly competition and "race" to locate as many caches as possible in a designated time period. It is a fun physical activity. A course is designed on a particular public land site or in a local park. Geocaching and outdoor ethics are emphasized and discussed with participants. A discussion of outdoor recreational opportunities on public lands is also provided.

GEOCACHING UNIT GOAL

Participants will learn the basics of geocaching and safely enjoy the challenges of locating caches.

UNIT OBJECTIVES

- **Adventurer Level**: Participants will:
  - Successfully demonstrate proper use of a GPS unit.
  - Successfully locate a number of caches.

- **Explorer Level**: To be developed.

- **Rock Star Level**: To be developed.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The Geocaching activity unit supports the following guiding themes developed by Clark County educators:

- Sub-theme 2. We share the intriguing stories of Southern Nevada’s diverse, interconnected natural world.

POTENTIAL ACTIVITY LOCATIONS
• Lee Meadows, Spring Mountains National Recreation Area
• Red Rock Canyon National Conservation Area
• Sunset Park
• Floyd Lamb City Park

ACTIVITY OUTLINE

The outline below contains suggestions for unit activities. The actual content of a scheduled event depends upon:

1. Group characteristics (ages, group dynamics, previous experiences, etc.)
2. Event timeframe
3. Location
4. Experience of the event facilitators

ACTIVITY PREPARATION

Caches have to be prepared and hidden prior to the activity. Each location is marked with a waypoint name that relates to the cache content. Mojave Desert cards can be used for the cache content, and a question bank can be generated with information provided on the cards.

Adventurer Level

Part 1 – INTRODUCTION
(5-10 minutes)

Event leaders facilitate introductions, convey enthusiasm, and generate eagerness for the day’s activities. The pre-activity assessment instrument is explained to and completed by participants. Nametags are created and distributed. One facilitator sets the stage by describing how the day is structured, explaining what kinds of activities will take place, and clearly stating participant behavioral expectations. Behavioral expectations are pre-determined guidelines set by event leaders. Examples of guidelines include the expectations that everyone stay with the group, that participants do not litter, and that participants respect each other by not pushing or shoving. Any specific park or location rules should be explained at this time. For example, items such as rocks or plants may not be collected in Lake Mead National Recreation Area.

Part 2 – THE BASICS
(15 minutes)

Basic instruction is given on how to use a GPS unit and how to locate caches on the course. Participant teams of 2-4 members are created and, if possible, an adult is assigned to each team. Each team is given a set of questions where each question ties to information found at a cache. Teams will be judged on the number of caches located and accuracy of answers. The facilitator will model finding a cache with the entire group.

Part 3 – THE RACE IS ON!
(70 – 90 minutes)
Time is allowed for teams to locate caches. Facilitators and other adult leaders should be aware of any safety issues and rectify the issues immediately.

Part 4 – CLOSURE
(15 minutes)

The main concepts are reviewed by facilitating discussions about what participants, enjoyed, discovered, and learned. The post-assessment instrument is explained and completed by participants. Geocaching related educational materials are presented to each participant. Adventurer Level participants also receive a certificate of completion.

Explorer Level
To be developed.

Rock Star Level
To be developed.

RESOURCES

Literature

Let's Go Geocaching: Boys' Life Reader (DK Readers) by DK Publishing
Geocaching: Hike and Seek with Your GPS (Technology in Action Series) by Erik Sherman

Web sites

http://www.geocaching.com
http://factsfacts.com/geocacher.htm

Suggestions for “take home” items for participants:

Discover Mojave Desert Card Set
Photos taken during the geocaching activity
Geocaching Activity

ACTIVITY CHECKLIST

☐ Original Permission Slips
☐ Vehicle Paperwork
☐ Roster
☐ First Aid Kit
☐ Pre- and Post Activity Assessments
☐ Performance Rubric
☐ Name Tags
☐ Clipboards
☐ Question Sets
☐ GPS Units
☐ Digital Camera
☐ Video Camera
☐ Mojave Desert Card Sets
☐ Bottled Water
☐ Snacks
☐ Pencils
☐ Markers
☐ Certificates
# Geocaching

## Sample Schedule of Activities

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 am</td>
<td>Meet at south end of Sunset Lake, Sunset Park</td>
</tr>
<tr>
<td></td>
<td>Introductions</td>
</tr>
<tr>
<td></td>
<td>Pre-activity assessment</td>
</tr>
<tr>
<td></td>
<td>Stage-setting</td>
</tr>
<tr>
<td>9:20 am</td>
<td>The Basics</td>
</tr>
<tr>
<td></td>
<td>• How to use a GPS unit to locate a cache</td>
</tr>
<tr>
<td></td>
<td>• Ethics of geocaching</td>
</tr>
<tr>
<td>9:45 am</td>
<td>The Race is On!</td>
</tr>
<tr>
<td></td>
<td>• Teams find geocache locations and answer questions based on information located in the cache</td>
</tr>
<tr>
<td>11:15 pm</td>
<td>Post-activity assessment</td>
</tr>
<tr>
<td></td>
<td>Closure</td>
</tr>
<tr>
<td></td>
<td>Certificate awards</td>
</tr>
<tr>
<td>11:45 pm</td>
<td>Depart Sunset Park</td>
</tr>
</tbody>
</table>
Geocaching Activity
Pre-Assessment Part I

What do you know about geocaching?

Nothing
Cache
Competition
Waypoint
GPS receiver
Treasure Hunt
Ethics
Geocaching Activity
Pre-Assessment Part II

1). I would tell my friends to do this geo-caching program.

Strongly agree  Agree  Disagree  Strongly Disagree

2). Geocaching is very interesting to me.

Strongly agree  Agree  Disagree  Strongly Disagree

3). Geocaching is fun.

Strongly agree  Agree  Disagree  Strongly Disagree

4). I would like to do another geocaching program.

Strongly agree  Agree  Disagree  Strongly Disagree

5). I would like to show my friends how to geocache.

Strongly agree  Agree  Disagree  Strongly Disagree
Geocaching Activity
Post-Assessment Part I

What did you learn about rock climbing?

- Nothing
- Cache
- Competition
- Waypoint
- GPS Receiver
- Treasure Hunt
- Ethics
Geocaching Activity
Post-Assessment Part II

1): I would tell my friends to do this geo-caching program.

Strongly agree  Agree  Disagree  Strongly Disagree

2). Geocaching was very interesting to me.

Strongly agree  Agree  Disagree  Strongly Disagree

3). Geocaching was fun.

Strongly agree  Agree  Disagree  Strongly Disagree

4). I would like to do another geocaching program.

Strongly agree  Agree  Disagree  Strongly Disagree

5). I would like to show my friends how to geocache.

Strongly agree  Agree  Disagree  Strongly Disagree
Geocaching Activity
Rubric • Adventurer Level

Group ___________________________  Date __________

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Participant successfully navigates with a GPS unit</th>
<th>Participant successfully locates a cache using GPS unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demonstrates the skill</td>
<td>Does not demonstrate the skill</td>
</tr>
</tbody>
</table>

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ROCK STAR ROCK CLIMBING

OVERVIEW

Rock climbing is a popular outdoor recreational activity in Southern Nevada with a range of climbing opportunities available in Red Rock Canyon National Conservation Area. It is an activity that promotes health and fitness, as well as being physically and mentally challenging. Indoor climbing facilities, used for a first level experience for participants, provide a “soft” introduction and a safe environment for participants to learn the basics of rock climbing. Climbing ethics are emphasized and discussed with participants. Rock climbing and other outdoor recreational opportunities on public lands are also discussed.
ROCK STAR ROCK CLIMBING UNIT GOAL

Participants will learn the basics of rock climbing and safely enjoy the challenges of climbing.

UNIT OBJECTIVES

Adventurer Level

Participants will:
• Successfully demonstrate proper climbing techniques on a beginner wall.
• Successfully demonstrate proper belaying technique.

Explorer Level

Participants will:
• Try to climb a rock wall.
• Successfully communicate while climbing with belayer.
• Successfully demonstrate proper belaying technique.

Rock Star Level

To be developed.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The Rock Star Rock Climbing activity unit supports the following guiding themes developed by Clark County educators:

Sub-theme 2. We share the intriguing stories of Southern Nevada’s diverse, interconnected natural world.

POTENTIAL ACTIVITY LOCATIONS

• Nevada Climbing Center
• Red Rock Climbing Center
• Red Rock Canyon National Conservation Area
• Spring Mountains National Recreation Area
ACTIVITY OUTLINE

The outline below contains suggestions for unit activities. The actual content of a scheduled event depends upon:

1. Group characteristics (ages, group dynamics, previous experiences, etc.)
2. Event timeframe
3. Location
4. Experience of the event facilitators

Adventurer Level

Part 1 – INTRODUCTION
(15-20 minutes)

Event leaders facilitate introductions, convey enthusiasm, and generate eagerness for the day’s activities. Nametags are created and distributed. One facilitator sets the stage by describing how the day is structured, explaining what kinds of activities will take place, and clearly stating participant behavioral expectations. Behavioral expectations are pre-determined guidelines set by event leaders. Examples of guidelines include the expectations that everyone stay with the group, that participants do not litter, and that participants respect each other by not pushing or shoving. Any specific park or location rules should be explained at this time. For example, items such as rocks or plants may not be collected in Lake Mead National Recreation Area.

Part 2 – THE BASICS
(20 minutes)

Basic instruction is given on how to put on and wear a climbing harness, how to clip into the rope system, how to climb on belay, and how to safely belay. When the instructor is satisfied that everyone can safely perform these components, student engage in the climbing activity.

Part 3 – GOING SOMEWHERE
(70 – 90 minutes)

Time is allowed for gaining experience with climbing, exploring personal strength limits, and for enjoyment. Participants learn that they must trust themselves, the rope, and each other as they take turns belaying. Facilitators and other adult leaders should be aware of any safety issues and rectify the issues immediately.

Part 4 – CLOSURE
(15 minutes)

The main concepts are reviewed by facilitating discussions about what participants, enjoyed, discovered, and learned. Climbing related educational materials are presented to each participant. Adventurer Level participants also receive a certificate of completion.
**Explorer Level**

Recommended Location: Near beginning of Trail Canyon Trail, Spring Mountains
National Recreation Area

**Part 1 – INTRODUCTION**
(15-20 minutes)

Event leaders facilitate introductions, convey enthusiasm, and generate eagerness for the day’s activities. The pre-activity assessment instrument is explained to and completed by participants. Nametags are created and distributed. One facilitator sets the stage by describing how the day is structured, explaining what kinds of activities will take place, and clearly stating participant behavioral expectations. Behavioral expectations are pre-determined guidelines set by event leaders. Examples of guidelines include the expectations that everyone stay with the group, that participants do not litter, and that participants respect each other by not pushing or shoving. Any specific park or location rules should be explained at this time. For example, items such as rocks or plants may not be collected in Lake Mead National Recreation Area.

**Part 2 – THE BASICS**
(20 minutes)

Basic instruction is given on how to put on and wear a climbing harness, how to clip into the rope system, how to climb on belay, and how to safely belay. Special attention is also paid to communications between the climber and belayer, including safety issues such as dislodged rocks. When the instructor is satisfied that everyone can safely perform these components, student engage in the climbing activity.

**Part 3 – GOING SOMEWHERE**
(70 – 90 minutes)

Participants are given time to climb, belay, and function as the back-up belay.

**Part 4 – CLOSURE**
(15 minutes)

The main concepts are reviewed by facilitating discussions about what participants, enjoyed, discovered, and learned. The post-assessment instrument is explained and completed by participants. Climbing related educational materials are presented to each participant. Adventurer Level participants also receive a certificate of completion.

**Rock Star Level**

To be developed.

**RESOURCES**

*Climbing Instructors*

UNLV Outdoor Adventures
Indoor Climbing Facilities

Nevada Climbing Center
Red Rock Climbing Center

Literature

Rock Climbing (Kids' Guides to the Outdoors) by Tim Seeberg
The Extreme Team #5: Rock On (Extreme Team Series) by Matt Christopher
Rock Climbing (First Book) by Larry Dean Brimner

Web sites


Suggestions for "take home" items for participants:

Photos taken during the climbing activity
Children's books
Souvenir carabiner
Rock Star Rock Climbing

ACTIVITY CHECKLIST

☐ Original Permission Slips
☐ Vehicle Paperwork
☐ Roster
☐ First Aid Kit
☐ Pre- and Post Activity Assessments
☐ Performance Rubric
☐ Name Tags
☐ Clipboards
☐ Digital Camera
☐ Video Camera
☐ Journals
☐ Bottled Water
☐ Snacks
☐ Pencils
☐ Markers
☐ Certificates
## Sample Schedule of Activities

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00 am</td>
<td>Meet at Nevada Indoor Climbing Center</td>
</tr>
<tr>
<td></td>
<td>Introductions</td>
</tr>
<tr>
<td></td>
<td>Pre-activity assessment</td>
</tr>
<tr>
<td></td>
<td>Stage-setting</td>
</tr>
<tr>
<td>11:20 am</td>
<td>The Basics</td>
</tr>
<tr>
<td></td>
<td>• How to put on climbing harness and hook into rope system</td>
</tr>
<tr>
<td></td>
<td>• Belaying instruction</td>
</tr>
<tr>
<td></td>
<td>• Communications between climber and belayer</td>
</tr>
<tr>
<td></td>
<td>• Rappelling down the wall</td>
</tr>
<tr>
<td>11:45 am</td>
<td>Going Somewhere</td>
</tr>
<tr>
<td></td>
<td>Climbing Practice</td>
</tr>
<tr>
<td>12:45 pm</td>
<td>Post-activity assessment</td>
</tr>
<tr>
<td></td>
<td>Closure</td>
</tr>
<tr>
<td></td>
<td>Certificate awards</td>
</tr>
<tr>
<td>1:00 pm</td>
<td>Depart</td>
</tr>
</tbody>
</table>
Rock Star Rock Climbing
Pre-Assessment Part I

What do you know about rock climbing?

<table>
<thead>
<tr>
<th>Nothing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rope</td>
<td></td>
</tr>
<tr>
<td>Belaying</td>
<td></td>
</tr>
<tr>
<td>Rappel</td>
<td></td>
</tr>
<tr>
<td>Harness</td>
<td></td>
</tr>
<tr>
<td>Carabiner</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td></td>
</tr>
</tbody>
</table>
1). I would tell my friends to do this rock-climbing program.

- Strongly agree
- Agree
- Disagree
- Strongly Disagree

2). Rock climbing is very interesting to me.

- Strongly agree
- Agree
- Disagree
- Strongly Disagree

3). Rock climbing is fun.

- Strongly agree
- Agree
- Disagree
- Strongly Disagree

4). I would like to do another rock-climbing program.

- Strongly agree
- Agree
- Disagree
- Strongly Disagree

5). I would like to show my friends how to climb rocks.

- Strongly agree
- Agree
- Disagree
- Strongly Disagree
Rock Star Rock Climbing  
Post-Assessment Part I

What did you learn about rock climbing?

- Nothing
- Rope
- Belaying
- Rappel
- Harness
- Carabiner
- Safety

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Rock Star Rock Climbing  
Post-Assessment Part II

1) I would tell my friends to do this rock-climbing program.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

2) Rock climbing was very interesting to me.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

3) Rock climbing was fun.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

4) I would like to do another rock-climbing program.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

5) I would like to show my friends how to climb rocks.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>
Rock Star Rock Climbing
Rubric • Adventurer Level

Group _____________________________ Date ____________

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Demonstrates the skill</th>
<th>Does not demonstrate the skill</th>
<th>Demonstrates the skill</th>
<th>Does not demonstrate the skill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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Education in the Environment • Annual Report • Year 2 • Page 98
The Discover Mojave Forever Earth Curriculum Manual is a living document, of which this is its first printed edition. This document outlines and provides resources for on-site programming, pre-visit lessons, and post-visit lessons for programs that are currently being field tested and assessed by the Public Lands Institute and Lake Mead National Recreation Area. Each lesson is aligned with Clark County School District and Nevada State Academic Standards. In addition, each lesson is correlated with the themes identified initially by the Southern Nevada Agency Partnership Conservation Education and Interpretation Team.

These programs will develop further and undergo additional refinement. This document is updated regularly. The layout and organization will also change as lessons and activities are finalized, and the graphical "look" of the handouts (i.e., activity materials, demonstrations, reference sheets, and worksheets for students, facilitators, and teachers) will also undergo modification. Please contact the Project Manager for the most up-to-date version of the programming described herein.

The Discover Mojave Forever Earth program is funded by the Southern Nevada Public Land Management Act and delivered by the Public Lands Institute, University of Nevada, Las Vegas on behalf of the National Park Service.
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ACKNOWLEDGEMENTS

The Forever Earth Curriculum Manual is a living document originally developed by: Daphne Sewing; Allison Brody, D.A.; and Jennell M. Miller, Ph.D., Public Lands Institute, University of Nevada, Las Vegas.

The content and subsequent activities are the work of many individuals representing the various agencies and organizations that make the Forever Earth program possible. Activities were created for delivery both aboard the Forever Earth vessel and on shore at Lake Mead National Recreation Area. The team focused on not only creating engaging activities but also ensured that the mission and vision of the National Park Service and Lake Mead National Recreation Area were accurately represented. Additionally, pre-visit and post-visit lessons were created to tie the field trip experience to classroom learning objectives. The team expertly guided major theme selection and key-question development for each grade level, ensuring that grade-appropriate science standards were met and that the Clark County educator's perspective was carefully considered.

Members of the Forever Earth Curriculum Team include:

- **Daphne Sewing**, Discover Mojave Forever Earth Project Manager, Public Lands Institute, University of Nevada, Las Vegas (Team Lead)
- **Ellen Anderson**, Environmental Education Specialist, National Park Service, Lake Mead National Recreation Area
- **Allison Brody**, D.A., Conservation Education and Interpretation Strategy Project Manager, Public Lands Institute, University of Nevada, Las Vegas
- **Jennell M. Miller**, Ph.D., Public Lands Institute, University of Nevada, Las Vegas
- **Amanda Rowland**, Environmental Education Specialist, National Park Service, Lake Mead National Recreation Area
- **Cheryl Wagner**, Project Facilitator, K-12 Science Curriculum, Clark County School District, Nevada
- **Michelle Weibel**, Graduate Research Assistant, Public Lands Institute, University of Nevada, Las Vegas
- **Mary Weisenmiller**, Project Facilitator, K-5 Science Curriculum, Clark County School District, Nevada
- **Mary Sowder**, Educator, Clark County School District and a UNLV doctoral student, developed the fourth grade pre- and post-activities. Also acknowledged are Mary Banbury, PhD., Assistant Professor, University of Nevada, Las Vegas; Kay Rohde, former Chief of Interpretation, Lake Mead National Recreation Area and SNAP Conservation Education and Interpretation Team Lead; Loretta D. Asay, Clark County School District; Ellen Ebert, K-12 Project Facilitator, Clark County School District; and Jeanne Klockow, Ph.D., former Education Curriculum Coordinator, Public Lands Institute, University of Nevada, Las Vegas for providing valuable insight and suggestions for the development of this programming.
INTRODUCTION

The Discover Mojave Forever Earth program is more than a field trip to Lake Mead National Recreation Area (NRA). The program takes place aboard the Forever Earth, a floating environmental learning center. It is designed to give students the rare opportunity to study different facets of water in the desert—such as its characteristics and quality, the species that rely on it, its ability to change a landscape, and much more. This educational experience complements traditional classroom studies with engaging, participatory, on-site activities and support lessons based upon a solid framework for inquiry and discovery. On-site activities and the supporting lessons described herein align with Clark County School District curriculum and are correlated to Nevada State Science Standards and Clark County School District Curriculum Essentials Framework and Science Objectives. Pre-visit lessons prepare students for their trip, introducing important background concepts, key questions, and themes. Post-visit lessons follow up on and reinforce the on-site learning, and more importantly, encourage "big-picture" synthesis and options for stewardship.

On-site programming takes place both on land and traveling aboard the Forever Earth vessel, a 70-foot houseboat built and donated by Forever Resorts, LLC and berthed at Forever Resorts, Callville Bay Marina on Lake Mead. The vessel is operated through a public/private agreement between Forever Resorts and the University of Nevada, Las Vegas. Forever Resorts envisioned the vessel as a means to support and encourage education, scientific study, and environmental monitoring of Lake Mead by student groups, researchers, and other organizations with the goals of improving and protecting environmental conditions.

Discover Mojave Forever Earth is one of several conservation education programs under development for selected sites throughout Clark County. These programs are a joint effort of the Public Lands Institute, University of Nevada, Las Vegas, the Southern Nevada Agency Partnership, and others. This and other conservation education programs funded by the Southern Nevada Public Land Management Act are intended to help students develop their own understanding and appreciation for our desert environs and to motivate them to wisely manage its unique environmental, economic, and cultural resources.

RATIONALE

Lake Mead, formed by the Hoover Dam, is part of the Colorado River system. It is the largest reservoir in the United States and is located about 30 miles southeast of Las Vegas, Nevada, between the states of Nevada and Arizona. Lake Mead is the primary water source for Southern Nevada communities and a major water source for California-based agriculture. Furthermore, three of America’s four desert ecosystems—the Mojave, the Great Basin, and the Sonoran deserts—converge within Lake Mead NRA. As a result, this seemingly barren area contains a surprising diversity of plants and animals, some of which are found nowhere else on earth. The significant water and other natural resources found within Lake Mead NRA provide extraordinary material for learning about science and the environment, in the environment.
CURRICULUM DESIGN FOUNDATIONS

The primary objective in developing curriculum for the Discover Mojave Forever Earth Project is to create interdisciplinary, interactive, and inquiry-based programs for students within the unique learning environment of Forever Earth, a floating environmental education center and research laboratory. Forever Earth is part of a larger area-wide, multi-partner, and interagency environmental education strategy, for which the Public Lands Institute, in cooperation with Southern Nevada Agency Partnership, are creating various curricula.

To ensure consistent curriculum development across projects, programs, lessons, and grade levels, the Public Lands Institute utilizes a curricular framework (a template), developed by Jeanne Klockow, Ph.D. It is important to note that while this framework ensures consistency, it also allows for the autonomous creativity critical for innovation. Built into Dr. Klockow's framework are means to address the standards or thematic statements of individual project stakeholders.

Additionally, in the development of this curriculum, we have kept sight of the organizational visions and missions of key stakeholder groups. The members of the development team represent many of the stakeholder groups, thus the product inevitably reflects the key visions of these members and their organizations. The work will be available for review by all stakeholders. The following table demonstrates how the Discover Mojave Forever Earth program is aligned to address the missions and goals of the individual partners and cooperators.

<table>
<thead>
<tr>
<th>PARTNER/COOPERATOR</th>
<th>MISSION OR GOALS</th>
<th>FOREVER EARTH PROGRAM ALIGNMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clark County School District</td>
<td>The district's mission states that students will have the knowledge, skills, attitudes, and ethics necessary to succeed academically and will practice responsible citizenship.</td>
<td>Forever Earth activities correlate with national, state, and school district science standards as well as other appropriate subject standards. Students are provided opportunities to practice problem-solving and higher level thinking skills through experiential science activities. Activities aboard Forever Earth complement traditional classroom studies by giving students real world learning experiences.</td>
</tr>
<tr>
<td>Forever Resorts</td>
<td>Corporate philosophy promotes the protection of the precious natural environments in which it operates as a high priority. Every Forever Resort property has earned the International Organization for Standards (ISO) 14001:2004 certification.</td>
<td>The Forever Earth vessel has the latest “green” technology on board. Program participants are asked to recycle, conserve water and other materials, and exhibit other environmentally friendly behaviors. Programs highlight water conservation and protection of water quality and Lake Mead.</td>
</tr>
</tbody>
</table>
| Organization                                      | Description                                                                                                                                                                                                                                                                                                                                                      | Impact                                                                                                                                                                                                                                                                                                                                 **
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------**
| Lake Mead National Recreation Area, National Park Service | The National Park Service is dedicated to conserving, unimpaired, the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations (National Park Service Mission, 1997 Strategic Plan, Washington, D.C.). | Participants learn about the importance of the lake and public land to the desert's flora and fauna as well as to its human inhabitants. **

| Outside Las Vegas Foundation | The mission of the Outside Las Vegas Foundation is to connect people to the public lands surrounding Las Vegas.                                                                                                                                                                                                                                                           | Through the diversity of activities associated with the Forever Earth program, participants (adults as well as youth) are connected to the recreational, scenic, historic, scientific, and other important features of the Lake Mead area. **

| Partners for Education about the Environment      | The vision for this collaborative group of informal educators states that "every resident and visitor will understand, appreciate, and take care of Southern Nevada's environment."                                                                                                                                  | Participants in Forever Earth programs explore the Lake Mead aquatic environment and its interrelationships with the surrounding desert. Water conservation and protection of water quality and Lake Mead are also highlighted in experiential programs. **

| Public Lands Institute                            | The Public Lands Institute is committed to facilitating and conducting high quality research, education, and outreach that promotes greater stewardship of public lands.                                                                                                                                                                                                 | Experiential programs for students promote increased knowledge about ecological principles, positive attitudes about science, and stewardship behaviors in regard to public lands. Forever Earth is also utilized by researchers and agencies that are responsible for Lake Mead's water quality. **

| Southern Nevada Agency Partnership (SNAP)         | SNAP works with each other, our communities, and our partners to conserve and enhance the federal lands of Southern Nevada for current and future generations.                                                                                                                                                                                                  | By their experiential nature, Forever Earth programs promote conservation and stewardship of public lands. The vessel is also available to researchers and agencies that are responsible for Lake Mead's water quality and management. **

| University of Nevada, Las Vegas (UNLV)            | UNLV's mission is to assist students in meeting the intellectual and ethical challenges of responsible citizenship and a full and productive life through opportunities to acquire the knowledge and common experiences that enhance critical thinking.                                                                                                               | UNLV faculty, staff, and students are involved in the Forever Earth program on many levels. Forever Earth is utilized for field trip purposes as well as for research and other educational uses. **


GRADE 4

Just Passing Through! The Water Cycle!

ON-SITE PROGRAMMING

2008/2009 Edition

Just Passing Through! The Water Cycle!
OVERVIEW

Water use is such an automatic and habitual daily activity that students often do not understand the consequences of its use. Seldom do they connect the water that comes out of the faucet to its sources in the natural world. Lake Mead on the Colorado River is one of the most intensely used reservoirs in the western United States, providing recreational activities and domestic drinking, industrial, and irrigation water for millions of users. The quality of this water must be maintained to guarantee a reliable and safe resource for its many uses. Inflow into Lake Mead primarily is from the Colorado River; however, about three percent of the inflow is from tributaries on the northern side of the Lake and from Las Vegas Wash on the northwest side of the Lake.

In “Just Passing Through! The Water Cycle!,” students begin exploring the importance of Lake Mead by making and recording observations of how water is being used in different ways by plants, animals, and people. Students view an animated powerpoint presentation that follows one drop of water through Lake Mead’s water use cycle and then re-create the cycle on a magnet board. Working as scientists, students determine if water is the same in all parts of the lake by comparing water samples from the middle of the lake and from Las Vegas Bay. By examining a number of scenarios, students use scientific reasoning to deduce the major reasons for the current lower lake level. In a culminating activity, students brainstorm ideas for personal actions that they can take to conserve or protect Lake Mead’s water.

OUTLINE

On-Site Programming

On-site programming includes activities that take place aboard Forever Earth and activities that take place on shore (typically the Callville Bay picnic area). For a large group, it is convenient to split the students into two or more groups. One or more groups can participate in the shore-based activities while one group is aboard Forever Earth; student groups switch when the Forever Earth group returns to the marina.

Forever Earth

Part 1  ➤ Welcome and Introductions
Part 2  ➤ Observations
Part 3  ➤ This Is Your Life, Bob
Part 4  ➤ Comparing Water from Different Parts of the Lake
Part 5  ➤ The Case of the Missing Water
Part 6  ➤ Closure: What Students Can Do

Shore

The Water Obstacle Course
Plumbing the Colorado

Corresponding Pre-Visit Lesson
Appear! Disappear! The Magic of Water!

Corresponding Post-Visit Lesson
• Going Full Cycle!

THEME
Lake Mead not only plays a huge role in supporting life in our desert but also provides a scientific laboratory for understanding how the water cycle works.

KEY QUESTIONS
Where does all the water in Lake Mead come from? Is the water the same in all parts of the lake? What happens to the water?

GOAL
Students will demonstrate an understanding of how Lake Mead fits into the water cycle and the importance of Lake Mead’s role in our daily lives.

OBJECTIVES
Students will:
• describe how water is used by living things, including by humans;
• create a diagram to describe how Lake Mead water is obtained and used by the area’s human population and then returned to Lake Mead;
• make predictions of how properties of water might be different in different parts of Lake Mead;
• make conclusions based on evidence about the reasons for the lower water level of Lake Mead; and
• list at least three personal actions that they can take to conserve and protect Lake Mead water.

NEVADA STATE STANDARDS CORRELATIONS
P.5.A.1. Students know matter exists in different states (i.e., solid, liquid, gas) which have distinct physical properties.
P.5.A.2. Students know heating or cooling can change some common materials, such as water, from one state to another.
L.5.C.4. Students know all organisms, including humans, can cause change in their environments.
E.5.A.2. Students know the processes of the water cycle, including the role of the Sun.
E.5.A.4. Students know the role of water in many phenomena related to weather (e.g., thunderstorms, snowstorms, flooding, and drought).
CLARK COUNTY SCHOOL DISTRICT SCIENCE CURRICULUM ESSENTIALS FRAMEWORK (CEF) CORRELATIONS

Students will:
(4)1.4. Conduct safe investigations with a partner and with a small group.
(4)1.5. Identify, gather, and safely use tools (magnet, thermometer, and lens) and materials needed in investigations.
(4)1.6. Compare a model with what it represents (solar system, electrical circuit, human body models).
(4)3.1. Investigate and describe the properties of water.
(4)3.2. Investigate and describe the water cycle, including the role of the sun.
(4)3.3. Investigate and describe the factors that affect the processes of evaporation and condensation.
(4)3.4. Investigate and explain that water can be a liquid, a gas, or a solid and can go back and forth from one form to another.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site grade 4 activities support the following guiding theme developed by Clark County-based educators:
• Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

PREREQUISITE CLASSROOM EXPERIENCES

A pre-visit classroom trip will be made by Forever Earth or National Park Service staff to introduce students to the Forever Earth program and their upcoming field trip. Students learn and agree to the “conduct rules” of Forever Earth, understand basic water safety concepts, and observe how and when to put on a Personal Flotation Device (PFD) during their time aboard Forever Earth.

VOCABULARY
• collection
• condensation
• desert wash
• evaporation
• pH
• plankton
• precipitation
• sewage treatment plant
• water clarity
• water conservation
• water cycle
• water treatment plant

ON-SITE ACTIVITIES: Forever Earth
Part 1  Welcome and Introductions
Forever Earth staff greets students in the parking lot. Students are divided into groups and given team lanyards. The facilitator welcomes students to Lake Mead National Recreation Area and Forever Earth and introduces the concept of National Parks and public lands, emphasizing that the field trip is taking place on public land. 
Facilitator Reference: Lake Mead NRA Fast Facts contains information to answer common questions about Lake Mead. The Captain or facilitator leads the safety presentation (see Facilitator Reference: Safety Talk Outline).

Part 2  Observations
Students practice observation skills and record observations of how living things use and depend on water.

The facilitator begins with a discussion of the importance of water in the daily lives of the students: How did you already use water today? Are people the only living things that use water?

From the top deck, students record observations of how water is being used on Student Worksheet: Observation Record.

Students share their observations with the group.

Part 3  This Is Your Life, Bob!
Through a PowerPoint presentation, students follow a drop of water through a water use cycle: from Lake Mead to Las Vegas and back to Lake Mead.

Students are each given a magnet board with icons that will appear as graphics in a powerpoint presentation delivered by the facilitator. The presentation takes students through a series of adventures experienced by “Bob the Water Drop” (Demonstration: Bob’s Wonderful Adventure and Facilitator Reference: Narrative of Bob’s Wonderful Adventure). The icons on the magnet board represent particular places or incidents along Bob’s journey from Lake Mead to Las Vegas and back to Lake Mead (e.g., water treatment plant; brushing teeth; Las Vegas Wash; etc.). At appropriate points in the presentation, students are asked to identify where Bob is and what he is experiencing by pointing at particular icons.

TIME 10 minutes
MATERIALS
Color-coded badges to indicate teams attached to lanyards

Facilitator Reference: Lake Mead NRA Fast Facts
Facilitator Reference: Safety Talk Outline

TIME 10 minutes
MATERIALS

Student Worksheet: Observation Record

TIME 20 minutes
MATERIALS

Magnet boards
Magnet pieces representing various waypoints of Lake Mead water
Demonstration: Bob’s Wonderful Adventure
Facilitator Reference: Narrative of Bob’s Wonderful Adventure
Laptop computer
Television monitor
At the conclusion of the powerpoint presentation, students are asked to demonstrate what they've learned by assembling diagrams on the magnet boards of how Lake Mead water might be used and returned to Lake Mead.

* Conclude with the last slide of the presentation by asking students what might happen next to Bob.

**Part 4  Comparing Water from Different Parts of the Lake**

Students conduct tests and compare data on water samples taken from Las Vegas Bay and from the middle of the lake.

From the previous activities, students should understand that Lake Mead water is used by people in Las Vegas for a variety of purposes, treated, and then returned to Lake Mead. Students compare water from the middle of the lake to a sample from Las Vegas Bay.

**Group 1** Students use probes to collect data for water temperature and pH. Students also use their senses to detect any noticeable odor.

**Group 2** Students use a Secchi Disk to measure turbidity. Students use plankton net to collect plankton. Students assist facilitator in making slides for stereoscope observation. Facilitator assists students with basic identification of collected microorganisms.

All data are recorded on **Student Worksheet: Data Collection Sheet**.

Groups 1 and 2 switch stations if time allows. Students compare data and average their results; efforts are made to ensure that students have a complete data set. Students answer the questions: How do the water samples compare? Is the water the same? In what ways are the water samples the same? Different?

**Part 5  The Case of the Missing Water**

In this activity, students investigate reasons for the lower lake level.

Five scenarios are presented that might explain why the lake level is much lower than usual. For each scenario, students are given information and data to evaluate and reach a conclusion. Scenarios:
1. Desert bighorn sheep drank all the water.
2. People used all the water.
3. There has been a drought in the mountains where the river begins.
4. The wind has evaporated all the water.
5. There is a leak in the dam.

**Part 6  ➤ Closure: What Students Can Do**

In this closure activity, students discuss what personal actions they can take to conserve and protect Lake Mead's water.

The facilitator draws the group's attention to the observations they first made about how living things, including humans, use and depend upon water. The students work in small groups and are asked to respond to two questions:

1. What can you do to help conserve (save, not waste, use wisely) water?
2. What would you like to tell people about Lake Mead?

The facilitator brings the groups together to share their thoughts.

**ON-SITE ACTIVITIES: Shore**

**The Water Drop Obstacle Course**

In this activity, students move through an obstacle course as drops of water.

Students will:

- Learn how water moves through the water cycle in different forms.
- Understand that Lake Mead is part of the Colorado River.
- Discover how Lake Mead fits in the larger picture of the water cycle.

**Part 1  ➤ Introduction to the Water Drop Obstacle Course**

Students are informed that, for this activity, each of them is a drop of water. What do you feel like? What do you look like? What do you smell like? What kinds of things might happen to a drop of water? What are some of the ways that water can move? (If the group has already participated in the activities aboard Forever Earth, begin by asking about some of the adventures that Bob the Water Drop experienced.)

Briefly explain that the obstacle course laid out in front of them is a model of some of the things that may happen to water in the Colorado
River watershed, including Lake Mead. Use a map of the Colorado River Watershed to show how some of the map features are represented by stations. Describe how the direction cards will tell each water drop to perform some sort of action that represents what is happening to them. The card will also tell them how to proceed and to which station. Demonstrate by reading a couple of the cards with them and showing how the movement to the next station represents what is happening to them as a drop of water. For example, when a drop of water evaporates, the card will instruct the student to skip to the next station. For English Language Learners, demonstrate more of the movement directions so there is an understanding of the actions they are to perform. Emphasize that none of the cards will tell the students to run to the next station and that the course is not a race.

Part 2  ➤ Go With the Flow

Begin the activity with a “practice” round. Ask the students to find a partner and tell them that, as a team, they will proceed through two stations. The facilitator assigns each team of students to a different station to begin their adventure. After reading a card, the team replaces the card in the envelope before proceeding to the next station. The facilitator stops the group after everyone has completed two stations and asks for volunteers to relate what happened to them as drops of water. Emphasize to students how they should understand what is happening to them as drops of water and why, rather than which station number it happened to be.

The facilitator gives students the option of now proceeding with a partner or as an individual. Each team or individual is given a plastic sandwich bag to collect the station cards. They will use the cards later to assist them in telling a story of what they experienced. Also remind students that the cards may send them to a station that is out of order numerically, that they may end up at the same station many times, and may never visit some stations. The teams and individual students are again scattered throughout the course and are given time to proceed through the obstacle course. The facilitator should judge the timing so that students have collected at least 12-15 cards.

Part 3  ➤ Telling The Story

The facilitator asks students: Where was the starting line for the Plastic sandwich bags
obstacle course? The finish line? Does our model represent what can happen to a drop of water fairly well? How long have these kinds of things been going on? What other adventures might a water drop have? Emphasize to students that the water that exists today is the same water that has always been on the earth and the same water that will be available in the future.

Using the collected cards as reminders of their adventures as water drops, students are asked to each tell a story relating some of these adventures. They may write, draw, or diagram their stories. Close the activity by having students volunteer to share their stories or drawings.

(FACILITATOR NOTE: Have students replace the cards in the envelopes at the respective stations before moving on to the next activity)

PLUMBING THE COLORADO

Note: This activity is adapted from the Discover A Watershed: The Colorado River activity book. For additional information, refer to the activity write-up beginning on page 277.

In this activity, students explore how water moves into and out of the Colorado River system.

Students will:

- Demonstrate water inputs and outputs of the Colorado River system.
- Gain an increased awareness of water users on the Colorado River, including those outside their geographic area.

Part 1  ➤ Introduction to Plumbing the Colorado

Explain that the Colorado River is extremely important because much of the area through which it flows is desert. By using dams and diversions to use or "plumb" the river, we're able to live and grow crops where it would otherwise have been extremely difficult. In this activity, the students will see how water is added to and removed from the river according to the type of process or use of the water.

Part 2  ➤ Plumbing the Colorado

First, direct students' attention to the "rope" model of the Colorado River watershed. Show where major features on the model are located: the headwaters of the Colorado and Green rivers; the confluence of the Colorado and Green rivers; Lake Mead; the

TIME 40 minutes

MATERIALS

Colorado River watershed
"rope" model
6 Measuring cups
6 Blue buckets

8 ½ x 11 paper
Colored pencils, markers, pencils, crayons
U.S./Mexico border; and the Gulf of California. Use the Colorado River watershed map to reinforce the concept of the model representing the flow of the Colorado River from its headwaters to the Gulf of California.

The students are divided into teams. Each team is given a blue bucket that represents the Colorado River. Students will move down the rope model, adding or removing water from their rivers (blue buckets) according to the instructions on the laminated cards. Explain that water in the white buckets represents sources of water (rain, snow, tributaries, etc.). Before letting the students begin the activity, the facilitator should take a few minutes to have students practice using the measuring cups.

Have each team start at the headwaters of the Colorado River, Card #1, and continue down the river to the Gulf of California. Adults should shadow the teams and assist with some of the more complicated measurements. Just below the confluence of the Green and Colorado Rivers, a laminated card asks students to predict how much water will be in the bucket when it reaches the Gulf of California. Emphasize to students that it is not a race and to perform their measurements carefully.

When the river reaches the Gulf of California, there should not be any water left in the bucket. All the water has been used upriver. This is what happens to the Colorado River most years. Only during extremely wet years does water flow all the way to the Gulf of California. Review students' predictions of how much water would be in the bucket when it reached the Gulf.

**Part 3  Conclusions**

Students are asked to review the reasons for when water was added to their bucket (river) and for when water was removed from their bucket (river).

Students are then asked what this means for:
- People living in Mexico
- People living along the Colorado River
- People growing food along the Colorado River
- Fish and wildlife
- All of us
Ask students to discuss what would happen in wet or dry years.

Conclude by having students summarize what they learned by doing this activity.

**ADAPTATIONS FOR DIVERSE LEARNERS**

- Consult with teachers prior to field trip to determine specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
- Implement peer assistance by involving teachers in the process of creating color teams.
- Provide diagrams, photos, or other visual organizers as appropriate for processes and techniques.
GRADE 4

Just Passing Through! The Water Cycle!

ON-SITE PROGRAMMING • SUPPORT MATERIALS
The Water Cycle: Just Passing Through!

<table>
<thead>
<tr>
<th>Two ways I found people having fun on the water:</th>
<th>Two things I saw along the shore that need water in order to live:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Two things I observed that live on or in the water:</th>
<th>Other things I saw that use water in some way:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
</tbody>
</table>
Demonstration:
BOB'S WONDERFUL ADVENTURE

Bob's Wonderful Adventure is an entertaining PowerPoint presentation developed to guide students through the water cycle in a way that is meaningful and pertinent to the area. Clipart images © Ron and Joe, Inc. are used with permission.

Note that the actual PowerPoint file includes animations.
What do you think... will happen to Bob next?
## Facilitator Reference:
**NARRATIVE OUTLINE OF BOB'S WONDERFUL ADVENTURE**

<table>
<thead>
<tr>
<th>Slide</th>
<th>Graphic</th>
<th>Narrative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intro slide</td>
<td>Now that we've made some observations about how water from Lake Mead is important to plants, animals, and people, let's learn a little bit more where the water in Lake Mead comes from, what happens to it, and where it might go. To help us, a special guest will show us his story. Let's meet Bob, the water drop.</td>
</tr>
<tr>
<td>2</td>
<td>Clouds, sun, sounds of thunder</td>
<td>Our story begins when Bob ended up in a cloud as water vapor. The cloud blew right over Lake Mead. The air got cooler and thunder could be heard.</td>
</tr>
<tr>
<td>3</td>
<td>Clouds, rain drops</td>
<td>It began to rain and water drops fell into Lake Mead. Rain is one kind of precipitation.</td>
</tr>
<tr>
<td>4</td>
<td>Lake Mead, Bob</td>
<td>One of the water drops was Bob!</td>
</tr>
<tr>
<td>5</td>
<td>Lake Mead, pipe, fish, Bob</td>
<td>So there was Bob hanging out with all the other water in the lake. But oh-oh, here comes a fish headed right for Bob! Look out! Whew, Bob went right out of the fish's gills. That was close! Wait, why is Bob being pulled towards that pipe? Where does this pipe go? Bob got sucked right into the pipe.</td>
</tr>
<tr>
<td>6</td>
<td>Black slide</td>
<td>It's awfully dark in this pipe for Bob. Where is he going?</td>
</tr>
<tr>
<td>7</td>
<td>Pipe, moving arrow</td>
<td>This pipe is headed towards Las Vegas. Lake Mead is where people in Las Vegas get their water.</td>
</tr>
<tr>
<td>8</td>
<td>Bob, &quot;green&quot; dirt</td>
<td>That means that Bob and other Lake Mead water drops need to get cleaned up a little before people can use them for drinking, to do laundry, or taking a shower.</td>
</tr>
<tr>
<td>9</td>
<td>Water treatment plant, moving arrow</td>
<td>So Bob gets sent to a water treatment plant, a place where dirt and harmful things are removed from Bob and the other water drops. When the water leaves here, it's good enough to drink!</td>
</tr>
<tr>
<td>10</td>
<td>Bob, sponge</td>
<td>At that water treatment plant, Bob got the treatment! When Bob first left the lake, he was not clean enough to drink. But now, after going to the water &quot;spa,&quot; he's all clean.</td>
</tr>
<tr>
<td>11</td>
<td>Black slide</td>
<td>Oh-oh, it's dark again. That can only mean one thing. Bob is another pipe, and where is he going this time?</td>
</tr>
<tr>
<td>12</td>
<td>House, arrow moving along pipe</td>
<td>Bob is heading towards a house! Maybe it's your house or your house or my house.</td>
</tr>
<tr>
<td>13</td>
<td>Bob with frown, moving in circles</td>
<td>AAhhh! Bob doesn't look happy! What's that minty smell? Look out, Bob is getting swirled around and around, and it goes dark again. Splat! What just happened?</td>
</tr>
<tr>
<td>14</td>
<td>Girl with big grin</td>
<td>Oh, that's what happened! Bob was just used to help brush this girl's teeth! And then he got spit down the drain with the rest of the water!</td>
</tr>
<tr>
<td>15</td>
<td>House, arrow moving along pipe</td>
<td>So now Bob is headed down a pipe away from the house along with a lot of other water that been used by people.</td>
</tr>
<tr>
<td>16</td>
<td>Bob with frown and dirt</td>
<td>Bob is with water that did the laundry, brushed teeth, flushed the toilet, cleaned the dishes, and much more. He's really dirty and doesn't smell so good. Where do you think Bob is going next?</td>
</tr>
<tr>
<td>17</td>
<td>Sewage treatment plant, moving arrow</td>
<td>Bob needs to be cleaned up! So he and the rest of the dirty water go a place where that happens, a sewage treatment plant. This place smells much different than the water treatment plant. There's a lot of dirty water here.</td>
</tr>
<tr>
<td>18</td>
<td>Bob with frown, moving sponge, Bob with smile</td>
<td>At the sewage treatment plant, Bob gets scrubbed and scrubbed. Pretty soon, he's smelling much better and looking very clean.</td>
</tr>
<tr>
<td>19</td>
<td>Bob, Las Vegas Wash, Lake Mead</td>
<td>Now Bob is on his way back to Lake Mead! From the sewage treatment plant, Bob is dumped out into a flowing creek called the Las Vegas Wash. This creek takes Bob all the way back to Lake Mead! What an adventure for Bob! Let's see if we can remember what happened to Bob after he fell into the lake as rain. On your magnet boards, use the arrows and pieces to describe Bob's adventure starting and ending in Lake Mead.</td>
</tr>
<tr>
<td>20</td>
<td>Diagram of Bob's adventure</td>
<td>Let's check to see if you have the pieces in the right order:</td>
</tr>
<tr>
<td></td>
<td>1) Bob began in Lake Mead.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Bob was sucked through a pipe and went to a water treatment plant to get cleaned and scrubbed until he was good enough to drink.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3) Bob went to a house in Las Vegas where he was used to brush a little girl's teeth.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4) Bob was not smelling so good and was really dirty, so he was sent to a sewage treatment plant to get cleaned up again.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5) Then Bob was sent down another pipe to the Las Vegas Wash, a creek that took him right back where he started – Lake Mead.</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Lake Mead, Bob, question</td>
<td>What do you think will happen to Bob next?</td>
</tr>
</tbody>
</table>
The Water Cycle: Just Passing Through!

Data Collection Sheet

<table>
<thead>
<tr>
<th></th>
<th>Middle of Lake Mead</th>
<th>Las Vegas Wash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>surface 2 m 5 m</td>
<td>surface 2 m 5 m</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C °C °C °C °C</td>
<td>°C °C °C °C °C</td>
</tr>
<tr>
<td></td>
<td>°F °F °F °F °F</td>
<td>°F °F °F °F °F</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secchi Disk Depth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Do you think there are things, like plankton, living in the water? □ yes □ no

2) Is there plankton in the middle of Lake Mead? □ yes □ no

3) Is there plankton in Las Vegas Wash? □ yes □ no

4) What kind of plankton did you find? ________________________________

5) Is the water in the middle of Lake Mead the same as the water in Las Vegas Wash? □ yes □ no

TEAM MEMBERS:
Student Worksheet:
CASE OF THE MISSING WATER

Under Construction
Facilitator Reference:
OBSTACLE COURSE LAYOUT

1. MOUNTAINS
   snow - rain - precipitation

2. RAIN

3. WATER TREATMENT PLANT

4. EVAPORATION

5. SWIMMING POOL

6. HOUSE

7. RADISH FIELD

8. OCEAN

9. SEWAGE TREATMENT PLANT

10. HOOVER DAM

11. CLOUD

12. LAS VEGAS WASH

13. STORM DRAIN

14. Tunnel Represents Colorado River

Tunnel Represents Colorado River
## Facilitator Reference:
### OBSTACLE COURSE – STATION MATERIALS

| Station # | Station                                  | Materials            | Purpose                                                        |
|-----------|------------------------------------------|----------------------|                                                               |
| 1         | Lake Mead                                | Rope                 | Lake boundary                                                  |
| 2         | Lake Mead                                | Rope                 | Lake boundary                                                  |
| 3         | Water treatment plant                    | Sponge               | Water cleaned for human use                                    |
| 4         | Colorado River                           | Tunnel               | Water flowing down river                                       |
| 5         | Swimming Pool                            | Tarp (optional)      | Represents pool                                                |
| 6         | House                                    | Hula Hoops (2)       | Swishing toothpaste; flushing toilet; washing car              |
| 7         | Radish Field                             | None                 | N/A                                                            |
| 8         | Ocean                                    | Rope                 | Ocean boundary                                                 |
| 9         | Sewage treatment plant                   | Sponge               | Water cleaned before returning to Lake Mead                   |
| 10        | Hoover Dam                               | Jump ropes (2)       | Water turning turbines to generate electricity                 |
| 11        | Cloud                                    | None                 | N/A                                                            |
| 12        | Las Vegas Wash                           | Tunnel               | Water flowing into Lake Mead                                   |
| 13        | Mountains/river                          | Tunnel               | Melting snow flowing down Colorado River to Lake Mead          |
| 14        | Storm Drain                              | Hula Hoop            | Water runoff that bypasses sewage treatment plant              |

### Other materials for activity:
- Tent stakes
- Bungee cords
- Hammer
- Plastic envelopes with direction cards for each station (13)
- Wooden dowels (13)
- Cones (13)
- Numbered marker for each station (13 total)
- Plastic sandwich bags
- 8 ½ x 11 paper
- Markers, colored pencils, crayons
- Pencils
Facilitator Reference:
OBSTACLE COURSE - STATION MARKERS

Shown below and on the next page are scaled down versions of the numbered station markers. The full sized images are printed, laminated, and attached to a stake at each station on the obstacle course. Clipart images © Ron and Joe, Inc. are used with permission.
Facilitator Reference:
OBSTACLE COURSE – CLUE CARDS

The following clue cards (scaled down here) are printed and placed in envelopes at the corresponding obstacle course station. Students collect the cards as they make their way through the course. In the subsequent portion of the activity, they use the cards to help them describe how water moves through the system. Note that some stations feature multiple cards.

1. Lake Mead
   You are floating in Lake Mead!
   1. Walk around the lake 3 times. Follow the rope.
   2. Walk to CONE #2.

2. Lake Mead
   You are leaving Lake Mead through Hoover Dam.
   Walk to CONE #10.

2. Lake Mead
   You are getting a scrub!
   You are at the Water Treatment Plant.
   1. Walk to CONE #6 to find out.

3. Water Treatment Plant
   RUB-A-DUB-DUB.
   You are getting a scrub! You are at the Water Treatment Plant.
   1. Use the sponge to wash yourself. What will happen next?
   2. Walk to CONE #6 to find out.

4. Water Treatment Plant
   RUB-A-DUB-DUB.
   You are getting a scrub! You are at the Water Treatment Plant.
   1. Use the sponge to wash yourself. What will happen next?
   2. Walk to CONE #6 to find out.
The Colorado River is very long! Where will you flow to next?

Walk to CONE #7 to find out!

The wind blows you to the mountains. Skip to CONE #13!

Do the hula hoop 3 times.

Twirl to CONE #8.

Do the hula hoop 3 times.

Twirl to CONE #9.
Radish Field
HOW COOL!
A farmer is watering a field of radishes with you!
1. Sprinkle the plants by doing 5 jumping jacks.
2. Evaporate and skip to CONE #13.

Ocean
WOW!
You went all the way to the ocean!
1. Do "the wave" while you count to 10.
2. Evaporate! Skip to CONE #13.

Sewage Treatment Plant
RUB-A-DUB-DUB!
You are getting a scrub... again!
This time you are getting clean at the sewage treatment plant.
1. Use the sponge to wash yourself. What will happen next?
2. Walk to CONE #12 to find out.

Hoover Dam
You use your muscles here at Hoover Dam! Spin the turbines to create electricity.
1. Jump rope 5 times.
2. Go down the Colorado River (the tunnel) to CONE #4.

Cloud
WHOO! Get ready!
You are part of a cloud high in the sky. You become a raindrop and fall back into Lake Mead.
Walk backwards to CONE #1.
Using words, pictures, and the clue cards they collected, students re-create the cycle of water through the Southern Nevada system after completing the obstacle course activity.
GRADE 4

Just Passing Through! The Water Cycle!

PRE-VISIT LESSON

APPEAR – DISAPPEAR! THE MAGIC OF WATER!
PRE-VISIT OVERVIEW

Water use is such an automatic and habitual daily activity that students often do not understand the consequences of its use. Seldom do they connect the water that comes out of the faucet to its sources in the natural world. Lake Mead on the Colorado River is one of the most intensely used reservoirs in the western United States, providing recreational activities and domestic drinking, industrial, and irrigation water for millions of users. The quality of this water must be maintained to guarantee a reliable and safe resource for its many uses. Inflow into Lake Mead primarily is from the Colorado River; however, about three percent of the inflow is from tributaries on the northern side of the Lake and from Las Vegas Wash on the northwest side of the Lake.

In “Just Passing Through! The Water Cycle!,” students use the Forever Earth vessel to begin exploring the importance of Lake Mead by making and recording observations of how water is being used in different ways by plants, animals, and people. Then students view an animated PowerPoint presentation that follows one drop of water through Lake Mead’s water use cycle and then re-create the cycle on a magnet board. Working as scientists, students determine if water is the same in all parts of the lake by comparing water samples from the middle of the lake and from Las Vegas Bay. By examining a number of scenarios, students use scientific reasoning to deduce the major reasons for the current lower lake level. In a culminating activity, students brainstorm ideas for personal actions that they can make to conserve or protect Lake Mead’s water.

These pre-visit activities are designed to prepare students for their Forever Earth experience by introducing them to the water cycle and to some of the factors that affect the cycle.

THEME

Lake Mead not only plays a huge role in supporting life in our desert but also provides a scientific laboratory for understanding how the water cycle works.

KEY QUESTIONS

Where does all the water in Lake Mead come from? Is the water the same in all parts of the lake? What happens to the water?

GOALS

Students will demonstrate an understanding of the processes of condensation and evaporation and the factors that affect these processes.

OBJECTIVES
Students will:

- Demonstrate how condensation occurs when water vapor touches a cool surface and changes into liquid;
- Understand how evaporation and condensation contribute to the movement of water through the water cycle;
- Describe evaporation as the process by which liquid water changes into water vapor, a gas;
- Explain how temperature affects the rate of evaporation; and
- Explain how surface area of a volume of water affects the rate of evaporation.

NEVADA STATE STANDARDS CORRELATION

N.5.A.1. Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method.

E.5.A.2. Students know water on Earth can be a liquid (rain) or a solid (snow and ice) and can go back and forth from one form to the other.

CLARK COUNTY SCHOOL DISTRICT CURRICULUM ESSENTIALS FRAMEWORK (CEF) CORRELATIONS

Students will:

(4)1.1 Generate investigable questions based on observations and interactions with objects, organisms, and phenomena.

(4)1.2 Use science notebook entries to develop, communicate, and justify descriptions, explanations, and predictions.

(4)1.3 Create and use labeled illustrations, graphs (number lines, pictographs, bar graphs, frequency tables), and charts to convey ideas, record observations, and make predictions.

(4)1.4 Conduct safe investigations with a partner and with a small group.

(4)1.5 Identify, gather, and safely use tools (magnet, thermometer, lens) and materials needed in investigations.

(4)1.10 Cooperate and contribute ideas within a group.

(4)3.1 Investigate and describe the properties of water.

(4)3.2 Investigate and describe the water cycle, including the role of the sun.

(4)3.3 Investigate and describe the factors that affect the processes of evaporation and condensation.

(4)3.4 Investigate and explain that water can be a liquid, a gas, or a solid and can go back and forth from one form to another.

(4)3.5 Investigate and describe how the earth is nearly spherical and covered with more water than land.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS
The pre-visit grade 4 activities support the following guiding theme developed by Clark County-based educators:

- Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

**VOCABULARY**

<table>
<thead>
<tr>
<th>collection</th>
<th>liquid</th>
<th>water</th>
</tr>
</thead>
<tbody>
<tr>
<td>condensation</td>
<td>precipitation</td>
<td>water conservation</td>
</tr>
<tr>
<td>condense</td>
<td>rain</td>
<td>water cycle</td>
</tr>
<tr>
<td>evaporation</td>
<td>surface area</td>
<td>water vapor</td>
</tr>
<tr>
<td>gas</td>
<td>thermometer</td>
<td></td>
</tr>
</tbody>
</table>

**PRE-VISIT LESSONS: APPEAR – DISAPPEAR! THE MAGIC OF WATER!**

**Pre-Visit Lesson 1: Evaporation**

**Part 1 - Introduction**

The teacher begins by asking the students what they already think they know about water. Following this brief discussion, the teacher introduces this lesson by communicating its objectives. "For the next few days we're going to be looking at water. Did you know that there is as much water in the earth's system today as there was when the earth was formed? Did you know that the water you may drink today is the same water that the dinosaurs drank? Today we're going to be looking ways that water seems to come and go on Earth."

If there is evidence of evaporation on the playground or school sidewalks (e.g. dried puddle marks) the teacher may take the class on a short "field trip" to observe evidence of "disappearing" water. (If no such evidence is apparent, the teacher may want to evaporate some puddles of muddy water ahead of time for this observation.) The teacher asks, "Where did the water in the puddle go? Did it really disappear? How do you know what happened to it? Have you seen anything else that looks like this? Where did the water in the puddle come from?" After giving a minute of think-time, students share their thoughts with a partner. The teacher then asks for volunteers to communicate their ideas about the disappearing water with the class.

Back in the classroom, the teacher holds up a container of water and asks, "Where did this water come from?" In response to students'
answers, the teacher should probe for the extent of their knowledge about the source of water for Las Vegas and should guide students toward an understanding of Lake Mead as the source of water for most of the Las Vegas Valley. Questions might include:

- Where does the water in the faucet come from?
- Where do the water pipes bring the water from?
- Where does the water in Lake Mead come from?

Once Lake Mead is identified as the source of water for most of the Las Vegas Valley, the teacher asks students, “Do you think Lake Mead always has the same amount of water in it? Why do you think so?” Once students have had a minute or two to think about the questions, they should share their ideas with a partner.

The teacher then distributes two photos of Lake Mead, one pre-drought and one post-drought, to each pair of students, asking them to look for evidence in the picture to support their ideas about the amount of water in the lake. Pairs of students should share their ideas with the class, including evidence from the pictures. The teacher should ask probing questions to help students connect the evidence of evaporation from the pictures to their observations of dried puddles.

A follow-up question is asked, “Why do you think the water level in the lake changes? Where does the water go?” The teacher should introduce the term precipitation as students contribute ideas about how rain, snow, etc. may fall in the lake and cause water levels to rise. The teacher collects student ideas and records them on a divided Circle Thinking Map (or other graphic organizer) on chart paper, to be used for review during the culminating activity.

![Diagram of a Circle Thinking Map with categories: Where does the water go? Lake Mead, Where does the water come from?](attachment:Diagram.png)

**Part 2  » Concept Development**
The teacher poses the problem of investigating the case of Lake Mead's "disappearing" water, and tells students that they will be looking at ways that they can make water seem to disappear. The teacher introduces an operational definition of the word, evaporation, as the process by which water becomes an invisible gas called water vapor. These words should be used to begin or add to an illustrated word bank.

The teacher explains that each pair of students will get some water that they will take outside and try to make evaporate as quickly as possible, and reviews the following procedure:

1. One student from each pair will get the materials needed from the supply table: one container of water, one graduated pipette or syringe, and one beaker.
2. Each pair of students will measure 25 ml of water into their graduated pipette or syringe and gently push it into the beaker. Students should make sure that they have exactly 25 ml of water in their beaker.
3. One student from each pair should return syringes and containers of water to the supply table.

Each pair of students will plan how to make the water in their beaker disappear and record it in their science notebooks. For ELL students, the teacher might take some time to record and illustrate on the board as students quickly brainstorm possible procedures (see example below).

How to make water seem to disappear

- Pour it on the sidewalk.
- Put it in a sunny place.
- Blow on the water.

Pairs of students should then produce their own procedure, and team members should record their plan, including a list of materials, in their science notebooks. Once all teams have written their plan, the teacher should go over any boundaries for working outside. Students should go back outside and
carry out their planned investigations, recording their observations in words and pictures in their science notebooks. The teacher should circulate among the teams to guide students' ideas with questions focusing on how the process of evaporation may be affected by surface area, air movement, and temperature.

- What happened to the water?
- Where did it go?
- How do you know?

Part 3 ▶ Linkage and Closure: Mini-Science Conference

Back in the classroom, student pairs should have time to reflect and record in words and/or pictures what they think they may have found as a result of their investigation and to record one or two questions they may have about evaporation as a result of their work.

The teachers should reorganize student pairs into larger groups of 4-6 students by putting pairs of students together according to the ways in which they evaporated their water. Student groups should compare and discuss their findings and questions in order to present to other teams.

Each group should briefly present their findings to the rest of the class. As they present, other class members should ask questions about their work, and the teacher should use questioning to guide any naive conceptions about science content or process that were formed by students in the process of their inquiry. (For example, if a student group concludes that putting the water in a warm place made it evaporate faster, the teacher should ask them if they have any evidence that water placed in a cooler location would evaporate more slowly. The teacher could then follow up with the question, "How could you find out?"") The teacher should also record student understandings and questions about factors affecting evaporation on a class content and questions chart.

Teacher and students should re-visit the divided circle map constructed at the beginning of the lesson. The teacher should ask, "What did we find out from our investigations that gave us evidence about what we thought we knew about the water in Lake Mead?" As class members discuss and compare the entries on the content chart to their ideas recorded on the circle map, the teacher should circulate, asking probing questions about the circle map entries to help students
correct any incomplete information.

The teacher should ask students to self-evaluate their work as a scientist during this investigation. Students should reflect about the level of their work in the following areas:

- Was I on-task as I worked with my partner to investigate?
- Did I write and draw things in my science notebook that I could use for evidence for the presentation of our findings?
- Did I help my group put together a presentation that helped the rest of the class understand what we think we learned?
- Did I ask questions of other groups?
- Did my questions help me and other students better understand what the presentations were trying to say?

What did I learn about Lake Mead?
What did I learn about evaporation?

EXTENSION
Repeat this lesson with the following changes:

- Instead of trying to evaporate the water as quickly as possible, the teacher should challenge the students to try to evaporate the water as slowly as possible.
- The teacher should supply a number of containers of different shapes and sizes (different surface areas) for the students to use.

RESOURCES

- Full Option Science System (FOSS) Environments module materials
- FOSS Science Stories

ADAPTATIONS FOR DIVERSE LEARNERS

- Create language-supportive collaborative learning groups to allow students to work together to answer questions.
- Use a think-pair-share to encourage thought sharing and discussion and allow for language processing time.
- Record observations with words and/or pictures.
- Create illustrated word bank, thinking maps, and charts.
ASSESSMENT

The teacher may assess student learning during the mini-science conference as they present their observations and reasoning. The teacher should look at how students participate in their group’s presentation; the quality of the science content (factors that affect the process of evaporation) and processes (using evidence collected in words and drawings in science notebooks) reflected in group presentations; and the number and quality of clarifying questions posed to other groups. Assessment data may be recorded as anecdotal records or checklists of learning objectives.

Pre-Visit Lesson 2: Condensation and the Water Cycle

Part 1  Introduction (Day 1)

The teacher begins by asking students what they have already learned about know water. The teachers should also review previously introduced vocabulary during this review. Following this brief discussion, the teacher introduces the lesson by communicating its objectives. “Today we’re going to be looking at how water on Earth is constantly recycled and reused. In the Las Vegas Valley, we use water stored in Lake Mead. Where did we say that the water in Lake Mead came from? (Colorado River, snow melt, rain, etc.) Where does the water come from to create precipitation?” The teacher should guide this discussion toward the idea that water is recycled partly by the processes of evaporation and precipitation.

Part 2  Concept Development

The teacher should have one student from each group get two plastic cups and 2 post-it notes. The students should use the post-it notes to label their cups “ice water” and “room temperature water.” The teacher should circulate through the class, filling one of their cups with blue-colored, ice-water and the other with blue-colored, room-temperature water. Students should draw both of these cups in their science notebooks.

After a few minutes, the teacher asks, “What do you notice about the cups?” followed up by questions guiding the students to think about what is happening to the ice-water cup.

- How did water get onto the outside of the ice-water cup? Where did it come from?
- Did water form on the outside of both cups? Why? Why not?
- Compare the water on the inside and outside of the ice-water cup.

TIME 10 minutes
MATERIALS

Plastic cups
Post-it notes
Science notebooks
Blue food coloring
Water
Ice
Graduated pipette or syringe
Dome lid

TIME 45 minutes
MATERIALS

Plastic cups
Post-it notes
Science notebooks
Blue food coloring
Water
Ice
Graduated pipette or syringe
Dome lid
How are they different? How are they the same?
What happens when you breathe on the outside of each cup?
What happens if you wipe the outside of the ice-water cup dry?
Where else have you seen water droplets like this form?

The teacher asks each group of students to agree on at least three ideas about what they are observing and then asks them to share those observations with one other group. Once groups have had time to share, the teacher should ask volunteers to share their group’s ideas with the whole class, making sure to listen for naïve understandings about condensation. (For example, if a group of students claim that the ice-water somehow traveled through the inside of the cup to the outside, the teacher might ask them to explain why the water on the outside of the cup is not blue.)

The teacher should tell the students that the droplets of water on the outside of the ice-water cup came from the water vapor in the air and that they are observing condensation. Condensation happens when warm water vapor touches a cool surface and changes from a gas into liquid water. The teacher should ask students to think of situations in their own life when condensation occurs and ask students to identify what made the warm water vapor cool and condense into liquid.

Students should record their observations in words and pictures in their science notebooks, and they should note one or two further questions related to their findings about condensation.

The teacher asks students to consider this challenge, “How could we get water droplets to form on the outside of the cup of room-temperature water?” The teacher should ask students to talk briefly to a partner about how they might accomplish this. The teacher should then ask volunteers to share their ideas with the class, giving time for other class members to respond to these ideas.

The teacher should introduce the materials for building a condensation chamber, a tool for looking at how condensation helps the Earth to recycle water. The teacher should show the students the dome lid, the cup, and the graduated pipette or syringe, and explain that they will put 50 ml of water into the dome lid. Explain that they will put the plastic cup upside-down on the top of the dome lid to make the condensation chamber. Then they will let the chamber sit in a sunny place and observe what happens after a day (or a few hours).
The teacher should ask one student from each group to get a dome lid, a plastic cup, a graduated pipette or syringe, a sticky note, and a container of water for their group. The students should assemble and label their condensation chambers and put them in a sunny place.

**Part 3 ➔ Linkage and Closure (Day 2)**

The teacher should ask one student from each group to get their group's condensation chamber from its sunny location.

The students should observe and talk about what they see. They should then record their observations in their science notebooks using words and pictures.

The teacher should ask groups to share their observations with the class, asking each group probing questions about how the water moved to the top of the cup.

The teacher should ask the class to generate a definition for condensation, and should record this on the board or class content chart.

**EXTENSION**

Cut the top off of a large soda or water bottle, below the narrow neck. Pour sand or soil into the bottle to create hills and valleys. Add a small plant (optional). Add enough water to this ecosystem to create a small lake (about 250 ml). Cover the top of the bottle with a sheet of plastic wrap and keep it in place with the rubber band. Set your mini-earth in a sunny place and observe what happens. (It won't take long, especially if the day is warm, for things to start happening.) Observe water droplets collecting on the underside of the plastic wrap (condensation). Where did this water come from? Will the water stay on plastic wrap? Where might it go? (This is a result of water molecules in the system becoming warm enough to evaporate and become vapor. The vapor rises until it meets with the plastic wrap at the top of the bottle, where the air is cooler- similar to the way the air on Earth rises until it meets the impermeable layer in the stratosphere. Since the vapor can't move through the plastic, it condenses to its liquid form.)

**RESOURCES**

Full Option Science System (FOSS) Environments module materials
FOSS Science Stories

**ADAPTATIONS FOR DIVERSE LEARNERS**
Create language-supportive collaborative learning groups to allow students to work together to answer questions. Use a think-pair-share to encourage thought sharing and discussion and allow for language processing time. Record observations with words and/or pictures. Create illustrated word bank, thinking maps, and charts.

**ASSESSMENT**

To assess how students might be making connections between these activities and their own experiences, pose the following tasks:

- List 5 places where you have observed condensation in your home or in your neighborhood.
- Choose one of these places. How do you know that condensation happened in this place? What caused the water to condense?

Allow students to share their ideas with one another and then write down their ideas. Check student responses for evidence of understanding. Did students correctly identify examples of condensation? Were they able to explain the process of condensation?
GRADE 4

Just Passing Through! The Water Cycle!

POST-VISIT LESSON

Going Full Cycle!
Just Passing Through! The Water Cycle!

POST-VISIT OVERVIEW

Water use is such an automatic and habitual daily activity that students often do not understand the consequences of its use. Seldom do they connect the water that comes out of the faucet to its sources in the natural world. Lake Mead on the Colorado River is one of the most intensely used reservoirs in the western United States, providing recreational activities and domestic drinking, industrial, and irrigation water for millions of users. The quality of this water must be maintained to guarantee a reliable and safe resource for its many uses. Inflow into Lake Mead primarily is from the Colorado River; however, about three percent of the inflow is from tributaries on the northern side of the Lake and from Las Vegas Wash on the northwest side of the Lake.

In "Just Passing Through! The Water Cycle!," students use the Forever Earth vessel to begin exploring the importance of Lake Mead by making and recording observations of how water is being used in different ways by plants, animals, and people. Then students view an animated PowerPoint presentation that follows one drop of water through Lake Mead's water use cycle and then re-create the cycle on a magnet board. Working as scientists, students determine if water is the same in all parts of the lake by comparing water samples from the middle of the lake and from Las Vegas Bay. By examining a number of scenarios, students use scientific reasoning to deduce the major reasons for the current lower lake level. In a culminating activity, students brainstorm ideas for personal actions that they can take to conserve or protect Lake Mead's water.

The following post-visit activities are designed to synthesize and expand the knowledge students have gained in their Forever Earth experience. Students apply their knowledge by building a model of the water cycle, recording observations of changes through time, and designing experiments to examine additional questions.

THEME

Lake Mead not only plays a huge role in supporting life in our desert but also provides a scientific laboratory for understanding how the water cycle works.

KEY QUESTIONS

Where does all the water in Lake Mead come from? Is the water the same in all parts of the lake? What happens to the water?

GOALS

Students will demonstrate an understanding of the processes of condensation and evaporation and the factors that affect these processes.
OBJECTIVES
Students will:

• Demonstrate how condensation occurs when water vapor touches a cool surface and changes into liquid;
• Understand how evaporation and condensation contribute to the movement of water through the water cycle;
• Describe evaporation as the process by which liquid water changes into water vapor, a gas;
• Explain how temperature affects the rate of evaporation; and
• Explain how surface area of a volume of water affects the rate of evaporation.

NEVADA STATE STANDARDS CORRELATION
N.5.A.1. Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method.
E.5.A.2. Students know water on Earth can be a liquid (rain) or a solid (snow and ice) and can go back and forth from one form to the other.

CLARK COUNTY SCHOOL DISTRICT CURRICULUM ESSENTIALS FRAMEWORK (CEF) CORRELATIONS
Students will:

(4)1.1 Generate investigable questions based on observations and interactions with objects, organisms, and phenomena.
(4)1.2 Use science notebook entries to develop, communicate, and justify descriptions, explanations, and predictions.
(4)1.3 Create and use labeled illustrations, graphs (number lines, pictographs, bar graphs, frequency tables), and charts to convey ideas, record observations, and make predictions.
(4)1.4 Conduct safe investigations with a partner and with a small group.
(4)1.5 Identify, gather, and safely use tools (magnet, thermometer, lens) and materials needed in investigations.
(4)1.10 Cooperate and contribute ideas within a group.
(4)3.1 Investigate and describe the properties of water.
(4)3.2 Investigate and describe the water cycle, including the role of the sun.
(4)3.3 Investigate and describe the factors that affect the processes of evaporation and condensation.
(4)3.4 Investigate and explain that water can be a liquid, a gas, or a solid and can go back and forth from one form to another.
(4)3.5 Investigate and describe how the earth is nearly spherical and covered with more water than land.

PREREQUISITE EXPERIENCE
Pre-visit classroom lessons
Forever Earth field trip
POST-VISIT LESSON: GOING FULL CYCLE!

Part 1  Introduct ion
The teacher begins by posting the divided circle map constructed during the pre-visit activity and asks students what they can add or change on the diagram from what they learned about water from their field trip. Students may talk with a partner and then suggest additions which the teacher adds in a different color to the diagram. The teacher encourages students to use vocabulary introduced during the pre-visit activities and practiced during the field trip activities: precipitation, liquid, water vapor, gas, evaporation, condensation, water cycle.

Part 2  Concept Development
The teacher will ask teams of students to assemble a model of the water cycle that they can use to observe and investigate in the classroom. (The teacher should post the directions and model these procedures for the class first.)

- Write your team names on a post-it note and put it in your bag.
- Using the graduated pipette or syringe, measure 50 m. of water into your small cup.
- Carefully place the cup of water into your plastic bag. BE CAREFUL NOT TO SPILL ANY WATER INTO THE BAG!
- Seal the top of the bag tightly.
- Tape your bag to a sunny window.

Students should leave their models in the sunlight while they draw and label the set up of the investigation in their notebooks. They should also take some time to discuss with their team members and record in their notebooks some predictions about what they think will happen in their models.
After some time (30 minutes – several hours, depending on the weather), students should observe their models again and record any changes in their notebooks. The teacher should use probing questions to help students reflect on what they observe.

1. How well did you predict what would happen to the water?
2. Where do you see any water in your model? How do you think it got there?

How is this model like what happens at Lake Mead (and other bodies of water on Earth)? (The water evaporates into the air and rises with the heat of the sun. As the warm water vapor hits the cooler bag, it condenses into small droplets – similar to the way clouds form. When the droplets become too heavy, they fall to the bottom of the bag. This is like what happens to clouds as they collect moisture and become cool enough to drop water to the earth as rain.)

Part 3  
Linkage and Closure

Teams should share their ideas with the rest of the class. The teacher should assess student learning as the groups present their ideas. As they present, other class members should ask questions about their work and the teacher should use observation and questioning to assess student learning and guide any naive conceptions about science content or process that were formed by students in the process of their inquiry.

- How do students explain the water in the bag? How well do their explanations reflect understanding of the processes of the water cycle? (With the heat of the sun, the water evaporates from the cup and condenses on the inside of the bag eventually dripping down to the bottom of the bag.)
- Do they use appropriate vocabulary (evaporation, condensation, water vapor, etc.) to describe the processes of the water cycle?

The teacher should ask teams to meet and generate questions for further investigation, using their water cycle models. These questions could be recorded and posted for future use (see extension activities).

EXTENSION

Students are encouraged to develop other questions that could be investigated using the mini-water cycle.

- Some people are worried about the effects of pollution on the Earth’s polar ice caps. If particles in the air make the white ice caps darken, the ice caps might melt. How do you think discoloration
would affect your water cycle? Would dark-colored water evaporate more quickly or more slowly than plain water? How could you find out?

- Is air temperature or water temperature more important to evaporation? How could you test this? Would you need more than one mini-water cycle? What tools would you need to measure the results of your investigation?

- How does direct sunlight affect evaporation? Try placing one water cycle system in the sun and one in the shade. What do you discover?

RESOURCES
Full Option Science System (FOSS) Environments module materials
Water Science for Schools
http://ga.water.usgs.gov/edu/index.html
http://www.epa.gov/safewater/kids/kids_k-3.html

ADAPTATIONS FOR DIVERSE LEARNERS
Create language-supportive collaborative learning groups to allow students to work together to answer questions.
Use a think-pair-share to encourage thought sharing and discussion and allow for language processing time.
Record observations with words and/or pictures.
Create illustrated word bank, thinking maps, and charts.

ASSESSMENT
Students are assessed in the large group discussions on presentation of their observations and reasoning, on participation in discussion, and on clarifying questions posed.

The teacher may also ask students to self-evaluate their work as a scientist during this investigation.
Students should reflect about the level of their work in the following areas:

- Was I on-task as I worked with my partner to investigate?
- Did I write and draw things in my science notebook that I could use for evidence for the presentation of our findings?
- Did I ask questions of other groups? Did my questions help me and other students better understand what the presentations were trying to say?
- What did I learn about the water cycle?
GRADE 5

FINICKY FISH FINISH...LAST!

ON-SITE PROGRAMMING

2008/2009 Edition
OVERVIEW

The razorback sucker is a native fish species that was once plentiful in the Colorado River system. This rugged fish is adapted to life in flowing waters, including the ever-changing cycles of drought and turbulent flooding that once characterized the Colorado. However, the Colorado River has been altered in ways that now make it hard for the razorback sucker to survive. Today, the razorback sucker is endangered, and as such is a concern of Lake Mead National Recreation Area, the Nevada Department of Wildlife, the U.S. Fish and Wildlife Service, and others. Together, these agencies are working to protect this Colorado River native from extinction.

In “Finicky Fish Finish...Last!” students explore what has happened to the Colorado River and the reasons why it is so difficult for the razorback sucker to thrive in a changed environment. Working as ichthyologists (fish biologists) at Lake Mead, students collect water quality data such as temperature, pH, and clarity—to determine whether current habitat conditions are sufficient for survival of young razorback suckers. Students observe and identify non-native fish in Lake Mead as they learn how the razorback sucker interacts with these neighbors. Students assess whether Lake Mead is still a good habitat for razorback suckers. Using the knowledge they’ve gained, students design ideal refuges for the razorback sucker, including ideas to get the word out about this endangered native fish.

OUTLINE

On-Site Programming

On-site programming includes activities that take place aboard Forever Earth and activities that take place on shore (typically the Callville Bay picnic area). For a large group, it is convenient to split the students into two or more groups. One or more groups can participate in the shore-based activities while one group is aboard Forever Earth; student groups switch when the Forever Earth group returns to the marina.

Forever Earth

Part 1  Welcome and Introductions
Part 2  Observation and Identification: Lake Mead Fish
Part 3  Onboard Safety Talk and Introduction to Native Fish of the Lower Colorado River
Part 4  Impact: Ecological Interactions between Native and Non-native Fish in Lake Mead
Part 5  Investigation: Physical Habitat Characteristics of Lake Mead
Part 6  Before and After

Shore

Chillin’ with the Chubs
Plumbing the Colorado
Corresponding Pre-Visit Lessons

- Species and their Habitat Needs
- Why is the Razorback Sucker Endangered?

Corresponding Post-Visit Lessons

- Getting the Word Out: Visually
- Getting the Word Out: Interviews and Podcasts

THEME
Species with specialized adaptations and narrow ranges of tolerance become vulnerable to extinction when their habitats undergo change.

KEY QUESTIONS
What threatens or endangers a species? What is an organism’s “range of tolerance” for survival? What are the questions and challenges associated with re-establishing an endangered species in an altered ecosystem?

GOAL
Students will demonstrate an understanding of the factors in an altered ecosystem that affect the survival of native species and the challenges of re-establishing endangered species.

OBJECTIVES
Students will:
- describe what is meant by “native species” and “non-native species;”
- describe how the altered habitat conditions of the lower Colorado River caused the native fish species populations to become endangered;
- describe the interactions of native and non-native fish in Lake Mead; and
- apply their knowledge of native fish and their habitat needs to design a refuge for razorback suckers.

NEVADA STATE STANDARDS CORRELATIONS
N.5.A.1. Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method.
N.5.A.2. Students know how to compare the results of their experiments to what scientists already know about the world.
N.5.A.3. Students know how to draw conclusions from scientific evidence.
N.5.B.3. Students know the benefits of working with a team and sharing findings.
L.5.C.2. Students know organisms interact with each other and with the non-living parts of their ecosystems.

L.5.C.3. Students know changes to an environment can be beneficial or detrimental to different organisms.

L.5.C.4. Students know all organisms, including humans, can cause changes in their environments.

- L.5.C.5. Students know plants and animals have adaptations allowing them to survive in specific ecosystems.

CLARK COUNTY SCHOOL DISTRICT SCIENCE CURRICULUM ESSENTIALS FRAMEWORK (CEF) CORRELATIONS

Students will:

(5)4.3. Investigate and describe how plants and animals require food, water, air, and space.

(5)4.5. Explain that living things get what they need from their environments.

(5)4.6. Investigate and describe the interrelationships and interdependence of organisms with each other and with the non-living parts of their habitats.

(5)4.7. Investigate and describe how some environmental conditions are more favorable than others to living things.

(5)4.8. Investigate and describe how organisms, including humans, can cause changes in their environments.

(5)4.10. Investigate and describe how environmental changes allow some plants and animals to survive and reproduce, but others die.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site grade 5 activities support the following guiding themes developed by Clark County-based educators:

- Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.

- Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.
PREREQUISITE CLASSROOM EXPERIENCE

Classroom Visit. A pre-visit classroom trip will be made by Forever Earth or National Park Service staff to introduce students to the Forever Earth program and what to expect during their field trip. Students learn and agree to the "conduct rules" of Forever Earth, understand basic water safety concepts, and observe how and when to put on a Personal Flotation Device (PFD) during their time aboard Forever Earth.

VOCABULARY

- calcium concentration
- dissolved oxygen
- ecosystem
- endangered species
- interpretive plan
- population
- re-establishment
- range of tolerance
- native species
- non-native species
- pH
- refuge
- threatened species
- turbidity
- watershed
- water clarity

ON-SITE ACTIVITIES: Forever Earth

Part 1  Welcome and Introductions
Forever Earth staff greet students in the parking lot. Students are divided into groups and given team lanyards. Facilitator welcomes students to Lake Mead National Recreation Area and Forever Earth and introduces the concept of National Parks and public lands, emphasizing that the field trip is taking place on public land.

Part 2  Observation and Identification: Lake Mead Fish
As students walk to Forever Earth along the dock, they are introduced to their role as ichthyologists and are guided to use observation skills to identify some of the fish in the lake that can be seen from the marina: common carp, bluegill, striped bass, and channel catfish (see Student Reference: Lake Mead Fish Identification). (NOTE: Students must not run on the dock, must not lean over the water from the dock, and must remain at least one-foot from the edge.)

Part 3  Onboard Safety Talk and Introduction to Native Fish of the Lower Colorado River
Captain or facilitator leads the safety presentation (see Facilitator Reference: Safety Talk Outline).

Students gain an understanding of the terms "native species" and "non-native species."
The facilitator uses a Fact or Fiction activity (see Demonstration: Lake Mead Fish Fact or Fiction) to introduce students to the unique attributes of the lower Colorado River native fish. Students compare these species to the non-native species that also exist in the lake today. Through discussion after the demonstration, students learn that Lake Mead was formed by the building of Hoover Dam. Students discuss how the lake differs from the river in terms of fish habitat.

Part 4  Impact: Ecological Interactions Between Native and Non-native Fish in Lake Mead
Students disembark at Sandy Beach and participate in a simulation activity (see Facilitator Reference: Razorback Sucker Survivor) to understand the interactions between native and non-native fishes. Alternatively, this activity can be done within the main cabin or on the top deck of Forever Earth.

Part 5  Investigation: Physical Habitat Characteristics of Lake Mead
Students are told they are going to analyze Lake Mead to see if it is still a good habitat for razorback suckers. Students collect and analyze data to determine fish habitat characteristics of Lake Mead. Data are recorded on the Student Worksheet: Data Collection Sheet.
Students are divided into 2 groups:

Group 1 Students use probes to collect data for dissolved oxygen, water temperature, and pH.

Group 2 Students use a Secchi Disk to measure turbidity.
Students use a plankton net to collect plankton. Students assist facilitator in making slides for stereoscope observation.
Students view collected plankton on TV monitor. Facilitator supports students with basic identification of collected microorganisms.

Groups 1 and 2 compare data and average their results. If time allows, Groups 1 and 2 switch so that both groups have a chance to collect all of the data.

Students compare collected data to the known survival ranges and optimal ranges for razorback sucker survival. With the help of the facilitator, students review the data in their entirety to decide whether Lake Mead is a good habitat for the razorback sucker.
Part 6  ▶ Before and After
Students work in their color teams to create visual representations of the razorback sucker's habitat before Hoover Dam was built and after the dam was built. They should incorporate what they've learned about this native fish and its adaptations, habitat needs, and ecological interactions into their representations. Students document and illustrate their ideas on chart paper. Teacher may collect the results to take back to the classroom to complete or to use in post-visit activities. If time allows, a version of "American Idol" can be introduced as a way of encouraging each team to share their work.

ON-SITE ACTIVITIES: Shore
CHILLIN' WITH THE CHUBS
Note: This activity is adapted from the Discover A Watershed: The Colorado River activity book. For additional information, refer to the activity write-up beginning on page 211.

In this simulation activity, students examine the effects of introduced species and dams on native fish populations in the Colorado River.

Students will:
• Compare pre-dam and post-dam habitat conditions in the Colorado River.
• Describe the effects that introduced species and dams have on native fish populations.
• Discuss solutions for protecting native fish populations.

Part 1  ▶ Introduction to Chillin' with the Chubs
Students are welcomed to Lake Mead National Recreation Area with a brief discussion of the concept of public lands, national parks, and the role of the National Park Service.

Begin by asking students what types of fish they have caught or seen in the area. Introduce the concept of native and non-native species. Ask if they have ever heard of a Colorado pikeminnow or a razorback sucker (use fish models as a visual aid); discuss how these fish were very common in the Colorado River prior to dams being built and to increased human occupation along the river. Ask students to suggest reasons why these native fish populations declined so rapidly. Lead the discussion so that three main factors, or stressors, emerge:

1) Construction of dams changed the physical environment of the river including variation of flows, water temperature, and turbidity.
2) Introduction of nonnative species changed the ecosystem; they prey on eggs and young of native fish.
3) Over-fishing by humans has reduced populations, especially of Colorado pikeminnow and totoaba.

**Part 2  Chillin' with the Chubs**

Tell students that they are going to be a native Colorado River fish and experience how populations of different species have changed in response to the different stressors they just discussed. Divide students into five (or fewer) groups with each group consisting of at least four students. Have each student in group wear lanyards representing a native fish such as humpback chub, bonytail chub, razorback sucker, Colorado pikeminnow, or desert pupfish. Assign one student to be the environmental stressor; this person represents the three different environmental facts that have led to declines in these native fish populations.

Tell students that their goal is to make it across the playing field without being tagged by the stressor. However, they will have hindrances that make it harder to cross. These obstacles represent how these native species are intolerant of new environmental changes. Refer to the table below to explain what students in each group must do as they cross the playing field.

<table>
<thead>
<tr>
<th>Species</th>
<th>Hindrance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humpback chub</td>
<td>Must stop every 8 steps and do 3 jumping jacks</td>
</tr>
<tr>
<td>Bonytail chub</td>
<td>Must walk sideways</td>
</tr>
<tr>
<td>Razorback sucker</td>
<td>Must hop on one foot</td>
</tr>
<tr>
<td>Colorado pikeminnow</td>
<td>Must spin in a circle every 5 steps</td>
</tr>
<tr>
<td>Desert pupfish</td>
<td>Must walk backwards, stopping to touch the ground every 10 steps</td>
</tr>
</tbody>
</table>

Record on flip chart paper the number of students in each group. Tell students that these numbers represent conditions in 1800, before dams and non-native species were introduced, and before commercial fish. The subsequent rounds represent later time periods when these factors were introduced.

For Round 1, the fish will try to make it to the end of the playing field without being tagged by the stressor. Students can walk fast, but not run. Record the number of fish that make it to the safe area. Students that get tagged should flip their Fact Cards to show the non-native or
tolerant species or environmental stressor. These students move to the middle of the playing field to become stressors. Record the total number of environmental stressors and non-native species.

Repeat the procedure for 3-4 more rounds. With more students as stressors, the number of native species left at the end of each round will be fewer. Record numbers of fish for each round.

**Part 3 ~ Conclusions**

Have students discuss the results. Because this is a simplified model, the decrease in native species happens at the same rate as the increase in non-native species. In actual situations, the rates would differ since the factors involved are more complicated.

Ask students to brainstorm ideas to help protect these endangered species. Ideas may include removing non-native fish, finding ways to increase water temperature and make flows more similar to pre-dam flows, banning certain types of fishing, etc.

**PLUMBING THE COLORADO**

*Note: This activity is adapted from the Discover A Watershed: The Colorado River activity book. For additional information, refer to the activity write-up beginning on page 277.*

In this activity, students explore how water moves into and out of the Colorado River system.

Students will:
- Demonstrate water inputs and outputs of the Colorado River system.
- Gain an increased awareness of water users on the Colorado River, including those outside their geographic area.

**Part 1 ~ Introduction to Plumbing the Colorado**

Explain that the Colorado River is extremely important because much of the area through which it flows is desert. By using dams and diversions to use or "plumb" the river, we’re able to live and grow crops where it would otherwise have been extremely difficult. In this activity, the students will see how water is added to and removed from the river according to the type of process or use of the water.

**Part 2 ~ Plumbing the Colorado**
First, direct students' attention to the "rope" model of the Colorado River watershed. Show where major features on the model are located: the headwaters of the Colorado and Green rivers; the confluence of the Colorado and Green rivers; Lake Mead; the U.S./Mexico border; and the Gulf of California. Use the Colorado River watershed map to reinforce the concept of the model representing the flow of the Colorado River from its headwaters to the Gulf of California.

The students are divided into teams. Each team is given a blue bucket that represents the Colorado River. Students will move down the rope model, adding or removing water from their rivers (blue buckets) according to the instructions on the laminated cards. Explain that water in the white buckets represents sources of water (rain, snow, tributaries, etc.). Before letting the students begin the activity, the facilitator should take a few minutes to have students practice using the measuring cups.

Have each team start at the headwaters of the Colorado River, Card #1, and continue down the river to the Gulf of California. Adults should shadow the teams and assist with some of the more complicated measurements. Just below the confluence of the Green and Colorado Rivers, a laminated card asks students to predict how much water will be in the bucket when it reaches the Gulf of California. Emphasize to students that it is not a race and to perform their measurements carefully.

When the river reaches the Gulf of California, there should not be any water left in the bucket. All the water has been used upriver. This is what happens to the Colorado River in most years. Only during extremely wet years does water flow all the way to the Gulf of California. Review students' predictions of how much water would be in the bucket when it reached the Gulf.

Part 3  Conclusions
Students are asked to review the reasons for when water was added to their bucket (river) and for when water was removed from their bucket (river).

Students are then asked what this means for:
- People living in Mexico
- People living along the Colorado River
- People growing food along the Colorado River

Colorado River watershed
"rope" model
6 Measuring cups
6 Blue buckets
6-8 White buckets filled with water
Colorado River watershed map
Laminated cards with information about quantity of water to be added or removed from river buckets and why
Fish and wildlife
All of us
Ask students to discuss what would happen in wet or dry years.

Conclude by having students summarize what they learned by doing this activity.

ADAPTATIONS FOR DIVERSE LEARNERS

• Consult with teachers prior to field trip to determine specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
• Implement peer assistance by involving teachers in the process of creating color teams.
• Provide diagrams, photos, or other visual organizers as appropriate for processes and techniques.
ADDITIONAL ON-SITE ACTIVITIES: Shore

NOTE: These activities may be used to replace or augment "Chillin' with the Chubs" or "Plumbing the Colorado."

BUILD A WATERSHED

In this activity, students work in small groups and build models of watersheds. Students will:

- Be able to define the term "watershed."
- Predict where water will flow in their watershed models.
- Explain how the flow of water or drainage patterns is affected by variables such as steepness of slope and arrangement of landforms (such as mountains, valleys, canyons, lakes, etc.).
- Predict where communities or individual homes might be located on their models.
- Apply what they've observed with the created models to the surrounding landscape.
- Understand that Lake Mead is part of the Colorado River and Colorado River watershed.

Part 1  Introduction to Building a Watershed

The students are asked what comes to their minds when they hear the word "watershed." The responses are used to assimilate a definition that the students can picture using the surrounding landscape.

A watershed is all the land area drained by a particular river, stream, or other water channel. From an aerial view, drainage patterns in watersheds resemble a network similar to the branching pattern of a tree or a state road system. Smaller streams empty into larger streams that empty into still larger streams or rivers.

A map of the Colorado River watershed is used to illustrate how a watershed is a defined area of land and how the many streams and rivers eventually flow into the Colorado River. The facilitator points to location of the headwaters of the Colorado River and then traces the flow of the Colorado through seven U.S. states and two Mexican states to the Gulf of California. The location of Lake Mead, Hoover Dam, and Las Vegas are highlighted for students as well as the importance of Lake Mead for people living in Las Vegas. The Colorado River watershed is the fifth largest in the United States. Students might also be asked if they can guess which watersheds might be larger.

After examining the map, a short discussion follows regarding why it is important to learn about or study a watershed. For example, why is it important to know what's occurring upstream from Las Vegas?

TIME 40 minutes

MATERIALS
Aluminum turkey baking pans
Aluminum foil
Masking tape
Newspaper
Spray bottles filled with water colored with blue food coloring
Map of Colorado River watershed
Downstream? (Weather events; erosion; plants; animals; locations of people; quality of water; movement of pollution; roads; farms; timber harvest; etc.)

Students are then informed that they will be able to learn more about the importance of watersheds by actually building a model of a watershed.

Part 2  Building a Watershed

The facilitator uses the surrounding landscape to point out variations of landforms, steepness, and vegetation. Students picture how water would flow downhill (fast or slow) and where it would flow (what directions). The facilitator may use a pre-constructed sample model to serve as a visual to describe how to build the model.

Students work in groups of 2-3. Each group is given an aluminum turkey baking pan, newspaper pages, masking tape, and aluminum foil. One end of the aluminum pan should be cut and folded outward to represent the “downstream” direction of the watershed. The facilitator demonstrates how to use the newspaper to twist and crumple into different shapes, using the masking tape to hold its shape. The newspaper shapes are placed in the aluminum pan and then covered with sheets of aluminum foil. (When covering the newspaper, it works best to work from downstream to upstream.) The foil can be molded around the newspaper shapes to provide relief and detail to the model.

Before the groups begin their models, they are reminded to think about the various landscapes they’ve observed and plan what kinds of features they want to have in their watershed models. For example, they should plan on whether to build steep mountains and canyons, rolling hills, wide river areas, lakes, and/or valleys, etc.

The groups are given about 10-15 minutes to complete their models. The models are leaned against the side of the concrete pavilion floor so that the downstream end of the model empties into the grass. (This facilitates the water flowing down through the model after water is sprayed onto the model.) Have the students point out differences between the models: less elevation vs. steep elevation, broad expanses vs. narrow canyons or valleys, etc. Then have each group predict where water will flow through their model when it rains and where, if any place, the water might collect, even temporarily.
Each group is given a spray bottle of water and asked to make it "rain" on their watershed. Encourage them to: 1) spray water over the entire watershed model; and 2) allow everyone in their group a chance to use the spray bottle.

Groups place the spray bottles on the ground next to their models. Each group should observe where and how the water flowed through their watershed and report if their original predictions were accurate along with additional observations.

The students are then asked to choose places in their watershed where they might build a home or locations where a town or city might be found. Have them defend or provide a rationale for their choices. Additional questions for discussion include: What kinds of things could change how fast or slow the water flows through a watershed? How do weather or weather events affect a watershed?

**Part 3  Conclusion**

Have all the students gather around one group’s watershed model. Use the model and the surrounding landscape to review the definition of a watershed. Discuss the importance of understanding how a watershed works and how humans can affect how water flows through a watershed. (This can be used as a transition to the “Consequences of Dams” role-play activity.)

Note: The watershed models should be dismantled by the groups before moving on to the next activity. Newspaper shapes and the aluminum foil can usually be reused by the next group of students. Recycle any aluminum foil and newspaper that cannot be reused.

**DAM CONSEQUENCES**

The object of this activity is for students to engage in a role play to evaluate positive and negative effects of damming a river.

Students will:

- understand differing perspectives and concerns related to the construction of a dam.

**Part 1  Introduction to Dam Consequences**

Dams are built for a number of reasons; dam construction has positive and negative effects:

- Dams provide electricity; water for irrigation of crops; and
help prevent flooding problems downriver.

• Dam construction and maintenance provide many jobs, which is good for the local economy.

• A dam can affect plants and animals in a variety of ways. It can take away food and habitat for animals like deer. It can take away nesting sites for birds and change the water temperature and clarity that native fish depend on to survive. It can also increase habitat for some species like the Bald Eagle, a threatened species that likes to catch fish from lakes.

• The lakes created by dams (called reservoirs) provide a lot of recreational opportunities such as swimming, water skiing, sailboarding, motorboating, fishing, and jetskiing. Rivers that don’t have dams also provide recreational opportunities, including fishing, hiking, rafting and kayaking.

Part 2 ㆍ Dam Consequences

Facilitator shows students a map/aerial photograph of Lake Mead with Hoover Dam and points out the course of the Colorado River prior to dam construction. Students are shown photos of a white-water river and told that they are being taken back to a different time and place. Students are asked to imagine what it would be like being on a raft on this river: Would the water be fast or slow? What would it sound like? What kinds of animals might you see? What kinds of plants? How is it different from a lake? How is it similar to a lake? Facilitator shows some photos of rivers and lakes.

The facilitator tells students that in this activity, they will explore the issues involved with rivers and dams from the viewpoints of people involved. They are going to be citizens of Rocksburg, population 900, located along the scenic Jones River some 60 miles from the nearest big city. As citizens, students will have to argue for or against the construction of the Rocksburg Scenic River Enhancement Project, consisting of a 75-foot high dam that will turn seven miles of river into a lake. Each student team will be given a role to play (Student Activity: Dam Consequences Role-Play Cards). Taking on the perspective of their role, they have to argue either for or against the dam to the Rocksburg City Council, consisting of another student team. Each student team will consider the pros and cons from the point of view of their assigned role, no matter what they think as students. Once they make their well thought-out argument to the
Rocksburg City Council, the council members will make the final decision on whether or not the dam should be built. The council members will listen to their constituency (the other five teams presenting) and keep in mind that they are elected officials—that is, they risk losing their jobs if their decision is unpopular. Of course, the council members can cast their votes according to their own conscience, if they so choose.

The facilitator divides the students into six teams. Each team is given a role card. They have 10 minutes to prepare their argument for or against the dam. The facilitator reminds students to argue from the point of view of their assigned role, no matter what they actually think. Each team will choose a spokesperson to argue their case.

Once the students have reviewed their roles, each team has two minutes to present their case to the City Council (the facilitator will be the timer). The council will then have 5 minutes to make their final decision and present to the townspeople of Rocksburg.

Part 3  Conclusions

Students review some of the pros and cons of damming a river. The facilitator provides closure to the activity by having students apply what they have learned to the construction of Hoover Dam and consider the pros and cons of its existence.
GRADE 5

FINICKY FISH FINISH...LAST!

ON-SITE PROGRAMMING • SUPPORT MATERIALS
common carp
- stout, high-backed, deep body
- two pairs of barbels on either side of mouth
- top of body is brass-colored

channel catfish
- small eyes
- eight barbels around mouth
- gray to slate-blue colored

striped bass
- slightly arched back
- lower jaw slightly longer than upper jaw
- dark, continuous stripes on body

bluegill
- large eye
- large mouth
- side is blue or blue-green with a purple luster

Illustrations by Duane Raver (Fresh Water Fish Collection, U.S. Fish and Wildlife Service)
Finicky Fish Finish...Last Fact or Fiction is a PowerPoint presentation that is delivered with a lot of energy. It functions to introduce some of the native and non-native fish that live in the Colorado River system today. This presentation both sets the tone for the rest of the program and leads into further discussion about the razorback sucker as an endangered species adapted for life as a Colorado River native.

A minnow lives in the Colorado River that can grow to 6-feet long and weigh 100 pounds.

FACT

To catch this fish, you could use a small rabbit as bait.

FACT

Voracious meat-eating Piranhas living in Lake Mead have eaten native fish populations.

FICTION
There's a fish in the Colorado River that can live to be 50 years old.

It's possible for the razorback sucker to survive on food that's smaller than a hair.

Like a camel, the razorback sucker uses its hump to store fat.

There is an amazing fish that lives not only in Lake Mead, but also Japan and many other places in the world!

FACT

Razorbak Sucker

FACT

Razorbak Sucker eats PLANKTON

FICTION

Common Carp

Photo/Illustration credits: Razorback sucker and Colorado pikeminnow illustrations © Joseph R. Tomelleri; Photo, Charles and Pat Mantle display a Colorado pikeminnow caught in the Colorado river around 1935, courtesy Sue Mantle; Common carp illustration from the Duane Raver Art: Fresh Water Fish Collection, U.S. Fish and Wildlife Service.
Facilitator Reference:
RAZORBACK SUCKER FAST FACTS

DISTINGUISHING PHYSICAL FEATURES
• brownish-green upper body with a yellow- to white-colored belly;
• abrupt, sharp edged hump on back behind head;
• fleshy lips used for sucking up food; and
• generally 16 to 28 inches long, weighing less than seven pounds
  but have been known to reach 36 inches and 18 pounds.

LIFE HISTORY SPECIFICS
• currently limited to 25% of historic range;
• have been known to live 40 to 50 years;
• capable of spawning at an age of 3 to 4 years and spawning occurs in spring;
• feed primarily on insects, plankton, and plant matter;
• natural habitat is in the Colorado River Basin;
• once valued as food by early settlers and miners of the Colorado River Basin; and
• hump is believed to provide stability in turbulent flow or to provide protection against being eaten by the Colorado pikeminnow (actual purpose of hump is unknown).

STATUS
• currently given full protection under the Endangered Species Act;
• federally listed as "Endangered" in 1991;
• became endangered under Colorado law as of 1979;
• was listed as protected under Utah law as of 1973;
• existing population is made up primarily of adult fish because non-native fish prey upon young;
• populations raised in hatcheries are being reintroduced in the Colorado, Gunnison, Green and San Juan rivers; and
• less than 500 razorback suckers currently live in Lake Mead.

POTENTIAL THREATS
• habitat alteration and destruction (primarily due to flow regulation);
• decline in water quality; and
• direct competition and predation by non-native fishes: carp, bluegill, green sunfish, largemouth bass, striped bass, tilapia, and crayfish are species that typically prey upon or compete with razorbacks.

Fast facts retrieved (May 26, 2006) from the following Internet sites:
1. The objective of this activity is for students to learn about the effects of damming the Colorado River and how the introduction of non-native fish species impacted razorback suckers. The object is for students representing razorback suckers to avoid becoming threatened, endangered, or extinct. Students will see how interactions with introduced fish and a changing ecosystem affect the razorback sucker's ability to find food, reproduce, and survive.

2. Show the students the three things that the razorback suckers in this activity will need to survive and maintain their population: food, correct water temperature (thermal preference $= 22.9$ - $24.8 \degree C$), and fingerling. Each of these three survival components will be represented on different colored Frisbees. If there is not sufficient food, fewer razorback suckers will be able to survive. If the water temperature is too high or too low, razorback suckers are less likely to thrive in their environment (e.g., in low temperatures, fish move more slowly and juveniles are less likely to escape predators, and reproduction rates are reduced in lower temperatures). If there aren't enough fingerlings, then there will be fewer razorback suckers in the habitat. "Threatened" is the term used to mean there are fewer razorback suckers than there were; "Endangered" means that there are so few that they are in danger of becoming extinct; "extinct" means that there are no more razorback suckers anywhere in the world (not even in a zoo).

3. Clear an area and place each Frisbee on the ground randomly to resemble a river. Tell students that the activity area represents the Colorado River. The river water is a certain temperature; there are places called "nurseries" where razorback sucker eggs hatch and grow up; and there are other places where insects, plankton, and other plant material provide food for razorback suckers. Next divide the class into five equal teams. Explain to Teams 1-4 that they represent a predatory fish called a striped bass. Each team represents 100 striped bass.

4. Inform Team 5 that they are razorback suckers – show them a picture. Provide each member of the Razorback Sucker Team with an identifying nametag.

5. Have the Razorback Sucker Team members come forward. Explain to them that each razorback sucker needs to collect one temperature Frisbee, one fingerling Frisbee, and one food Frisbee to survive the round. Tell them that they have to collect these in an orderly fashion – no pushing, shoving, etc., and that they have to wait for your word to go. Say: "Go!"

6. Each Razorback Sucker Team member should have no trouble finding the three Frisbees they need to
survive. Congratulate them on their survival skills, and replace the Frisbees in the “river.” The razorback sucker population is doing fine!

7. Round 2: Ask the members of Striped Bass Team 1 to step forward. Each of these striped bass is hungry and will “take” either one food Frisbee or one fingerling razorback sucker. Have them go into the river and stand on a food Frisbee or a fingerling razorback sucker Frisbee (student’s choice). These Frisbees are no longer available to our Razorback Sucker Team members. Have the Razorback Sucker Team step forward and, on your prompt, find the three Frisbees they need to survive.

8. Each Razorback Sucker Team member should be able to find the three Frisbees they need. Congratulate them again on their clever survival skills, and ask them: Was it more difficult to find what you needed to survive? Why? Replace the Frisbees into the river, telling Striped Bass Team 1 to remain where they are. Although there is now danger for their young and competition for food, 100 striped bass and the razorback suckers can survive together.

9. Round 3: It’s 1935, and the construction of the Hoover Dam is complete. The dam was built to control the wildly unpredictable levels of the Colorado River, which ranged from periods of extreme flooding to periods where it was nearly dried up. The Hoover Dam created Lake Mead and provided a means to generate electricity, but, of course, it also changed the Colorado River forever. Of special significance to the razorback sucker: as Lake Mead is formed, the water becomes much deeper, and because sunlight can’t penetrate beyond a certain depth to warm it, the water becomes much colder (especially the deeper you go). If you have enough students, create a Hoover Dam Team. These students stand and link arms at one end of the “river channel” of Frisbees. Once the students are in place, shift the Frisbees into a more circular layout to represent the filling in of Lake Mead. In the lake, striped bass can survive easily, but razorback suckers have a narrow range of tolerance – it has to find suitable places to live where the temperature is warmer, usually near the surface. Turn over several temperature Frisbees to represent colder temperatures. Make sure to let students know that these Frisbees are now unavailable. Because Lake Mead is a great habitat for striped bass, have Striped Bass Team 2 step forward, representing 100 more striped bass, and find a Frisbee (either food or fingerling) to stand on. Have the Razorback Sucker Team step forward and, on your prompt, find the three Frisbees they need to survive.

10. One or more razorback suckers won’t find all three Frisbees they need to survive. If they are missing one or more Frisbees, their population shrinks because fewer razorback suckers have survived. Hand a life jacket to each of the Razorback Sucker Team members that did not get all three Frisbees – the life jacket represents that the population has become threatened. Ask the students: How many striped bass are in the lake this time? Was it more difficult to find what you needed to survive? Why?

11. Round 4 and 5: Repeat, adding Teams 3 and 4 for each round. A Razorback Sucker Team member holding a life jacket that can’t collect all three Frisbees must now wear the life jacket to signify that their population has become endangered. A Razorback Sucker Team member wearing
a life jacket that can’t collect all three Frisbees is asked to step out because they are now extinct.

After each round, ask: *How many striped bass are in the lake this time? Was it more difficult to find what you needed to survive? Why?*

12. To conclude, ask the students what was real and not real about the activity. The activity presents a simplified but conceptually accurate view of what has happened to the razorback sucker’s habitat and population over the years. The introduced striped bass and other non-native fish compete for food and are predators of young razorback suckers.

13. Next students will determine whether the conditions of Lake Mead provide habitat components within the range of tolerance of razorback suckers.
Investigation:
Is Lake Mead a good place for razorback suckers to live?

1) **Temperature** ➞ FACTS: razorback sucker survival: 16°C to 32°C  
Best: 23°C to 25°C

<table>
<thead>
<tr>
<th>Temperature Measurement</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the surface</td>
<td>°F</td>
</tr>
<tr>
<td>2 meters below surface</td>
<td>°F</td>
</tr>
<tr>
<td>5 meters below surface</td>
<td>°F</td>
</tr>
</tbody>
</table>

a. Can razorback suckers live in the **temperatures** you found?  
   □ YES □ NO

b. Are these the BEST **temperatures** for razorback suckers?  
   □ YES □ NO

2) **pH** ➞ FACTS: razorback sucker survival: pH = 7.5 to 10  
Best: pH is 8 to 9

<table>
<thead>
<tr>
<th>pH Measurement</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the surface</td>
<td></td>
</tr>
<tr>
<td>2 meters below surface</td>
<td></td>
</tr>
<tr>
<td>5 meters below surface</td>
<td></td>
</tr>
</tbody>
</table>

a. Can razorback suckers live at the **pH** you found?  
   □ YES □ NO

b. Is the BEST **pH** found here?  
   □ YES □ NO

3) **Water clarity** ➞ FACTS: razorback suckers like muddy water best.  
Survival: .1 m to .43 m  
Best: less than .5 m

Secchi disc depth today: ________________
a. Can razorback suckers live at the water clarity you found? □ YES □ NO
b. Is the BEST water clarity found here? □ YES □ NO

4) Food ➔ FACT: razorback suckers eat plankton, especially Daphnia and copepods.

a. Is there food for razorback suckers here? □ YES □ NO
b. What kind of food did you find? Sketch it in the box.

5) Razorback suckers are adapted to live in flowing water. Before the dam, the Colorado River used to go through cycles of drought and raging floods.

Describe how the water is flowing in Lake Mead. Circle your answer

FAST       SLOW       NOT AT ALL

6) Razorback suckers are adapted to live in areas that flood. Floods provide backwaters (large puddles) that serve as nurseries for young razorbacks.

Do you see large puddles along the shore? □ YES □ NO
7) Is Lake Mead an ideal place for razorback suckers to live? □ YES □ NO

Student Reference
PH SCALE AND EXAMPLES

ACIDIC

pH = 0  battery acid
pH = 1  lemon juice
pH = 2  Coke/Pepsi
pH = 3  orange juice
pH = 4
pH = 5  bananas
pH = 6  milk
pH = 7  pure water
pH = 8  sea water
pH = 9  baking soda
pH = 10  TUMS®

NEUTRAL

pH = 11

BASIC

pH = 12  soapy water
pH = 13  bleach
pH = 14
Adapted from the Acid Rain Student's Site: www.epa.gov/acidrain/site_students/phscale.html
**Phytoplankton**

- microscopic **plants** that live in water
- first in the food chain
- use chlorophyll to make sugars out of energy from the sun, chemicals (like nitrogen), and dissolved carbon dioxide gas.

**Zooplankton**

- microscopic **animals** and single-celled organisms that live in water
- eat other plankton

Image credits: Brachionus and Copepod © Kirsten Work, Ph.D.; Daphnia © Texas Tech University; Diatoms © Donald F. Charles, Ph.D.; Nitzschia © Protist Information Server; Pandorina © University of Texas, Austin; Trachelomonas © The SilicaSecchiDisk; Tricotria provided with the permission of The Academy of Natural Sciences, Philadelphia, PA
Student Activity:
CHILLIN’ WITH THE CHUBS FACT CARDS (SHEET 1)

Humpback chub (*Gila cypha*)
- Hump behind its head and large fins help it to maneuver in strong currents and whitewater.
- Evolved 3–5 million years ago.
- Lifespan: up to 30 years.
- Length: up to 18 inches.

Striped bass (*Morone saxatalis*)
- Introduced to reservoirs in the Colorado River system; native to the Atlantic coast.
- Popular game fish because it is good to eat.
- Lifespan: up to 31 years.
- Length: 24 inches or more (up to 60 pounds!).

Bonytail chub (*Gila elegans*)
- Large fins and streamlined body.
- Rarest endangered fish species in the Colorado Basin.
- Evolved 3–5 million years ago.
- Lifespan: up to 50 years.
- Length: 22 inches or more.

Rainbow trout (*Oncorhynchus mykiss*)
- Named for its rosy lateral stripe.
- Popular game fish native to western North America.
- Lifespan: up to 11 years.
- Length: 16 inches or more.

Razorback sucker (*Xyrauchen texanus*)
- Large, bony ridge behind head.
- Fleshy lips used for feeding on river bottom.
- Evolved: 4 million years ago.
- Lifespan: 40 years or more.
- Length: 36 inches or more.
### Student Activity:
**CHILLIN’ WITH THE CHUBS FACT CARDS (SHEET 2)**

<table>
<thead>
<tr>
<th>Colorado pikeminnow (<em>Ptychocheilus lucius</em>)</th>
<th>Rainbow trout (<em>Oncorhynchus mykiss</em>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Torpedo-shaped body and large mouth.</td>
<td>• Named for its rosy lateral stripe.</td>
</tr>
<tr>
<td>• Largest native minnow in North America.</td>
<td>• Popular game fish native to western North America.</td>
</tr>
<tr>
<td>• Evolved: 3–4 million years ago.</td>
<td>• Lifespan: up to 11 years.</td>
</tr>
<tr>
<td>• Lifespan: 50 years or more.</td>
<td>• Length: 16 inches or more.</td>
</tr>
<tr>
<td>• Length: up to 60 inches.</td>
<td></td>
</tr>
</tbody>
</table>

**Desert pupfish (*Cyprinodon macularius*)**

- Is adapted to tolerate rapid changes in water temperature and salinity that occur when desert pools shrink due to evaporation.
- Large scales vary in color from brilliant blue to metallic gray.
- Length: 5 inches or less.

**ENVIRONMENTAL STRESSOR**

© Claire Emery and Project WET International
<table>
<thead>
<tr>
<th>1</th>
<th>The Colorado River begins in the mountains with lots of rain and melting snow!</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lots of rain and melting snow means ... you <strong>ADD 4 1/3 CUPS of water.</strong></td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>People in Denver need water! They take water from the Colorado River.</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td><strong>REMOVE 1 CUP</strong> of water from your river.</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Two rivers add more water into the Colorado River.</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>More water! <strong>ADD 2 CUPS of water to your river.</strong></td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>A BIG river called the Green River adds a lot of water to the Colorado River.</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>More water! <strong>ADD 5 2/3 CUPS of water to your river.</strong></td>
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<tr>
<td><strong>5</strong></td>
<td><strong>5</strong></td>
<td></td>
</tr>
<tr>
<td>Lake Powell loses a lot of water because of <strong>EVAPORATION.</strong></td>
<td>Evaporation means... you <strong>REMOVE</strong> 1 CUP of water from your river.</td>
<td></td>
</tr>
<tr>
<td><strong>OVER</strong></td>
<td><strong>OVER</strong></td>
<td></td>
</tr>
<tr>
<td><strong>6</strong></td>
<td><strong>6</strong></td>
<td></td>
</tr>
<tr>
<td>Lake Mead loses a lot of water because of <strong>EVAPORATION.</strong></td>
<td>Evaporation means... you <strong>REMOVE</strong> 1 1/4 CUPS of water from your river.</td>
<td></td>
</tr>
<tr>
<td><strong>OVER</strong></td>
<td><strong>OVER</strong></td>
<td></td>
</tr>
<tr>
<td><strong>7</strong></td>
<td><strong>7</strong></td>
<td></td>
</tr>
<tr>
<td>People in Las Vegas need water! They take water from Lake Mead.</td>
<td><strong>REMOVE</strong> 2/3 CUP of water from your river.</td>
<td></td>
</tr>
<tr>
<td><strong>OVER</strong></td>
<td><strong>OVER</strong></td>
<td></td>
</tr>
<tr>
<td><strong>8</strong></td>
<td><strong>8</strong></td>
<td></td>
</tr>
<tr>
<td>Lake Havasu loses a lot of water because of <strong>EVAPORATION.</strong></td>
<td>Evaporation means... you <strong>REMOVE</strong> 1 CUP of water from your river.</td>
<td></td>
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<tr>
<td><strong>OVER</strong></td>
<td><strong>OVER</strong></td>
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</tr>
<tr>
<td><strong>9</strong></td>
<td>People in Arizona need water! They take water from the Colorado River.</td>
<td></td>
</tr>
<tr>
<td><strong>9</strong></td>
<td>REMOVE 1 1/3 CUP of water from your river.</td>
<td></td>
</tr>
<tr>
<td><strong>10</strong></td>
<td>Water is needed for growing food! Water from the Colorado River is used for farming.</td>
<td></td>
</tr>
<tr>
<td><strong>10</strong></td>
<td>Using water to grow food means ... you REMOVE 3 3/4 CUPS of water from your river.</td>
<td></td>
</tr>
<tr>
<td><strong>11</strong></td>
<td>Farmers in Mexico need water to grow food. Water from the Colorado River is used.</td>
<td></td>
</tr>
<tr>
<td><strong>11</strong></td>
<td>Using water to grow food means ... you REMOVE 2 CUPS of water from your river.</td>
<td></td>
</tr>
<tr>
<td>Lee’s Ferry</td>
<td>Lee’s Ferry</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Gulf of California</td>
<td>Gulf of California</td>
<td></td>
</tr>
<tr>
<td>U.S. Mexico Border</td>
<td>U.S. Mexico Border</td>
<td></td>
</tr>
</tbody>
</table>

**STOP!**
Take a look at how much water you have in your river. How much water will be in your river when you reach the Gulf of California? Tell an adult!

**STOP!**
Take a look at how much water you have in your river. How much water will be in your river when you reach the Gulf of California? Tell an adult!
Student Activity:
DAM CONSEQUENCES ROLE-PLAY CARDS

CONSTRUCTION WORKER

There has been little work for construction workers recently, and you're very worried about how you will feed your family and send your children to school. If the dam is built, you'll have a good job for perhaps two years. If the dam is not built, there is no promise of immediate work. You have heard, however, that there are plans to build a bridge within the next year, and you might be able to get a job on that project.

FARMER

Wow! First there was a deadly drought that lasted for two years. Then a huge rainstorm came, and the river overflowed its banks. The water flooded three of your fields, delaying planting. You are wondering how you will be able to grow your crops this year. You are very interested in the dam's potential for protecting crops from floods as well as its ability to provide water for irrigation.

PARK RANGER

As a park ranger, it is your job to save habitats and animals and to teach people to love nature. You have worked in the area for more than 30 years. You know every trail along the river like the back of your hand and have studied the plants and animals that depend on the river.

WHITewater RAFTING COMPANY

You own a whitewater rafting company and use the river for commercial rafting. You employ 30 people during the spring and summer rafting seasons. You are very concerned about losing the rapids on the "best 7 miles of the river!" As well, your company leads hikes into the narrow slot canyons that would be destroyed by the lake.
LOCAL STOREKEEPER

You own the convenience store on the corner of River Junction and Main Street. You would be able to see the dam from your front window. You wonder how the dam will affect your business. Although you would lose the business of the fishermen, rafters, and hikers that come to your store now, you would probably gain the business of the construction workers and, once the dam was built, the boaters that come to the lake.

CITY COUNCIL MEMBER

The people of Rockport voted for you in the last election because you promised to listen to their opinions and make decisions that would benefit them. You know that some people want this dam and some do not. You must listen to what your constituents want and then make the final decision about whether the dam will be built.

As your constituents make their presentations, think how you will decide if their argument is more or less compelling than someone else’s. You can use the following to help you evaluate their presentations:

- Is the argument clear? Does it make sense?
- Are you convinced of how people will be affected by the dam—will they be harmed or will they benefit? In what ways? How many people will be affected?
- How will plants and animals be harmed? How will they benefit?
- How much will it cost?
GRADE 5

FINICKY FISH FINISH...LAST!

PRE-VISIT LESSONS

HABITAT NEEDS (DAY ONE)

WHY IS THE RAZORBACK SUCKER ENDANGERED? (DAYS TWO AND THREE)
FINICKY FISH FINISH...LAST!

PRE-VISIT OVERVIEW

The razorback sucker is a native fish species that was once plentiful in the Colorado River system. This rugged fish is adapted to life in flowing waters, including the ever-changing cycles of drought and turbulent flooding that once characterized the Colorado. However, the Colorado River has been altered in ways that now make it hard for the razorback sucker to survive. Today, the razorback sucker is endangered, and as such is a concern of Lake Mead National Recreation Area, the Nevada Department of Wildlife, the U.S. Fish and Wildlife Service, and others. Together, these agencies are working to protect this Colorado River native from extinction.

In “Finicky Fish Finish...Last!” students use the Forever Earth vessel to explore what has happened to the Colorado River and the reasons why it is so difficult for the razorback sucker to thrive in a changed environment. Working as ichthyologists (fish biologists) at Lake Mead, students collect water quality data such as temperature, pH, and clarity—to determine whether current habitat conditions are sufficient for survival of young razorback suckers. Students observe and identify non-native fish in Lake Mead as they learn how the razorback sucker interacts with these neighbors. Students assess whether Lake Mead is still a good habitat for razorback suckers. Using the knowledge they’ve gained, students design ideal refuges for the razorback sucker, including ideas to get the word out about this endangered native fish.

These pre-visit activities are designed to prepare students for this on-site experience by introducing them to habitat needs of all species and to initiate student inquiry into why species, such as the razorback sucker, become endangered.

THEME

Species with specialized adaptations and narrow ranges of tolerance become vulnerable to extinction when their habitats undergo change.

KEY QUESTIONS

What threatens or endangers a species? What is an organism’s “range of tolerance” for survival?

What are the questions and challenges associated with re-establishing an endangered species in an altered ecosystem?

GOALS

Students will demonstrate an understanding of:

- what happens to an ecosystem that contributes to the endangerment of a species; and
- what factors need to be considered for survival of an organism and a species.
OBJECTIVES

Students will:

• describe what is meant by "endangered species" and "threatened species;"
• delineate what the major environmental factors are in an aquatic environment;
• understand that organisms interact within their ecosystems;
• research what factors must be considered to ensure that a species' range of tolerance is met; and
• understand that science involves asking and answering questions and comparing the answers to what scientists know about the world.

NEVADA STATE STANDARDS CORRELATION

N.5.A.1. Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method.
N.5.A.2. Students know how to compare the results of their experiments to what scientists already know about the world.
N.5.A.4. Students know graphic representations of recorded data can be used to make predictions.
N.5.B.2. Students know technologies impact society, both positively and negatively.
N.5.B.3. Students know the benefits of working with a team and sharing findings.
L.5.A.2. Students know reproduction is an essential characteristic for the continuation of every species.
L.5.C.2. Students know organisms interact with each other and with the non-living parts of their ecosystem.
L.5.C.3. Students know changes to an environment can be beneficial or detrimental to different organisms.
L.5.C.4. Students know all organisms, including humans, can cause changes in their environments.

CLARK COUNTY SCHOOL DISTRICT CURRICULUM ESSENTIALS FRAMEWORK (CEF) CORRELATIONS

Students will:

• investigate and describe how plants and animals require food, water, air, and space;
• explain that living things get what they need from their environments;
• investigate and describe the interrelationships and interdependence of organisms with each other and with the non-living parts of their habitats;
• investigate and describe how some environmental conditions are more favorable than others to living things;
• investigate and describe how organisms, including humans, can cause changes in their environments;
• investigate and describe how, for any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all; and
• investigate and describe how environmental changes allow some plants and animals to survive and reproduce, but others may die.

**SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME**

**CORRELATIONS**
The on-site grade 5 activities support the following guiding themes developed by Clark County-based educators:

• Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.

• Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

**PREREQUISITE CLASSROOM EXPERIENCES**
Students who have used the Full Option Science System (FOSS) Environments modules listed below will gain the most from the pre-visit lessons.

- Investigation 1: Terrestrial Environments
- Investigation 2: Bugs and Beetles
- Investigation 3: Water Tolerance
- Investigation 4: Aquatic Environments
- Investigation 5: Brine Shrimp Hatching

**VOCABULARY**
- ecology
- ecosystem
- endangered species
- environment
- environmental factors
- extinction
- food web
- habitat
- organism
- range of tolerance
- re-establishment
- species
- survival
- threatened species
- thrive

**PRE-VISIT LESSON: HABITAT NEEDS (DAY ONE)**

**Part 1 ▶ Introduction**
1. The teacher introduces students to the idea of a field trip to extend their study of environments. Suspense is built by telling the class that they will visit a large aquatic environment in the area. Students guess possible locations. Students are told that they will be research scientists for Lake Mead—beginning today (in the...
classroom) and continuing after their return.

2. The teacher presents the Forever Earth PowerPoint (Demonstration: Introduction to Forever Earth) depicting the Lake Mead aquatic environment and the floating classroom, Forever Earth. Students are given a map (Student Reference: Colorado River System Map) and asked to identify Lake Mead.

3. The teacher introduces the problem: *The razorback sucker, a fish species native to the Colorado River, is endangered.* Students examine the map showing the historical and current range of the razorback sucker (Student Reference: Then and Now—Homes of the Razorback Sucker and Bonytail Chub).

   The teacher reads a historical account of the razorback sucker in the Colorado River (Teacher Reference: The Razorback Sucker A Teacher Read Aloud).

4. Students are split into small groups, and the teacher facilitates having students address the problem by linking prior knowledge of threatened or endangered species (e.g., Mojave Max).

5. The teacher charts the terms “endangered species” and “threatened species.” Students discuss the meaning of these terms with their group members, then with the class.

6. Teacher charts the definitions. Students record the definitions in their notebooks.

7. Whole group discussion: *What species do you know that are endangered or threatened?* The teacher charts responses.

**Part 2  Concept Development**

1. The teacher asks students to write in their science notebooks a response to the following question: *What do living organisms need to survive?* Students pair/share their lists.

2. Students decide (as a class) which environmental factors are needed for survival (i.e., air, water, food, and space). The teacher
charts responses.

3. The teacher shows students photos while explaining that scientists and researchers are concerned for the future of threatened and endangered fish species native to the Colorado River Basin. Four species of major concern are the Colorado pikeminnow, razorback sucker, bonytail chub, and humpback chub. These species exist nowhere else on earth.

The teacher emphasizes that the razorback sucker is the focus of the students' upcoming study in the classroom and aboard Forever Earth (and on land) at Lake Mead National Recreation Area.

Facts about and images of the four endangered Colorado River Basin fish species (above) can be downloaded from:


4. Students brainstorm (in groups) what changes could have occurred to the aquatic environment such that razorback suckers can no longer thrive in it. Student groups share their ideas with the class, and the teacher charts them.

5. The teacher presents a mini-lesson on food webs. Students are asked: With this information in mind, is there anything missing from the list (brainstorm) of what could have happened to the razorback sucker?

6. Students reflect on (in their notebooks) the possible reasons for the endangerment of the razorback sucker including the environmental factors charted (air, water, food, and space). From the food web examination, students might guess that the endangered species are also preyed upon.

Part 3  Presentation of Findings

Students bring their notebooks to the science circle. They share their reflections and final thoughts about possible reasons why these species are endangered. Class members respond by asking clarifying questions and by probing for reasoning to support conjectures.
Part 4  Linkage and Closure

The teacher summarizes by explaining that living organisms need food, water, air, and space in order to survive—and that they must get these needs met by their environment. The teacher states the following:

"We know what an endangered species is and what environmental factors affect a species’ survival. From our work in the Environments Kit (FOSS), we have learned that species have a range of tolerance for each of these environmental factors. We have thought of some reasons why the razorback sucker is endangered. Next we will research what the scientists have to say about possible reasons for its endangerment.

EXTENSIONS

• Students conduct background informational research on other threatened and endangered species, especially those native to Southern Nevada.

RESOURCES

• Full Option Science System (FOSS) Environments module materials
• FOSS Science Stories
• Fish Facts: humpback chub, bonytail chub, Colorado pikeminnow, and razorback sucker; document includes a Joseph R. Tomelleri illustration of each fish.

ADAPTATIONS FOR DIVERSE LEARNERS

• Create peer reader and writer groups.
• Allow students to work in collaborative groups to answer questions.
• Use a science circle to encourage thought sharing and discussion.
• Limit Internet research to the following one-page razorback sucker sites:
  www.nps.gov/applications/nature/documents/Razorback%20Sucker.doc
  http://dine.sanjuan.k12.ut.us/heritage/land/animals/reptiles/razor_sucker.htm
  http://library.thinkquest.org/2551/species/razorbacksucker.html

ASSESSMENT

Students are assessed in the science circle on oral presentation of conjectures and reasoning, on participation in discussion, and on clarifying questions posed.
Part 1  Introduction

1. The teacher provides linkage to the Day One Pre-Visit Lesson through a Think-Pair-Share Activity (Lyman, 1981). Students are asked to volunteer facts they've learned, so far, about the razorback sucker (e.g., where it lives, what it needs to survive, how it interacts with other species, etc.). The teacher charts the responses.

2. The teacher summarizes by stating the following:
   Yesterday we discussed that living organisms require food, water, air, and space to survive in their habitats, and that they must get what they need from their environments. We established a definition for endangered species, and we discussed what environmental factors may affect an organism’s survival. We have thought of some possible reasons for the razorback sucker’s endangerment.

3. Teacher informs the class that they will go to the computer lab to find out how scientists explain the razorback sucker’s endangered species status. Students will also investigate what scientists are considering in terms of re-establishing the razorback sucker in Lake Mead and other parts of the Colorado River System. The teacher asks students to review Student Reference: Colorado River System Map in pairs and discuss what they notice about the Colorado River. Then the teacher asks the class to identify locations on the map (e.g., what states does the Colorado River flow through, where is Lake Mead, and where is Las Vegas?).

4. The teacher presents the overarching issue:
   Scientists are trying to re-establish the razorback sucker in the Lower Colorado River system, and it hasn’t been easy. There are numerous challenges to re-establishing an endangered species into an altered ecosystem.

   Students are given a map that shows the historic and current locations of populations of razorback suckers and bonytail chubs.
The teacher facilitates a class discussion about how the distributions of these fish populations have changed.

5. Students work in collaborative groups of four to brainstorm responses to the following questions:

- What do scientists need to know about a species and an environment in order to re-establish a species successfully?
- What questions does a scientist ask before re-establishing a threatened or endangered species into an altered ecosystem?
- What are the challenges of re-establishing a species into an altered ecosystem?

6. Within the collaborative groups of four, assign one of the following informational research questions to individual members such that each group will have all four questions answered.

- What is a razorback sucker; what are its distinguishing features?
- Why is the razorback sucker on the Endangered Species list? Why are there fewer razorback suckers now?
- What type of research is being done on the razorback sucker? What environmental factors are scientists monitoring in areas where the razorback sucker is being re-established?
- What is the range of the razorback sucker in the Colorado River System; where are re-establishment projects taking place?

7. Students take science notebooks and choose a partner within their group to research the razorback sucker in the computer lab.

**Part 2 - Concept Development**

Within their science notebooks, students document their research on the razorback sucker and print pertinent pictures and maps from the Internet (Student Reference: Researching the Razorback Sucker).
Part 3  Linkage and Closure

The teacher facilitates a Think-Pair-Share (Lyman, 1981) Activity. Make a list of what you learned today about razorback suckers. The teacher charts the responses.

The teacher summarizes as follows: From our research today we have seen that scientists are looking at the relationships that organisms have with each other and how species depend on specific qualities of the living and non-living parts of their habitats for survival. Scientists use this information to decide how best to re-establish the razorback sucker and to monitor the success of their re-establishment projects. Tomorrow in your groups of four you will have time to prepare and present your findings to the whole class.

Part 4  Presentation of Findings

Students share their findings in their collaborative groups of four. Groups prepare poster presentations to include:

- Physical attributes of the razorback sucker;
- The range of the razorback sucker and where re-establishment projects are occurring;
- Environmental factors or changes that may have contributed to the decline in population of the razorback sucker; and
- Scientific investigations into the re-establishment of an endangered/threatened species into an ecosystem.

Collaborative groups present their posters. The teacher concludes: We now have a good background for our upcoming visit to Forever Earth at Lake Mead—part of the Colorado River System where we will go to learn more about the razorback sucker.

EXTENSIONS

- Students investigate other threatened or endangered species, especially those in Southern Nevada.
- On maps of the Colorado River System, students locate and mark the sites where research or conservation efforts are occurring for the razorback sucker or other threatened or endangered species.

RESOURCES

- Full Option Science System (FOSS) Environments module materials
• FOSS Science Stories
• Teacher Resource: Grade 5 Internet Resource list
• U.S. Fish and Wildlife Service, Mountain-Prairie Region
  Razorback Sucker Recovery Plan and Goals:

ADAPTATIONS FOR DIVERSE LEARNERS
• Consult with Forever Earth project manager prior to field trip to discuss specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
• Create peer reader and writer groups.
• Allow students to work in collaborative groups to answer questions.
• Pre-print and provide students with the following one-page descriptions of the razorback sucker:
  www.nps.gov/applications/nature/documents/Razorback%20Sucker.doc
  http://dine-sanjuan.k12.ut.us/heritage/land/animals/reptiles/razor_sucker.htm
  http://library.thinkquest.org/2551/species/razorbacksucker.html

ASSESSMENT
The poster presentation is evaluated by the whole group. Discussion should consider whether key concepts are included and represented accurately, or whether there are misconceptions in the presentation. Groups are assessed according to ability to function and to self-monitor for task completion.
GRADE 5

FINICKY FISH FINISH...LAST!

PRE-VISIT LESSONS • SUPPORT MATERIALS
Student Reference:
COLORADO RIVER SYSTEM MAP

THE COLORADO RIVER
BASE IMAGE OBTAINED VIA THE XEROX PARC MAP SERVER AT HTTP://PUBWEB.PARC.XEROX.COM/

LEGEND
- STATE BOUNDARIES
- COAST LINES
- COLORADO RIVER
- OTHER RIVERS
Historical range and current concentrations of bonytail and razorback sucker (Minckley and Deacon 1991). http://biology.usgs.gov/s+t/noframe/r166.htm
A

ntonio de Espejo, traveling upstream on the Rio Grande in 1582 from the present site of El Paso, Texas, wrote in his diary that he and his party encountered a village of upwards of one thousand Indians, who welcomed the Spanish with presents of mesquite and "many varieties of fish."

Fish are not part of our usual image of the desert. Indeed, when the sun blazes hot and the only water in sight is the deceptive shimmer of mirages, it is hard to imagine that any real water exists in the desert. But before the enormous changes brought about by dams, irrigation withdrawals, and wholesale lowering of groundwater levels, rivers did indeed run through the desert. A century ago or less, these same desert rivers offered such an abundant bounty that fish vendors hawked fresh catches on the streets of Phoenix, Bisbee, Albuquerque, and El Paso.

Each desert river system, isolated by the surrounding expanse of waterless landscape, evolved its own distinctive fish, from six-foot-long Colorado pikeminnow to tiny topminnows, and from archaic-looking shovel-nosed sturgeon to sleek trout. Each kind of fish fit a unique niche in its river system. One of the most unusual-looking products of this evolutionary interaction between fish and river is the razorback sucker.

Imagine a big fish, growing up to three feet long in its adulthood, with a body flattened from side to side. Its head is blunt, with a protuberant forward bulge, and underneath a small mouth sporting thick, warty lips. Behind its large eyes rises the reason for this odd fish's name: its back kinks upward in a narrow edge, just like the shape of an old-fashioned straight razor.

From the side, a razorback sucker looks quite bizarre, with its blunt-nosed head and high, humped back. But the fish is perfectly adapted for the habitat where it lives out its adult years: desert rivers. Its flattened body and knife-thin back hump act as a keel, helping the fish easily stay oriented in roaring currents. That tiny mouth with its thick lips vacuums up small bits of food, mainly fly and mosquito larvae, and algae from river-bottom rocks.

Razorback suckers can live to be forty or fifty years old. Once so abundant throughout the Colorado River system from southwestern Wyoming to the Gulf of California that they could be speared with pitchforks from irrigation canals, these keel-backed fish are now on the endangered species list, along with dozens of other desert fish species.

We cannot let razorback suckers and the other unique fish of desert rivers become extinct. For one thing, they each play a crucial part in their ecosystems. Razorback suckers, for instance, are important predators of flies and mosquitoes. For another, a desert without its fish and rivers is no fit place for humans, either.

Adapted from Tweit S. (n.d.) The Razorback Sucker, retrieved April 1, 2006 from www.southernnewmexico.com/Articles/Wildlife/TheRazorbackSuckerWildLiv.html
Student Reference:
RESEARCHING THE RAZORBACK SUCKER

ONLINE SOURCES OF GENERAL INFORMATION ABOUT THE RAZORBACK SUCKER

Nevada Department of Wildlife
The Nevada Department of Wildlife provides a fact sheet about the razorback sucker:
www.ndow.org/wild/animals/facts/fish_razorback_sucker.shtml

San Juan School District
San Juan Heritage site presents the intertwining elements that make up the San Juan county area, including the razorback sucker:
http://dine.sanjuan.k12.ut.us/heritage/land/animals/reptiles/razor_sucker.htm

Southern New Mexico Travel and Tourism
This link is the source of the Read-Aloud Pre-visit activity:

Thinkquest
Thinkquest provides fast facts and information on diet, breeding, and conservation status of the razorback sucker at:
http://library.thinkquest.org/2551/species/razorbacksucker.html

U.S. Department of the Interior National Biological Service
Visit the National Biological Service web pages hosted by the U.S. Geological Service to read Bonytail and Razorback Sucker in the Colorado River Basin by Gordon Mueller of the National Biological Service and Paul Marsh of Arizona State University:
http://biology.usgs.gov/s+t/noframe/r166.htm

U.S. Fish and Wildlife Service
In addition to general information, this site also provides status of the species and recovery strategies and goals:
http://coloradoriverrecovery.fws.gov/Crrzb.htm

ONLINE SOURCES OF INFORMATION ABOUT RAZORBACK SUCKER RECOVERY AND RESEARCH

Arizona Game and Fish Department
www.gf.state.az.us/w_c/research_razorback.shtml

Bureau of Reclamation
www.usbr.gov/LC/region/pao/brochures/sucker.html

Southern Nevada Water Authority

Wild Fish Habitat Initiative
http://wildfish.montana.edu/Cases/browse_details.asp?ProjectID=58

U.S. Fish and Wildlife Service
http://coloradoriverrecovery.fws.gov/Crrzb.htm
GRADE 5

FINICKY FISH FINISH LAST!

POST-VISIT LESSONS

Getting the Word Out: Visually

Getting the Word Out: Interviews and Podcasts
FINICKY FISH FINISH...LAST!

Post-Visit Overview

The razorback sucker is a native fish species that was once plentiful in the Colorado River system. This rugged fish is adapted to life in flowing waters, including the ever-changing cycles of drought and turbulent flooding that once characterized the Colorado. However, the Colorado River has been altered in ways that now make it hard for the razorback sucker to survive. Today, the razorback sucker is endangered, and as such is a concern of Lake Mead National Recreation Area, the Nevada Department of Wildlife, the U.S. Fish and Wildlife Service, and others. Together, these agencies are working to protect this Colorado River native from extinction.

In "Finicky Fish Finish...Last!" students use the Forever Earth vessel to explore what has happened to the Colorado River and the reasons why it is so difficult for the razorback sucker to thrive in a changed environment. Working as ichthyologists (fish biologists) at Lake Mead, students collect water quality data such as temperature, pH, and clarity—to determine whether current habitat conditions are sufficient for survival of young razorback suckers. Students observe and identify non-native fish in Lake Mead as they learn how the razorback sucker interacts with these neighbors. Students assess whether Lake Mead is still a good habitat for razorback suckers. Using the knowledge they’ve gained, students design ideal refuges for the razorback sucker, including ideas to get the word out about this endangered native fish.

The following post-visit activities are designed to synthesize and expand the knowledge students have gained in their Forever Earth experience. Students use their knowledge to spread the word about threatened and endangered species either visually by creating a wayside exhibit or by using podcast technology.

OPTION 1 Getting the Word Out: Visually

THEME

Species with specialized adaptations and narrow ranges of tolerance become vulnerable to extinction when their habitats undergo change.

KEY QUESTIONS

What threatens or endangers a species? What is an organism’s “range of tolerance” for survival?
What are the questions associated with reestablishing a threatened or endangered species into an altered ecosystem?

GOALS
Students will demonstrate an understanding of:

- what happens to an ecosystem that contributes to the endangerment of a species; and
- what factors need to be considered for survival of an organism and a species.

OBJECTIVES

Students will:

- describe what is meant by “endangered species” and “threatened species;”
- delineate what the major environmental factors are in an aquatic environment;
- explain how organisms interact within their ecosystems;
- research what factors must be considered to ensure that a species “range of tolerance” is met;
- demonstrate their understanding that science involves asking and answering questions and comparing the answers to what scientists already know about the world;
- summarize visually what they have learned about razorback suckers aboard Forever Earth by planning and creating artwork for an interpretive wayside exhibit; and
- incorporate stewardship messages in the public information exercise.

NEVADA STATE STANDARDS CORRELATION

N.5.B.2. Students know technologies impact society, both positively and negatively.
N.5.B.3. Students know the benefits of working with a team and sharing findings.
L.5.A.2. Students know reproduction is an essential characteristic for the continuation of every species.
L.5.C.1. Students know the organization of simple food webs.
L.5.C.2. Students know organisms interact with each other and with the non-living parts of their ecosystem.
L.5.C.3. Students know changes to an environment can be beneficial or detrimental to different organisms.
L.5.C.4. Students know all organisms, including humans, can cause changes in their environments.
L.5.C.5. Students know plants and animals have adaptations allowing them to survive in specific ecosystems.

CLARK COUNTY SCHOOL DISTRICT CURRICULUM ESSENTIALS FRAMEWORK (CEF)

Students will:

- investigate and describe how plants and animals require food, water, air, and space;
- explain that living things get what they need from their environments;
- investigate and describe the interrelationships and interdependence of organisms with each other and with the non-living parts of their habitats;
- investigate and describe how some environmental conditions are more favorable than others to living things;
- investigate and describe how organisms, including humans, can cause changes in their environments;
• investigate and describe how, for any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all; and
• investigate and describe how environmental changes allow some plants and animals to survive and reproduce, but others may die.

PREREQUISITE EXPERIENCE

• Pre-visit classroom lessons
• Forever Earth field trip
• If creating interpretive panels digitally, experience with and access to graphics software is required.

VOCABULARY

• endangered species
• extinction
• habitat
• interpretation
• organism
• range of tolerance
• reestablishment
• reintroduction
• target audience
• theme
• topic
• threatened species
• visual communication
• wayside exhibit

Getting the Word Out: Visually

Part 1  Introduction

The teacher asks students: *Is it important to educate the public about endangered species? Why?*

Students are introduced to the idea of interpretive wayside exhibits; they discuss the differences between a sign (such as an advertisement poster or billboards) and interpretive wayside exhibits.

Note for teacher:

*An interpretive wayside exhibit is an outdoor display for an audience of visitors to a natural area or place of historical significance. Generally, it is a poster that is embedded in acrylic and attached to a metal or wooden stand. The wayside exhibit is installed, usually, near the location where visitors can see or experience something of the concept being interpreted.*

Students examine sample interpretive panels (see Teacher Reference: Sample Interpretive Wayside Exhibits) of actual wayside (and some indoor) exhibits. Students list the general components of the interpretive panels: title, diagrams, maps, photos, photo legends, illustrations, blocks of copy, color, backgrounds, organization.

TIME 20-25 minutes

MATERIALS

Teacher Reference: Sample Interpretive Wayside Exhibits
Computer connected to the Internet
Projector
The teacher facilitates discussion: *What is eye-catching in the samples? What is the role of each component?* The teacher charts responses.

It's not important for the students to read every word on the sample exhibits. For many of the samples, it is not possible to read the copy due to the size of the photos. The idea is to expose students to the major components of interpretive panels and have them decide what is eye-catching and what is not. It is important to make the observation that the panels are meant to be read from a short distance (vs. reading a brochure or paper, which one holds).

**Part 2 ➤ Planning and Creating the Interpretive Panels**

The class discusses the challenges of creating media for broad target audiences. *What do visitors to a lake have in common and how are they different from each other? What are ways to keep media interesting and accessible to everybody?*

The teacher introduces “topics” and “themes” *(Student Reference: Planning an Interpretive Panel)*. For example:

Sample Topic: “Birds”

Possible themes for the topic “Birds”

- Birds are an amazing group of animals because of their special adaptations for flight.
- Native birds in this country are rapidly disappearing because of habitat loss.
- Reestablishment of trumpeter swans is challenging because they lose important survival skills when they are raised in captivity.

Students work in groups to brainstorm themes for their interpretive wayside exhibits. Possible themes could elaborate on “Pre-lesson: Endangered Species” Poster Presentation Topics:

- Distinguishing features of the habitat and the role the razorback sucker plays in the ecosystem.
- Reasons for endangerment or decline in a population using the razorback sucker as an example.
- Current scientific investigations, such as razorback sucker recovery on the Lower Colorado River (AZ Game and Fish): www.gf.state.az.us/w_c/research_razorback.shtml
• What environmental factors are being monitored in terms of reintroduction of threatened and endangered species?

Students gather and review the materials they have already collected on the razorback sucker. Next, they discuss what visitors should know, feel, and do after viewing an interpretive wayside exhibit on razorback suckers. For example:

1) Visitors will be able to describe the habitat requirements of razorback suckers.
2) Visitors will feel good about the preservation work being done (with their tax dollars) to help the species.
3) Visitors will want to see a razorback sucker exhibit in the Nature Center.
4) Visitors will consider contributing to an imaginary “Preserve the Razorback Sucker” fund.

Ask students to work with a partner to select a theme from the brainstorm activity above, decide on objectives, plan, write copy to develop the theme, select photos, create artwork and diagrams to illustrate the text, and assemble into a poster that could serve as an interpretive panel for a wayside exhibit on razorback suckers.

EXTENSIONS

• Students create an audio recording (may also include enhancing music/sound effects) to accompany the interpretive wayside exhibit.
• Students design a brochure that visitors can take home that accompanies the wayside exhibit.
• Students create a bilingual interpretive panel for the wayside exhibit.
• Students plan an interactive exhibit or program.
• Students draw up a story board and text for an online, virtual exhibit or interpretive activity.

View online interpretation at:
www.nps.gov/webrangers/
RESOURCES

ONLINE RESOURCES FOR INTERPRETIVE WAYSIDE EXHIBIT DEVELOPMENT

Events Tasmania
“Developing Interpretive Themes” by Sam Ham, Ph.D. and Betty Weller
www.eventstasmania.com/theme%20development%20handout.pdf

The Montana Lewis & Clark Bicentennial Commission
“Graphic Guidelines Appendix for Lewis and Clark Wayside Exhibits”
www.montanalewisandclark.org/resources/experts/AppendixV.pdf

National Park Service
“Harpers Ferry Center Wayside Exhibit Design”
http://nps.gov/hfc/products/waysides/way-process-design.htm

“Interpretive Themes” by David L. Larson,
National Park Service, Interpretive Development Program
www.nps.gov/idp/interp/101/themes.pdf

John Veverka & Associates
“Interpretive Planning & Interpretive Training”
www.heritageinterp.com/developing_theme_and_objectives.htm

Note: Students and teachers should also refer to pre-visit references and materials on the razorback sucker.

ADAPTATIONS FOR DIVERSE LEARNERS

• Use samples of finished interviews as models.
• Allow peer readers/writers.
• Keep your directions clear, precise, and succinct.
• Create graphic organizers for each step of the process in planning and creating the interpretive exhibit.
• Assign preferential seating.
• Pre-teach critical vocabulary.
• Establish and teach rules that communicate expectations.

ASSESSMENT

• Students can evaluate their own work through reflective journal entries.
• Conduct a classroom peer review session (i.e., after students share their interpretive panels, pose questions: What do you know and feel? What will you do? Does the feedback match the original intent for the panel?).
• Create a teacher or teacher/student rubric. Peers give interpretive wayside exhibit panels one recommendation and one commendation.

OPTION 2 Getting the Word Out: Interviews and Podcasts

THEME
Species with specialized adaptations and narrow ranges of tolerance become vulnerable to extinction when their habitats undergo change.

KEY QUESTIONS
What threatens or endangers a species? What is an organism's "range of tolerance" for survival? What are the questions associated with reestablishing a threatened or endangered species into an altered ecosystem?

GOALS
Students will demonstrate an understanding of:
• what happens to an ecosystem that contributes to the endangerment of a species; and
• what factors need to be considered for survival of an organism and a species.

OBJECTIVES
Students will:
• describe what is meant by "endangered species" and "threatened species;"
• delineate what the major environmental factors are in an aquatic environment;
• explain how organisms interact within their ecosystems;
• research what factors must be considered to ensure that a species "range of tolerance" is met;
• demonstrate their understanding that science involves asking and answering questions and comparing the answers to what scientists already know about the world;
• write interview questions for a threatened or endangered species; and
• create a podcast of an interview with a threatened or endangered species.

NEVADA STATE STANDARDS CORRELATION
N.5.B.2. Students know technologies impact society, both positively and negatively.
N.5.B.3. Students know the benefits of working with a team and sharing findings.
L.5.A.2. Students know reproduction is an essential characteristic for the continuation of every species.
L.5.C.1. Students know the organization of simple food webs.
L.5.C.2. Students know organisms interact with each other and with the non-living parts of their ecosystem.
L.5.C.3. Students know changes to an environment can be beneficial or detrimental to different organisms.
L.5.C.4. Students know all organisms, including humans, can cause changes in their environments.
L.5.C.5. Students know plants and animals have adaptations allowing them to survive in specific ecosystems.

CLARK COUNTY SCHOOL DISTRICT CURRICULUM ESSENTIALS

FRAMEWORK (CEF)
Students will:
• investigate and describe how plants and animals require food, water, air, and space;
• explain that living things get what they need from their environments;
• investigate and describe the interrelationships and interdependence of organisms with each other and with the non-living parts of their habitats;
• investigate and describe how some environmental conditions are more favorable than others to living things;
• investigate and describe how organisms, including humans, can cause changes in their environments;
• investigate and describe how, for any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all; and
• investigate and describe how environmental changes allow some plants and animals to survive and reproduce, but others may die.

PREREQUISITE EXPERIENCE
• Pre-visit classroom lessons
• Forever Earth field trip

VOCABULARY
• endangered species
• organism
• extinction
• podcast
• habitat
• range of tolerance
• hosting service
• reintroduction
• statutes
• threatened species

Part 1  Introduction
The teacher asks students: Why do we need laws to protect threatened or endangered species? The teacher discusses Nevada statutes protecting native species from extinction (Teacher Reference: Nevada Statutes).

Students are made aware that there are differences between state and federal statutes protecting native species from extinction (Teacher Reference: Threatened and Endangered Species in Nevada).
Students review the definitions of "threatened species" and "endangered species." Students examine the lists of threatened and endangered species in Nevada and in Clark County (Student Reference: Threatened Species in Nevada; Student Reference: Endangered Species in Nevada).

Part 2  Interview and Podcasts
Student brainstorm answers to the following: *What do you know about interviews?* *What do you know about podcasts?* The teacher charts responses.

The teacher discusses the definition of a podcast (a recorded "show" similar to a radio show that can be downloaded to an iPod, MP3 player, or computer) and presents examples of podcast interviews. The Education Podcast Network—The Landmark Project Internet site has a collection of podcasts recorded by elementary, middle, and secondary students. Examples are available at: http://epnweb.org/index.php?openpod=16#16

The class discusses special techniques used in the examples of podcasts, e.g., sound effects, music, or songs. The teacher emphasizes the importance of using techniques that match the concept and purpose of the communication.

The class discusses characteristics of the sample podcast voices such as volume (not too loud or too soft), rate (not too fast or too slow), pitch (not too high or too deep), clarity (easily understood), and pronunciation of words. *Do the voices convey emotion? Do the speakers emphasize key words or phrases?*

The class discusses the quality of the sample podcast interview questions. Are they interesting, to the point, controversial, etc.?

Part 3  Concept Development
Students are divided into pairs. Each pair is assigned a threatened or endangered species (Student Reference: Threatened Species in Nevada and Student Reference: Endangered Species in Nevada) to research. Findings are recorded on Student Worksheet: Background Notes for the Interview).

Students review Student Reference: Writing Interview Questions.
Student pairs write interview questions for their threatened or endangered species. Then they write responses to the questions from the viewpoint of the species.

One student plays the part of the interviewer and the other plays the part of the species. Partners practice reading their interview scripts with each other and in front of the class. Students read their parts naturally and with expression. Students may revise their scripts based upon feedback they receive from the class.

Part 4 • Presentation of Findings
The teacher reviews Teacher Reference: Creating A Podcast; teachers may also contact the education computer specialist in the school district. Students review Student Reference: Creating A Podcast. Students record and publish their podcasts on an online hosting service.

Additional options for presentation:
- Advertise podcasts to environmental federal and state agencies and organizations.
- Share podcasts with the project manager of Forever Earth.
- Share podcasts with the Division of Interpretation at Lake Mead National Recreation Area.

EXTENSIONS
Students create a storyboard for a video podcast interview. On one side, include the interview script, sound effects/music; on the other side include the corresponding visual image. Students record and publish the video podcast on an online hosting service.

RESOURCES
FEDERAL LISTING OF THREATENED AND ENDANGERED SPECIES IN NEVADA
Nevada Natural Heritage Program, Department of Conservation and Natural Resources
Threatened: http://heritage.nv.gov/threatnd.htm
Endangered: http://heritage.nv.gov/endangered.htm

NEVADA STATUTES FOR THREATENED AND ENDANGERED SPECIES
Animal Legal and Historical Center
http://www.animallaw.info/statutes/stusnv503_584.htm
PRINT RESOURCES ON THREATENED AND ENDANGERED SPECIES


Bohrer, B. (2006, April 3). Yellowstone grizzlies divide scientists: Experts disagree whether bear population has grown enough to lift protections. Las Vegas Review Journal, p. 3B.


PODCASTING

The Official Guide to Podcasting EBook
www.thepodcastingebook.com/

Podsafe Music Network
http://music.podshow.com/

ADAPTATIONS FOR DIVERSE LEARNERS

• Use samples of finished interviews as models.
• Allow peer readers/writers.
• Keep your directions clear, precise, and succinct.
• Assign preferential seating.
• Pre-teach critical vocabulary.
• Establish and teach rules that communicate expectations.

ASSESSMENT

• Brainstorm the qualities of a good interview with the students; discuss quality standards; assist the students in the creation of a rubric.
• Brainstorm the qualities of a good podcast with the students; discuss quality standards; assist the students in the creation of a rubric.
• Students can evaluate their own work through reflective journal entries.
• Conduct a peer review in class. After students share their podcasts, peers give them one commendation and one recommendation.
GRADE 5

FINICKY FISH FINISH...LAST!

POST-VISIT LESSONS • SUPPORT MATERIALS
ONLINE RESOURCES

Ecos Communications
Ecos Communications specializes in creating various types of exhibits for science and cultural history themes.  
www.ecos.us/project_interp_golden.html#  
› Move the mouse over "Portfolio;"  
› Move the mouse over "Interpretive Signage;"  
› Click on individual project titles;  
› Click on "Start Slideshow" under the first image in each project to see more interpretive panels from the project.

Interpretive Graphics
Interpretive Graphics specializes in the development of interpretive and historical signs, markers, and exhibits:  
www.interpretivegraphics.com/view.html  
› Click on each project listed on the left side of the page.

National Park Service
Harpers Ferry Center creates all types of interpretive media for units of the National Park Service. This link web page provides examples of Harpers Ferry Center wayside exhibit panels and bases:  
www.nps.gov/hfc/products/waysides/way-products.htm

Ormsby and Thickstun Interpretive Design
This company creates all types of interpretive products with natural history themes.  
www.ormsbythickstun.com/  
› Click on "Wayside Exhibit Panels" in the left frame.

State of Vermont
The Lake Champlain Basin Program recently created numerous wayside exhibits. View two examples at the following links:  
www.anr.state.vt.us/champ/wayside/PDFS/Phosphorus_Reduction/Industrial_Waste.pdf  
www.anr.state.vt.us/champ/wayside/PDFS/Poulney_Mettowee/Stormwater.pdf
You are a famous designer and you've been hired by the National Park Service to create a new wayside exhibit at Lake Mead National Recreation Area. What is the topic? Razorback Suckers, of course!

WHAT DO WE KNOW?

In class and on your Forever Earth field trip, you have studied the razorback sucker and learned about:

- what makes it so cool
- why it is endangered
- what environmental factors affect its survival and what its range of tolerance is
- what challenges exist to reintroduce this species into an altered ecosystem
- what environmental factors need to be considered for its successful re-establishment

WHAT DO WE DO?

Your teacher has shown you some samples of interpretive wayside exhibits. An interpretive wayside exhibit is more than a sign. It doesn't just list information or give someone rules to follow (e.g., No Trespassing!). The artwork and text are especially chosen to guide an audience to know something, feel something, and do something based on what they've been shown.

The first step in creating a wayside exhibit is to select a theme, which will be the main concept or take-home message of your panel. Next you will define the objectives for your creation. It helps to draw comparisons between the information you present and ideas (such as family, home, loss, etc.,) that anyone can understand.

OUR TOPIC IS RAZORBACK SUCKERS... WHAT IS OUR THEME?

A good theme for your interpretive panel should:

- be stated as a short, simple, complete sentence;
- contain one main idea;
- be interesting and inspiring; and
- answer the question "So what?"

It is possible to think of many themes for a particular topic. First, brainstorm possible themes based on what you know about razorback suckers. Don’t worry about wording each theme perfectly. Once you have a list of possible themes, pick out the most interesting ones to reword and develop.
POSSIBLE THEMES FOR THE TOPIC "RAZORBACK SUCKERS"

Brainstorm at least four ways to complete the following sentence:

- When it comes to razorback suckers, I think it is really important that visitors understand...

1. 

2. 

3. 

4. 

OUR THEME: 

After visiting and viewing our wayside exhibit, most visitors will:

Know:

Feel:

Do:
Teacher Reference:
NEVADA STATUTES

TITLE 45. WILDLIFE CHAPTER 503. HUNTING, FISHING AND TRAPPING;
MISCELLANEOUS PROTECTIVE MEASURES. PROTECTION AND PROPAGATION OF NATIVE FAUNA


Citation: N. R. S. 503.584; NV ST 503.584-89

Summary: These statutes provide that the Legislature of Nevada has an interest in protecting native species from extinction and sets forth the authority to establish programs to protect designated species. However, if a native species is found to be destructive under the statute, the statute provides for removal if appropriate. Under statute, the ultimate responsibility for management rests with the governor for reviewing state programs and entering into interstate and federal agreements.

Statute in Full:
503.584. Legislative finding; conservation, protection and propagation of selected species
1. The legislature finds that:
   (a) The economic growth of the State of Nevada has been attended with some serious and unfortunate consequences. Nevada has experienced the extermination or extirpation of some of her native species of animals, including fish and vertebrate wildlife. Serious losses have occurred and are occurring in other species of native wild animals with important economic, educational, historical, political, recreational, scientific and aesthetic values.
   (b) The people of the State of Nevada have an obligation to conserve and protect the various species of native fish and wildlife that are threatened with extinction.

2. The purpose of NRS 503.584 to 503.589, inclusive, is to provide a program for the:
   (a) Conservation, protection, restoration and propagation of selected species of native fish and other vertebrate wildlife, including migratory birds; and
   (b) Perpetuation of the populations and habitats of such species. 503.585. Placement of animal threatened with extinction on list of fully protected species; special permit for capture, removal or destruction. A species or subspecies of native fish, wildlife and other fauna must be regarded as threatened with extinction when the commission, after consultation with competent authorities, determines that its existence is endangered and its survival requires assistance because of overexploitation, disease or other factors or its habitat is threatened with destruction, drastic modification or severe curtailment. Any animal so declared to be threatened with extinction must be placed on the list of fully protected species, and no member of its kind may be captured, removed or destroyed at any time by any means except under special permit issued by the division.
503.586. Translocation or destruction of endangered species found to be destructive
Where any bird, mammal or other wildlife which is declared to be in danger of extinction pursuant to NRS 503.585 is found to be destructive of domestic animals or fowl or a menace to health, the division may provide for its destruction or its removal, alive, for translocating.

- 503.587. Utilization of commission's authority to manage land
The commission shall use its authority to manage land to carry out a program for conserving, protecting, restoring and propagating selected species of native fish, wildlife and other vertebrates and their habitats which are threatened with extinction and destruction.

503.588. Governor's responsibilities
The governor shall review the programs which he administers and, to the extent practicable, utilize such programs in furtherance of the purpose of NRS 503.584 to 503.589, inclusive, and shall encourage other state and federal agencies to use their authorities in such a manner. 503.589. Administrator's powers and duties
In carrying out the program authorized by NRS 503.584 to 503.589, inclusive, the administrator shall cooperate, to the maximum extent practicable, with other states and with the counties in the State of Nevada, and he may enter into agreements with such other states and counties and with other legal entities for the administration and management of any area established pursuant to NRS 503.584 to 503.589, inclusive, for the conservation, protection, restoration and propagation of species of native fish, wildlife and other fauna which are threatened with extinction.
Teacher Reference:
THREATENED AND ENDANGERED SPECIES IN NEVADA

THREATENED SPECIES IN NEVADA

There are sixteen threatened plant and animal species in Nevada (see Student Reference: THREATENED SPECIES IN NEVADA). The Federal Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), as of 23 January 2003 defines a threatened species as any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and an endangered species as any species which is in danger of extinction throughout all or a significant portion of its range.


ENDANGERED SPECIES IN NEVADA

There are twenty-five endangered plant and animal species in Nevada (see Student Reference: ENDANGERED SPECIES IN NEVADA). The Federal Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), as of 23 January 2003 defines an endangered species as any species which is in danger of extinction throughout all or a significant portion of its range.


Note: The U.S. Fish and Wildlife Service keeps the gray wolf (Canis lupus) on the Nevada state list of endangered species, even though agency biologists acknowledge the animals have been extinct in the state for decades.
# Threatened Species in Nevada

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PLANT</strong></td>
<td></td>
</tr>
<tr>
<td>Ash Meadows milkvetch</td>
<td><em>Astragalus phoenix</em></td>
</tr>
<tr>
<td>Spring-loving centaury</td>
<td><em>Centaurium namophilum</em></td>
</tr>
<tr>
<td>Ash Meadows sunray</td>
<td><em>Enceliopsis nudicaulis var. corrugata</em></td>
</tr>
<tr>
<td>Ash Meadows gumplant</td>
<td><em>Grindelia fraxinopratensis</em></td>
</tr>
<tr>
<td>Ash Meadows ivesia</td>
<td><em>Ivesia kingii var. eremica</em></td>
</tr>
<tr>
<td>Ash Meadows blazingstar</td>
<td><em>Mentzelia leucophylla</em></td>
</tr>
<tr>
<td>Ute lady's tresses</td>
<td><em>Spiranthes diluvaris</em> (possibly extirpated in NV)</td>
</tr>
<tr>
<td><strong>INVERT.</strong></td>
<td></td>
</tr>
<tr>
<td>Ash Meadows naucorid</td>
<td><em>Ambrysus argamosus</em></td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
</tr>
<tr>
<td>Warner sucker</td>
<td><em>Catostomus warnerensis</em></td>
</tr>
<tr>
<td>Railroad Valley springfish</td>
<td><em>Crenichthys nevadae</em></td>
</tr>
<tr>
<td>Desert dace</td>
<td><em>Eremichthys acros</em></td>
</tr>
<tr>
<td>Big Spring spinedace</td>
<td><em>Lepidomeda mollispinis pratensis</em></td>
</tr>
<tr>
<td>Lahontan cutthroat trout</td>
<td><em>Oncorhynchus clarki henshawi</em></td>
</tr>
<tr>
<td>Bull trout</td>
<td><em>Salvelinus confluentus</em></td>
</tr>
<tr>
<td><strong>REPTILE</strong></td>
<td>Desert tortoise</td>
</tr>
<tr>
<td></td>
<td><em>Gopherus agassizii</em></td>
</tr>
<tr>
<td><strong>BIRD</strong></td>
<td>Bald Eagle</td>
</tr>
<tr>
<td></td>
<td><em>Haliaeetus leucocephalus</em></td>
</tr>
</tbody>
</table>

- Federally Listed Threatened Species in Clark County
**Student Reference:**
**ENDANGERED SPECIES IN NEVADA**

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLANT</td>
<td></td>
</tr>
<tr>
<td>Steamboat buckwheat</td>
<td>Eriogonum ovalifolium var. williamsiae</td>
</tr>
<tr>
<td>Amargosa niterwort</td>
<td>Nitrophila mohavensis</td>
</tr>
<tr>
<td>INSECT</td>
<td></td>
</tr>
<tr>
<td>Carson wandering skipper</td>
<td>Pseudocopaedoes eunus obscurus</td>
</tr>
<tr>
<td>FISH</td>
<td></td>
</tr>
<tr>
<td>Cui-ui</td>
<td>Chasmistes cujus</td>
</tr>
<tr>
<td>White River springfish</td>
<td>Crenichthys baileyi baileyi</td>
</tr>
<tr>
<td>Hiko White River springfish</td>
<td>Crenichthys baileyi grandis</td>
</tr>
<tr>
<td>Devils Hole pupfish</td>
<td>Cyprinodon diabolis</td>
</tr>
<tr>
<td>Ash Meadows Amargosa pupfish</td>
<td>Cyprinodon nevadensis mionectes</td>
</tr>
<tr>
<td>Warm Springs Amargosa pupfish</td>
<td>Cyprinodon nevadensis pectoralis</td>
</tr>
<tr>
<td>Pahrump poolfish</td>
<td>Empetrichthys latos latos</td>
</tr>
<tr>
<td>Bonytail chub</td>
<td>Gila elegans</td>
</tr>
<tr>
<td>Pahranagat roundtail chub</td>
<td>Gila robusta jordani</td>
</tr>
<tr>
<td>Virgin River chub</td>
<td>Gila seminuda</td>
</tr>
<tr>
<td>White River spinedace</td>
<td>Lepidomeda albivallis</td>
</tr>
<tr>
<td>Moapa dace</td>
<td>Moapa coriacea</td>
</tr>
<tr>
<td>Woundfin</td>
<td>Plagopterus argentissimus</td>
</tr>
<tr>
<td>Independence Valley speckled dace</td>
<td>Rhinichthys osculus lethoporus</td>
</tr>
<tr>
<td>Ash Meadows speckled dace</td>
<td>Rhinichthys osculus nevadensis</td>
</tr>
<tr>
<td>Clover Valley speckled dace</td>
<td>Rhinichthys osculus oligoporus</td>
</tr>
<tr>
<td>Razorback sucker</td>
<td>Xyrauchen texanus</td>
</tr>
<tr>
<td>BIRD</td>
<td></td>
</tr>
<tr>
<td>Southwestern willow flycatcher</td>
<td>Empidonax traillii extimus</td>
</tr>
<tr>
<td>Wood stork</td>
<td>Mycteria americana (accidental to Nevada)</td>
</tr>
<tr>
<td>Brown pelican</td>
<td>Pelecanus occidentalis (accidental to Nevada)</td>
</tr>
<tr>
<td>Yuma clapper rail</td>
<td>Rallus longirostris yumanensis</td>
</tr>
<tr>
<td>Least tern</td>
<td>Sterna antillarum (accidental to Nevada)</td>
</tr>
</tbody>
</table>

- Federally Listed Endangered Species in Clark County
You are a well-known radio host, and your future guest is a member of a threatened or endangered species. You must prepare yourself to conduct the upcoming interview by learning about your guest and writing interview questions!

**FINDING OUT**

Type the name of the species into a search engine such as [www.google.com](http://www.google.com) or [www.Ask.com](http://www.Ask.com). You can use the common name or scientific name. As you read the web pages, keep your eyes peeled for information that would interest your listening audience.

**KEEPING TRACK**

As you read, take notes. Use your interview organizer worksheet to keep track of your facts:


**LET'S THINK IT THROUGH!**

Hmmm... What might a member of a threatened or endangered species say if he or she could talk? Think about what message you want your interview to make clear to the public. This is your chance for the public to learn about a species—from the species itself!

Also, think about your audience. You design your interview to interest the audience of your choice! If your audience is made up of sports fans, maybe you could make comparisons to sports; if your audience loves the outdoors, be sure to thoroughly describe the lands where the species lives. What do you want your audience to know, feel, and understand after they've listened to the interview? What do you want them to do?

Look for a “hook” for your interview such as humor, an attention-grabbing fact, or a frightening prediction; it is important to immediately capture the attention of the listener/viewer.
WRITING THE QUESTIONS

Introduction
Your first questions should help your plant, animal, bird, fish, reptile, or invertebrate to relax. Write questions that help your subject introduce itself. For example:
- What is your scientific name and your common name? Do you know what your names mean or how you got them?
- Where do you live?
- Can you describe yourself to our listening audience?

Digging Deeper...about the past
Write questions that help your subject to talk about its experiences. For example:
- What was life like for you in the “good old days” before you became threatened or endangered?

Digging Deeper...about what happened
The next set of questions you write should allow your interviewee an opportunity to explain in detail what happened to him or her. For example:
- Your name is on the federal and Nevada state Endangered Species List, which means that you are in danger of extinction. Why is your life endangered?
- Your name is on the federal and Nevada state Threatened Species List, which means that you are likely to become endangered or extinct. Why is your life threatened?

Now write some follow-up questions that call for details, clarification, or more explanation:
- I understand that your worst enemy is ________________. Would you agree with that? Why or why not?

Digging Deeper...about your guest's feelings
Write questions that also explore your subject’s feelings of happiness, anger, fear, or hope. For example:
- What are your fears for your children?
- Who, if anyone, has given you hope?
Digging Deeper...about the big picture

Finally, write questions that give this member of the species an opportunity to comment on the "big picture," to judge, predict, or summarize. For example:

- What do you think humans should have done differently?
- What can humans do now to help you, in your opinion?
- Do you really think that you can be re-established into ________________?
- What would your ideal home be like?

TIPS FOR THE INTERVIEW

- Refer to your questions during the interview so you don’t forget anything.
- During the interview, some of your guest’s responses may make you think of additional questions. Write them down as you think of them and come back to them or immediately ask them.
Student Worksheet:
BACKGROUND NOTES FOR THE INTERVIEW

MY SPECIES: _______  MY AUDIENCE: _______
- HOOK IDEAS: _______________________

WHO?

WHAT?

WHEN?

WHERE?

WHY?
Teacher Reference:
CREATING A PODCAST

Getting the Gear

- You will need a laptop or desktop computer with an Internet connection.
- Be sure to have a microphone on the laptop or computer you are using.
- Find and download free software programs to record your podcast (Refer to "My Podcast Resources" below for software suggestions).

Recording the Podcast

- Be sure the students have a quiet place to record.
- On your computer, open the sound recording program and begin recording the podcast.
- Students may add background music and sound effects to make the podcasts more entertaining.
- Some software has sound editing tools. You can experiment with these to improve the quality of the podcast.
- Save the podcast as an MP3 file.

Publishing the Podcast

- When the podcasts are finished you will upload them to a hosting service.
- Be sure to remind students to share their podcasts!
- You may also wish to advertise your students' podcasts.

Podcast Resources

The Education Podcast Network

This site contains a wide range of podcast programming that may be helpful to teachers looking for content to teach with and about. It also provides several examples of podcasts that teachers and students can listen to on a variety of topics in a wide range of subjects areas.
http://epnweb.org

Interactive Voices

This site provides a wide array of voices and sound effects that can be used in a podcast production. It also provides several resources to assist in the development of a podcast.
www.interactivevoices.com/
O'Reilly Media, Inc.
This website provides information on how to develop a podcast. It covers such topics as the audio sources needed, tools of the trade, troubleshooting challenges, and putting the podcast together.
www.macdevcenter.com/pub/a/mac/2005/01/25/podcast.html

The Podcasting EBook: Your Complete Guide
This EBook (available for purchase) provides an informative look at podcasting. The site offers the latest information about podcasting along with samples of professional podcasts.
www.thepodcastingebook.com/

Podsafe Music Network
This site provides several examples of podcasts integrated with different styles of music. This site also provides a variety of music to sample for podcast production.
http://music.podshow.com/

Teaching Ideas Website
This site provides very specific teaching ideas for implementing podcasts. It offers examples of podcasts produced by children along with simple guidelines of how to teach children about podcasts. The sample podcasts provided include a children's radio show with music, jingles, and an interview.
www.teachingideas.co.uk/ict/podcasting.htm

Yahoo Podcast Site
The Yahoo Podcast site gives a step-by-step guide to creating a podcast in very simple terms. Instructions for creating a podcast are broken down into very easy steps. The site also offers suggestions on where to house the podcast once it has been developed.
http://podcasts.yahoo.com/publish?i=2
What is a Podcast?

A Podcast is a presentation (audio or video) that is put on the Internet for people to download. Once a person downloads a podcast, he or she can play it anytime on a personal computer, MP3 player, Ipod, or other device. An audio podcast sounds just like a radio program. You can make an audio podcast with a standard computer, a microphone, free software, and a web site for posting your program. A podcast can be downloaded to any computer connected to the Internet.¹

Your job

In class and on your Forever Earth field trip, you learned answers to the questions:

- What threatens or endangers a species?
- What environmental factors affect an organism’s survival?
- What is an organism’s “range of tolerance”?
- Can endangered/threatened species be re-established into an ecosystem?

You and your partner will bring the answers to these questions to life by creating a podcast interview. You have written the script to an interview with a member of a threatened or endangered species. One of you will play the role of the host and the other will play the guest. It’s time to podcast your script of an interview with a threatened or endangered species!

Planning the Podcast

Get ideas by listening to the podcasts your teacher plays for you. Taking notes about what you like and dislike about the shows.

The Icing on the Cake

- Select background music to make your podcast appealing. Check out the Podsafe Music Network site at http://music.podshow.com/
- If you plan on using video, select appealing scenery and photographs.
- After you have written your script, practice reading it. Read with expression!!
- Give your podcast a “catchy” title like “Save that Sucker” for an interview with a razorback sucker.

GRADE 6

ALIEN INVADERS!

ON-SITE PROGRAMMING

2008/2009 Edition
ALIEN INVADERS!

OVERVIEW

Alien invaders don't just come from outer space! An invasive alien species can be any species on earth that moves from its native ecosystem into a new ecosystem and then causes or is likely to cause economic or environmental harm or harm to human health. In January, 2007 quagga mussels were found in Lake Mead, the first discovery of these invasive mussels in western United States. Quagga mussels are an aquatic species that are native to Eastern Europe and were introduced into the Great Lakes in the late 1980s.

In the "Alien Invaders!" program, students investigate how quagga mussels might affect Lake Mead. Students collect water quality data such as clarity, pH, and temperature to determine current habitat conditions that have allowed quagga mussels to thrive in Lake Mead. Students learn about the consequences that quagga mussels could have on the lake and its living and non-living resources. Using the knowledge they've gained, students create their own management plans to prevent the spread of quagga mussels to other waterways.

OUTLINE

On-Site Programming
On-site programming includes activities that take place aboard Forever Earth and activities that take place on shore (typically the Callville Bay picnic area). For a large group, it is convenient to split the students into two or more groups. One or more groups can participate in the shore-based activities while one group is aboard Forever Earth; student groups switch when the Forever Earth group returns to the marina.

Forever Earth
- Part 1: Welcome, Introductions, and Safety Talk
- Part 2: Introduction: Invasive Species
- Part 3: Investigation: Could Quagga Mussels Thrive in Lake Mead?
- Part 4: Impact: Potential Effects of Zebra Mussels on the Living and Non-living Components of the Lake Mead Ecosystem
- Part 5: Synthesis: What Can We Do to Prevent the Spread of Quagga Mussels to other Lakes and Rivers?

Shore
- CSI: Who Stole All the Water?
- Chillin' with the Chubs

Corresponding Pre-Visit Lessons
- Introduced and Invasive Species
- Water Characteristics

Corresponding Post-Visit Lesson
• Invasive Species Public Service Announcement

THEME

Introduction of an invasive species upsets the balance of an ecosystem.

KEY QUESTIONS

Why are quagga mussels thriving in Lake Mead? What effects might quagga mussels have on plants, animals, and people? How can we prevent the spread of quagga mussels?

GOAL

Students will understand how invasive species affect the living and non-living components of ecosystems.

OBJECTIVES

Students will:
- explain how quagga mussels are introduced into an aquatic ecosystem;
- describe habitat requirements for quagga mussels to thrive in an aquatic ecosystem;
- describe the effects of quagga mussels on living and nonliving components of the Lake Mead environment;
- create a management plan to prevent the spread of quagga mussels to other waterways.

NEVADA SCIENCE CONTENT STANDARDS

N.8.A.1. Students know how to identify and critically evaluate information in data, tables, and graphs.
N.8.A.5. Students know how to use appropriate technology and laboratory procedures safely for observing, measuring, recording, and analyzing data.
N.8.B.1. Students understand that consequences of technologies can cause resource depletion and environmental degradation, but technology can also increase resource availability, mitigate environmental degradation, and make new resources economical.
L.8.C.3. Students will evaluate how changes in environments can be beneficial or harmful.
L.8.C.4. Students will know inter-related factors affect the number and type of organisms an ecosystem can support.
CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 6)

Students will:
- display data in appropriate charts, graphs, and tables;
- use proper lab equipment correctly and safely; and
- discuss the costs and benefits of human and natural caused changes in an environment.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site grade 6 activities support the following guiding themes developed by Clark County-based educators:
- Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.
- Maintaining growth and quality of life, and protecting watershed, water quality and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

PREREQUISITE CLASSROOM EXPERIENCE

Classroom Visit. A pre-visit classroom trip will be made by Forever Earth or National Park Service staff to introduce students to the Forever Earth program and what to expect during their field trip. Students learn and agree to the "conduct rules" of Forever Earth, understand basic water safety concepts, and observe how and when to put on a Personal Flotation Device (PFD) during their time aboard Forever Earth.

VOCABULARY
- calcium
- range of tolerance
- probe
- ecosystem
- management plan
- turbidity
- environment
- native species
- veliger
- dissolved oxygen
- non-native species
- water clarity
- habitat
- pH
- water hardness
- invasive species
- plankton

ON-SITE ACTIVITIES: Forever Earth
Part 1  Welcome, Introductions, and Safety Talk  
Forever Earth staff greets students. Students are divided into groups and given team lanyards. Facilitator welcomes students to Lake Mead National Recreation Area and Forever Earth and introduces the concept of National Parks and public lands, emphasizing that the field trip is taking place on public lands. Facilitator Reference: Lake Mead NRA Fast Facts contains information to answer common questions about Lake Mead. The Captain or facilitator leads the safety presentation (see Facilitator Reference: Safety Talk Outline).

Part 2  Introduction: Invasive Species  
Students are informed of the explosive way an invasive species overtakes a new environment and understand the dramatic changes that an invasive species makes to its new environment.

The facilitator first introduces students to the concept and definition of invasive species. The Fact or Fiction activity (Demonstration: Invasive Species Fact or Fiction) provides students with graphic examples of how these species can impact an environment.

The example of the quagga mussel is introduced with background information (Facilitator Reference: Quagga Mussel Fast Facts). A discussion is facilitated with students on how quagga mussels are introduced into new environments, what types of effects they have on their new environment, and that they have recently been found in Lake Mead.

Part 3  Investigation: Why Are Quagga Mussels Taking Over Lake Mead?  
Students are told they are going to analyze Lake Mead to determine the characteristics that have allowed quagga mussels to thrive and take over Lake Mead. Data are recorded on the Student Worksheet: Data Collection Sheet.

Students are divided into 2 groups:

- **Group 1**: Students use probes to collect data for dissolved oxygen, water temperature, and pH.
- **Group 2**: Students use a Secchi Disk to measure turbidity.

Students use a plankton net to collect plankton. Students assist facilitator in making slides for stereoscope observation. Students view collected plankton on TV monitor. Facilitator supports students with basic identification of collected species.
microorganisms.

Groups 1 and 2 compare data and average their results. If time allows, Groups 1 and 2 switch so that both groups have a chance to collect all of the data.

Students compare collected data to the known survival ranges and optimal ranges for quagga mussel survival. With the help of the facilitator, students review the data in their entirety to determine why quagga mussels have taken over the Lake Mead aquatic environment.

**Part 4** - Impacts of quagga mussels on the living and non-living components of the Lake Mead ecosystem - Mussel Maneuvers

In small groups of three, students are a set of activity cards that they lay out in four rows of three cards each, with the “A” cards comprising the bottom row and “D” cards on the top row (Student Activity Materials: Mussel Maneuvers Cards and Tracking Sheet). For this activity, each student is a quagga mussel. The group begins by choosing a card from Row A and reading the text on the back of the card. The card has two parts. The first block of text describes what is happening to the quagga mussels, and the group is instructed to choose a card from the same row or the next row. The second part of the card describes what effects the quagga mussels are having on an environmental or social factor. As students progress through the rows of cards, they keep track of the “benefits,” “harm,” and “no effect” that quagga mussels have on particular components. As students maneuver through the rows of cards they learn about how quagga mussels affect a variety of living and non-living components of an ecosystem.

Note: Facilitator involvement is critical for the success of this activity; additional information can be found within Facilitator Reference: Possible Solutions to Mussel Maneuvers Consequences.

Discussion questions: What were some of the negative effects? The positive effects? How were fish affected? How would the turbidity of the lake be changed? Is that a positive effect? Was there anything that quagga mussels had no effect upon?

**Part 5** - Synthesis: What can we do to prevent the spread of quagga mussels to other waterways?

Students analyze the advantages and disadvantages of different
management options for preventing the spread of quagga mussels to other lakes and rivers.

Students are divided into teams of 3-4 students. The facilitator tells them that they are National Park Service managers and are being "given a $150,000 budget to prevent the spread of quagga mussels to other lakes and rivers. By reviewing the Student Reference: Quagga Mussels Management Options Booklet, students examine several "real" management options and discuss the advantages and disadvantages of each. They choose those options that they think will be most effective—but the costs have to fall within their budget. Each group prepares its management plan by recording their choices on chart paper or provided worksheet (Student Worksheet: Budget Sheet).

When students are finished, the facilitator asks each group what they chose to do and why: What are some of the advantages of what they chose? Disadvantages?

Questions for discussion:
Was there any one choice that would solve the problem? What could you do personally to help prevent quagga mussels from spreading? What could you do as a class?

ON-SITE ACTIVITIES: Shore
CSI: WHO STOLE ALL THE WATER?

In this activity, students are introduced to the concept of invasive species by solving a fabricated crime.

Students will:
• Identify several species of native and non-native plants found in the Mojave Desert.
• Use deductive reasoning to determine which plant species is an invasive species and learn about its impacts.

Part 1  Introduction
Students are welcomed to Lake Mead National Recreation Area with a brief discussion of the concept of public lands, national parks, and the role of the National Park Service.

Introduce the activity by dramatizing that a crime was committed last week at the picnic area. Over 800 gallons of water was stolen. It is up to
the students as eco-detectives to determine who stole the water. In order to solve the crime, the students will need a description of the crime scene and procedures to follow.

Begin a discussion of how water is a precious resource in the desert, and plants and animals that live in the desert possess adaptations that allow their survival. Introduce the concept of native species by discussing plant adaptations that minimize water loss such as:

- Small leaves or no leaves
- Waxy coating
- Light color
- Hairy coverings
- Pads to store water

**Part 2  ▶ Solving the Crime**

The students are divided into groups, and each group is given a **Student Materials: Crime File** containing Mug Shots of the most likely suspects and Procedure Checklists. The most likely suspects are plants in the surrounding area (picnic area and adjacent desert wash). Discuss the procedures to be used as well as safety guidelines for examining the crime scene:

1. Find the plant depicted in the mug shot and discuss each item listed below with your group.
2. Use your hand lens to examine the leaves.
3. Use the PDA to take a picture of the suspect.
4. If your group believes a suspect to be innocent, place the mug shot in the "INNOCENT" pocket of your Crime file.

Instruct students on how to use a hand lens as well as how to take pictures with a PDA.

Make sure that students understand that, just as in real detective work, there may be clues that lead to false conclusions. The guilty plant may not be obvious.

**Part 3  ▶ GUILTY!**

After examining all the suspects, students should have identified a most likely suspect. Facilitate a discussion among the students by asking:

*Who do you think stole the water?*
*Why is this plant most likely to be guilty?*
*What other plants were likely suspects?*
*Why do you these plants are innocent?*
*How does the tamarisk affect other desert plants? What other impacts*
might it have?
Include discussion of the concepts of native and non-native plants as well as invasive species.

CHILLIN' WITH THE CHUBS
Note: This activity is adapted from the Discover A Watershed: The Colorado River activity book. For additional information, refer to the activity write-up beginning on page 211.

In this simulation activity, students examine the effects of introduced species and dams on native fish populations in the Colorado River.

Students will:
• Compare pre-dam and post-dam habitat conditions in the Colorado River.
• Describe the effects that introduced species and dams have on native fish populations.
• Discuss solutions for protecting native fish populations

Part 1  Introduction to Chillin’ with the Chubs
Students are welcomed to Lake Mead National Recreation Area with a brief discussion of the concept of public lands, national parks, and the role of the National Park Service.

Begin by asking students what types of fish they have caught or seen in the area. Introduce the concept of native and non-native species. Ask if they have ever heard of a Colorado pikeminnow or a razorback sucker (use fish models as a visual aid); discuss how these fish were very common in the Colorado River prior to dams being built and to increased human occupation along the river. Ask students to suggest reasons why these native fish populations declined so rapidly. Lead the discussion so that three main factors, or stressors, emerge:

4) Construction of dams changed the physical environment of the river including variation of flows, water temperature, and turbidity.
5) Introduction of nonnative species changed the ecosystem; they prey on eggs and young of native fish.
6) Over-fishing by humans has reduced populations, especially of Colorado pikeminnow and totoaba.

Part 2  Chillin’ with the Chubs
Tell students that they are going to be a native Colorado River fish and experience how populations of different species have changed in

TIME 30 minutes
MATERIALS
Models of Colorado pikeminnow and razorback sucker
Cones for marking boundaries
response to the different stressors they just discussed. Divide students into five (or fewer) groups with each group consisting of at least four students. Have each student in group wear lanyards representing a native fish such as humpback chub, bonytail chub, razorback sucker, Colorado pikeminnow, or desert pupfish. Assign one student to be the environmental stressor; this person represents the three different environmental facts that have led to declines in these native fish populations.

Tell students that their goal is to make it across the playing field without being tagged by the stressor. However, they will have hindrances that make it harder to cross. These obstacles represent how these native species are intolerant of new environmental changes. Refer to the table below to explain what students in each group must do as they cross the playing field.

<table>
<thead>
<tr>
<th>Species</th>
<th>Hindrance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humpback chub</td>
<td>Must stop every 8 steps and do 3 jumping jacks</td>
</tr>
<tr>
<td>Bonytail chub</td>
<td>Must walk sideways</td>
</tr>
<tr>
<td>Razorback sucker</td>
<td>Must hop on one foot</td>
</tr>
<tr>
<td>Colorado pikeminnow</td>
<td>Must spin in a circle every 5 steps</td>
</tr>
<tr>
<td>Desert pupfish</td>
<td>Must walk backwards, stopping to touch the ground every 10 steps</td>
</tr>
</tbody>
</table>

Record on flip chart paper the number of students in each group. Tell students that these numbers represent conditions in 1800, before dams and non-native species were introduced, and before commercial fish. The subsequent rounds represent later time periods when these factors were introduced.

For Round 1, the fish will try to make it to the end of the playing field without being tagged by the stressor. Students can walk fast, but not run. Record the number of fish that make it to the safe area. Students that get tagged should flip their Fact Cards to show the non-native or tolerant species or environmental stressor. These students move to the middle of the playing field to become stressors. Record the total number of environmental stressors and non-native species.

Repeat the procedure for 3-4 more rounds. With more students as stressors, the number of native species left at the end of each round will be fewer. Record numbers of fish for each round.
Part 3  Conclusions

Have students discuss the results. Because this is a simplified model, the decrease in native species happens at the same rate as the increase in non-native species. In actual situations, the rates would differ since the factors involved are more complicated.

Ask students to brainstorm ideas to help protect these endangered species. Ideas may include removing non-native fish, finding ways to increase water temperature and make flows more similar to pre-dam flows, banning certain types of fishing, etc.

ADAPTATIONS FOR DIVERSE LEARNERS

- Consult with teachers prior to field trip to determine specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
- Implement peer assistance by involving teachers in the process of creating color teams.
- Provide diagrams, photos, or other visual organizers as appropriate for processes and techniques.

ADDITIONAL ON-SITE ACTIVITIES: Shore

NOTE: This activity may be used to replace or augment "CSI: Who Stole All the Water?" and/or "Chillin’ with the Chubs."

INVASIVE PLANTS AT LAKE MEAD NRA – A GUIDED HIKE

Students take a short walk to discover native plant adaptations and learn about impacts of native species.

Students will:

- identify at least two plant adaptations and explain how those adaptations relate to survival in Mojave Desert conditions;
- measure, record, and compare wind speed and temperatures;
- compare and contrast an area with native plants with an area with non-native plants;
- be able to define the terms: native species, non-native species, and introduced species; and
- be able to explain two strategies for preventing invasive species from being introduced into natural areas.

Part 1  Introduction

The hike activity, which begins at the picnic area, is set up by first asking students what kinds of weather conditions we deal with in the Mojave Desert (e.g., high temperatures in summer, wind, and little rainfall). Native plants have a variety of adaptations that make it possible for them to survive in the extreme conditions of the Mojave
Desert. Students are asked to list what they brought with them for the hike (e.g., water, hat, sunglasses, sunblock, wore light-colored clothing, etc.). These items or strategies can be compared to some of the adaptations of native plants. Many of these adaptations will be discovered during the hike. Students are reminded of some basic rules for the hike.

**Part 2 ▶ Concept Development**

**First stop: beavertail cactus**

A cactus is a common plant associated with the desert. Just as the students are each carrying a water bottle, some plants like the beavertail cactus are able to hold large amounts of water in their thick pads. Water is taken up by the roots which are generally short and just below the soil surface in order to quickly absorb water after a rain shower. Beavertail cacti use the water to form a gel-like substance, which can be stored within the plant. Students are asked to look for other plants with fleshy stems as they continue to hike.

**Second stop: creosote bush**

The students are asked to make observations of a creosote bush, especially the leaves and stems. Students smell the plant by cupping part of it in their hands. They gently blow on the cupped part of the plant, and the moisture from their breath brings out the smell of the creosote. On rainy days in many parts of the desert, you can smell the creosote bush. Many plants limit what moisture they lose through evaporation by covering their leaves or pads with a wavy or oily coating. This works much the same way as sun block in protecting us from "drying out" and burning our skin in the sun. Native desert plants also have very small leaves or no leaves (some have spines instead) in order to reduce surfaces exposed to the sun.

**Third stop: rocky outcrop**

At this stop, students conduct several weather measurements. Working in small groups, the students measure and record on **Student Worksheet: Data Collection Sheet** the following: wind speed; air temperature; ground temperature under a plant; ground temperature in full sun; rock surface temperature in full sun; etc. Results are then discussed with review of the difficulties of living in the desert and that the key to survival is the ability to have and/or hold water.

(This is the turn-around point for the hike.)
Fourth stop: view of Callville Bay Campground
While looking down at the campground, students compare how different it is from the area where they are standing. Students are asked to explain why the two areas are different. The differences relate to the types of plants and water availability. The campground is on an irrigation system. The plants in the campground are mostly non-native species that require an irrigation system for survival. Examples of these non-native plants include oleander, olive, palm trees, and mulberry. When the campground was built back in the 1960s, these were the plants that were chosen for the campground. Currently, the Park Service is working on a plan that will, over time, replace these non-native species with native species, where appropriate.

There are native plants in the desert that require large amounts of water, but they live around natural springs where water is available all the time. One non-native invasive species is the tamarisk or salt cedar. This invasive species can be found all around the shore line of Lake Mead and can be found near all of the 40 springs within the recreation area. The Park Service has a very intensive tamarisk removal program, concentrating in the areas near springs. Tamarisk competes directly with the native plant species for water and can crowd out and prevent native plant species from growing. This can affect water availability for wildlife and can impact the biodiversity within the spring community.
GRADE 6

ALIEN INVADERS!

ON-SITE PROGRAMMING • SUPPORT MATERIALS
Demonstration:
INVASIVE SPECIES FACT OR FICTION POWERPOINT

Alien Invaders Fact or Fiction is a PowerPoint presentation that is delivered with a lot of energy. It functions to reinforce the definition of "invasive species" and to underscore the tremendous amount of impact that invasive species have on the environments they invade. The presentation sets the tone for the rest of the program. Note that the actual PowerPoint contains additional animated images for each slide.

There is an animal that feeds by sucking out the bodily fluids of fish in the great lakes.

There is a tree in the desert that can "drink" 300 gallons of water in one day.

Caterpillars of this moth species can completely defoliate an entire oak tree in just one week.

FACT

FACT

FACT
Voracious meat-eating piranhas living in Lake Mead have eaten all the native fish.

Fiction

A power plant executive will spend hundreds of millions of dollars to remove a small clam from a water pipe.

Fact
Sea lamprey (*Petromyzon marinus*) are predaceous, eel-like fish native to the coastal regions of both sides of the Atlantic Ocean. They entered the Great Lakes through the Welland Canal about 1921. Having no natural predators, the lamprey proceeded to devastate whitefish and lake trout populations. To feed, the lamprey latches onto its prey with a sucking disk and sharp teeth and then carves a hole into the flesh. Anti-coagulant chemicals in its saliva ensure that the wound remains open for days while the lamprey feeds.

Since 1956, the governments of the United States and Canada, working jointly through the Great Lakes Fishery Commission, have implemented a successful sea lamprey control program. In 1958, scientists found TFM—a chemical that selectively kills sea lamprey larvae in their spawning streams—and brought the lamprey invasion under control. Lamprey numbers in Lake Michigan are currently only about 10 percent of their peak numbers in the 1950s. However, some biologists are concerned that these surviving populations might develop a resistance to the lampricide or, just as worrisome, an ability to spawn on the deltas of stream mouths where the deeper waters are not suitable for lampricide treatment.
Tamarisk, or salt cedar, disrupts natural food chains and interferes with the water table by replacing native plants. Starting in the 1850s, several species of tamarisk were imported to the United States as ornamentals and for use in erosion control. Since its introduction, tamarisk has spread quickly along waterways, where it tends to form dense thickets along streams and springs, displacing native trees such as cottonwood, willow, and mesquite. Tamarisk can spread both vegetatively, by adventitious (developing on stems, leaves, and even old roots) roots or submerged stems, and sexually, by seeds. It has taken over more than one million acres of area along waterways.

Sahara mustard
Numerous Old World mustards have invaded North America. Of these Sahara mustard (aka several other names) is the newest and by far the worst. It is a robust, fast-growing, drought-tolerant winter annual that prefers sandy soils. The basal rosette of divided hairy leaves can span three feet in wet years. The nearly leafless flowering stems branch profusely and grow to a height of about two feet, creating the appearance of a shrub from a distance. The small light yellow flowers are self-pollinating, so each of the thousands of them sets a seed pod. Large plants produce up to 16,000 seeds. Dried plants break off at the base and tumble like Russian thistle (tumbleweed, Salsola tragus), spreading seeds rapidly across the landscape. When wet, the seeds are sticky with mucilage and can be transported long distances by animals and perhaps vehicles.

Originally brought to the United States in 1869 to create silk, the **gypsy moth** escaped captivity and can now be found throughout the eastern U.S., feeding on more than 300 species of trees. The gypsy moth, *Lymantria dispar*, is one of North America’s most devastating forest pests. The species originally evolved in Europe and Asia and has existed there for thousands of years. In the late 1860s, the gypsy moth was accidentally introduced near Boston, Massachusetts by E. Leopold Trouvelot. About 10 years after this introduction, the first outbreaks began in Trouvelot’s neighborhood, and in 1890, the state and federal governments began their attempts to eradicate the gypsy moth. These attempts ultimately failed and since that time, the range of the gypsy moth has continued to spread. Every year, isolated populations are discovered beyond the contiguous range of the gypsy moth. However, these populations are eradicated or they disappear without intervention. It is inevitable that the gypsy moth will continue to expand its range in the future.

**Nuisance Mussels**

Although only as big as your thumbnail, these zebra and quagga mussels cause $5 billion worth of damages each year. They are believed to have been transported to the Great Lakes via ballast water from a transoceanic vessel. By removing most of the phytoplankton or food for microscopic zooplankton and filter feeders, which in turn support larval and juvenile fishes and other animals, these mussels can effectively starve the native populations of infested lakes and rivers.
The *quagga mussel* (*Dreissena rostriformis bugensis*) is one of seven species. This species is indigenous to the Dnieper River drainage of Ukraine. The quagga mussel was first observed in North America in September 1989 when it was discovered in Lake Erie. It was not identified as a distinct species until 1991. The species was called the quagga Mussel after the quagga, an extinct subspecies of African zebra, possibly because, like the quagga, its stripes fade.

Within two to three weeks, quagga veligers (larvae) "settle" and attach by strong byssus threads to hard or soft surfaces. They grow best in areas of free-flowing water where they can filter out large quantities of plankton.
Facilitator Reference: QUAGGA MUSSEL FAST FACTS

ORIGIN and SPREAD
• Quagga mussels, *Dreissena bugensis*, are indigenous to the Dneiper River drainage of Ukraine.
• Quagga mussels were introduced into the Great Lakes in 1986 in ship ballast water. Until their discovery in Lake Mead, they had been limited to the upper Mississippi River and the Great Lakes.
• The primary way quagga mussels can spread westward is on boats trailered by the public or commercial haulers.
• Since the Lake Mead discovery, quagga mussels have also been verified in Lake Powell, Lake Mojave and Lake Havasu.

LIFE HISTORY and HABITAT REQUIREMENTS
• A single spawning female potentially releases tens of thousands to millions of eggs.
• Quagga mussel larvae are known as “veligers.”
• Life stages of the zebra mussel are: egg → larva (veliger) → juvenile → adult.
• Quagga mussel eggs and larvae are microscopic; adults can grow to 1 inch in size.
• The life span of the quagga mussel is two to five years.
• Unlike the zebra mussel which requires hard surfaces, quagga mussel larvae can settle and attach to hard or soft surfaces.
• Water flowing faster than 1.5-2.0 m/sec affects larval settlement and fertilization.
• Adult quagga mussels do not survive in water where the pH is lower than 6.5.
• Quagga mussels are uncommon in water with Secchi disk depths under 1 meter. It is thought that high turbidity may interfere with feeding.
• Adult mussels colonize all types of living and non-living surfaces including boats, water-intake pipes, buoys, docks, piers, plants, and slow-moving animals such as native clams, crayfish, and turtles.

IMPACT
The greatest direct ecological impact of quagga mussels relates to their feeding behavior. Quagga mussels are filter feeders and can process up to 1 gallon of water per day per mussel. This feeding ability combined with high numbers rapidly clears the water of even the largest lakes.

Also, quagga mussels can:
• Ruin a boat engine by blocking the cooling system, causing overheating.
• Increase drag on the bottom of a boat, reducing speed and wasting fuel.
• Overwhelm local waters and cover beaches with broken shells with sharp edges, making these areas unpleasant and smelly.
## Alien Invaders

### Investigation:
Why are quagga mussels taking over Lake Mead?

### 7) Temperature

**FACTS:** quagga mussel survival: 4°C to 25°C  
**Best:** 12°C to 20°C

<table>
<thead>
<tr>
<th>Temperature Measurement</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the surface</td>
<td>°F</td>
</tr>
<tr>
<td>2 meters below surface</td>
<td>°F</td>
</tr>
<tr>
<td>5 meters below surface</td>
<td>°F</td>
</tr>
</tbody>
</table>

c. Can quagga mussels live in the **temperatures** you found?  
d. Are these the **BEST** **temperatures** for quagga mussels to grow?  

### 8) pH

**FACTS:** quagga mussel survival: pH = 6.5 to 8.7  
**Best:** pH is HIGHER than 7.0

<table>
<thead>
<tr>
<th>pH Measurement</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the surface</td>
<td></td>
</tr>
<tr>
<td>2 meters below surface</td>
<td></td>
</tr>
<tr>
<td>5 meters below surface</td>
<td></td>
</tr>
</tbody>
</table>

c. Can quagga mussels live at the **pH** you found?  
d. Is the **BEST** **pH** found here?  

☐ YES  ☐ NO
<table>
<thead>
<tr>
<th>9) Food</th>
<th>FACT: quagga mussels like to eat plankton, especially Daphnia and copepods.</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Is there <strong>food</strong> for quagga mussels here? □ YES □ NO</td>
<td></td>
</tr>
<tr>
<td>d. What kind of <strong>food</strong> did you find? Sketch it in the box.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10)</th>
<th>Big</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why are quagga mussels taking over Lake Mead?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11)</th>
<th>What</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>will happen to water clarity?</strong></td>
<td></td>
</tr>
<tr>
<td>a. Secchi disc depth today: _____________________</td>
<td></td>
</tr>
</tbody>
</table>
b. As quagga mussels take over, how will the secchi disc depth change? ________________
ACIDIC

\begin{itemize}
\item pH = 0: battery acid
\item pH = 1: lemon juice
\item pH = 2: Coke/Pepsi
\item pH = 3: orange juice
\item pH = 4: bananas
\item pH = 5: milk
\item pH = 6: pure water
\item pH = 7: sea water
\item pH = 8: baking soda
\item pH = 9: TUMS®
\item pH = 10: soapy water
\item pH = 11: bleach
\end{itemize}

BASIC

Adapted from the Acid Rain Student’s Site: www.epa.gov/acidrain/site_students/phscale.html
Student Reference:  
PLANKTON IDENTIFICATION SHEET

**Phytoplankton**
- microscopic plants that live in water
- first in the food chain
- use chlorophyll to make sugars out of energy from the sun, chemicals (like nitrogen), and dissolved carbon dioxide gas.

**Zooplankton**
- microscopic animals and single-celled organisms that live in water
- eat other plankton

**Veliger**
- the free-swimming, microscopic young (larvae) of zebra mussels and other fresh water mollusks
- eat plankton

Image credits: Brachionus and Copepod © Kirsten Work, Ph.D.; Daphnia © Texas Tech University; Diatoms © Donald F. Charles, Ph.D.; Nitzschia © Prolist Information Server; Pandorina © University of Texas, Austin; Trachelomonas © The SilicaSecchiDisk; Trichotria provided with the permission of The Academy of Natural Sciences, Philadelphia, PA
POSSIBLE SOLUTIONS TO MUSSEL MANEUVERS

CONSEQUENCES

A PLACE
Lucky You... You find plenty of places — like rocks and water pipes — where you can attach. Move forward
But, before you go... What about the water pipes? Are quagga mussels beneficial, harmful, or neither to water pipes?

CONSEQUENCE: Quagga mussels are harmful to water pipes; quagga mussels clog pipes. In the case of the
Monroe Plant in Michigan, cleaning zebra mussels, a species related to quagga mussels, from the water intake
system cost more than $300,000 in 1989 (LePage, W. The Impact of Dreissena polymorpha on Waterworks

A FISH
Oh, no! There are lots of striped bass here! They've already eaten many of your young — and look, here comes
another one! Draw again from this row. But, before you go... What about the striped bass? Are
quagga mussels beneficial, harmful, or neither to striped bass?

CONSEQUENCE: Quagga mussels are beneficial to striped bass; striped bass eat quagga mussel veligers.

A CHEMISTRY
Right on! You've landed in a lake with lots of calcium, which you need to grow a strong shell. Move forward. But,
before you go... What about the other organisms with shells in the lake? Most do not need as much calcium as the
quagga mussel. Are quagga mussels beneficial, harmful, or neither to other animals with shells?

CONSEQUENCE: Quagga mussels, in terms of calcium, have no effect on the other animals with shells. Students
might suggest that quagga mussels could clear the water of calcium. This is a great answer, but in reality there is so
much calcium in the lake that it would be impossible for quagga mussels to deplete it.

B CHEMISTRY
Yuck! There's been an accident at the dock, and lots of oil spilled into the water. You can't survive here! Draw again
from this row. But, before you go... What about the other organisms in the lake? After the oil spill is cleaned up, what
happens to them if there are no longer quagga mussels here?

CONSEQUENCE: If the other organisms can recover from the oil spill, they will likely benefit from the loss of quagga
mussels. One really needs more information on the types of animals that lived in this area to decide whether the loss
of quagga mussels is beneficial or harmful.

B BIRD
Well... there are several birds that eat quagga mussels, including great blue herons and cormorants. But you just laid 1,000,000 eggs! Move forward. But, before you go... What about great blue herons and cormorants? Are quagga mussels beneficial, harmful, or neither to these birds?

CONSEQUENCE: Quagga mussels are beneficial to these birds; they eat quagga mussels. But quagga mussels can also be harmful to birds. As filter feeders, quagga mussels can incorporate toxins from polluted water into their tissues; these toxins are passed on to the birds when they eat them.

NEIGHBORS
Yikes! The razorback sucker is a fish neighbor that, like you, eats plankton for food. But no need to worry—you can easily eat far more than this fish! Move forward. But, before you go... What about the razorback sucker? Are quagga mussels beneficial, harmful, or neither to razorback suckers?

CONSEQUENCE: Quagga mussels are harmful to razorback suckers because they deplete the food source (plankton) for this native fish.

CHEMISTRY
Hmmm... the pH of the lake is only 6.0—this makes it hard to make your shell. You can’t live here! Draw again from this row. But, before you go... What about the other animals that can live in a lake with a pH 6.0? Are quagga mussels beneficial, harmful, or neither to these animals?

CONSEQUENCE: Quagga mussels have no effect on these animals, since they will never cohabit an area with them. Animals that have a broad range of pH tolerance might exist in an area that can be invaded by quagga mussels. In that case, these species would be subject to quagga mussel damage.

LIGHT
Uh, oh. You ended up at the bottom of a deep lake. It’s so dark here that plankton can’t grow. With no food, you can’t survive here! Draw again from this row. But, before you go... What about the other organisms that live here? Are quagga mussels beneficial, harmful, or neither to the organisms that can survive here?

CONSEQUENCE: Quagga mussels have no effect on these animals, since they will never share an area with them.

CRAYFISH
Hey! Hop on for a free ride! It may seem odd, but quagga mussels can attach to crayfish, clams, and other animals. Move forward. But, before you go... What about the crayfish? Are quagga mussels beneficial, harmful, or neither to crayfish?

CONSEQUENCE: Quagga mussels are harmful to these animals; when many quagga mussels attach to an animal such as a crayfish, the animal’s movement is limited and can even be suffocated.
**FOOD**
All gone! There are so many quagga mussels that all of the plankton has been eaten from this part of the lake. There’s no more food, so you can’t live here anymore! Draw again from this row. But, before you go... What about the other animals that eat plankton in this part of the lake? Were quagga mussels beneficial, harmful, or neither to the other animals that live here?

CONSEQUENCE: Quagga mussels were harmful to native animals that also eat plankton; without food, native species will die.

**TEMPERATURE**
Brrr... it sure got cold this winter! It wouldn’t have been so bad if you weren’t stuck in this shallow inlet. As it is, you are struggling to survive. Draw again from this row. But, before you go... what about the other animals in the inlet? Were quagga mussels beneficial, harmful, or neither for them?

CONSEQUENCE: Quagga mussels were probably harmful to native animals living in the inlet, but without more information we can’t say. The types of animals living in the inlet were probably young fish that depend on plankton for food, which quagga mussels eat. If clams or mussels lived in the inlet, the quagga mussels could have attached to them, suffocating them.

**PLACE**
Wow! The marina is filled with boats! Just look at all the places where you can attach! Congratulations: you finished! But, before you go... What about the boats? Are quagga mussels beneficial, harmful, or neither for the boats?

CONSEQUENCE: Quagga mussels are harmful to boats. Quagga mussels will block a boat’s engine cooling system and cause the boat to overheat. Also mussels attached to hulls can increase drag and increase fuel consumption.
### Alien Invaders

#### Mussel Maneuvers
Use this sheet to keep track of the number of times quagga mussels benefit, harm, and have no effect on their new environment during the card activity!

<table>
<thead>
<tr>
<th>Category</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beneficial</td>
<td></td>
</tr>
<tr>
<td>Harmful</td>
<td></td>
</tr>
<tr>
<td>Neither</td>
<td></td>
</tr>
</tbody>
</table>

#### Team Members

---
Management Plan
Create a Management Plan Budget. Each team has $150,000 to spend.

<table>
<thead>
<tr>
<th>Expense</th>
<th>Cost</th>
<th>We will spend:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media Campaign</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Local T.V. Commercial</td>
<td>$30,000</td>
<td></td>
</tr>
<tr>
<td>B. Newspaper Ad.</td>
<td>$11,000</td>
<td></td>
</tr>
<tr>
<td>C. Park Posters/Park News</td>
<td>$4,000</td>
<td></td>
</tr>
<tr>
<td>D. Park Brochure</td>
<td>$11,000</td>
<td></td>
</tr>
<tr>
<td>E. Billboard</td>
<td>$30,000</td>
<td></td>
</tr>
<tr>
<td>F. Super Bowl Ad.</td>
<td>$2,600,000</td>
<td></td>
</tr>
</tbody>
</table>

| Boat/Trailer Inspection  |          |                |
| A. Rangers               | $454,000  |                |
| B. Rangers               | $91,000   |                |
| C. Rangers               | $20,000   |                |
| D. Volunteers            | $15,000   |                |

| Monitoring               |          |                |
| A. Biologist             | $25,000  |                |
| B. Biologist             | $8,000   |                |
| C. Volunteers            | $8,000   |                |

Team Members
GRADE 6

ALIEN INVADERS!

PRE-VISIT LESSON

Introduced and Invasive Species
ALIEN INVADERS!

PRE-VISIT OVERVIEW

Alien invaders don't just come from outer space! An invasive alien species can be any species on earth that moves from its native ecosystem into a new ecosystem and then causes or is likely to cause economic or environmental harm or harm to human health. In January, 2007 quagga mussels were found in Lake Mead, the first discovery of these invasive mussels in western United States. Quagga mussels are an aquatic species that are native to Eastern Europe and were introduced into the Great Lakes in the late 1980s.

In the "Alien Invaders!" program, students use the Forever Earth vessel to investigate how quagga mussels might affect Lake Mead. Students collect water quality data such as clarity, pH, and temperature to determine whether current habitat conditions would allow quagga mussels to survive and thrive. Students learn about the consequences the quagga mussels could have on the lake and its living and non-living resources. Using the knowledge they've gained, students create their own management plans to prevent the spread of quagga mussels to other waterways.

Two pre-visit activities have been designed to prepare students for this on-site experience. The first activity (described here) involves students in the concepts of introduced and invasive species. The second activity (Water Characteristics) gives students an opportunity to explore water quality conditions as they relate to the habitat needs of an organism. Once students understand the purpose of each test, they will gain experience using testing equipment and performing data collection and analysis.

THEME

Introduction of an invasive species upsets the balance of an ecosystem.

KEY QUESTIONS

What effect can an invasive species have on an environment? What, if anything, can or should be done to prevent or control the introduction of an invasive species?

GOAL

Students will demonstrate an understanding of the tradeoffs of introducing new species to an ecosystem.

OBJECTIVES

Students will:

- describe what is meant by introduced species and invasive species;
- discuss the advantages and disadvantages of introducing new species into an ecosystem; and
- make predictions based on evidence.

NEVADA STATE STANDARDS CORRELATION
N.8.A.1. Students know how to identify and critically evaluate information in data tables and graphs.

N.8.A.2. Students know how to critically evaluate information to distinguish between fact and opinion.

N.8.B.1. Students understand that consequences of technologies can cause resource depletions and environmental degradation, but technology can also increase resource availability, mitigate environmental degradation, and make new resources economical.

L.8.C.3. Students will evaluate how changes in environments can be beneficial or harmful.

L.8.C.4. Students know that inter-related factors affect the number and type of organisms an ecosystem can support.

CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 6)

Students will:

• make predictions based on data;
• make inferences based on observations or data;
• evaluate explanations based on evidence;
• discuss the costs and benefits of human-caused changes in the environment; and
• use examples to describe how inter-related factors influence the number and type of organisms an ecosystem can support.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME

CORRELATIONS

The pre-visit grade 6 activities support the following guiding themes developed by Clark County-based educators:

• Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.

• Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

PREREQUISITE CLASSROOM EXPERIENCES

Lessons and discussions on the:

• definition of a species;
• study of ecology;
• advantages and disadvantages (also called tradeoffs); and
• use of the terms "invasive" and "introduced."

Small group application in problem solving:

• using observations and data to make inferences and predictions;
• formulating and analyzing problems;
• listing costs/benefits or advantages/disadvantages; and
• using evidence in decision making.

VOCABULARY

- advantages
- debate
- disadvantages
- ecology
- ecosystem
- environment
- extinction
- habitat
- introduced species
- invasive species
- pros and cons
- re-establishment
- species
- survival
- trade-offs

PRE-VISIT LESSON: Introduced and Invasive Species

Part 1 ➤ Introduction
In this introductory discussion activity, students learn about the definitions of “introduced” species and “invasive” species.

1. The following questions are displayed, and students are asked to write their responses in their journals:
   Identify at least two organisms that we see in the Las Vegas area that do not “belong” here. Why do you think they don’t belong here? What are the trade-offs of introducing new species into an environment?

2. Students share their answers and discuss briefly. The teacher initiates the lesson on introduced species by asking provocative questions listed in the student textbook, Science and Life Issues, p. E-4. Questions: Have you ever thought that it would be cool to have parrots flying around in your backyard? Or wished that there were hippos in a nearby lake? What happens when you introduce an organism into a new environment?

Part 2 ➤ Concept Development
In this activity, students explore a case study where a fish species was introduced into an African lake and destroyed the native fish populations.

2. Students are asked to dig a little deeper by locating Lake Victoria on a map of the world. Maps are available at the following Internet sites:
   www.worldlakes.org/uploads/victoria_index.jpg
   http://encarta.msn.com/map_701514012/Victoria_Lake.html

3. The teacher displays photos of cichlids and Nile perch. Photographs are available at the following Internet sites:
   www.issg.org/database/species/ecology.asp?si=89
   http://en.wikipedia.org/wiki/Nile_perch
   http://animaldiversity.umnz.umich.edu/site/accounts/information/Lates_niloticus.html

   Students discuss physical characteristics of the two types of fish:
   How are they the same? How are they different?

4. Students complete Student Worksheet: Gathering Evidence as they continue to read Activity 72 in their textbooks. This reading can be done alone, in groups, or with the entire class.

   After reading Activity 72 and a short class discussion of the reading, students also complete Student Worksheet: Predictions Based on Evidence.

   Students complete the analysis questions on p. E-9; students may work alone or in small groups. Students discuss their answers to the analysis questions. The teacher explains the difference between "introduced" and "invasive" species and asks if all "introduced species" are "invasive." (Answer: Not necessarily. Introduced species become invasive only if they are introduced in an area with excellent conditions for their survival such that they can reproduce and negatively impact their new ecosystem.)

**Part 3  Presentation of Findings**

Students debate the pros and cons of introducing new species into an environment.

The class is split into two groups. One group is assigned to be "pro" and one group to be "con." The teacher explains that it is important to
learn both sides of an issue using evidence and to see all sides of an issue even if one has strong beliefs on one side of the issue.

The two groups use the evidence they have gathered in the discussion and reading to debate the tradeoffs of introducing new species into an environment.

**Part 4  ➤ Linkage and Closure**

After the class debate, students write summary essays that demonstrate understanding of introduced species, invasive species, and the impacts of introducing new species into an ecosystem.

**EXTENSIONS**

- Students investigate other invasive species, especially those in Southern Nevada.
- Students prepare a poster that visually illustrates the trade-offs of introducing species into a new ecosystem.

**RESOURCES**


Maps of Lake Victoria:
- www.worldlakes.org/uploads/victoria_index.jpg

General information on Lake Victoria:
- www.worldlakes.org/lakedetails.asp?lakeid=8361

Information and pictures of Cichlids of Lake Victoria:
- www.agiweb.org/geotimes/apr03/WebExtra042503.html

Information and pictures of Nile perch:
- http://animaldiversity.ummz.umich.edu/site/accounts/information/Lates_niloticus.html
- www.megapesca.com/nileperch.html

**ADAPTATIONS FOR DIVERSE LEARNERS**

- Consult with Forever Earth project manager prior to field trip to discuss specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
• Allow peer readers or writers.
• Allow students to work in groups to answer questions.
• Pre-write topic sentence and sentence starters for essay.

**ASSESSMENT**

The teacher carefully listens to the debate; consider whether key concepts are included and represented accurately or whether there are misconceptions in the presentation. Groups are assessed according to ability to function and to self-monitor for task completion.
GRADE 6

ALIEN INVADERS!

PRE-VISIT • SUPPORT MATERIALS

Introduced and Invasive Species
Student Worksheet:
GATHERING EVIDENCE

Fill in the table as you read Activity 72: “The Miracle Fish?” (page #E-5 to E-8 in Science and Life issues).

<table>
<thead>
<tr>
<th></th>
<th>NATIVE SPECIES: Small Fish (cichlids)</th>
<th>INTRODUCED SPECIES: Big Fish (Nile perch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical description</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>Benefits/Advantages to humans (PRO)</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>Costs/disadvantages to humans (CON)</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>Changes in numbers of species over time</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>Why numbers changed over time</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>
Student Worksheet:
PREDICTIONS BASED ON EVIDENCE

Fill in this table after you read and discuss with the class Activity 72: "The Miracle Fish?" (page # E-5 to E-8 in Science and Life Issues).

<table>
<thead>
<tr>
<th>NATIVE SPECIES:</th>
<th>INTRODUCED SPECIES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Fish (cichlids)</td>
<td>Big Fish (Kile perch)</td>
</tr>
<tr>
<td>Based on your evidence, what do you predict will happen in the next several years?</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>
GRADE 6

ALIEN INVADERS!

PRE-VISIT LESSON

Water Characteristics
ALIEN INVADERS!

PRE-VISIT OVERVIEW

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In the "Alien Invaders!" program, students use the Forever Earth vessel to investigate how quagga mussels might affect Lake Mead. Students collect water quality data such as clarity, pH, and temperature to determine whether current habitat conditions would allow quagga mussels to survive and thrive. Students learn about the consequences the quagga mussels could have on the lake and its living and non-living resources. Using the knowledge they've gained, students create their own management plans to prevent the spread of quagga mussels to other waterways.

Two pre-visit activities have been designed to prepare students for this on-site experience. The first activity (Introduced and Invasive Species) involves students in the concepts of introduced and invasive species. The second (described here) gives students an opportunity to explore water quality conditions as they relate to the habitat needs of an organism. Once students understand the purpose of each test, they will gain experience using testing equipment and performing data collection and analysis.

THEME

Introduction of an invasive species upsets the balance of an ecosystem.

KEY QUESTIONS

What effect can an invasive species have on an environment? What, if anything, can or should be done to prevent or control the introduction of an invasive species?

GOAL

Students will understand and know how to test for the following characteristics of water: calcium concentration, dissolved oxygen, pH, temperature, and turbidity.

OBJECTIVES

Students will:

- explain the significance of the water quality indicators: pH, turbidity, temperature, calcium, and dissolved oxygen;
- demonstrate the ability to test water for pH, turbidity, temperature, calcium, and dissolved oxygen;
- identify a minimum of three causes for change in water quality; and
- discuss potential impacts that changes in water quality may have on organisms living in water.
NEVADA STATE STANDARDS CORRELATION

N.8.A.1. Students know how to identify and critically evaluate information in data tables and graphs.
N.8.A.5. Students know how to use appropriate technology and laboratory procedures safely for observing, measuring, recording, and analyzing data.
L.8.C.4. Students know inter-related factors affect the number and type of organisms an ecosystem can support.
E.8.A.3. Students know the properties that make water an essential component of the earth's system.

CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 6)

Students will:
• display data in appropriate charts, graphs, and tables;
• use proper lab equipment correctly and safely; and
• discuss the costs and benefits of human and natural caused changes in an environment.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME

The pre-visit grade 6 activities support the following guiding themes developed by Clark County-based educators:
• Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.
• Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

PREREQUISITE CLASSROOM EXPERIENCES

Lessons on:
• proper use of water quality tests or probeware (depends upon school; refer to “Resources” for suggestions);
• advantages and disadvantages (tradeoffs); and
• computer and Internet use.

Small group application in problem solving:
• using observations and data to make inferences;
• formulating and analyzing problems; and
• using evidence to make predictions.

VOCABULARY
• calcium
• Fahrenheit
• Celsius
• pH
• temperature
• turbidity
PRE-VISIT LESSON: Water Characteristics

Part 1 - Introduction
Students observe samples of water to stimulate discussions of water quality and its importance.

Students observe six different samples of water that the teacher has put into small clear vials or beakers. Students record observations in their laboratory notebooks.

Students write the answer to the following question in their notebooks: If you were allowed, which of the water samples would you most likely be willing to drink? Justify your answer with evidence. (SAFETY: Students should not taste the water samples!)

Discussion Questions: Why is the quality of water important to us and to other organisms? Where do we get our drinking water? (Lake Mead) What other organisms depend upon Lake Mead water? Generally, how are these organisms dependent on Lake Mead water?

Students are informed that they will be learning about water quality and how to measure the important characteristics of water.

Part 2 - Concept Development
Students work in groups of five. Using the Internet, each student in the group researches one of the following characteristics of water: pH, turbidity, dissolved oxygen, temperature, and calcium concentration. Some recommended sites are listed on Student Reference: Resources for Water Quality Research. Students can use AskJeeves for Kids (http://www.askforkids.com/) or other search engines to find additional information.

Each member records what he or she learns on his or her copy of Student Worksheet: Water Characteristics.

Each group member shares accumulated information about the assigned water quality characteristic with other members of the group. As they listen and ask questions about the different characteristics of

TIME 15 minutes
MATERIALS
Water samples in clear containers: tap water, bottled water, water from Lake Mead (if inconvenient to obtain, simulate by using another sample of tap water); muddy water; water with a low pH (use vinegar or dilute acid to 4.0-5.0 pH); salt water

Student laboratory notebooks

TIME 30 minutes
MATERIALS
Computers with Internet Resources that can used to facilitate discussion of water quality: http://ga.water.usgs.gov/edu/characteristics.html

Student Reference: Resources for Water Quality Research

Student Worksheet: Water Characteristics
water, students complete the remainder of the Student Worksheet: Water Characteristics. A classroom discussion about water quality and the five characteristics provides closure to this part of the activity.

**Part 3  » Learning more—in the laboratory**

Students measure five characteristics of water: pH, temperature, turbidity, dissolved oxygen, and calcium concentration.

The five water samples used for observation at the start of the lesson are used by the students for testing water quality. Working in teams of three, each student conducts all five measurements on each water sample. Each test should be done three times.

If there are not enough probes or testing kits, each group may measure one water characteristic for each of the five samples.

Students record the data in tables created for that purpose in their lab books or record the data on the Student Worksheet: Water Quality Data. Averages are calculated for each test for each sample. Students discuss why more than one test should be done (validity, reliability).

**Part 4  » Presentation of Findings**

Students summarize their findings in a lab report recorded in their laboratory notebooks or on Student Worksheet: Water Quality Data.

**EXTENSIONS**

Students can bring in samples of water from various places around town, ponds, aquariums, etc. and measure the water quality.

Compare data from water testing at Lake Mead to the data collected in the laboratory. Lake Mead data can be found at: http://nevada.usgs.gov/lmqw/dataformat.htm

**RESOURCES**

The following websites contain a wealth of information of water-related topics.

- Common water measurements used by USGS: http://ga.water.usgs.gov/edu/characteristics.html
- Learn more about water, its uses, and conservation: http://ga.water.usgs.gov/edu/msac.html
- Refer to Student Reference: Resources for Water Quality Research for additional website information.

Water quality kits and testing materials can be obtained from scientific supply companies such as:
ADAPTATIONS FOR DIVERSE LEARNERS

- Consult with Forever Earth project manager prior to field trip to discuss specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
- Instead of handouts, students could make their own tables and graphic organizers in their lab books.
- Group students appropriately so that students can help each other.
- Encourage communication between lab groups.

ASSESSMENT

- Student worksheets
- Lab Reports and Analysis Questions
- Group interactions during the lab activities
GRADE 6

ALIEN INVADERS!

PRE-VISIT • SUPPORT MATERIALS

Water Characteristics
Student Worksheet:
RESOURCES FOR WATER QUALITY RESEARCH

Online Resources

AskJeeves for Kids
Search for Internet sites with information about water and water characteristics:
www.askforkids.com

U.S. Geological Survey
Check out the U.S. Geological Survey for short explanations of general water quality tests:
http://ga.water.usgs.gov/edu/characteristics.html

Read short descriptions of ground water quality and tests:
http://ga.water.usgs.gov/edu/earthgwquality.html

GREEN – Global Rivers Environmental Education Network
Learn about water quality conditions and potential causes of change in conditions:
www.green.org/files.cgi/212_Making_Water_Quality_Connections.pdf

Specific Water Quality Tests

Calcium
http://kywater.org/ww/ramp/rmcalc.htm
www.amdareef.com/hc_chem2.htm
www.ianpubs.unl.edu/epublic/pages/publicationD.jsp?publicationId=175
www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/calciu/index_e.html

Dissolved Oxygen
http://waterontheweb.org/under/waterquality/oxygen.html
www.state.ky.us/nrepc/water/wcpdo.htm

pH
http://waterontheweb.org/under/waterquality/pH.html

Temperature
http://waterontheweb.org/under/waterquality/temperature.html

Turbidity
http://waterontheweb.org/under/waterquality/turbidity.html
Student Worksheet:
WATER CHARACTERISTICS

Work in teams of 5 to find the answers to the following. Assign one of the characteristics to each team member. Once each student has researched his/her topic, join together to share and discuss.

<table>
<thead>
<tr>
<th>DRINKING? • BATHING? • FISHING? • SWIMMING?</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is pH?</td>
</tr>
<tr>
<td>What is a normal pH for drinking water?</td>
</tr>
<tr>
<td>How does the pH of water affect living things?</td>
</tr>
<tr>
<td>Identify 3 things that could cause the pH of water in a lake or ocean to change.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>What is TEMPERATURE?</td>
</tr>
<tr>
<td>How does water temperature affect living things?</td>
</tr>
<tr>
<td>Identify 3 things that could cause the temperature of water in a lake or ocean to change.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>What is TURBIDITY?</td>
</tr>
<tr>
<td>What is an acceptable turbidity value for drinking water?</td>
</tr>
<tr>
<td>How does water turbidity affect living things?</td>
</tr>
<tr>
<td>Identify 3 things that could cause the turbidity of water in a lake or ocean to change.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>What is DISSOLVED OXYGEN?</td>
</tr>
<tr>
<td>What is an acceptable dissolved oxygen value for a fresh water lake?</td>
</tr>
<tr>
<td>How does dissolved oxygen in the water affect living things?</td>
</tr>
<tr>
<td>Identify 3 things that could cause the amount of dissolved oxygen in a lake or ocean to change.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>What is CALCIUM?</td>
</tr>
<tr>
<td>What is an acceptable calcium concentration for drinking water?</td>
</tr>
<tr>
<td>How does the concentration of calcium in water affect living things?</td>
</tr>
<tr>
<td>Identify 3 things that could cause the calcium concentration of water in a lake or ocean to change.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Which one of the 5 characteristics is most important to our group, and why?</td>
</tr>
</tbody>
</table>
LAB ACTIVITY—WATER QUALITY TESTING

Work in groups of 3 to complete this activity. Use the tools and the procedures demonstrated by your teacher to measure 5 characteristics of 5 different water samples. Each test must be completed by you and your two partners. Record results of all three of your tests; then average the results. Put the average values in the shaded boxes.

<table>
<thead>
<tr>
<th>WATER SAMPLE</th>
<th>PH</th>
<th>TURBIDITY (NTU)</th>
<th>DISSOLVED OXYGEN (PPM)</th>
<th>TEMPERATURE (° CELSIUS)</th>
<th>CALCIUM (PPT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample A</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
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<tr>
<td></td>
<td>Test #2:</td>
<td>Test #2:</td>
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<td>Test #3:</td>
<td>Test #3:</td>
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<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
</tr>
<tr>
<td>Sample B</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
</tr>
<tr>
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<td>Test #2:</td>
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<td>Average:</td>
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<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
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<tr>
<td>Sample C</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
<td>Test #1:</td>
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<td>Test #3:</td>
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<td></td>
<td>Average:</td>
<td>Average:</td>
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<td>Average:</td>
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</tr>
</tbody>
</table>
### Sample D

<table>
<thead>
<tr>
<th>Test #1:</th>
<th>Test #1:</th>
<th>Test #1:</th>
<th>Test #1:</th>
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<tbody>
<tr>
<td>Test #2:</td>
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<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
</tr>
</tbody>
</table>

### Sample E

<table>
<thead>
<tr>
<th>Test #1:</th>
<th>Test #1:</th>
<th>Test #1:</th>
<th>Test #1:</th>
<th>Test #1:</th>
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<tbody>
<tr>
<td>Test #2:</td>
<td>Test #2:</td>
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<td>Test #3:</td>
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<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
<td>Average:</td>
</tr>
</tbody>
</table>

### Analysis Questions

1. Why weren't the values you obtained the same as those obtained by your lab partners?

2. Why is it important to take measurements more than one time?
3. Use your data from your *Water Characteristics* handout to answer the following questions:
   
   a. How did your pH results compare to a normal pH for drinking water?
   
   b. How did your turbidity data compare to an acceptable turbidity value for drinking water?
   
   c. How did your dissolved oxygen data compare to an acceptable dissolved oxygen value for lake water?
   
   d. How did your calcium data compare to an acceptable salt concentration for drinking water?

4. Knowing what you now know, which of the water samples would you most likely taste if you were allowed to taste any of them? Justify your answer with evidence.

5. How does your answer to question #4 differ from the answer you gave when you first observed the water samples?

6. Which of the samples of water (A, B, C, D, or E) would most likely be acceptable water quality for the fish of Lake Mead? Justify your answer with evidence.
GRADE 6

ALIEN INVADERS!

POST-VISIT LESSON

Invasive Species Public Service Announcement
ALIEN INVADERS!

POST-VISIT OVERVIEW
The following post-visit activity is designed to synthesize and expand the knowledge students have gained in their Forever Earth experience by creating a Public Service Announcement (PSA) about an invasive species. By completing this activity, students re-analyze the impact of such species on an ecosystem and consider the value in educating and motivating the public in regard to invasive species.

THEME
Introduction of an invasive species upsets the balance of an ecosystem.

KEY QUESTIONS
What effect can an invasive species have on an environment? What, if anything, can or should be done to prevent or control the introduction of an invasive species?

GOAL
Students will determine the costs and benefits of selected invasive species on the environment.

OBJECTIVE
Students will write a public service announcement (PSA) on the environmental costs of invasive species.

NEVADA STATE STANDARDS CORRELATION
L.8.C.3. Students will evaluate how changes in environments can be beneficial or harmful.
L.8.C.4. Students know inter-related factors affect the number and type of organisms an ecosystem can support.
E.L.A. 6.6.2 Use organizing techniques appropriate to the purpose of writing.
E.L.A. 6.6.6 Produce writing with a voice that shows awareness of intended audience and purpose.
E.L.A. 6.6.7 Share final drafts with a designated audience.
E.L.A. 9.6.2 Develop and deliver presentations that include media aids appropriate to audience and purpose.

CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 6)
Students will:
• discuss the costs and benefits of human-caused changes in the environment; and
• use examples to describe how interrelated factors influence the number and type of organisms an ecosystem can support.
SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME

CORRELATIONS

The post-visit grade 6 activities support the following guiding themes developed by Clark County-based educators:

- Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.
- Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

PREREQUISITE CLASSROOM EXPERIENCES

- Classroom lesson on introduced/invasive species
- Forever Earth field trip

VOCABULARY

- descriptive, informative, and persuasive writing
- invasive species
- public service announcement (PSA)

- slogan
- target audience

POST-VISIT LESSON: Invasive Species Public Service Announcement

Part 1  Introduction

Students are told that they will apply what they've learned about invasive species (such as zebra mussels) to produce a public service announcement (PSA) to get the word out to the public about these "alien invaders."

Students are presented with examples of print, video, audio advertisements, and public service announcements (PSAs).

The teacher discusses the differences between marketing products and selling ideas (i.e., between commercial advertisements and PSAs).

PSAs from the National Weather Service such as "Flooding Ahead; Turn Around; Don't Drown," can be downloaded from: www.nws.noaa.gov/os/water/tadd/tadd-resources.shtml

PSAs on topics such as boat and water safety and harmful exotic

TIME 30-60 minutes

MATERIALS

Print, video, and audio advertisements and public service announcements
TV/VCR
Audio tape recorder
Computer with Internet access
species can be downloaded from:
www.dnr.state.mn.us/news/psas/index.html

PSAs on Aquatic Nuisance species can be downloaded from:
www.100thmeridian.org/video.asp

Commercials can be downloaded from:
http://video.google.com/superbowl.html

Part 2 ▶ Digging Deeper
The teacher facilitates a class discussion about the following topics and concepts:

1. Target audiences. How do advertisements, commercials, and PSAs differ according to the age, gender, or special interests of the audience?

2. Images. Do the images inform, persuade, stir up emotion, enhance the message, or appeal to certain audiences? What makes the images dramatic or memorable?

3. Special effects or techniques. How are sound effects, music or songs, celebrities, humor, or emotion used to make the advertisement, commercial, or PSA more effective or memorable?

Students categorize the messages of the advertisements, commercials and PSAs according to the intended purpose. Is the purpose to present a description, to provide information, or to persuade?

Students brainstorm memorable messages or slogans from advertisements, commercials, and PSAs. Students discuss how a short descriptive slogan can capture the message (Student Reference: Catchy Slogans/Messages).

Part 3 ▶ Concept Development
Begin by having students recall the definition of invasive species. Connect their recall with what they learned about zebra mussels during the Forever Earth field trip.

TIME 30-60 minutes
MATERIALS
Science Textbook
Computer with Internet access
Note taking materials
Students select and research an invasive species (Student Reference: Invasive Species). Students should take notes on the geographic area of origin and on the ecological and economic impacts caused by their selected invasive species.

Part 4  Linkage and Presentation of Findings
Students work in pairs to plan and write a 30 or 60 second PSA urging the public to:

• prevent the introduction of zebra mussels into Lake Mead; or
• advocate for control of another invasive species.

Refer to Student Reference: Writing a PSA.

Have students practice reading their PSAs before sharing them with the rest of the class. Consider helping students to share their PSAs with:

• Peers at their school
• Forever Earth project manager
• Interpreters from the Lake Mead National Recreation Area
• Las Vegas Review-Journal, or local radio/TV station.

EXTENSIONS

• Students create a storyboard for a video PSA. On one side, include the message/slogan and sound effects or music. On the other side include the corresponding visual image. Film the PSA and send it to a television station.
• Create a PSA for radio. After recording it, send the PSA to a radio station that appeals to the target audience.
• Make a poster of the PSA.

RESOURCES

INVASIVE SPECIES INFORMATION ONLINE RESOURCES

100th Meridian Initiative
Information on how to help this organization stop the spread of zebra mussels is provided at:
www.100thmeridian.org/zebras.asp

Photos, posters, slogans to stop the spread of zebra mussel are available at:
http://www.100thmeridian.org/photos.asp

The Biodiversity Partnership
This document lists the name, type, origin, extent and damage caused by invasive species in Nevada:
www.biodiversitypartners.org/invasive/factsheets/NV.pdf

Bureau of Land Management (BLM)
BLM's war against weeds in Nevada is described at:
www.nv.blm.gov/Resources/noxious_weeds_revised.htm

Center for Invasive Plant Management
Learn how one organization supports natural resource managers, scientists, and educators pursuing ecological approaches to invasive plant management at:
www.weedcenter.org/

University of Nevada, Reno
Wanted Posters for Invasive Weeds can be found at:
http://www.ag.unr.edu/wsj/ipm/Wanted_posters/wpost.html

OTHER INVASIVE SPECIES RESOURCES
Order a free "Zebra Mussel Watch" wallet-sized card that describes the zebra mussel problem; explains how to identify it; and offers suggestions for preventing its accidental transport into new territory.
http://seagrant.wisc.edu/zebramussels/orderform.asp


PSA-WRITING RESOURCES
Press Release Writing Tips: How to Write Public Service Announcements

Marketing Your Message: PSA Bibliography
www.psaresearch.com/

The R-J Speakers Bureau: Free speakers in Marketing and Advertising 387-2944

ADAPTATIONS FOR DIVERSE LEARNERS

- Consult with Forever Earth project manager prior to field trip to discuss specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
- Assign preferential seating.
- Allow peer readers and writers.
- Provide samples of finished products as models.
- Create graphic organizers.
• Pre-teach critical vocabulary.
• Establish and teach rules that communicate expectations.

**ASSESSMENT**

Brainstorm the qualities of a good PSA with the students; discuss quality standards; assist the students in the creation of a rubric.

Students may evaluate their own work through reflective journal entries.

Conduct a peer review in class. After students share their PSAs, students give the presenter(s) one commendation and one recommendation.
GRADE 6

ALIEN INVADERS!

POST-VISIT LESSONS • SUPPORT MATERIALS
### Products and Services

<table>
<thead>
<tr>
<th>Company</th>
<th>Slogan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple Computer – iPod</td>
<td>&quot;50,000 songs in your hand&quot;</td>
</tr>
<tr>
<td>Britney Spears – Curious</td>
<td>&quot;Do You Dare?&quot;</td>
</tr>
<tr>
<td>Capital One</td>
<td>&quot;What's in your wallet?&quot;</td>
</tr>
<tr>
<td>Cingular Wireless</td>
<td>&quot;Raising the bar&quot;</td>
</tr>
<tr>
<td>HBO</td>
<td>&quot;It's not TV; it's HBO.&quot;</td>
</tr>
<tr>
<td>Las Vegas</td>
<td>&quot;What happens here, stays here.&quot;</td>
</tr>
<tr>
<td>Nike</td>
<td>&quot;Just do it&quot;</td>
</tr>
<tr>
<td>PlayStation 2</td>
<td>&quot;Live in your world; play in ours.&quot;</td>
</tr>
<tr>
<td>State Farm Insurance</td>
<td>&quot;Like a good neighbor, State Farm is there.&quot;</td>
</tr>
<tr>
<td>Verizon Wireless</td>
<td>&quot;Can you hear me now?&quot;</td>
</tr>
</tbody>
</table>

### Public Service Announcements

<table>
<thead>
<tr>
<th>Organization</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Crime Prevention Council</td>
<td>&quot;Take a bite out of crime!&quot;</td>
</tr>
<tr>
<td>National Highway Traffic Safety Administration</td>
<td>&quot;Click It or Ticket&quot; and &quot;You could learn a lot from a dummy. Buckle Up.&quot;</td>
</tr>
<tr>
<td>Partnership for a Drug-free America</td>
<td>&quot;This is your brain. This is your brain on drugs. Any questions?&quot;</td>
</tr>
<tr>
<td>U. S. Forest Service</td>
<td>&quot;Give a hoot, don't pollute.&quot;</td>
</tr>
<tr>
<td>United Negro College Fund</td>
<td>&quot;A mind is a terrible thing to waste.&quot;</td>
</tr>
<tr>
<td>U.S. Department of Transportation</td>
<td>&quot;Friends Don't Let Friends Drive Drunk&quot;</td>
</tr>
<tr>
<td>COMMON NAME</td>
<td>SCIENTIFIC NAME</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>African malcolmia</td>
<td>Malcolmia africana</td>
</tr>
<tr>
<td>Arabian grass</td>
<td>Schismus arabicus</td>
</tr>
<tr>
<td>Asian longhorn beetle</td>
<td>Anoplophora glabripennis</td>
</tr>
<tr>
<td>Athel</td>
<td>Tamarix aphylla</td>
</tr>
<tr>
<td>Barbwire Russian thistle</td>
<td>Salsola paulsenii</td>
</tr>
<tr>
<td>Brown tree snake</td>
<td>Boiga irregularis</td>
</tr>
<tr>
<td>Camelthorn</td>
<td>Alhagi pseudoalhagi</td>
</tr>
<tr>
<td>Cheatgrass</td>
<td>Bromus tectorum</td>
</tr>
<tr>
<td>Hydrilla</td>
<td>Hydrilla verticullata</td>
</tr>
<tr>
<td>Kudzu</td>
<td>Pueraria lobata</td>
</tr>
<tr>
<td>Malta star thistle</td>
<td>Centaurea melitensis</td>
</tr>
<tr>
<td>Mediterranean grass</td>
<td>Schismus barbatus</td>
</tr>
<tr>
<td>Mexican paloverde</td>
<td>Parkinsonia aculeate</td>
</tr>
<tr>
<td>New Zealand mudsnail</td>
<td>Potamopyrgus antipodarum</td>
</tr>
<tr>
<td>Nile perch</td>
<td>Lates niloticus</td>
</tr>
<tr>
<td>Nutria</td>
<td>Myocastor coypus</td>
</tr>
<tr>
<td>Oleander</td>
<td>Nerium oleander</td>
</tr>
<tr>
<td>Purple loosestrife</td>
<td>Lythrum salicaria</td>
</tr>
<tr>
<td>Red brome</td>
<td>Bromus madritensis ssp. rubens</td>
</tr>
<tr>
<td>Russian knapweed</td>
<td>Acroptilon repens</td>
</tr>
<tr>
<td>Sahara mustard</td>
<td>Brassica tournefortii</td>
</tr>
<tr>
<td>Saltcedar, salt bush, or tamarisk</td>
<td>Tamarix ramosissima</td>
</tr>
<tr>
<td>Starling</td>
<td>Stumus vulgaris</td>
</tr>
<tr>
<td>Tall whitetop</td>
<td>Lepidium latifolium</td>
</tr>
<tr>
<td>Tiger mosquito</td>
<td>Aedes albopicicus</td>
</tr>
<tr>
<td>Tree tobacco</td>
<td>Nicotiana glauca</td>
</tr>
<tr>
<td>Zebra mussel</td>
<td>Dreissena polymorpha</td>
</tr>
</tbody>
</table>
Student Reference:
WRITING A PUBLIC SERVICE ANNOUNCEMENT

A Public Service Announcement, also known as a PSA, is a short message that takes 30 to 60 seconds to say on radio, television, or the Internet. PSAs can also be printed in magazines, the newspaper, or even on billboards. PSAs call attention to issues that affect people's lives. They notify or warn the public about the possible consequences of an action. PSAs raise awareness. They don't sell products. Your job is to write a 30 to 60 second PSA and create a “catchy” jingle or slogan about invasive species.

WHAT DO WE KNOW?
Through your classes and your Forever Earth field trip, you have learned answers to the question, “What effects can an invasive species have on an environment?” Now, your job is to write a PSA that addresses the question, “What, if anything, can or should be done to prevent or control the introduction of an invasive species?” Working with a partner, write a 30 or 60 second public service announcement urging the public to:
• prevent the introduction of zebra mussels into Lake Mead; or
• control the spread of invasive species such as tamarisk, cheat grass, brassica, or Russian thistle.

WHAT DO WE DO?
You have already been given a handout of some catchy slogans that are part of actual PSAs. Now it's time to plan your own PSA. Consider the following tips for writing a PSA:

• Get ideas for your PSA by watching local TV and listening to local radio stations.
• Select your target audience. Appeal to their interests, e.g., boating, fishing, birding, camping, or environmental protection.
• Research your invasive species.
• Brainstorm all the possible messages about your invasive species that you could include in your PSA. Then select the most important message to get across to the listener/viewer.
• Double check your facts. It is important for your message to be accurate.
JUST DO IT! WRITE AND FINALIZE YOUR PSA

- Look for a "hook" for your PSA such as music, humor, an attention-grabbing fact, or a frightening prediction; it is important to immediately capture the attention of the listener/viewer.
- Write the copy (text) for your PSA.
- Select background music and scenery to make your message appealing.
- Test your message aloud. A PSA should be brief, clear, and dramatic: since they are 60 seconds or less, make every word count.
GRADE 7

GSI
Geo Scene Investigation!

ON-SITE PROGRAMMING

2008/2009 Edition
OVERVIEW

Geologists are scientists who study the structure and history of the Earth and its processes. Like detectives, geologists work to unravel the mysteries of the landscapes we see today using clues left behind by the geologic events that formed them. Through Forever Earth, students can get close to fascinating geological features and landforms to better understand the geologic processes that have shaped the Mojave Desert.

GSI: Geo Scene Investigation! introduces students to the differences between observations and interpretations and to some of the fundamental principles of geology. Students identify specific geologic processes and landforms in the landscape surrounding them at Lake Mead National Recreation Area (NRA) by solving mysteries with a set of geology-related clues.

OUTLINE

On-Site Programming

On-site programming includes activities that take place aboard Forever Earth and activities that take place on shore (typically the Callville Bay picnic area). For a large group, it is convenient to split the students into two or more groups. One or more groups can participate in the shore-based activities while one group is aboard Forever Earth; student groups switch when the Forever Earth group returns to the marina.

Forever Earth

Part 1 ➔ Welcome, Introductions, and Safety Talk
Part 2 ➔ Introduction: CSI? and GSI!
Part 3 ➔ Geology of Lake Mead (Overview)
Part 4 ➔ a. Gathering Knowledge 
           b. Interpreting the Landscape
Part 5 ➔ Synthesis: Applying Our Knowledge Beyond Lake Mead

Shore

Walk the Line – Lake Mead Geology
The Rock Cycle – Rock and Role

Corresponding Pre-Visit Lessons

- Topographic and Geologic Maps
- Lake Mead Geologic WebQuest
Corresponding Post-Visit Lesson

- Geologic Art Activity

**THEME**

The landscape reveals its story in the features and formations you see today.

**KEY QUESTIONS**

What geologic forces and processes created the landscape in Lake Mead National Recreation Area?
What forces and processes are still at work today?

**GOAL**

Students will demonstrate understanding of the geologic forces and processes that created the landscape in Lake Mead NRA and the forces and processes that continue to impact and shape today's landscape.

**OBJECTIVES**

Students will:
- explain how observations and interpretations are different;
- recognize different geologic landforms and processes on the Lake Mead landscape;
- identify common rocks and minerals of the Lake Mead area; and
- apply their knowledge of geologic landforms and processes to other areas in Southern Nevada and in the Southwest.

**NEVADA SCIENCE CONTENT STANDARDS**

N.8.A.3. Students know different explanations can be given for the same evidence.
N.8.A.6. Students know scientific inquiry includes evaluating results of scientific investigations, experiments, observations, theoretical and mathematical models and explanations proposed by other scientists.
N.8.B.2. Students know scientific knowledge is revised through a process of incorporating new evidence gained through on-going investigation and collaborative discussion.
E.8.C.1. Students know sedimentary rocks and fossils provide evidence for changing environments and the constancy of geologic processes.
E.8.C.2. Students know how rocks at the Earth's surface weather, forming sediments that are buried, then compacted, heated and often re-crystallized into new rock.
E.8.C.5. Students know how geologic processes account for state and regional topography.

**CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 7)**

Students will:
- give examples of how different explanations can be given for the same evidence;
- distinguish between sedimentary, igneous, and metamorphic rocks;
• describe how water can exert forces (physical weathering) on landforms;
• describe how water, wind, glaciers, and gravity contribute to erosion;
• describe how landforms are the result of a combination of constructive and destructive processes; and
• describe the geologic processes that are responsible for the Great Basin region, Lake Tahoe, the Sierra Nevada Mountains, earthquakes in Nevada, Spring Mountain Range, Red Rock Canyon, and Valley of Fire.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME
CORRELATIONS
The on-site grade 7 activities support the following theme statement developed by Clark County-based educators:
• Sub theme 2. We share the intriguing stories of Southern Nevada’s diverse, interconnected natural world.
This sub theme is derived from the guiding theme statement: Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.

PREREQUISITE CLASSROOM EXPERIENCES
Classroom Visit. A pre-visit classroom trip will be made by Forever Earth or National Park Service staff to introduce students to the Forever Earth program and what to expect during their field trip. Students learn and agree to the “conduct rules” of Forever Earth, understand basic water safety concepts, and observe how and when to put on a Personal Flotation Device (PFD) during their time aboard Forever Earth.

VOCABULARY
• constructive processes
• cross-bedding
• destructive processes
• erosion
• igneous
• interpretation
• lava flow
• mass wasting
• metamorphic
• observation
• relative aging
• sedimentary
• tilting
• wash
• weathering

ON-SITE ACTIVITIES: Forever Earth

Part 1  Welcome, Introductions, and Safety Talk
Forever Earth staff greets students, welcomes them to Lake Mead National Recreation Area and Forever Earth and introduces the concept of National Parks and public lands, emphasizing that the field trip is taking place on public lands. Facilitator Reference: Lake Mead NRA Fast Facts contains information to answer common questions about Lake Mead. The Captain or facilitator leads the safety presentation (see Facilitator Reference: Safety Talk Outline).

Part 2  Introduction: CSI? and GSII
This activity introduces students to the differences between
observations and interpretations and to some of the fundamental principles of geology.

The facilitator displays the mystery drawing on the television monitor. After giving the students time to view the drawing, the students are asked for their observations. The observations are listed on chart paper.

Students are then asked to volunteer their interpretations about the sequence of events that happened. Time is allowed for debate and arguing competing hypotheses. The discussions are used to highlight the difference between observation and interpretation.

Geologic images from the powerpoint presentation (Demonstration: Interpreting What You See) are used to show how geologists use observation skills to gather evidence before making interpretations of what they’ve seen. The students’ interpretations of the mystery drawing are used to draw parallels to geologic principles. (See Facilitator Reference: Notes for Interpreting What You See.)

**Part 3  Geology of Lake Mead (Overview)**

A brief overview of Lake Mead's geology is provided using the surrounding landscape or Lake Mead Geology Time Lapse DVD (Facilitator Reference: Overview of Lake Mead Geology).

The major stages of Lake Mead’s geologic history are represented as acts of a play. Use visual aids representing the act numbers and descriptive act titles. After describing the events that took place during an act, randomly distribute the title and act number to students. After all the acts have been described, have the students place the titles in correct sequential order.

**Part 4a  Gathering Knowledge**

Students learn about some of the area’s common rocks and minerals while earning geo-points to be used in the next part of this activity. Students are divided into two groups and within these groups, subdivided into smaller groups of 2-3 students each. For this activity, the subgroups are “competing” against each other, but are also working together in competition against the other large group.

Each subgroup is given a laboratory specimen kit containing rocks and minerals.
minerals common to the Lake Mead area. Using provided reference books, field guides, and other information, students acquire knowledge about each of the specimens and share that knowledge with the facilitators. Geo-points are earned based on the knowledge gained; the points are needed for the next part of the activity.

Part 4b  Interpreting the Landscape

In this part of the activity, students identify specific geologic processes and landforms in the surrounding landscape by solving a set of clues.

The two large groups are separated physically by having one group use the upper deck and by having the other group use the main cabin. (The groups switch areas before the boat arrives at the next predetermined location.)

At a pre-arranged location on the lake, each subgroup of students is given a clue (Student Activity Material: Clue Cards) that may or may not be enough information to find a certain geologic feature. All subgroups are looking for the feature. If a sub-group cannot solve the mystery, it can “buy” another sub-group’s clue, using the geo-points earned earlier. The facilitator has an obvious clue that gives away the answer if a sub-group is unable to solve the mystery after buying all the other available clues (Facilitator Reference: Clue Card Text).

When a sub-group solves a mystery, students use their PDA to take a digital photo of the feature. The photo is shown to the facilitator for verification.

The procedure is repeated until all the mysteries have been solved at that particular location. In route to the next location, groups return to their laboratory kits to earn additional geo-points.

Part 5  Applying Our Knowledge Beyond Lake Mead

Students apply what they have learned about interpreting geologic processes and identifying geologic features to other landscapes in Southern Nevada and in the Southwest.

A set of cards is given to each group of students. Each card has either: 1) A photo of a regional landscape or geologic feature; and 2) A term or phrase that describes the geologic process or feature highlighted or pinpointed in the photo. Each photo card has one
matching descriptor card.

Students are asked to match the descriptor card to the photo card that provides the BEST match. When complete, the groups compare their matches and defend their choices when differences arise.

Closure for the field trip focuses on what students have learned about how geologists interpret the landscape, the major events in Lake Mead’s geologic history, and what geologic forces and processes are still at work today at Lake Mead.

(NOTE: Digital photos taken during the treasure hunt activity are downloaded onto a CD and given to the teacher for use in a post-trip activity. See the post-trip lesson, The Story in Art Project.)

ON-SITE ACTIVITIES: Shore

WALK THE LINE – LAKE MEAD GEOLOGY

In this activity, students take up positions along a trail to represent a specific time period and, subsequently, create a geologic timeline.
Students will:

• understand the immensity of geologic time.

Part 1 🔴 Welcome and Introductions
Forever Earth staff greet students. Students are divided into groups and given team lanyards. Facilitator welcomes students to Lake Mead National Recreation Area and Forever Earth and introduces the concept of National Parks and public lands, emphasizing that the field trip is taking place on public lands. Facilitator Reference: Lake Mead NRA Fast Facts contains information to answer common questions about Lake Mead.

Part 2 🔴 Introduction to Lake Mead Geology
The spectacular rock formations in the Lake Mead area tell the story of almost two billion years of geologic time. Evidence of past climates/environments and geologic processes are hidden in the multicolored rocks. How can you tell how old a rock is? How can you tell how old a person is?

Using material from Facilitator Reference: Overview of Lake Mead Geology, the facilitator leads a discussion about observational skills in the field and how geologists use positioning along with research to create a timeline for rocks. Landforms, rock types, geologic timescale, and geologic time are discussed. Facilitator records discussion on chart paper. Students are told that they will represent points in time along a geologic timeline.

Each student (or pair of students) is given a time period card for a specific geologic time period within the range of 1.7 billion years ago (BYA) to 5 million years ago (MYA); each time period card includes a description of the geologic time period it represents. Students use Student Reference: Geologic Time Scale to orient themselves in time.

Part 3 🔴 Walking the Line
Students review their time period cards as they walk together from the picnic area to the trailhead. Once at the trailhead, students order themselves by date in a timeline that begins with 5MYA and ends at 1.7 BYA.
At the trailhead, the student with the most recent time period will read his or her card aloud, explaining what was happening 5 MYA. Students continue to hike, stopping at 71-foot intervals stopping to read time period cards in order, until the end of the trail is reached and the last card representing the oldest point on our timeline, 1.7 BYA, is read.

Now the hike will be reversed, with each student dropping out at his or her "point" along the geologic timeline (the trail is the timeline and each student represents a point on the timeline). Once positioned at their individual points, students examine the landscape and try to imagine how their surroundings appeared during their period as described on the time period cards. They spend some time sketching the geologic footprint (as they imagine it) that was made during the period they represent. Once the last person (5 MYA) has stopped at his or her point to sketch, students are asked to look up and down the trail and observe themselves as points along a geologic timeline. The first person (1.7 BYA) may now return to the trailhead, with younger and younger time points joining in the return hike as they are reached.

At the picnic area, students tape together the geologic footprint sketches in order, from oldest to youngest, to create an illustrated geologic timeline of Lake Mead.

**Part 4  Conclusion**

The facilitator engages students in a discussion of what elements and features they included in their time period sketches and why. What was hard to imagine? What tools and skills do geologists use to re-create geologic processes back in time? How is geology different than other scientific fields like biology and chemistry?

**THE ROCK CYCLE – ROCK AND ROLE**

Students assume the role of one of the three different rock types and create a representation of the rock cycle.

Students will:
• distinguish between sedimentary, igneous, and metamorphic rocks;
• describe the rock cycle and processes that transform rocks; and
• discuss the implications of the rock cycle on the landscape.

Part 1  ▶ Welcome and Introductions
Forever Earth staff greet students. Students are divided into groups and given team lanyards. Facilitator welcomes students to Lake Mead National Recreation Area and Forever Earth and introduces the concept of National Parks and public lands, emphasizing that the field trip is taking place on public lands. Facilitator Reference: Lake Mead NRA Fast Facts contains information to answer common questions about Lake Mead. (Note: this part should be skipped if students have already been introduced and welcomed as part of another activity.)

Part 2  ▶ Introduction to Lake Mead Geology
The facilitator asks students about cycles on earth (life cycle, photosynthesis, water cycle, etc.) leading into a discussion of the rock cycle:
There are three major types of rocks: igneous, metamorphic, and sedimentary. Rocks change from one type to another over geologic time, and they are always on the move through the rock cycle. Different processes (such as heat and pressure) act on a rock to convert it into another rock type. When looking at a rock, how can we tell what rock type it might be? The facilitator leads a detailed discussion of major rock types, the rock cycle, and the processes at work in the rock cycle with information from Facilitator Reference: Rock Cycle.

Part 3  ▶ Rocking and “Role”-ing
Each student is assigned a rock and a role. The facilitator tapes a card with a rock type printed on it on to each student's back. The students are then given a clipboard with student reference sheets attached. Students take turns showing each other their backs and asking each other yes and no questions (Student Reference: Rock Classification Chart) to determine what type of rock they represent. Once they have correctly determined their rock types, they will draw their life/rock cycle, using Student Reference: Rock Cycle Diagram for reference.

Students will then act out the rock cycle as a group skit. Some students retain their previous rock type roles and others are newly

TIME 60 minutes
MATERIALS
Color-coded badges (colors indicate teams) attached to lanyards
Facilitator Reference: Lake Mead NRA Fast Facts

Facilitator Reference: Rock Cycle
Rock-type cards, tape, blank paper, sketching materials
Student Reference: Rock Classification Chart
Student Reference: Rock Cycle Diagram
assigned the various processes acting on rocks in the rock cycle (e.g., heat and pressure, melting, cooling, weathering and erosion, and compaction). Students are encouraged to assemble themselves into a large rock cycle by looking at the Student Reference: Rock Cycle Diagram.

If time allows, the facilitator takes students on a short hike around the area looking for rocks and rock formations representing the various stages of the rock cycle. During the hike, the facilitator points out small rock examples and large landscape-level examples of rocks at various stages in the rock cycle. Students are encouraged to discuss the rock cycle in terms of its impact on the landscape.

Part 4 ▶ Conclusion
Once the hike is completed, students recap the rock cycle. Students take turns describing portions of the rock cycle in the style of a travelogue, travel brochure, or commercial.

ADAPTATIONS FOR DIVERSE LEARNERS
- Consult with teachers prior to field trip to determine specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
- Implement peer assistance by involving teachers in the process of creating color teams.
- Provide diagrams, photos, or other visual organizers as appropriate for processes and techniques.
GRADE 7

GSI
Geo Scene Investigation!

ON-SITE PROGRAMMING • SUPPORT MATERIALS
Interpreting what You See is a PowerPoint presentation developed by the U.S. Geological Survey as part of Lesson 3 (GeoSieuth) of its School Yard Geology program.

The power of this exercise is that it exposes students to geology within a context that they can understand. The process of examining a mystery scene highlights general observational skills, which are also essential in the study of geology. Geology is actually lot like detective work. One must use common sense along with fundamental principles. In this lesson, many geology principles are presented in a non-geologic context and then related to their geological application.

http://education.usgs.gov/schoolyard/

Note that the actual PowerPoint file includes animations.
What happened here?

Tilted shales and sandstones in Rainbow Basin, near Barstow, California.
Facilitator Reference:
NOTES FOR INTERPRETING WHAT YOU SEE

<table>
<thead>
<tr>
<th>Slide</th>
<th>Graphic</th>
<th>Narrative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>Title slide; Mystery Drawing</td>
<td>Now that we've learned how observation and interpretation are different, let's take a look at how the same detective skills that we used for this mystery can also be applied to geology.</td>
</tr>
<tr>
<td>3</td>
<td>Layers on Top of Layers, Timing</td>
<td>One of the basic principles or rules of geology is that when layers of rocks are deposited, they usually start out flat or horizontal. This is because they often form under water where individual grains of sediment settle down to the bottom of the ocean, lake, or stream. Settling leads to horizontal layers. We can also tell something about the sequence of events. The oldest layers are on the bottom, and younger, new layers get added on top of what is already there.</td>
</tr>
<tr>
<td>4</td>
<td>Mystery Drawing; Arrow Depictions</td>
<td>In our drawing, what examples can you find of horizontal layering and timing of events? Man and rug are placed horizontally. The man is on top of the rug, so he had to fall AFTER the rug was placed on the floor.</td>
</tr>
</tbody>
</table>
| 5     | Relative Dating, Absolute Dating | Geologists are interested in how old things are and when things happened. They describe how something is in two ways. You can usually tell which rocks are older because the oldest rocks are on the bottom. This description describes the relationship between the ages and positions of different layers. This is called "relative dating."

It’s also possible to tell how old a rock layer is by measuring the decay of uranium or other radioactive elements found in rocks (it’s similar to carbon-14 dating). This is called “absolute dating.” |
| 6     | Mystery Drawing; Arrow Depictions | Can you find an example of relative dating in the drawing? Rug came first, then man on top of rug. Papers were on desk, then coffee spilled on papers.

There are two examples of absolute dating in the drawing? Wrist watch on the man. Calendar open on the desk. |
| 7     | What happened here?       | These are tilted layers. When we discover layers that are no longer horizontal, we know that something must have happened. They started out flat, or else they wouldn’t form such nice layers. Then at a later time, they must have been tilted. Again, we can discover the sequence of events from looking at the shapes and positions of layers.

Which are the oldest rocks in the photo? The ones on the left side; the youngest rocks are on top of these, at the back right. |
| 8     | Tilted shales and sandstones | This is another example of tilted layers. |
| 9     | Unconformity              | Sometimes layers give an indication of many events. First, there was a set |
of layers laid down flat. Then they got tilted like the previous photo. Over time, the tips of the layers got eroded down into a new, flat surface. Then another set of flat layers got deposited on top.

This feature is called an "unconformity" because one set of layers does not fit in with tilting of the other set of layers (it doesn't conform). In other words, something is missing.

| 10 | Mystery Drawing; Arrow Depictions | What unconformity can you find in our mystery drawing? In other words, what is obviously missing?
The cord extending from the wall to the desk indicates that something, maybe a telephone or a computer, might be missing. |
| 11 | Cross Cutting | Sometimes, layers get cut by something else. Here, the reddish-brown layers were deposited horizontally. Then the dark layer cut across all the other layers. We know the dark layer is younger because you can’t cut layers until they have been deposited. This dark layer was originally molten magma that was squeezed into the layers as it fought its way towards the surface and then eventually solidified. |
| 12 | Mystery Drawing; Arrow Depictions | What example of cross cutting can you find in the mystery drawing?
Coffee spilled onto the papers. The papers were there before the coffee spilled. |
| 13 | Sand Dune Process | The sand dune on the left is being shaped by the wind today. Sand dunes are an example where you form layers that are not horizontal. The rocks with the wispy layers on the right are ancient sand dunes, and you see a bunch of different layers. We can use this knowledge of the process of sand dune growth to learn about ancient wind patterns. Because the layers on the right are in all different directions, we can learn that the wind direction must have changed over the years when these rocks were deposited. |
| 14 | Mystery Drawing; Arrow Depictions | Is there an indication of wind direction in the mystery drawing?
The curtains tell us which way the wind is blowing.
How about the cup? Did the wind blow it over?
Probably not, because the cup would have fallen in a different direction. |
Facilitator Reference:  
OVERVIEW OF LAKE MEAD GEOLOGY

Events that date from the very beginning of the Earth set the stage for the birth of the Colorado River.

What happened geologically to produce the landscape we see today? What was the stage like that ultimately produced the Colorado River? What are the processes that are still at work today?

To begin exploring and discovering the answers to these questions, we can look at what’s happened in the past and also examine the clues that are evident on today’s landscape. Lake Mead’s geologic past can be organized like acts in a play. These geologic “acts” represent the area’s significant geologic events. The acts are not equal in terms of time (millions of years), nor is all geologic time accounted for during this “play.”

ACT I
Two Kinds of Seas: Sea of Water, Sea of Sand (185-560 mya)
During this time, Lake Mead NRA would have been submerged below a sea. Lots of plants and animals accumulated along shoals and reefs. When they died, skeletons accumulated on the bottom in layers along with fine sediments, forming sedimentary rocks such as shale and limestone. Gypsum-rich silts were also deposited during this time.

The seas retreated and desert replaced the sea. Winds howled, and huge dunes formed. The climate was similar to the Sahara Desert.

What else was happening on Earth during this time period? The first fish and land plants appeared; there were mass extinctions; the first mammals appeared.

ACT II
STRETCH! Basin and Range (20-37 mya)
Changes in crustal plates caused thinning and cracking of the earth’s crust. Mountains were uplifted and valleys dropped down. This formed the existing “basin and range” topography.

What else was happening on Earth during this time period? The Age of Dinosaurs had already passed during intermission between Acts I and II; the Rocky Mountains had also formed by this time.

Act III
KABOOM! Volcanoes! (5-13 mya)
As the crust was stretched, cracks or faults formed. Volcanoes and lava flows erupted. Rocks were tilted, folded, and moved. A fault that cut through a strato volcano ripped it into two pieces that are now 12 miles apart (Hamblin Cleopatra Volcano).

The volcanic episodes became less explosive and basalt erupted out of cinder cones onto the top of valley fill forming black-capped mesas like Fortification Hill and Callville Mesa.

Act IV
A River is Born! (5 mya to present)
A small stream flowing south from the Lake Mead area cut through a set of cliffs and captured an older river flowing east. This became the Colorado River, carving canyons and eroding deep valley deposits. Prior to this, the geologic story was one of building rock layers. The river changed the story to one of erosion and down cutting. The processes at work today are visible everywhere: weathering and erosion by a variety of agents.

What else was happening during this time period? Early ancestral humans appear in the fossil record during this time period; much of North America was covered by ice for almost two million years.
Rock I.D. Dichotomous Key

Geo Scene Investigation G.S.I.

1. Place 1 drop of HCl on the rock. Does it react by fizzing a lot?
   - A. Yes.  
     limestone
   - B. No.
     (go to #2)

2. Are there obvious crystals?
   - A. Yes.
     (go to #3)
   - B. No.
     (go to #5)

3. Is the specimen dark in color?
   - A. Yes.
     basalt
   - B. No.
     (go to #4)

4. Is the rock coarse-grained (big grains) or fine-grained (small grains)?
   - A. Yes.
     granite
   - B. No.
     rhyolite

5. Are the grains rounded?
   - A. Yes.
     sandstone
   - B. No.
     (go to #6)

6. Does the specimen have grains too small to see, and is it soft and crumbly?
   - A. Yes.
     shale

Sample Table:

<table>
<thead>
<tr>
<th>sample no.</th>
<th>identity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
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<tr>
<td>8</td>
<td></td>
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</tr>
<tr>
<td>11</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
1. What color was left on the streak plate by the mineral?
   A. Black.
   B. NOT Black. (go to #2)
   galena

2. Is the mineral harder than glass?
   A. Yes. (go to #3)
   B. No. (go to #4)

3. What color and luster does the mineral have?
   A. White and glassy.
   B. Cream-colored to pink in color with some shiny glassy surfaces.
   quartz
   feldspar

4. Does the mineral react with HCl?
   A. Yes.
   B. No. (go to #5)
   calcite

5. Can paper-thin sheets peel off the mineral?
   A. Yes.
   B. No.
   mica
   gypsum
Mineral I.D. Worksheet
Geo Scene Investigation G.S.I.

Physical properties used to identify minerals

A. **color** Record the color of the sample. For example: white; gray; pink; black; etc.

B. **streak** This is the color of the mineral when powdered. To test for streak, draw the mineral against the streak plate (the white porcelain tile in your kit). Record the color left on the streak plate.

C. **luster** This is the way a mineral reflects light. Does it have a metallic luster, a shiny and gold or silver color? Does it have a nonmetallic luster (does not look like a metal in color, but still may be shiny)? If it has a nonmetallic luster, record one of the following descriptors: pearly; glassy; resinous (has the appearance of resin); silky; or earthy (dull).

D. **hardness** This is a mineral’s resistance to scratching. Draw the mineral against the glass plate. If it leaves a scratch on the glass, the mineral is harder than glass. If no scratch is seen, the mineral is not harder than glass. Record “yes” or “no” in the table.

E. **reaction with dilute hydrochloric acid** Place one drop of HCL on the sample. Look for “fizzing” as evidence of a reaction. Record “yes” or “no” in the table.

<table>
<thead>
<tr>
<th>sample no.</th>
<th>color</th>
<th>streak</th>
<th>luster</th>
<th>harder than glass?</th>
<th>reacts with HCl?</th>
<th>identity</th>
</tr>
</thead>
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</table>

After recording properties (A-E), use the key to identify the mineral. Record the name of each mineral in the last column.
**Student Reference:**

ROCK AND MINERAL CLASSIFICATION PROCESS

---

### rock sample

1. Identify the rock sample.
2. Is it igneous, sedimentary, or metamorphic?
3. What are the key components or chemicals that make up this rock?
4. How did this rock form?
5. How do people use this kind of rock?

### mineral sample

1. Identify the mineral sample.
2. How is the mineral formed?
3. This mineral is the main component of what rocks?
4. How do people use this mineral?
1 QUARTZ
Non-metallic Mineral
Chemistry: SiO₂ (silicon dioxide)
Color: White, clear, pink, purple, brown, black
Luster: Glassy
Streak: White, but harder than streak plate
Hardness: 7.0
Specific gravity: 2.6
Source: Unnamed Prospect, T28S R61E Sec. 34, Clark

2 MICA
Non-metallic Mineral
Chemistry: K₂Al₂Si₃O₁₀(OH,F)_₂ (Potassium aluminum silicate hydroxide fluoride)
Color: White, silver, yellow, green, brown
Luster: Vitreous to pearly
Streak: White
Hardness: 2-2.5
Specific gravity: 2.8

3 CALCITE
Non-metallic Mineral
Chemistry: CaCO₃ (calcium carbonate, "fizzes" in hydrochloric acid)
Color: White, clear, yellow, pink, blue
Luster: Glassy to pearly
Streak: White
Hardness: 3.0
Specific gravity: 2.7
Source: Marigold Mine, Glamis Gold Inc., Humboldt Co., NV
|   | 4 | FELDSPAR  
(variety microcline)  
Metallic Mineral |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Chemistry:</td>
<td>KAlSi₃O₈ (potassium aluminum silicate)</td>
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<tr>
<td>Color:</td>
<td>White, cream</td>
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</tr>
<tr>
<td>Luster:</td>
<td>Vitreous, pearly</td>
<td></td>
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<tr>
<td>Streak:</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Hardness:</td>
<td>6.0</td>
<td></td>
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<tr>
<td>Specific gravity:</td>
<td>2.56</td>
<td></td>
</tr>
<tr>
<td>Source:</td>
<td>Crystal Peak, Sierra County, CA</td>
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</tbody>
</table>

|   | 5 | GYPSUM  
(variety selenite)  
Non-metallic Mineral |
<table>
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</thead>
<tbody>
<tr>
<td>Chemistry:</td>
<td>CaSO₄·2H₂O (hydrated calcium sulfate)</td>
<td></td>
</tr>
<tr>
<td>Color:</td>
<td>Clear, white</td>
<td></td>
</tr>
<tr>
<td>Luster:</td>
<td>Pearly, vitreous</td>
<td></td>
</tr>
<tr>
<td>Streak:</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Hardness:</td>
<td>2.0</td>
<td></td>
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<tr>
<td>Specific gravity:</td>
<td>2.3</td>
<td></td>
</tr>
</tbody>
</table>
GALENA
Metallic Mineral

Chemistry: PbS (lead sulfide)
Color: Lead gray, silvery gray, black
Luster: Metallic
Streak: Gray-black
Hardness: 2.5
Specific gravity: 7.3-7.6
Source: Doe Run Corp., Viburnum, MO
7
BASALT
(Igneous, Volcanic)

Description: Very finely crystalline; dark grey to purplish black rock. May contain olivine and orthopyroxene. Some samples may contain gas cavities (vesicles).
Age: Pleistocene or Holocene Epoch, up to 2 million years old
Location: The Crater, 4 miles north of Silver Peak on SR 265, T1S R39E Sec27, Esmeralda Co., NV

8
SHALE
(Sedimentary)
Layered Mudstone

Description: Very fine-grained, well-sorted. Breaks into layers. Generally soft but will not fall apart on wetting. Dark to gray to black color. Some invertebrate fossils.
Source: Diamond Peak Formation
Age: Late Mississippian to Early Pennsylvanian, 300-340 million years old.
Location: Roadcut approx. 4 miles NW of Elko, Elko Co., NV
9  SANDSTONE  
(Sedimentary)  

Description: Medium-grained sand (0.25-0.5 mm), well-sorted, moderately rounded quartz grains, cemented by iron oxide and calcite. Shows distinctive layering or bedding. Some faint cross-bedding may be visible.  
Source: Aztec Sandstone  
Age: Late Triassic – Early Jurassic Periods, approx. 200-215 million years old  
Location: Las Vegas Rock Quarry near Mt. Potosi, Spring Mtns., Clark Co., NV

10  LIMESTONE  
(Sedimentary)  

Description: Fine-grained blue-gray rock with 50% or more of the rock composed of calcium carbonate, primarily the mineral calcite. (Contains invertebrate fossils.)  
Source: Bird Spring Limestone  
Age: Pennsylvanian-Permian Periods, 240-330 million years old  
Location: T24S R58E SW ¼ Sec. 20, Goodsprings District, Clark Co., NV

11  GRANITE  
(Igneous, Intrusive)  

Description: Medium to coarsely crystalline rock, generally light colored, composed of quartz (gray, glassy), plagioclase feldspar (pinkish), biotite mica (dark brown-black, shiny round flakes) and hornblende (greenish-black rectangles). Solidifies inside crust, generally deep under volcanoes.  
Source: Sand Springs Pluton  
Age: Cretaceous Period, 78-82 million years old  
Location: Gote Flat, Sand Springs Range, T16N R32E Sec 34, Churchill County, NV
RHYOLITE
(Igneous, Volcanic)

Description: A finely crystalline, light colored rock composed of the same minerals as granite. May contain volcanic glass shards and vesicles (gas bubbles).
Source: Paintbrush Tuff
Age: Miocene Epoch - 12.4-13.2 million years old
Location: Stonewall Pass - road cut along US Hwy 95, Nye County, NV
Possible Location – Middle of the Lake

Relative Dating
- Which rock layer is older?
- Don't date your cousin!
- Wouldn't it be great if the older rock layers had gray hair?
- The youngest rocks are usually found in the top layers of rocks.

Igneous
- "Born of fire!"
- Tall, frothy espresso.
- There's a lot of this kind of rock around volcanoes.
- Not sedimentary or metamorphic.

Water Line
- Years of drought.
- Mineral crust left behind.
- 90-feet above the lake's surface??!! Sure doesn't look that high.
- Ring around the bathtub.

Sedimentary
- Jello desserts sometimes come in layers.
- You can often find fossils in this type of rock.
- Sandstone and limestone are examples of this type of rock.
- NOT metamorphic or igneous.

Lava Flow
- Burnt ketchup cooled in place.
- Black cap.
- A blast from the past.
- Magma that flows over the Earth's surface.

Possible Location – Swallow Cove

Cross-bedding
- Formed by currents of wind or water.
- Don't be cross with me.
• This sandstone can be very colorful, composed of sweeping lines that lie at a great variety of angles.
• Your mom might be cross with you if you don’t make your bed every morning.

Cross-cutting
• Young rock intrudes into older rock.
• Where young rock and old rock meet.
• “Cutting” in front of somebody in line is rude.
• Doesn’t look like a cross.
• Younger rock using in the geology cross walk.

Wash
• Can be shaped like a “W.”
• Green stuff! Life!
• Runoff area.
• Has nothing to do with a Laundromat.

Mass Wasting
• Totally wasted, man!
• Crash, BOOM – break away – it’s gravity man!
• BIG destruction.
• Mass of rock and soil slip down the slope.

Tilting
• Pinball wizards don’t do it.
• Confused layers.
• Unsettled sediments.
• You’ll “Tilt” your head when you find these layers.

Biological Weathering
• Rocks meet their match.
• Root it out.
• These green things have muscle.
• Plants and fracturing rocks.

Mechanical Weathering
• Instead of fixing things, this mechanic breaks them!
• Rock rotting.
• This destructive process attacks the weaknesses in rock surfaces.
• Breaking down rock into soil.

Erosion
• Crumbling rocks go mobile.
• Gone with the wind…or water!
• AKA “exfoliation.”
• The result on a grand scale: The Grand Canyon!

**Possible Location – Sandy Beach**

**Wave-cut Terraces**
• Water-made floor for break dancing.
• Shelves.
• Evidence of wave retreat.
• Benches formed by wave erosion.

**Coppice dunes**
• Pockets of life!
• Shady places for lizards, insects, and other small creatures.
• It all started when a single plant took root and started to grow!
• Vegetated mounds of sand.
Solutions to Clues

Geo Scene Investigation G.S.I.

Biological Weathering
Coppice Dunes
Cross-Bedding
Cross-Cutting
Erosion
Fault
Igneous
Limestone
Magma
Mass Wasting

Mechanical Weathering
Metamorphic
Relative Dating
Sandstone
Sedimentary
Tilting
Volcano
Wash
Water Line
Wave-cut Terraces or Platforms
Student Activity Material:
CARD SET WITH PHOTOS OF REGIONAL LANDSCAPES AND GEOLOGIC FEATURES AND DESCRIPTOR CARDS

Under Construction
# Geologic Time Scale

## Eon Era

<table>
<thead>
<tr>
<th>Geologic Time Scale</th>
<th>Present</th>
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<tbody>
<tr>
<td>Quaternary</td>
<td>Holocene 0.01</td>
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<tr>
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<td>Pleistocene 1.6</td>
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<tr>
<td>Neogene</td>
<td>Pliocene 5.3</td>
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<td></td>
<td>Miocene 23.7</td>
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<tr>
<td>Paleogene</td>
<td>Oligocene 36.6</td>
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<td>Eocene 57.8</td>
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<td>Paleozoic Cretaceous 66.4</td>
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<td>Jurassic 144</td>
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<td>Triassic 208</td>
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<td>Paleozoic Permian 245</td>
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<td>Pennsylvanian 286</td>
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<td>Mississippian 320</td>
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<td>Devonian 360</td>
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<td>Silurian 408</td>
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<td>Cambrian 505</td>
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<td>Proterozoic 570</td>
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<td>Archean 2500</td>
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<td>Hadean 3800</td>
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<tr>
<td>Precambrian 4550</td>
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(From Decade of North American Geology, 1983)
The Rock Cycle is a group of changes. Igneous rock can change into sedimentary rock or into metamorphic rock. Sedimentary rock can change into metamorphic rock or into igneous rock. Metamorphic rock can change into igneous or sedimentary rock.

Igneous rock forms when magma cools and makes crystals. Magma is a hot liquid made of melted minerals. The minerals can form crystals when they cool. Igneous rock can form underground, where the magma cools slowly. Or, igneous rock can form above ground, where the magma cools quickly.

When it pours out on Earth's surface, magma is called lava. Yes, the same liquid rock matter that you see coming out of volcanoes.

On Earth's surface, wind and water can break rock into pieces. They can also carry rock pieces to another place. Usually, the rock pieces, called sediments, drop from the wind or water to make a layer. The layer can be buried under other layers of sediments. After a long time the sediments can be cemented together to make sedimentary rock. In this way, igneous rock can become sedimentary rock.

All rock can be heated. But where does the heat come from? Inside Earth there is heat from pressure (push your hands together very hard and feel the heat). There is heat from friction (rub your hands together and feel the heat). There is also heat from radioactive decay (the process that gives us nuclear power plants that make electricity).

So, what does the heat do to the rock? It bakes the rock.

Baked rock does not melt, but it does change. It forms crystals. If it has crystals already, it forms larger crystals. Because this rock changes, it is called metamorphic. Remember that a caterpillar changes to become a butterfly. That change is called metamorphosis. Metamorphosis can occur in rock when they are heated to 300 to 700 degrees Celsius.
When Earth's tectonic plates move around, they produce heat. When they collide, they build mountains and metamorphose (met-ah-MORE-foes) the rock.

The rock cycle continues. Mountains made of metamorphic rocks can be broken up and washed away by streams. New sediments from these mountains can make new sedimentary rock.

The rock cycle never stops.

Retrieved from: www.cotf.edu/ete/modules/msese/earthsysflr/rock.html

Student Reference:
ROCK CYCLE DIAGRAM

Retrieved from: www.cotf.edu/ete/modules/msese/earthsysflr/rock.html
GRADE 7

GSI
Geo Scene Investigation!

PRE-VISIT LESSON

Topographic and Geologic Maps
**PRE-VISIT OVERVIEW**

Geologists are scientists who study the structure and history of the Earth and its processes. Like detectives, geologists work to unravel the mysteries of the landscapes we see today using clues left behind by the geologic events that formed them. Through Forever Earth, students can get close to fascinating geological features and landforms to better understand the geologic processes that have shaped the Mojave Desert.

GSI: Geo Scene Investigation! introduces students to the differences between observations and interpretations and to some of the fundamental principles of geology. Students identify specific geologic processes and landforms in the landscape surrounding them at Lake Mead National Recreation Area (Lake Mead NRA) by solving mysteries with a set of geology-related clues.

Two pre-visit activities have been designed to prepare students for the on-site experience. The first activity (described herein) introduces students to topographic and geologic maps and their respective purposes. The second activity (Lake Mead Geologic WebQuest) is an inquiry-oriented activity designed to introduce students to the geology, landforms, geologic processes, and geologic timeline of Lake Mead NRA.

**THEME**

The landscape reveals its story in the features and formations you see today.

**KEY QUESTIONS**

What geologic forces and processes created the landscape in Lake Mead National Recreation Area?
What forces and processes are still at work today?

**GOAL**

Students will demonstrate understanding of the geologic forces and processes that created the landscape in Lake Mead NRA and the forces and processes that continue to impact and shape today's landscape.

**OBJECTIVES**

Students will:
- understand a topographic map and its relationship to landforms and features of the area it describes.
- understand a geologic map and its relationship to the various types of rocks that exist in different locations.
- be able to discuss why the information provided by topographic and geologic maps is important and how they both contribute to our understanding of the landscape.
NEVADA SCIENCE CONTENT STANDARDS

E.8.C.5. Students know how geologic processes account for state and regional topography.

CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 7)

Students will:
- use charts, graphs, tables, and maps to identify trends and provide explanations of various landforms.
- critique explanations and evidence presented by peers.
- present results and data to class.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME

CORRELATIONS

The on-site grade 7 activities support the following theme statement developed by Clark County-based educators:
- Sub theme 2. We share the intriguing stories of Southern Nevada's diverse, interconnected natural world.

This sub theme is derived from the guiding theme statement: Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.

PREREQUISITE CLASSROOM EXPERIENCES

Lessons and discussions on:
- general purpose map use and reading (including direction and orientation)
- latitude and longitude (review if necessary)
  A short animated movie on latitude and longitude is available online at: www.infoplease.com/p/brainpop/latitudeandlongitude.html
- geology as a field of study
- igneous, metamorphic, and sedimentary rocks and specific examples and characteristics of each

Small group application in problem solving:
- formulating questions and analyzing problems
- using observations
- representing objects with symbols
- landmarks and orientation

VOCABULARY

- contour line
- geologic map
- igneous rock
- landform
- metamorphic rock
- observation
- sedimentary rock
- topography
- topographic map

PRE-VISIT LESSON: Geologic and Topographic Maps
Part 1  ▶ Introduction to Maps

This introductory activity is designed to review and strengthen students' general knowledge of maps and mapping.

1. Students are shown examples of different maps (e.g., road maps of states and cities, maps of the world, star maps, highway maps, small maps of regions that accompany news stories, and other maps as available). It would be especially useful to have different types of maps for the same place.

2. In groups of four, students brainstorm what types of information people can get from a map. The class shares their ideas, and the teacher records them on the board or on chart paper.

3. The teacher facilitates a discussion about the value of maps and the information that can be gained from them. Students consider (aloud or in their journals): Why did people start creating maps? Why do we need many different maps of the same location? Why can't a single map show all possible information about a place? What are the advantages and the disadvantages of different kinds of maps? Students should conclude that it is not possible to depict all of the possible information about a place on a single piece of paper, and that for a map to be understandable, it can contain only limited information.

4. Students are informed that over the next few days they will be learning about two types of special purpose maps (topographic and geologic) and the information that they can get from these maps. What they learn from these maps will help them better understand the earth and prepare them for a field trip on the Forever Earth houseboat at Lake Mead National Recreation Area.

Part 2  ▶ Topographic Maps

Topographic Maps: Topographic ("topo") maps demonstrate 3-D topography on a flat piece of paper with curved lines called contour lines. Contour lines connect points of the same elevation. If you were to walk along a single contour line, you wouldn't have to climb uphill or downhill. Elevation changes rapidly where lines are very close together (i.e., the area is very steep). Areas where lines are far apart...
have little elevation change (i.e., the area is relatively flat). The numbers you see on topographical maps are elevation in feet or meters.

1. Students are shown a topographic map. The teacher points out key features such as landforms (e.g., hills, valleys, cliffs, etc.), water features (e.g., streams, rivers, and lakes), and roads and other human-made structures. Students work alone and in small groups to answer questions on Student Worksheet: Reading Topographic Maps. (Note that the worksheet questions may be modified to suit the topographic map used.) The teacher reviews worksheet answers with the class and checks (see Teacher Reference: Key to Reading Topographic Maps) to make sure that students understand the basics of reading topographic maps.

2. In small groups (2-4 students), the class examines topographic maps of the local area. Groups can be given the same or different maps. See Resources (below) to obtain regional topographic maps. It is important that at least some of the maps provided include regions that will be visited on the Forever Earth trip. The teacher tells students that the topography learned in the classroom will be observed in real life on the field trip! Students answer the questions on Student Worksheet: Regional Topography.

**Part 3  Geologic Maps**

Geologic Maps: A geologic map shows the distribution of geologic features, including different kinds of rocks and faults. A geologic map is usually printed on top of a topographical map (the base map) to help the viewer locate him or herself on the map. The base map is printed with light colors, so it doesn’t interfere with seeing the geologic features on the map. The geology is represented by colors, lines, and special symbols unique to geologic maps. Understanding these features will allow you to understand much of the geology shown in almost any standard geologic map. The most striking features of geologic maps are its colors. Each color represents a certain kind of rock of a given age range.

1. Students review the types of rocks they have studied (sedimentary, metamorphic, and igneous, and specific examples and characteristics of each type). Students look at the table at the bottom of page R9 in their student text book. The teacher facilitates
a discussion on how geologists use information about the rocks in a specific area to help them understand the past. Ask the students questions such as: *How would you know by looking at the rocks that a volcano had erupted long ago in a particular area? What characteristics of a rock might make you believe that it is relatively "young" and was never very deep under the outer layer of rock and soil?*

The teacher explains that geologists display information about the rocks, faults, and other geologic features of a particular region on a special purpose map called a geologic map. Students look at the geologic map on page R10 in the student text. In small groups students discuss what information the map conveys. Each group should list 5 things that the map tells them. The class shares and discusses answers.

2. In small groups (2-4 students), the class examines geologic maps of the local area. Groups can be given the same or different maps. See Resources (below) to obtain regional geologic maps. Students complete Student Worksheet: Geologic Map of Local Area.

Next, students trace a portion of the geologic map onto tracing paper and use colors to shade the various types of rocks (discussed in Part 3.1, above) found in each location.

Students work as a team to develop a presentation about the area using the traced drawing and either real samples of rocks, or diagrams and descriptions (in students' own words) of rocks found in each location. Students can use actual rocks if they are available, or sketches, diagrams, and/or pictures from the internet or books.

**Part 4  Presentation of Findings**

Students share their geologic presentations with the class, and explain the processes they used to create them.

**Part 5  Synthesis and Closure**

Because they provide different information about the same location, both topographic and geologic maps add to our knowledge about the land. After completing the above topographic and geologic map activities, it is important that students demonstrate an understanding of the relationship between these two related tools, and the value of
these tools for a scientist studying the land.

This closing activity should help the students focus on the relationship between the maps, the advantages and disadvantages of each type of map, and it will also help prepare the students to discuss some of the features they will see during their field trip on Lake Mead.

Working in small groups (3-4 students), students develop a list of what they can learn by studying a topographic map. Have groups share with the class and record on the board or chart paper.

Working in the same small groups, have students develop a list of what they can learn by studying a geologic map. Have groups share with the class and record on the board or on chart paper.

Discuss what the students have learned, highlighting the advantages of each map and the value to a scientist (e.g. documents and identifies elevations; various landforms such as cliffs, hills, mountains, valley, water; locates and identifies different types of rocks; identifies features such as folds and faults; can help in understanding the history of the land.)

Have each group look once again at the maps of the local region. Ask them as a group to choose one small location* on the map they might like to explore. Have each group complete Student Worksheet: Where We Would Like to Explore. Then, have each group share their location information and why they would like to explore it with the class.

*Note: To guide students to choose locations they will actually be visiting, the teacher should consult with Forever Earth program manager to determine the areas at Lake Mead National Recreation Area where students will be traveling during their field trip. Remind students to look for their location when they are on the field trip.

The teacher concludes with the following:

Now we know how to use both topographic and geologic maps. In the next activity, Lake Mead Geologic WebQuest, and on our Forever Earth field trip, you will use this skill to help you identify landforms and the geologic processes that created them.
EXTENSIONS

- Advanced students can locate topographic maps and geologic maps online for homework.
- Students investigate other areas such as a favorite vacation spot or someone's birth place and identify topographical and geological differences between the chosen place and the local region.
- In the final activity of the lesson, students are asked to identify specific locations that they will be visiting (as part of the upcoming field trip). At the field trip site, students record what they observe at the pre-identified location. During the field trip, discuss how the information on the maps helped them identify the location.

RESOURCES

Student text book

General Websites
U.S. Geological Survey Topographic Map Symbols:
http://erg.usgs.gov/isb/pubs/booklets/symbols/

Prentice Hall's Science Explorer interactive 3-D topographic map simulation by ForgeFX *(requires shockwave player)*:
www.forgefX.com/casestudies/prenticehall/
click on "Play it" under the Topographic Map section

Geologic and Topographic Maps Online

U.S. Geological Survey site:
http://usgs.gov
www.usgs.gov/pubprod/

National Geologic Map Database (provides downloadable maps and hardcopy maps that can be ordered):
http://ngmdb.usgs.gov/

The following sites allow you to generate your own topographic maps, which can be printed at the size of your choice:
http://mapserver.maptech.com/homepage/index.cfm
www.topozone.com/

Local Map Retailers
Alan Bible Visitor Center (Lake Mead National Recreation Area)
Recreational Equipment Inc. (REI)
Sport Chalet

ADAPTATIONS FOR DIVERSE LEARNERS

- Consult with Forever Earth project manager prior to field trip to discuss specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
- Implement peer assistance by strategically forming student groups.
- For the geologic map exercise, replace tracing with the following: provide copies of an existing, uncolored geologic map and have students color it appropriately (students can make a color key or the teacher can provide a color key).

ASSESSMENT

The teacher checks to ensure that handouts are completed correctly. The teacher carefully listens to the geologic map presentation and considers whether key concepts are included and represented accurately. Groups are assessed according to ability to function and to self-monitor for task completion.
GRADE 7

GSI
Geo Scene Investigation!

PRE-VISIT • SUPPORT MATERIALS

Topographic and Geologic Maps
Student Worksheet: 
READING TOPOGRAPHIC MAPS

Take a look at the topographic map on page R8 in your text book, and answer the following questions:

1. What city and state is represented on this topographic map?

2. What does each of the following colors on the map represent? How do you know? (fill in the table)

<table>
<thead>
<tr>
<th>COLOR</th>
<th>REPRESENTS</th>
<th>HOW DO YOU KNOW? (EVIDENCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>black</td>
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</tbody>
</table>

3. The thin brown/red lines are called "contour lines" and they represent the elevations of the land. Trace a few of the lines with your finger and notice the numbers that are found on some of the lines. What do these numbers represent?

4. Sometimes the contour lines are very close together (see bottom right of the map) and sometimes these lines are farther apart (see upper half of map). What is the significance of how close these lines are?

5. How can you tell the real-life distance between two places on the map? Explain.

6. Name one feature on the map that is at the highest elevation you can locate.
Take a look at the topographic map on page R8 in your textbook, and answer the following questions:

1. What city and state is represented on this topographic map? Etna, New York

2. What does each of the following colors on the map represent, and how do you know? (fill in the table)

<table>
<thead>
<tr>
<th>COLOR</th>
<th>REPRESENTS</th>
<th>HOW DO YOU KNOW? (EVIDENCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td>water</td>
<td>The creek is labeled; it looks like a waterway that is found on other maps.</td>
</tr>
<tr>
<td>green</td>
<td>trees or plants</td>
<td>Green is generally used on maps to show plants or vegetation.</td>
</tr>
<tr>
<td>black</td>
<td>roads, other human-made structures</td>
<td>Roads and streets are labeled; black dots are along sides of the roads, which means they are probably buildings or something put there by humans</td>
</tr>
</tbody>
</table>

3. The thin brown/red lines are called "contour lines" and they represent the altitudes of the land. Trace a few of the lines with your finger and notice the numbers that are found on some of the lines. What do these numbers represent?

   elevation

4. Sometimes the contour lines are very close together (see bottom right of the map) and sometimes these lines are farther apart (see upper half of map). What is the significance of how close these lines are?

   Closely spaced lines represent areas with more drastic changes in elevation, such as steep hillsides and cliffs. More widely spaced lines represent areas with gradual changes in elevation such as plains or wide valley floors.

5. How can you tell the real-life distance between two places on the map? Explain.

   The legend at the bottom of the map tells you the scale. You can use that scale to measure distances.

6. Name one feature on the map that is at the highest elevation you can locate.

   The highest elevation is 1082. Sheldon Road is near that elevation for a short distance. Also, Wood Road crosses that elevation.
You have been given a topographic map of a local area. Work together to answer the following questions:

1. What region does your map represent? Before you study the map, describe what you already know about that region.

2. Where are the highest elevations on your map? Use evidence on your map to clearly describe these areas (for example: identify structures or use latitude and longitude to describe locations).

3. Where are the lowest elevations on your map? Use evidence on your map to clearly describe these areas (for example: identify structures or use latitude and longitude to describe locations).

4. Where are the steepest slopes in your region? Use evidence on your map to clearly describe these areas (for example: identify structures or use latitude and longitude to describe locations).

5. Is the area represented on your regional topographic map generally flat, or are there many hills and or valleys? Use evidence from your map to explain your answer.
Your teacher has provided you with a geologic map of a local area. Work together to answer the following questions:

1. Identify locations of the following types of rocks on your map. Provide the latitude and longitude coordinates of at least one site where each are found:

<table>
<thead>
<tr>
<th>TYPE OF ROCK</th>
<th>MAP LOCATION (Latitude and Longitude)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedimentary Rock</td>
<td></td>
</tr>
<tr>
<td>Igneous Rock</td>
<td></td>
</tr>
<tr>
<td>Metamorphic Rock</td>
<td></td>
</tr>
</tbody>
</table>

2. Use the map and the geologic key on the map. Write a paragraph that discusses the relationship between location and types of rocks found. For example, are rocks found at higher elevations generally of one type while rocks found at lower elevations are of a different type? Also, how are the ages of the rocks related to where they are located?
Student Worksheet: WHERE WE WOULD LIKE TO EXPLORE

LOCATION OUR GROUP WOULD LIKE TO EXPLORE
(Latitude and longitude coordinates, or map grid coordinates):

DESCRIPTION OF THE LOCATION
Include elevations (is it a mountain, a hill, a valley, or what?), type of rocks found in the area, and other key features of the location.

Why would you like to explore this location? Be specific, and include the reasons from all group members.

Do you think you will be able to identify this location when you travel to Lake Mead for the field trip? Explain.
GRADE 7

GSI
Geo Scene Investigation!

PRE-VISIT LESSON

Lake Mead Geologic WebQuest
PRE-VISIT OVERVIEW
Geologists are scientists who study the structure and history of the Earth and its processes. Like detectives, geologists work to unravel the mysteries of the landscapes we see today using clues left behind by the geologic events that formed them. Through Forever Earth, students can get close to fascinating geological features and landforms to better understand the geologic processes that have shaped the Mojave Desert.

GSI: Geo Scene Investigation! introduces students to the differences between observations and interpretations and to some of the fundamental principles of geology. Students identify specific geologic processes and landforms in the landscape surrounding them at Lake Mead National Recreation Area (Lake Mead NRA) by solving mysteries with a set of geology-related clues.

Two pre-visit activities have been designed to prepare students for the on-site experience. The first activity (Topographic and Geologic Maps) introduces students to topographic and geologic maps and their respective purposes. The second activity (described herein) is an inquiry-oriented activity designed to introduce students to the geology, landforms, geologic processes, and geologic timeline of Lake Mead NRA.

THEME
The landscape reveals its story in the features and formations you see today.

KEY QUESTIONS
What geologic forces and processes created the landscape in Lake Mead NRA?
What forces and processes are still at work today?

GOAL
Students will demonstrate understanding of the geologic forces and processes that created the landscape in Lake Mead NRA and the forces and processes that continue to impact and shape today's landscape.

OBJECTIVES
Students will:
- use the Internet and other resources to gather information about Lake Mead NRA geology;
- use existing maps of Lake Mead NRA to create their own map showing landforms and geologic features relevant to this exercise;
- recognize major landforms at Lake Mead NRA and understand that these landforms result from distinct geologic processes; and
- construct a time line for Lake Mead geology and understand the age of geologic formations and landforms.
NEVADA SCIENCE CONTENT STANDARDS

E.8.C.1. Students know sedimentary rocks and fossils provide evidence for changing environments and the constancy of geologic processes.

E.8.C.5. Students know how geologic processes account for state and regional topography.

N.8.B.2. Students know scientific knowledge is revised through a process of incorporating new evidence gained through on-going investigation and collaborative discussion.

CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 7)

Students will:

- distinguish between sedimentary, igneous, and metamorphic rocks;
- describe how water can exert forces (physical weathering) on landforms;
- diagram the rock cycle;
- model erosion and deposition;
- describe how water, wind, glaciers, and gravity contribute to erosion;
- describe how landforms are the result of a combination of constructive and destructive processes;
- describe the value of collaboration in developing scientific understanding;
- critique explanations and evidence presented by peers;
- present results and data to class; and
- discuss careers related to Earth Science.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site grade 7 activities support the following theme statement developed by Clark County-based educators:

Sub theme 2. We share the intriguing stories of Southern Nevada’s diverse, interconnected natural world.

This sub theme is derived from the guiding theme statement: Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.

PREREQUISITE CLASSROOM EXPERIENCES

Lessons and discussions on:

- rock types and the rock cycle.
- geology as a field of research.

Small group application in problem solving:

- logistics in cooperative research and working in teams (e.g., using time efficiently, deciding who does what).
- use of computers and the Internet to gather information.

VOCABULARY
• cliff
• constructive forces
• cross-bedding
• destructive forces

• igneous rock
• lava flow
• mass wasting
• metamorphic rock

• sedimentary rock
• tilting
• wave-cut terraces

PRE-VISIT LESSON: Lake Mead Geologic WebQuest

Part 1 ➔ Introduction to WebQuest
This activity is an inquiry-oriented activity designed to introduce students to the geology, landforms, and geologic processes of Lake Mead NRA. Most of the information collected by students is to be drawn from the Internet.

The class is told that they are going on a WebQuest to gather relevant information on the geology, landforms, and geologic processes at Lake Mead NRA that they will encounter on their upcoming G.S.I. Geo Scene Investigation field trip. The teacher divides the class into teams of four, and each team member will serve as one of four specialists: Cartographer, Geologist, Geomorphologist, and Historian.

Part 2 ➔ Embarking on the WebQuest
Within each team, members take a few moments to discuss and decide which student will play the role of which specialist. They should also discuss how they might assist each other as team mates (e.g., one specialist might find information that could be helpful to one of his or her team mates). Students then proceed to the computer laboratory to embark on the WebQuest following the directions given in Student Reference: Lake Mead Geologic WebQuest and according to the roles they have selected.

Note: all rock samples must be collected only from places where it is legal to do so. No rocks may be removed from any state or national park areas.

Part 3 ➔ Putting it All Together
The teams compile their research into a class presentation. The presentation consists of oral and visual components. Student groups may decide on the format or the teacher chooses a format for the presentation. Suggested formats: poster, model, PowerPoint presentations, or other digital presentation formats.
Part 4 ➔ Presentation of Findings
Groups present their projects to the class. Each member of the group must participate in the oral presentation. A suggested grading rubric is provided (Teacher Reference: Lake Mead Geologic WebQuest Rubric).

Part 5 ➔ Synthesis and Closure
The class considers the career roles that students played in this activity, either aloud or in their journals. Possible questions: Did you like the job of the specialist you selected? Why or why not? Did another specialty seemed more interesting to you? Why do you think research teams are made up of groups of diverse specialists who work together?

The teacher summarizes: We have studied the landscape of Lake Mead National Recreation Area and know a little about "the story" of its formation and features. We'll keep this information in mind when we visit Lake Mead for our Forever Earth field trip.

EXTENSIONS
• Students share their presentations with other classes.
• Students write an essay describing what they think will happen (geologically) to the Lake Mead National Recreation Area during the next 100 years, 1000 years, 10,000 years, 1,000,000 years, or more.
• The teacher helps and prepares students to contact a professional in their area of research. An interview could be conducted online (by e-mail) or in person.

RESOURCES
Student text book

Webquest Websites
Teachers can learn more about Webquests as a teaching tool at the following websites:
   http://webquest.sdsu.edu/
   http://webquest.org

ADAPTATIONS FOR DIVERSE LEARNERS
• Consult with the Forever Earth project manager prior to field trip to discuss specific needs of the class or individuals; decide which aspects or the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
• Implement peer assistance by strategically forming student groups.
• Provide models of finished presentations and assist teams in selecting the best format for their presentations.

ASSESSMENT
The teacher carefully listens to the geologic map presentation and considers whether key concepts are included and represented accurately, using Teacher Reference: Lake Mead Geologic WebQuest Rubric. Additionally, teams are assessed according to ability to function and to self-monitor for task completion.
GRADE 7

GSI
Geo Scene Investigation!

PRE-VISIT • SUPPORT MATERIALS

Lake Mead Geologic WebQuest
Student Worksheet:
LAKE MEAD GEOLOGIC WEBQUEST

TASK

You are part of a team of specialists investigating the geology of landforms at Lake Mead National Recreation Area. Before you go to your study site aboard Forever Earth, you'll need to prepare yourself to identify some of the geologic features you will see and understand how they came about. You and your team must cooperate as you gather answers to the following questions:

- What are the names, descriptions, and locations of the major landforms (mountains, islands, etc.) in and around Lake Mead?
- What are these landforms made of? What are the different types of rocks that can be seen on the land surrounding Lake Mead?
- How did these landforms get there? What are the history and events that led to the development of the unique topography of the lands?
- How old are these landforms?

PROCESS

Each team member is a specialist. You must decide together who will play which role! Specialists gather information needed to answer the question stated on his or her job sheet. Take some time to discuss what each person will be doing before splitting up, so that if one member comes across something that is useful to the other, he or she can share it. As you find information, be sure to evaluate its quality. Once everyone has got their information, members teach each other what they've found and work together to prepare a presentation that puts it all together. You can prepare a story, a poster, a PowerPoint show, or other type of presentation.

TIPS FOR GATHERING INFORMATION

- Use the Internet, your text book, and other resources to complete your job. There is a list of Internet resources on each job sheet. You will have to look through several resources and find the most appropriate information in each.
- Save information you find by taking notes, printing web pages, and by copying and pasting information from Internet sites into a word document. Be sure to keep references for each piece of information that you collect.
EVALUATION

Remember, you will be working as a team, and your final grade will be a team grade. You will be evaluated on the following during this activity:

• Cooperation with your team
• Quality of the information you gather
• Ability to adapt the information from the sources for your audience (not just copying information from the websites or other resources, word for word)
• Including graphics or visuals
• Technical quality of your final presentation (grammar, spelling, etc.)
• Organization of your final presentation
• Quality of your group oral presentation (Rehearse! Speak clearly and loud enough for everyone to hear.)
JOB SHEET 1

JOB TITLE: Cartographer

DUTIES: Cartographers are map makers. You will examine existing maps of Lake Mead and create a new map showing just the major features in the Boulder Basin region of Lake Mead. Draw a general outline of the basin, and include the following on your map: Castle Cove, Swallow Cove, Sandy Cove, Callville Bay, Government Wash, Black Island, Las Vegas Wash, and Hoover Dam. Also include locations and names of surrounding mountains. And remember, a good cartographer wouldn't forget to add a scale bar and north arrow to his or her map.

QUESTION: What are the names, descriptions, and locations of the major landforms in and around Lake Mead?

RESOURCES: Map of Lake Mead NRA:
www.nps.gov/lame/planyourvisit/upload/map_LAME_colorbrochure_inside.pdf

Map of Boulder Basin (Lake Mead NRA):
www.nps.gov/lame/bbasin.pdf
JOB SHEET 2

JOB TITLE: Geologist

DUTIES: A geologist studies the minerals and rocks that make up the Earth. Research the major types of rocks found in Lake Mead National Recreation Area and how those rocks formed. Gather samples or photographs of these types of rocks from your neighborhood, from a classroom rock collection, or from the Internet. Include examples of the types of metamorphic, sedimentary, and igneous rocks that might be found around Lake Mead. IMPORTANT: ONLY COLLECT ROCKS FROM SITES WHERE IT IS LEGAL TO DO SO. People are not allowed to collect rocks from any state or national park lands.

QUESTION: What are landforms made of? What are the different types of rocks found on the land surrounding Lake Mead?

RESOURCES:
- Descriptions of the three basic rock types and examples:
  http://jersey.uoregon.edu/~mstrick/AskGeoMan/geoQuery13.html
- Description of rock types and the rock cycle:
  http://www.minsocam.org/MSA/K12/rkcycle/rkcycleindex.html
- Information about land forms, geological age, and composition of rocks at Lake Mead:
- Photographs of the geology of Lake Mead and surrounding areas:
JOB SHEET 3

JOB TITLE: Geomorphologist

DUTIES: A geomorphologist is a geologist who studies Earth's landforms and the geologic and climatic processes and human activities which form them. Research how major land features of Lake Mead National Recreation Area formed, and what those land forms look like. Investigate physical and biological weathering, including erosion due to wind, water, and plants. Include the following features, many of which you will see during your Forever Earth field trip: lava flows, tilting, cross-bedding, and wave-cut terraces.

QUESTION: How did these landforms get there? What are the history and events that led to the development of the unique topography of the lands?

RESOURCES: A short video showing the formation of wave-cut terraces:
http://emvc.geol.ucsb.edu/download/wavecut.php

Pictures and descriptions of cross-bedding:
http://www.uoregon.edu/~millerm/crossbeds.html

Explanation of wave-cut terraces:
http://www.uwec.edu/jolhm/Past_Classes/1999/RENO/oct08/geography.htm

Pictures of cross-bedding:

Pictures of landforms:
http://geoimages.berkeley.edu/GeolImages/Johnson/Landforms/Landforms.html

Information about land forms, geological age, and composition of rocks at Lake Mead:

Photographs of the geology of Lake Mead and surrounding areas:
JOB SHEET 4

JOB TITLE: Historical Geologist

DUTIES: A historical geologist is a geologist who uses the principles of geology to reconstruct and understand the history of the Earth. Construct a geologic time line for the Lake Mead area. Include at least one major "land-changing" event that occurred in this area during each of the following eras: Precambrian, Paleozoic, Mesozoic, and Cenozoic.

QUESTION: How old are these landforms?

RESOURCES: A geological time scale of the Eastern Mojave Desert:
http://www2.nature.nps.gov/geology/USGSNPS/mojave/mojatime.pdf

Information on the geologic history of the Lake Mead National Recreation Area – click on virtual field trip and explore the different ages on each page:

Information about land forms, geological age, and composition of rocks at Lake Mead:
### Teacher Reference:
#### LAKE MEAD GEOLOGIC WEBQUEST RUBRIC

<table>
<thead>
<tr>
<th>TOPIC CONTENT</th>
<th>Novice (4 pts.)</th>
<th>Intermediate (7 pts.)</th>
<th>Expert (10 pts.)</th>
<th>Self Evaluation and comments</th>
<th>Total Points (50 possible, teacher score)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Includes some essential information, but many facts are missing</td>
<td>Includes essential information; demonstrates a satisfactory understanding of the required topics</td>
<td>Covers the required elements completely and in depth; a thorough understanding of the required topics is evidenced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRAMMATICAL MECHANICS</td>
<td>Five or more grammatical errors, misspelled words, or other errors</td>
<td>One to four grammatical errors, misspelled words, or other errors</td>
<td>Project is free of grammatical errors, misspelled words, or other errors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TECHNICAL COMPONENTS OF PROJECT</td>
<td>Includes at least 3 sources of information; information is directly lifted from resources</td>
<td>Includes information and graphics from resources; between 3 and 5 different resources were used and referenced; work was paraphrased and summarized, not cut directly from resources</td>
<td>Includes information and graphics from resources; more than 5 different resources were used; technical presentation is detailed and very creative; advanced presentation skills are evidenced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COOPERATION WITH GROUP</td>
<td>Group worked well, but only with repeated intervention from teacher; group had difficulty with sharing responsibilities and helping each other learn</td>
<td>Group worked well together with very limited teacher intervention; students shared responsibility</td>
<td>Group worked very well together; members assumed roles and successfully completed project; repeated encouragement and motivation was evidenced among group members</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORAL PRESENTATION</td>
<td>Difficult, halting presentation; unable to address questions asked by students and teacher; presentation was not organized well, nor was it rehearsed; one student does most of the presentation</td>
<td>Presentation was satisfactory; each student in group participated; some hesitation or lack of voice projection, but adequate preparation and rehearsal is obvious; audience is somewhat engaged</td>
<td>Excellent presentation done with enthusiasm and expertise; all students participate fully in presentation knowledge of the topics is apparent; speaking is clear, loud, and precise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL POINTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GRADE 7

GSI
Geo Scene Investigation!

POST-VISIT LESSON

The Story in Art
POST-VISIT OVERVIEW
The following post-visit activity is designed to synthesize and expand the knowledge students have gained in their Forever Earth experience. Students will demonstrate, with a visual creation, their understanding of at least five major components of the land and land forms that are part of the Lake Mead National Recreation Area.

THEME
The landscape reveals its story in the features and formations you see today.

KEY QUESTIONS
What geologic forces and processes created the landscape in Lake Mead National Recreation Area? What forces and processes are still at work today?

GOAL
Students will demonstrate understanding of the geologic forces and processes that created the landscape in Lake Mead National Recreation Area and the forces and processes that continue impact and shape today's landscape.

OBJECTIVE
Through a visual creation, students will demonstrate their understanding of at least five major components of the land and land forms that are part of the Lake Mead National Recreation Area.

NEVADA STATE STANDARDS CORRELATION
E.8.C.1. Student knows sedimentary rocks and fossils provide evidence for changing environments and the constancy of geologic processes.
E.8.C.2. Student knows rocks at Earth's surface weather, forming sediments that are buried, then compacted, heated and often recrystallized into new rock.
E.8.C.5. Student knows how geologic processes account for state and regional topography.

CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 7)
Students will:
• distinguish between sedimentary, igneous, and metamorphic rocks.
• describe how water can exert forces (physical weathering) on landforms.
• describe how landforms are the result of a combination of constructive and destructive processes.
• model erosion and deposition.
describe how water, wind, (glaciers,) and gravity contribute to erosion.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site grade 7 activities support the following theme statement developed by Clark County-based educators:

• Sub theme 2. We share the intriguing stories of Southern Nevada’s diverse, interconnected natural world.

This sub theme is derived from the guiding theme statement: Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.

PREREQUISITE EXPERIENCES

• Pre-visit classroom lessons
• Forever Earth field trip

VOCABULARY

- constructive processes
- cross-bedding
- destructive processes
- erosion
- igneous
- lava flow
- mass wasting
- metamorphic
- relative aging
- sedimentary
- tilting
- wash
- weathering

POST-VISIT LESSON: The Story in Art

Part 1 ▶ Introduction and Review

PREVIEW/REVIEW:
Students respond to the following in their journal: List five geological features or processes that you were able to observe while on the Forever Earth field trip. To the best of your ability, describe in words what each of those features looked like. Include color, texture, shape, size, etc. in your description.

The teacher facilitates a round-robin student discussion about geological process, land forms, rock types, and Lake Mead geology that they have been studying. General questions, pre-printed on strips, are drawn at random. Additional follow-up questions regarding photographed sites are asked as appropriate. Sample questions:

• How can you distinguish metamorphic, igneous, sedimentary rocks based on appearance?

TIME 30 minutes
MATERIALS
- student journals
- journal questions written on the board
- computer and LCD projector
- Completed pre-visit projects, student notebooks, and projected photos (of geology) taken during the field trip (or existing photos of Lake Mead geology), questions printed on strips of paper
• How do metamorphic rocks form?
• How do igneous rocks form?
• How do sedimentary rocks form?
• Where in the Lake Mead NRA might you find each type of rock?
• What is an example of chemical weathering that you saw at Lake Mead NRA, and how do you know it is chemical weathering?
• What is an example of physical weathering that you saw at Lake Mead NRA, and how do you know it is physical weathering?
• How do wave-cut terraces form?
• Describe an example of "tilting" that you saw at Lake Mead NRA.
• What geologic features do you recall from the mapping activity were actually observed at Lake Mead NRA?
• Other questions as appropriate based on your classroom experiences on the Forever Earth Field trip.

Students use their student notebooks, pre-visit materials, and any photos taken during the field trip to answer and discuss the above. Encourage use of vocabulary developed during the pre-tllip and field trip experiences.

Existing photos of Lake Mead NRA geology that may also be used to facilitate discussion are available at the following sites:

A virtual geology field trip:

Lake Mead photos on the NPS Website:
www.nps.gov/lame/photos.html

**Part 2  Concept Development**

1. Students review their journal responses (from Part 1) and choose at least five features that they observed and learned about during their Forever Earth field trip. Students may wish to refer back to the projected and printed photos from their trip.

2. Students are each given one "pie piece" (see **Student Worksheet: Pie Piece Template**). The template sheet contains two pie pieces, so the sheet will have to be cut in half. Students will cut out the shape AFTER they do their art work on it.

3. Have students illustrate the five (or more) features they selected.
Each feature should be named, and the illustrations should be representative of the actual feature. See Teacher Reference: Sample Illustration. Note that the sample is in black and white, but that students should do their artwork using color.

*Students should really think about the features that they choose before they begin to illustrate them because they will need to explain and justify their visual interpretations.

Part 3  Concept Development
Students share their finished work with at least three other students, explaining each component of their pie piece and why they chose to illustrate it the way they did. Students initial the backs of the pieces they review.

Part 4  Presentation of Findings and Closure
Students cut out and assemble their pieces to form circles, using tape. Eight pie pieces joined in a circle will produce a 40 cm artwork that will remind the class of what they learned during the Forever Earth field trip. The teacher posts the circles in the classroom or in the hallway for others to see.

EXTENSIONS
 Require students to include up to 10 landforms and processes. Rather than a pie piece, students could sketch a panoramic view of Lake Mead showing as many landforms and geological processes as possible. Require the students to logically place the items (for example, the lava flows can be seen on top of the mountains, wave cut terraces are seen at and just above water level, etc.).

RESOURCES
Any and all of the resources (Internet sites and print outs, books, photos, maps, photos taken at the lake) collected for the pre-visit and on-site lessons should be used in this culminating lesson.

ADAPTATIONS FOR DIVERSE LEARNERS
• Consult with Forever Earth project manager prior to field trip to discuss specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
• Assign preferential seating.
• Allow students to work on the project in pairs or groups.
• Provide samples of finished products as models.
• Pre-teach critical vocabulary.
• Establish and teach rules that communicate expectations.
ASSESSMENT

It is suggested that the project not be graded on artistic ability. Rather, assess based upon completion (five geologic features included, appropriate representation of each item, finished pie piece shared with other students).
GRADE 7

GSI
Geo Scene Investigation!

POST-VISIT LESSONS • SUPPORT MATERIALS

The Story in Art
Students Worksheet:
PIE PIECE TEMPLATE
Teacher Reference:
SAMPLE ILLUSTRATION
High School Activities Outline

BACKGROUND
During the past two years, high school teachers who have scheduled Forever Earth field trips have fallen into one of two categories:

1. Science resource teachers who request the Grade 5 curriculum (Finicky Fish Finish Last!) or the Grade 6 curriculum (Alien Invaders!) to match the science learning levels of their students; or
2. Science teachers who have already established their own field trip objectives and have clear ideas of what will be accomplished on Forever Earth. Note: Teachers wishing to use their own curriculum are asked to submit a description of their proposed program that includes an itinerary with specific destinations for pre-approval.

Forever Earth facilitators take leadership roles for groups fitting the first category description. For groups in the second category, the science teacher takes the lead in facilitating activities with the assistance of a Forever Earth facilitator.

To meet the needs of high school science teachers who may not fit into one of the two categories described above, the following activity outline provides a protocol for conducting water quality monitoring. The outline also includes educational goals and objectives and shows how Nevada State Standards and Clark County District Objectives are addressed. The protocol can be adapted to meet the needs of the group, as well as its time and equipment constraints.

OVERVIEW
Snowmelt in the Rocky Mountains flows through a series of tributaries into the Colorado River, which winds its way south for 1,400 miles and empties into the Gulf of California. Along the way, dams trap the water in a series of reservoirs, of which Lake Mead is the largest. All of Southern Nevada's drinking water comes from the Colorado River via Lake Mead. Thus, protecting Lake Mead's water quality is of paramount importance. Potential sources of contamination include urban chemicals such as fertilizers and pesticides, industrial activities, and hydrocarbon discharge from recreational boats and other watercraft.

The following activity outline is excerpted from Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools. This field manual compiles a series of tests and protocols
for calculating a standard measurement of water quality, used by a number of schools and universities across the country. Drawing upon this field manual, Michael Brundage, a high school science teacher in the Clark County School District, developed a standardized protocol for measuring Lake Mead’s water quality, and used it with his students for a number of years. For more detailed information about the tests and protocols described below, teachers should obtain the field manual or borrow a copy from the Forever Earth Project Manager.

**THEME**

Millions of people depend on the maintenance of high water quality in Lake Mead.

**KEY QUESTIONS**

What is the quality of Lake Mead’s water? How do humans impact water quality in Lake Mead and within the Colorado River watershed? What can be done to protect Lake Mead’s water quality?

**GOAL**

Students will use a standardized protocol for testing the water quality of Lake Mead and will demonstrate an understanding of the importance of Lake Mead’s water quality and the lake’s role within the Colorado River watershed.

**OBJECTIVES**

Students will:

- develop a Water Quality Index by conducting water quality measurement tests;
- contribute new data to a central data base;
- synthesize and interpret collected data.

**NEVADA STATE STANDARDS CORRELATIONS**

N.12.A.1. Students know tables, charts, illustrations, and graphs can be used in making arguments and claims in oral and written presentation.

N.12.A.2. Students know scientists maintain a permanent record of procedures, data, analyses, decisions, and understandings of scientific investigations.

N.12.B.1. Students know science, technology, and society influenced one another in both positive and negative ways.


E.12.C.4. Students know processes of obtaining, using, and recycling of renewable and nonrenewable resources.
CLARK COUNTY SCHOOL DISTRICT OBJECTIVES

(Correlations to specific high school courses will be completed.)

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site high school activities support the following guiding theme developed by Clark County-based educators:

* Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

  * Sub-theme 1. Human activity profoundly alters the ecosystems of southern Nevada. We and our partners care about protection and preservation of these sensitive lands.

PREREQUISITE CLASSROOM EXPERIENCES

A pre-visit classroom trip will be made by Forever Earth or National Park Service staff to introduce students to the Forever Earth program and their upcoming field trip. Students learn and agree to the "conduct rules" of Forever Earth, understand basic water safety concepts, and observe how and when to put on a Personal Flotation Device (PFD) during their time aboard Forever Earth.

VOCABULARY

- biological oxygen demand
- dissolved oxygen
- fecal coliform
- nitrates
- pH
- temperature
- total phosphate
- total solids
- turbidity
- water quality
- water quality index (WQI)
- watershed

ON-SITE ACTIVITIES: Forever Earth

Materials: Hach water quality testing kit or other water chemistry kit
Time: 4 hours
Reference:

In order to compare rivers, lakes, and other waterways in various parts of the country, the National Sanitation Foundation created and designed a standard index, called the Water Quality Index (WQI). The WQI, one of the most widely used of all existing water quality indices, is a unitless number ranging from 1 to 100. A higher number is indicative of better water quality. The table below gives a general qualitative description for a WQI range.

<table>
<thead>
<tr>
<th>WQI</th>
<th>Water Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25</td>
<td>Poor</td>
</tr>
<tr>
<td>25-50</td>
<td>Fair</td>
</tr>
<tr>
<td>50-70</td>
<td>Medium</td>
</tr>
<tr>
<td>70-90</td>
<td>Good</td>
</tr>
<tr>
<td>90-100</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

To determine the WQI, nine tests are performed:
- dissolved oxygen
- fecal coliform
- pH
- biochemical oxygen demand (5-day)
- temperature
- total phosphate
- nitrates
- turbidity
- total solids

The field manual, referenced above, provides an overview of these tests, including what they mean and how to do them (e.g., proper sampling techniques). The instructions accompanying the Hach kit are used to perform the actual tests. The full range of tests is conducted at two sites: the first is near Swallow Cove and the other is in Las Vegas Bay. GPS coordinates will be determined for these sites. It is suggested that samples be taken at depths of 5 meters, 10 meters, and 20 meters. This is done so that data collected over a period of time can be compared.

The next step is calculating the results and arriving at the WQI. The majority, if not all, of these calculations will be completed in the classroom with the raw data collected during the field trip. Chapter 4 of the field manual provides the procedure for calculating the overall WQI for each sample site. There is a strong possibility that students may not be able to complete all nine tests. For example, the fecal coliform
test requires an incubator and other special equipment. The amount of time aboard Forever Earth may be another limiting factor that determines which tests are actually conducted. There is a process outlined on page 11, Chapter 1, for estimating the WQI if the students are unable to conduct all nine water quality tests.

As a way to synthesize and share their results, students can create a PowerPoint presentation or other visual presentation that highlights their findings and conclusions about Lake Mead's water quality. This final product, as well as the raw data, should be shared with the Forever Earth Project Manager.

**EXTENSIONS**

- Students contact the Forever Earth Project Manager for data collected by other Clark County School District students. Test results are compared and similarities and differences discussed.
- Further discussion of the students’ findings can lead to investigating questions such as:
  - What did you learn about your drinking water source?
  - What actions are taken to protect Lake Mead water quality?
  - Are there any actions that need to be taken to improve water quality, and thereby the lives of people that depend upon Lake Mead?
Key Publications in Scholarly Publishing

From Web sites to newsletters to journal articles to books, a wealth of information is available for you to see if professional and scholarly publishing is right for you. Below are just a few.

Web Sites
In addition to the sites given earlier, be sure to visit these Web sites:

- **Canadian Centre for Studies in Publishing**
- **Center for the Book, Library of Congress**
  - http://lcweb.loc.gov/loc/cfbook
- **Chicago Book Clinic**
  - http://www.chicagobookclinic.org
- **Evangelical Christian Publishers Association**
  - http://www.ecpa.org
- **International Association of Scholarly Publishers**
  - http://www.iasp.at
- **International Publishers Association**
- **National Association of Independent Publishers**
  - http://www.publishersreport.com
- **National Information Standards Organization**
  - http://www.niso.org
- **Publishers Marketing Association**
  - http://pma-online.org
- **Small Press Center**
  - http://www.smallpress.org
- **Small Publishers Association of North America**
  - http://www.SPANnet.org

Periodicals

- **Cites & Insights: Crawford at Large** is a print newsletter available free in PDF format at Crawford at Large, the link should be http://cites.boisestate.edu
  Editor: Walt Crawford, copyrighted by Walt Crawford.
- **Convergence: the journal of research into new media technologies** is a quarterly publication from the University of Luton.
Press in the UK. Editors: Julia Knight, Jeanette Steemers, and Alexis Weedon. University of Luton Press, University of Luton, 75 Castle Street, Luton Beds. LU1 3AJ, UK, ulp@lutton.ac.uk, www.ulp.org.uk. US 2002 individual subscription rates are $72 (surface mail) and $80 (airmail).


European Science Editing, the journal of the European Association of Science Editors, is partly available on the association’s Web site. Chief Editor: Hervé Maisonneuve. European Association of Science Editors, EASE Secretariat, c/o Mrs. Jennifer Gretton, P.O. Box 426, Guildford, GU4 7ZH, UK, www.ease.org.uk. Membership includes a free subscription to the print version.


Mill Creek Partners Newsletters, three e-mail newsletters, each a summary of recent developments in selected areas of publishing. The newsletter of most interest to those interested in scholarly publishing is Book and Professional (including Scientific/Technical/Medical) Publishing is free to registered users at http://www.millcreekpartners.com/news/news.htm

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Articles & Guidelines
The Journal of Scholarly Publishing dedicated Vol. 28, No. 4, July 1997, as a special issue on “Education for Publishing.” Articles include “Contemporary Publishing and the Challenges for Publishing Education” (John Curtain); “Education for Acquisitions” (Laura Macleod); “Nature versus Nurture in the Making of a Manuscript Editor” (Pam Upton); “Educating the Designer’s Eye” (Mary Mendell); “The Knowledge: Journeys on a Learning Curve” (Tony Crouch); “Marketing Scholarly Publishing: Monographs as Lite Beer” (Carolyn Wood); “Preparing for a Financial Career in Publishing” (Lain Adkins); “Internships as a Publishing Training Tool” (Shannon Davies); “Classroom Training for Publishing” (Tracey Sobol); “Week-in-Residence: Professional Development for Experienced Publishers” (Lisa Dellwo); “Education for Publishing: The Needs of the Global South” (Ian Montagnes).

White Papers
The Sheridan Press, Hanover, PA, commissioned 10 papers (below). Write to The Sheridan Press, Printing and Publishing Services, 450 Fame Ave., Hanover, PA 17331, or send a fax request to 717/633-8900.
Books & Directories


Literary Marketplace (annual directory). Information Today, Inc.


Scholarly Electronic Publishing Bibliography (SEPB) has been published since 1992 and hosted at the University of Houston Libraries since 1996. Charles W. Bailey, Jr., editor. SEPB evolved into an electronic book that presents citations for more than 1400 selected English-language articles, books, and other printed and electronic sources that are useful in understanding scholarly electronic publishing efforts on the Internet. Updated every two months. Free at http://info.lib.uh.edu/sepb/sepb.html.


