

Special Report

*Bringing Environmental Education
to Diverse Audiences*



Mission of the National Wildlife Refuge System

The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

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Barrett Elementary School

Fourth-graders went on a digital scavenger hunt at Elizabeth Hartwell Mason Neck National Wildlife Refuge, not far from their school in Virginia. (See Infused with Wildlife, page 21)

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A student photo displayed at the Colorado State Capitol was auctioned by the Friends. (See Journals and JPGs, page 17)

A Message from the Director U.S. Fish and Wildlife Service



National wildlife refuges are some of the most special places in the world for wildlife. That's why we must introduce children to these special places early and often. The great biologist E.O. Wilson noted that, "Most children have a bug period, and I never outgrew mine. Hands-on experience at the critical time, not systematic knowledge, is what counts in the making of a naturalist."

Although many children do have extraordinary experiences in the outdoors, studies show that young people today are spending only half as much time outside as their parents did. The environmental education programs of national wildlife refuges are the best way we can reverse those trends and connect with diverse student populations in both urban and rural areas.

In this Special Report, you will read about children who are acting out the life cycle of a Laysan albatross, gaining traditional and scientific knowledge about fish in Alaska, finding ghost crabs on Texas Gulf Coast beaches, and measuring water quality in Florida. Such experiences will stay with children all their lives. Research tells us that such "wild nature" adventures during childhood are associated with environmentally-friendly behaviors in adulthood. I hope you'll gain new insight and ideas from these examples and that you will share your own successes with your colleagues.

Environmental education is fundamental to nurturing a strong land ethic. I strongly encourage you to find ways to replicate or adapt some of these programs on your refuge and in your work to connect children to America's great outdoors. A new generation of conservationists will thank you.

Dan Ashe



Lessons from the Albatross

Teaching Second-Graders about Life Cycles and Stewardship

By Kendall Slee

The Laysan albatross that spend part of their lives on Hawai'i's Kaua'i Island are fascinating. That's why the staff of Kilauea Point National Wildlife Refuge decided to focus on the seabirds for an elementary-level education program in the 2010-2011 school year.

A seabird found only along the coast where colonies exist, the albatross are easy to identify. Standing 32 inches tall, with a wingspan of more than six feet, albatross – called Mol- in the native language – can steal a show with their mating dance of sky calling, bill clapping, head tucks and bobbing, deep bows, and outstretched necks and wings. Most of their life milestones can be observed November to June – perfect for the school year – and albatross are usually flying and nesting near their colony on Kilauea Point.

So Shayna Carney, the refuge's former supervisory park ranger, envisioned a program designed around life cycles, a state curriculum standard for second graders.

Carney wrote the first lesson about seabird adaptations and Caroline Tucker was hired as a part-time environmental educator to write the rest of the curriculum, focusing on life stages of the albatross from egg to adult. (See sidebar on "The Life Stages of a Laysan Albatross.") Refuge staff taught five 45-minute lessons in the classroom (see "Laysan Albatross Lesson Outline") and provided 12 additional lessons per month for five months. The program

Laysan albatross spend months foraging on the open ocean, then return to their colonies on land for breeding season—November through July.

culminated in a two-hour field trip to the refuge in April and May.

The program was taught to 12 second-grade classes – 245 students – from six public, private and charter schools on the northern and eastern side of the island. All are no more than a 45-minute drive from the refuge. The Hawai'i Youth Conservation Corps, the state branch of Americorps, hired volunteer Scott Clapsaddle to help Tucker teach the lessons; the refuge's interpretive rangers filled out the teaching ranks. The refuge Friends group, Kilauea Point Natural History Association, funded bus transportation for the field trip as well as supplies and educational materials.

Dancing Like an Albatross

The program emphasized participatory learning, whether students danced like an albatross or tested the strength of an egg. "I think when you are doing hands-on experiential learning, it sticks in your mind better than if you're just hearing it and seeing it," Tucker says. Nanea Sproat-Armitage, a teacher at Kilauea School, says she was impressed by how much information her students retained month to month from the lessons. The program helped students gain a deeper understanding of a bird they might recognize but know little about, she says.

Diane McDonald, a teacher at Hanalei School, agrees. "A couple of the main points of the program that really stuck with my students were the distances these birds fly and how long the birds stay at sea, how strong an egg shell is and how the mother and father both take care of the chick," she says. "The students also had a great time learning

The Life Stages of a Laysan Albatross

Laysan Albatross can be spotted on Kaua'i and other islands of the Hawai'ian archipelago November through July, when they alight on land to mate and breed after months of foraging on the open ocean.

In November, the albatross return to their breeding grounds – usually the same place where they hatched. They begin nesting with their mates. The birds are monogamous. Parents take turns incubating their single egg until it hatches in January or February.

Once the chick hatches, parents will leave the nest in search of food, and return to feed their chick regurgitated squid oil and flying fish eggs.

The albatross begin seeking mates when they are three to five years old. Single albatross can be seen performing elaborate mating dances from November through June as they search for and bond with a mate. The courting process is extensive. Bonded pairs eventually breed when they are between six and eight years old.

Chicks fledge in June and July, and will spend the next several years feeding in the open ocean. After they begin breeding, they spend their non-breeding months at sea. The Laysan albatross live 40 to 60 years.

Kīlauea Point National Wildlife Refuge’s albatross education program covered the life stages of an albatross from egg to fluffy chick to breeding adult.



Chris Swenson

Students learned how marine debris can be deadly to albatross and they brainstormed ways to help: recycling, using re-usable lunch containers, cleaning up beaches and spreading the word about how litter hurts the birds.

the different mating dances and then recognized the dances during our visit.”

While refuge staff visited the schools about once a month, teachers extended the lessons with displays and discussions, typically posting pictures of the albatross at their life stage throughout the year. Most had a little stuffed albatross displayed in front of the room. Each class also received a small book about albatross written by a refuge volunteer.

Responding to Teacher Feedback

Refuge staff encouraged teachers’ feedback and adjusted lessons accordingly. Informal feedback from teachers guided Tucker on small revisions – such as what activities the students enjoyed most or whether they were grasping key concepts. “If an activity was too confusing, with the teacher’s help—and usually on the spot—I could change the instructions to meet the needs of individual students and the class as a whole,” Tucker says.

Flexibility proved key. The field trip to the refuge turned up a few challenges when many classes lacked enough parent volunteers to lead small groups through a scavenger hunt at a series of learning stations.

“We found that some of our scavenger hunt clues were too complicated for second-graders, and we needed to let go of some of the details,” Tucker says. “In the end the most important thing was making sure they had a good experience in the outdoors and could feel good about what they knew about the albatross and stewardship.”

Active Stewardship

Students learned how marine debris can be deadly to albatross and they brainstormed ways to help: recycling, using re-usable lunch containers, cleaning up beaches and spreading the word about how litter hurts the birds.

A program highlight for Kīlauea Point supervisory park ranger Jennifer Waipa was seeing children exhibit their knowledge during the field trip. “The kids really grabbed on to certain things they’d learned through the lessons – like the word ‘chalaza.’” To introduce and reinforce the word for the tissue that attaches the yolk within the egg, lesson instructors asked the students to repeat the rhyme, “The chalaza holds the yolk in place-uh.”

“Weeks or months later, you could see how the lessons were created in a way that helped them retain that information,” Waipa says.

Laysan Albatross Lesson Outline

Lesson 1: Build a Bird

Concepts: Basic information about national wildlife refuges, Kī-lauea Point and seabird adaptations.

Active component: A student is transformed into a bird with the help of classmates who provide suggestions for elements to add – feathers, webbed feet, sharp hooked beak, long wings.

Lesson 2: So You Think You Can Dance... Like an Albatross?

Concepts: Courtship.

Active component: Students create an albatross mask prior to lesson. During the classroom visit, students learn about courtship rituals, including a few of the 25 dance moves albatross use to find and impress a potential mate. Students wear “gooney bird” masks and try some of the dances in small groups.

Lesson 3: An Egg-stravaganza!

Concepts: An egg is a habitat for a growing baby bird.

Active component: Students participate in an “egg-speriment” to test the strength of an egg. Two students stand in front of the class and squeeze eggs – one from the sides, one from top to bottom. “Usually if an egg breaks, it would be the one squeezed from the sides,” Tucker says. “This is a visual way to show that the strength of an egg is due to its shape. It is the strongest shape in nature.”

Another experiment: Place books on an upright egg to see how much weight it can bear. Many classes reached 10 to 12 textbooks before the egg broke. Students also learned names and functions for each part of an egg by acting out parts and repeating catchy phrases.

Lesson 4: Food for the Brood

Concepts: Both parents care for the newly hatched chick; one parent forages at sea and brings back fish and squid, while the other broods over the chick to keep it warm and protect it from predators.

Active component: Students learn firsthand the challenges of being a parent albatross by playing a relay-race game. Split into groups, students are given a “nest” with a “chick” inside (using a bowl with a photo of a chick in a nest). Each group has a “feeding area” in the classroom that holds “food items” such as squid, flying fish eggs and flying fish (all simulated by fishing lures or poker chips.) The first person must run to the feeding area to collect food, using an origami “beak,” and bring it back to “feed” the chick (deposit it in the bowl) while the remaining “parent” protects the nest from “predators” (facilitators or teachers wearing cat masks).

“This is a physical way to demonstrate how difficult it can be to be a parent albatross and have such important duties,” Tucker explains. “Students were challenged to run, use hand-eye coordination to collect the food, stay near the nest and guard the chick, as well as show aggression (albatross-style, of course!) to predators to protect their young.”

Lesson 5: Ready for Take-Off

Concepts: Albatross chicks must go through several changes before they leave the colony and begin their adult lives.

Active component: Students measure their own wingspan prior to the classroom visit. During the lesson, each student makes a personalized “bird band.” The bands are then mixed up and the teacher tries to match each student with the correct band, using only the information on the band (wingspan, hair color, etc.)

Lesson 6: Field Trip: Kīlauea Point Scavenger Hunt

Concepts: Review of the life cycle stages and recollection of information shared throughout the program.

Active component: Students work in small groups to solve clues, find secret locations, and complete challenges all around Kīlauea Point.



Kīlauea Point National Wildlife Refuge environmental educator Caroline Tucker (far left) and Americorps volunteer Scott Clapsaddle (far right) put on their best albatross faces with a class of second-graders.

Diane McDonald



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Minnesota Refuge Partner School Program

Making School Visits More than “One-Hit No-Wonder”

By Suzanne Trapp

“What are we really accomplishing running 20,000 students through the refuge each year?”

Beth Ullenberg, supervisory visitor services manager at one of the largest urban refuges in the National Wildlife Refuge System, summarized staff sentiment when she arrived at Minnesota Valley National Wildlife Refuge in 2006. “We’d have two hours to teach anywhere from 60 to 120 students about nature. Teachers and students were not always engaged, and the majority of staff time was spent trying to control the group.” The result was what Ullenberg described as a “one-hit no-wonder” experience.

Staff agreed. They had little confidence that students understood the value of the National Wildlife Refuge System, let alone the refuge treasure in their own urban backyard. What emerged in 2006 was the Refuge Partner Schools Program, which places the quality of student and teacher experiences at the forefront of the environmental education program.

The program has enrolled three schools: East Union Elementary in Carver, Minnesota, the American Indian School in St. Paul and Jackson Elementary in Shakopee. Staff, interns, volunteers,

teachers and parent chaperones all contribute their time to the program.

The 2011-12 school year marks the fifth season of the Refuge Partner School Program. During this time, principal retention and support have proved critical to the program’s success.

Indeed, the best Partner Schools have a principal who strongly supports outdoor learning, wants to see teachers use the refuge as an outdoor classroom and supports associated teacher training.

To provide outdoor experiences and environmental learning to students least likely to visit a wildlife refuge on their own, Minnesota Valley Refuge considered the percentage of ethnically diverse and low-income students when it selected Refuge Partner Schools. Such demographic information is available from the state’s Department of Education website. Additionally, the refuge sought partner schools that lacked environmental educators or naturalist staff and a nature area within walking distance.

At first, several Twin Cities environmental magnet schools seemed the logical choice for participation. They were eager to join and clearly met the criteria of strong principle support. However, with nature areas just outside their back doors and environmental education specialists or naturalists on staff, these schools did not need mentoring.

The program structure

Each school initially signs a three-year cooperative agreement. The principal commits to sending each class (K-5) to the refuge at least three times a year. “This is the hands-on piece that I wanted,” says Jenny Killian, a second- and third-grade teacher at East Union Elementary School, which has participated in the program for its entire five years. By getting the kids out in nature, the instruction “becomes more meaningful,” she says. “It sticks in those little brains more than it would if we just read about it in books.”

In addition, teachers set aside one hour in the classroom to allow refuge staff to introduce an activity before each two-hour field trip. Teachers are invited to attend workshops in natural history, outdoor teaching techniques, and other national environmental education curricula led by refuge staff and partners, all free of charge.

At the end of the third year, teachers and refuge staff assess the partnership. If it continues, a two- or three-year extension is granted. Students continue to visit the refuge on the same schedule but teachers present the field trip pre-activity. Teachers are asked to brainstorm with students about Service Learning projects that help both the refuge and the learning experience. East Union Elementary students, for example, created a colorful, interactive magnetic mural that shows the variety of plants and wildlife on the refuge. The mural hangs in the Rapids Lake Education and Visitor Center.

Right: Catching wildlife in the Prairie Insect Survey is a favorite fall field trip.

Left: Elementary students created a colorful, interactive magnetic mural that shows the variety of plants and wildlife on Minnesota Valley Refuge.





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Who goes there? Three Refuge Partner Schools send students to Minnesota Valley National Wildlife Refuge for spring, fall and winter field trips.

Survey, targeted toward second- and third-graders, although this may be altered to suit first-graders since the state guidelines are changing. Students collect a half-dozen or so butterflies, grasshoppers and other insects and use a chart to record how they are similar and different. They create graphs, tally numbers, write or draw about their observations and build their math and critical observation skills – all in one exercise.

In Habitat – Who Needs It? kindergartners learn the four major components of habitat – food, water, shelter and space – and the difference between wild and domestic animals. As they visit different habitats on the refuge, they think about the food and water sources in each.

In Seeds on the Go, second- and third-graders collect different seeds in various habitats, consider how plants disperse seeds and think about how the seeds might move in the habitat. They also learn about refuge management – such as controlling the dispersal of nonnative reed canary grass seeds.

After three years and two revisions, the teaching matrix outlines not only ensure three years of visits to the refuge, but they also provide increasingly challenging lessons that meet state educational standards in math, English, physical education, social studies as well as science.

Each year, fifth-graders graduating from the program spend a Friday in spring learning how to fish on the refuge. Thanks to Youth Fishing Day sponsors such as the Red Lake Nation, the Minnesota Department of Natural Resources, General Mills and Gander Mountain, students learn to cast, tie a knot, identify common Minnesota fish species and create fish art before going home with their own rod, reel and tackle set.

The curriculum

For teachers to embrace the refuge as an extension of their classrooms, the Refuge Partner School curriculum had to meet state education standards. According to Killian, no valuable class time is lost because the material covered at the refuge correlates with required instruction. For refuge staff and management to support the program, it had to increase student environmental awareness and foster a stewardship ethic. For the program to compete with offerings at nearby, Partner School Coordinator nature and environmental centers, it had to provide a unique experience to teachers and students.

After three years and two revisions, the teaching matrix outlines not only ensure three years visits to the refuge, but they also provide increasingly challenging lessons that meet state educational standards in math, English, physical education, social studies as well as science. It builds on student knowledge and experience gained each year.

Students learn hands-on, real-life research and data collection techniques related to management on wildlife refuges. They also have a chance to snowshoe hike, fish and observe wildlife. Teachers regularly suggest additions and revisions to the curriculum.

Some popular courses include Prairie Insect

Students from East Union Elementary School use nets and buckets for Pond Insect Investigation.



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The cost

The program hosted 3,039 student visits during the 2010-11 school year. Busing costs totaled roughly \$13,600. Yearly busing costs average about \$350 per classroom.

In the first two years, nine refuge staff hours are devoted to each partner classroom. The time commitment drops to six hours per class in the next three partnership years as teachers become

prepared to lead their own classroom pre-field trip activity. Additional administrative time is needed to purchase materials and schedule field trips.

While one refuge staffer usually presents the bulk of the field trip lesson, refuge volunteers assist with small group activities during each field trip. Parent chaperones act as additional small group leaders.

If you are interested in starting a Refuge Partner School program, you can download curriculum and other helpful materials from <http://www.fws.gov/midwest/MinnesotaValley/refugeteachers/>. For more information, contact Suzanne Trapp at 952-361-4502 or by email, Suzanne_Trapp@fws.gov.

Minnesota Valley National Wildlife Refuge Partner School Curriculum Matrix			
Years 2-5	Fall	Winter	Spring
Kindergarten	Habitat – Who Needs It?	Who Goes There?	Forests Are More than Trees
Grade 1	Tracking Nature through the Seasons	Survivor: Minnesota Winter	A Peek at Plants
Grade 2	Prairie Insects or Meet the Mammals	WSI: Wildlife Scene Investigators	Pond Investigation
Grade 3	Seeds on the Go!	Tree Math or Bird's Beaks & Adaptations	How Animals Communicate or Wetland Safari
Grade 4	Migration Matters	Winter Under a Microscope	Water Canaries
Grade 5	Minnesota Biomes or White-tailed Deer: How Many?	Tracking Wildlife or Compass Crusade	Landforms or Birding Basics

The Blue Goose Bus Fund

School budgets have left many schools – especially those in low-income areas – unable to absorb busing costs. Indeed, teachers have identified transportation costs as the number one barrier to the Refuge Partners Program. In response, the non-profit Refuge Friends, Inc., which works with Minnesota Valley Refuge, established the Blue Goose Bus Fund. Schools that join the program can apply for partial or total busing scholarship.

There are alternatives to funding by a Refuge Friends organizations. In response to dwindling school district budgets, many foundations have offered grants to support school field trips. Even a 50:50 cost share will entice schools to participate. Fund your refuge's share with grant dollars and let the schools raise the remaining funds.

Many parents have formed school support organizations that assist with raising funds for special projects. Businesses are often looking for meaningful ways to contribute to their community. Consider working with local Audubon, Ducks Unlimited, Optimists or Lions Clubs chapters, among other non-profit organizations.

Watching wetland birds at Bass Ponds is a popular spring field trip activity.



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The Smell of Marsh Mud: Matagorda Island National Wildlife Refuge

Offering Multiple Options for Hands-on Study of an Ecosystem

by Karen Leggett

A barrier island along the coastal bend of Texas that has no causeway, highway or ferry for access, Matagorda Island provides an unparalleled opportunity both to protect natural resources and offer the hands-on environmental educational experience that such an isolated ecosystem can offer.

Hundreds are taking advantage each year as Aransas National Wildlife Refuge Complex uses the island as a key component of its environmental education program.

Many of the schools served by the refuge's education program are primarily Hispanic, and the students' first experience with the bay and the Gulf of Mexico often occurs during a field trip. "It is important that our future leaders understand the interdependence of the estuarine system and the need to protect it. It is through field trips and interaction that a true appreciation and understanding can develop," says Aransas Refuge environmental education specialist Tonya Nix.

The Science and Spanish Club Network – a group of middle school clubs connected to school districts and youth organizations – brings teens to Aransas Refuge, as does the Port Lavaca Water Watchers Club, which reaches primarily underserved urban Hispanic students.

Estuary Education

Aransas Refuge has the largest wetland habitat in the northern part of the Mission-Aransas National Estuarine Research Reserve, a nationally designated complex of wetland, terrestrial and marine environments. One purpose of these reserves is to promote environmental education about estuaries.

A young crane catches a blue crab at Aransas National Wildlife Refuge in Texas. Students learn the connections among water quality, blue crabs and cranes.

While educational field trips have gone to Matagorda Island for decades, in 2008 Nix began meeting with other environmental education professionals, teachers and scientists from the University of Texas and Padre Island National Seashore to outline shared educational goals, including improved understanding of Texas coastal ecosystems and stewardship of coastal resources.

The goals are based on national science standards and aligned with Texas Essential Knowledge and Skills (TEKS) objectives. The group identified objectives and activities for each natural area that did not overlap. "We want visitors to have a unique experience at Matagorda Island, not something they can experience at Port Aransas or on boats that go into the bay," says Nix. Matagorda Island provides an opportunity to teach about the ecosystem of a barrier island.

Getting to the Island and Staying There

When school, Scout or other groups come to Matagorda Island, they spend one or two nights in a rustic bunkhouse originally used by cowboys when the south end of the island was an active cattle ranch. There is no charge for the bunkhouse as long as it is being used for environmental education. Groups must bring their own bedding, toiletries, drinking water and food; the bunkhouse has a full kitchen, complete with cooking supplies. Energy comes from gas and solar panels.

Groups must also arrange their own transportation to the island on private charter boats. Nix says the students with the Port Lavaca Water Watchers Club save all year to pay for boats to bring them to the island. She says the refuge is considering seeking grants or

encouraging the Friends organization to hold fundraisers to defray some of the field trip expenses

The island has a small lab with locally gathered specimens, a few microscopes, plankton nets and viewers, and dissecting kits. Audio-visual equipment is available in a small classroom.

Melinda Nielsen, who brings fifth- and sixth-graders students from Bay Area Montessori School in Houston, says, "The venue is authentic and away from home, enabling students to investigate bay, marsh, coastal grassland, freshwater ponds, estuary and beach shore areas all at once to see how they are dependent on each other."

From Goals on Paper to Hands-on Learning

When groups make plans for a Matagorda Island field trip, they choose from seven lesson plans, including a beach habitat mini-course and a beginning birding nature trek. Some plans existed prior to the Mission-Aransas Reserve collaboration. Others were adapted from The Nature Conservancy, which conducted programs on the island before it became part of the refuge. Nix teaches whichever lesson plan the group chooses.

The Matagorda Island experience is intended to teach students about the value of the estuary as a nursery for developing organisms and the importance of the island as a feeding source for migratory birds. Species are observed and studied in their natural habitats, allowing students to connect with nature while learning the importance of working together to insure the animals/habitats we have today are here for future generations.

Each lesson plan includes a goal, objective, recommended age group, time and season, as well as a very specific list of the TEKS objectives met by that plan. An eighth-grade TEKS requirement



Richard Gonzalez

Cleaning up beach debris requires hard work and team work for students on Matagorda Island.



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Children learn to identify ghost crab tracks and burrows.

Beach Habitat Mini-Course

The objectives of this course are to give participants an understanding of the Gulf beach as an appealing but deceptively harsh habitat for resident biota. Other objectives include:

- Learn to perceive the ecological zones on the beach.
- Find and identify some characteristic animals that live in each zone.
- Observe and discuss the adaptations that permit survival on the beach and the food web that supports these resident creatures.
- Learn some ways that humans can disrupt the natural cycles on a beach.

Site: Gulf beach at Wynne Road

Recommended length: 2+ hrs

Recommended age: Grades 8-12 and adults

Recommended season/time: spring, summer, fall

Materials provided by refuge (except for personal clothing items)

- Outside clothes with sleeves and long trousers to get wet to the knees; wet shoes; hat; sun block.
- four slurpers
- four plastic jars
- four plastic cubes
- two hand nets
- two hand magnifiers
- two 20-30 foot seines for the group
- two five-gallon buckets for the group
- thermometer
- refractometer
- megaphone
- group water jug
- First-aid kit with meat tenderizer
- 2-way radio

Sample activities and questions

There are activities and questions related to several key wildlife species on the beach – tiger beetle, beach hopper, sand digger, palp worm, mole grubs and ghost crabs.

- Catch a tiger beetle in a plastic cube for observation. How does it tolerate sun and heat? How about swimmers and fishermen?
- Find coquinas, the small clams living in the swash zone. Note the sturdy, wedge-shaped shell adapted to the battering surf and shifting sand.

that could be met on Matagorda Island, for example, is for students to conduct field and laboratory investigations using safe, environmentally appropriate and ethical practices.

Another eighth-grade TEKS requirement is for students to learn about the interdependence among living systems. Aransas Refuge provides critical habitat for the endangered whooping crane, which depends on blue crabs as a food source. So students learn about the relationship between water quality and blue crabs. “If the water is too salty, blue crabs will not reproduce,” explains Nix. “Blue crabs, and therefore whooping cranes, are dependent on water quality”

Inquiry Education

Nix guides students through each lesson with a process called inquiry education. When students are on the beach but before they have started digging for ghost crabs, they are asked to consider:

- What signs do you observe that tell us that a critter lives in the sand?
- What critters do you think may live on this beach? Why?
- How would living in a burrow be beneficial to survival on the beach?

Ghost crabs dig down to the water table. Students are asked to figure out

Students with the Science and Spanish Club Network created their own “flash mob dance,” which they perform when Aransas Refuge has an exhibit at local wildlife festivals.

the best place to dig to find ghost crabs. Ultimately, they begin digging close to the water. They are instructed to handle their ghost crabs with care when placing them into a jar and resuming the conversation.

- How does the crab survive on the beach?
- What special adaptations does the crab have to survive in this environment?
- Does the crab have natural camouflage?
- What would be the benefit of being nocturnal?
- How might continual automobile traffic affect ghost crabs populations?

Students observe a ghost crab with scientific precision – the hard exoskeleton, jointed legs, agile movements, special hairs to absorb water from burrow walls, gills that do not need constant immersion in water, pop-up eyes with near 360-degree visual field.

Ghost crabs feed mostly at night on coquinas and smaller crabs. They are preyed upon by birds, coyotes, badgers and feral hogs. After measuring the temperature of the surface and interior of a burrow, students talk about the advantage of being inside or outside the burrow on a hot day.

You're Invited to a Flash Flock Party

Aransas Refuge frequently hosts teens in the Science and Spanish Club Network (SSCN), a multicultural environmental education project created by the Gulf of Mexico Foundation.

SSCN clubs first came to the mainland units of the refuge. Encouraged by Nix, they now come to Matagorda Island as well. Although Nix does use a beach ecology curriculum with these youngsters, they are more likely to learn about the estuarine ecosystem by working in it, doing service projects like beach cleanup. SSCN teens have



Richard Gonzalez

“You see the light go off in kids’ eyes when they get it. They are not out there trying to be cool. Marsh mud smells and they are getting wet and dirty while learning. By the time they leave, they still have a little Matagorda Island smell.”
Tonya Nix

rebuilt a trail beaten down by alligators, observed whooping crane habitat, and – in six visits between 2009 and 2011 – picked up more than 30 tons of trash from the Gulf coast shoreline.

In 2010, SSCN organized a Whooping Crane Flash Flock Party to celebrate both the refuge birthday and Tom Stehn, the refuge’s recently retired whooping crane biologist. Half the celebrants wore red, white and black while Stehn showed up in the whooping crane costume he used to work undercover with the cranes. SSCN teens created their own “flash mob dance,” which they now perform when Aransas Refuge has an exhibit at local wildlife festivals.

SSCN mentor and grant writer Richard Gonzalez planned a Whoop Dance Competition at the Aransas Pass Shrimporee in June 2012, when Aransas Refuge celebrated its 75th anniversary. He has also sent Flash Flock Party Kits to other national wildlife refuges with whooping cranes (Quivira in Kansas, Necedah in Wisconsin, Chassahowitza and St. Marks in Florida) as well as Wood Buffalo National Park in Canada, where the Aransas flock spends the summer. Both Quivira and St. Marks Refuges are making plans to have kids do The Whoop when the first cranes arrive at their refuges.

The Flash Flock Party Kit includes life-size wood cuts of cranes, smaller-than-life size blue crabs and ideas for creating an event that raises awareness about the endangered status of North America’s tallest bird, such as celebrating the day the cranes begin arriving or leaving, building on-site science displays, putting cranes on a parade float or establishing a wildlife biologist day. Gonzalez also believes The Whoop should be just the first of many endangered species theme songs and dances developed by students – he says he’s looking forward to the Kemp’s Ridley Sea Turtle Mambo, the Ocelot Trot or the Bison Bounce.

For information on Whooping Crane Flash Flock Party Kits – or ideas on adapting the party to other species – contact Richard Gonzalez at Richard@gulfmex.org.



Journals and JPGs

Introducing Youth to Wildlife in Colorado and Wyoming

By Karen Leggett

National Elk Refuge is in its fifth year of partnering with multiple organizations to provide a structured program for second-graders in two local elementary schools with large Hispanic populations. One is a nonprofit organization called pARTners, which helps educators use art to enhance learning and invited the refuge to organize some field trips.

Lori Iverson, supervisory recreation planner at National Elk Refuge, thought it was a perfect chance for “kids to learn a sense of place and use journaling to watch a place change throughout the seasons.” Iverson participates in planning meetings with several organizations, including pARTners, all committed to creating an interdisciplinary environmental education program centered on visits to or near the refuge. “It’s one large program,” says Iverson, “with many elements.”

During the first program in 2006, professional artists and photographers provided basic drawing and photography lessons in the classroom to 150 children, who also learned how art can be applied to science. Children brought journals and cameras provided by the Jackson Hole Wildlife Film Festival on each trip to the refuge. They filled their journals with stories and observations and created keepsake covers to preserve their work. After each visit, Film Festival staff gave students a 4x6 copy of one of their photos to put in the journal. Each class also received digital copies of all the student photos.

Seasonal Visits to the Refuge

Before the first trip to the refuge in October, a local geologist met students in the classroom to introduce the concept of how geology influences the flora and fauna of a region. A geologist also accompanied the students on their

The Jackson Hole Wildlife Film Festival provided cameras and journals for the children, who filled the journals with stories and observations and created keepsake covers to preserve their work.

Students use hand lenses and an aquatic insect chart to identify food sources for the birds they observed earlier in the day.

visit to the refuge to study such rock formations as Miller Butte.

Before the winter visit to the refuge, youngsters learned in the classroom about the area’s common mammals and the role of predators in the ecosystem. This lesson was provided by Beringia South, a local nonprofit organization dedicated to preservation of the natural environment. A refuge staff person visited the classroom once to teach students about elk migration and biology, including winter survival habits, as well as appropriate ways to view wildlife to reduce stress on the animals.

The winter visit to the refuge included a sleigh ride during which students identified the major Jackson Hole landforms, learned to tell the difference between mature male and female elk and describe such elk behaviors as mewing, bugling and sparring. They also visited the feed shed to learn about the refuge’s role in supplementing winter feeding.

Classes in the spring focused on raptors and migratory birds. Students dissected pellets in the classroom to identify the creatures being consumed by birds. On the refuge, students identified birds at a wetland site.



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Open to Change

The program created by National Elk Refuge and its partners addresses at least four state curriculum standards:

1. Students describe the landforms in Jackson Hole.
2. Students learn about the interdependence of all living things.
3. Students learn how they are responsible members of their community and the environment around them.
4. Students understand the possible hazards during scientific investigations and practice safety procedures.

While lessons are designed to meet these standards, the specifics may change from year to year according to the interests and capabilities of participating organizations. In 2010, for example, Gina Pasini, a seasonal biological technician at Red Rock Lakes National Wildlife Refuge in Montana, spent a two-week detail at National Elk Refuge developing learning stations for the spring field trip.



Supervisory recreation planner Lori Iverson discusses nature journals with students.

At one station, a refuge volunteer taught students how to use binoculars and took them on a bird walk. At the second station, Pasini focused on bird beaks and foods. After a short lesson about how beaks are adapted for the food a bird eats, children used hand lenses to identify aquatic insects that had been scooped from the water by student volunteer Cord Schultz, who was completing 40 hours of required community service on the refuge. Then Pasini prepared a “macroinvertebrate soup” with the insects available nearby.

Making School Collaborations Work

Iverson, a former teacher herself, believes there are several keys to initiating and maintaining effective partnerships with schools.

✦ Find out what a particular school or teacher needs. “Teachers always get requests from people who want to come into their classroom. As an environmental educator, you have to ask, ‘What can I do for you?’ rather than, ‘Here’s something I have for you.’”

✦ Communicate with teachers regularly – typically with one lead teacher from each school.

✦ Make sure lessons are aligned with curriculum objectives, which are usually established by states and local school districts; many states are now

adopting national core standards. These standards are available online and might include such objectives as, “Students communicate the basic needs of living things and their connection to the environment.” Some states, including California and Maryland, have specific environmental literacy standards.

✦ Don’t just look at science standards; teach to other subject areas wherever you can, especially language arts, social studies or math. Iverson always tries to mention other subjects she knows teachers must cover: “Adaptation. That’s a big word – let’s spell it. Or perhaps, if there is a food source available, but it’s a long ways away, an

“If you put a camera in someone’s hands, they have to look at the world more closely,” says photography instructor David Showalter.



David Showalter

animal may not go to get it. If there are 1,000 calories of food but they’re 500 yards away, how much energy will the animal expend to get the food?”

✦ Before visiting a classroom, focus some attention on classroom management. Find out if there are children with disabilities who need accommodations, if there are behavioral issues, or if some children don’t speak English.

Cameras in Action at Rocky Mountain Arsenal

Rocky Mountain Arsenal National Wildlife Refuge in Commerce City, CO, has also used cameras with grand effect – including student photos displayed in the rotunda of the state capitol in Denver.

In 2008, former refuge education specialist Stacy Armitage contacted Pentax, headquartered in nearby Golden, seeking someone who could co-teach a photography class. Instead, Pentax donated 10 cameras, lenses and memory cards. David Showalter, a professional photographer who was taking pictures on the refuge for a book, agreed to volunteer his skills for a refuge photography program with at-risk youth. Cameras in Action began as a three-day summer workshop to connect kids to nature.

“I didn’t know how important it was until I started doing it,” said Showalter, who photographed the refuge for his book *Prairie Thunder*. “Give kids a camera, and it completes the circuit between them and nature. They start crawling around and bringing back a lot of intimate landscapes. It’s almost like they are hard-wired to explore.”

The program targets 15- to 17-year-olds, often minorities, both from area high

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schools and The Link, a local resource center for at-risk young people. The executive director's husband volunteered at the refuge. About 16 students participate each year. The program took a break in 2011 while the refuge finished its new visitor center. In 2012, the refuge will offer a two-day workshop for high school students plus a two-day program for middle school students, which is a more appropriate match for the youngsters served by The Link. The changes were made to spread scarce resources as broadly as possible and continue the successful partnership with The Link.

Two-day workshops mean time is of the essence. "Maximize time in the field," emphasizes Showalter. "There is no reason to spend time learning Photoshop™ when we can get kids in the field or photographing a detail of a bird feather in the visitor center." The teens work in pairs, each team named for a refuge animal. Armed with cameras and field guides, the teams are

expected to return with observations written in a notebook, information from a field guide – and ideally – photos of their team's critter. At the end of the day, they gather to evaluate each other's photos.

Each student has a camera – a high-end digital SLR in this case. But Van Dreese cautions, "The more elaborate the camera, the more knowledgeable the instructor must be. A simple point and shoot could be most useful. I don't know that a specific camera is what makes this program so successful. In fact, I sometimes find our fancy cameras have too many functions and confuse the kids."

Workshop participants choose their best photo for display in the Colorado State Capitol Building, an opportunity arranged by a refuge volunteer who also volunteered at the Capitol. The Friends of the Front Range – the refuge Friends organization – paid to have each photo framed; the framed photos are later auctioned by the Friends as a fundraiser. Participants take home a framed photo as well as a

CD of all their photos and 10 prints of any size they choose. They also receive a certificate showing themselves taking pictures.

"The presentation at the capitol was a big deal," says L.A. Rogers, assistant director at The Link. "We work with a lot of lower income youth who don't always have opportunities. Being trained by a professional photographer and being able to pick a picture to share – every kid was at the capitol with a parent or representative. This was definitely on the 'cool' spectrum!"

Showalter acknowledges that everyone, even professional photographers, "needs affirmation and a sense of accomplishment," but he perceives a larger purpose for Cameras in Action as well. "If you put a camera in someone's hands, they have to look at the world more closely. We need to light a lot of sparks or we are going to have a conservation void in the future."



Refuge volunteer Jim Snyder points out a bird's nest in the cattails to a group of young naturalists.

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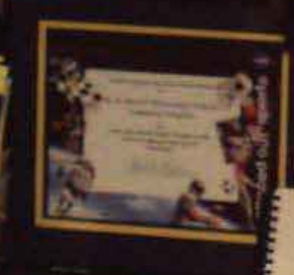
What is a wildlife refuge?
What animals plant & habitats
are in a refuge?
Why are wildlife refuges
important?
What do people do on



How can
birds
our
lives, and
the
change?



Potomac
Wildlife Refuge
Maryland



Infused with Wildlife

Teaching Refuges to All Students

By Karen Leggett

While some schools offer foreign language immersion programs, Kate Waller Barrett Elementary School in Arlington, VA, offered Refuge System immersion in 2011-12. Nearly every subject, special event, field trip and family activity was infused with national wildlife refuges, wildlife or habitat conservation and ... Puddles, the Refuge System mascot.

Barrett Elementary is an urban school just outside Washington, D.C., with 510 students in grades K-5. Almost half do not speak English as their first language and more than half are eligible for free or reduced-price lunches. Two teachers with boundless energy and imagination – Laurie Sullivan and Allyson Greene – oversee Barrett Elementary’s Project Discovery, in which students delve deeply into such topics as NASA, engineering and now wildlife. They get strong support from the school librarian, classroom teachers and principal.

Sullivan submitted a year’s worth of activities, projects and curriculum to the ToyotaTAPESTRY grant program, with a letter of support from the Refuge System. Barrett Elementary won a \$10,000 Toyota grant that has been spent primarily on computers; digital cameras; an honorarium for nature photographer Corey Hilz, who taught the children about the elements of design and fundamentals of nature photography; transportation for field trips; postage stamps and other miscellaneous supplies. Another \$2,000 grant from the ING investment company paid for binoculars and additional cameras. Most of the projects required more creativity, time and enthusiasm than money, although the Refuge System’s Washington Office provided significant quantities of brochures, banners, Refuge Week posters, Refuge System coloring books, stickers, pens, other educational items and speakers on numerous occasions.

Teachers Cristina Torres and Laurie Sullivan help children practice costume-rearing whooping crane chicks.

The school learned in spring 2011 that it had won the Toyota grant and so prepared the student body for the refuges-filled curriculum that beckoned for the next school year. As children were itching to end school in June 2011, the Refuge System mascot Puddles danced through a school assembly, leading everyone in a loud and lively rendition of Rock the Refuge (on YouTube at <http://bit.ly/xyB8Dl>). The song was written by Wendy Cohen, a resource teacher for gifted students, and reprised throughout the 2011 - 2012 school year. Children were encouraged to take photos of their outdoor adventures during the summer – and even visit nearby wildlife refuges – while teachers were invited to training sessions.

Prepping Students and Teachers

About a dozen teachers came to Patuxent Research Refuge in Maryland for a half-day workshop that included a tram ride through forest, wetland and meadow habitats, viewing displays in the visitor center and discussing lessons to be used before, during and after field trips. On another occasion, Potomac River National Wildlife Refuge Complex park ranger Patricia Wood led about two dozen Barrett teachers in a Project WILD workshop. Each teacher received the Project WILD Curriculum and Activity Guide, which is aligned with the Virginia Standards of Learning.

When it was time for third- and fifth-graders to visit Patuxent Refuge in the fall, they were ready. Barrett Elementary librarian Margaret Frick had children research plants and birds they would find at Patuxent Refuge; refuge staff remarked on the student’s level of preparation.



Barrett Elementary School

Students mailed letters to family members, friends and other refuges asking them to send back photos of Flat Puddles on a national wildlife refuge.

Before the year was over, Barrett students would also visit Elizabeth Hartwell Mason Neck and Occoquan Bay National Wildlife Refuges in Virginia. When fourth-graders were hiking through Mason Neck Refuge and State Park in November, they took photos of plants and landscape, such as an eroding hill with a tree about to fall, water flowing over one part of the trail, leaves or fungus on a tree. One student in each hiking group recorded the exact location of each item or specimen. In April, fourth-graders visited the refuge again, carrying laminated cards of the photos and the precise location. As they found each item in this digital scavenger hunt, students had to note any changes they could observe. Students also visited Occoquan Bay Refuge to participate in bird banding.

Throughout the year, Barrett Elementary’s activities were chronicled in an extensive blog (<http://tinyurl.com/BarrettNature>), a Facebook page (<http://tinyurl.com/BarrettNatureFacebook>), photos posted on Flickr (www.flickr.com/photos/projectdiscovery/) and videos on YouTube (www.YouTube.com/BarrettNature).



Barrett Elementary School

On a giant map of the United States, Puddles “drove” a school bus through several states every time the children read another 5,000 books. Reading is the fuel for the bus to pass by more and more national wildlife refuges.

Day by Day in the Classroom

Principal Terry Bratt challenged students to read 60,000 books during the school year. On a giant map of the United States, Puddles “drove” a school bus through several states every time the children read another 5,000 books. Reading is the fuel for the bus to pass by more and more national wildlife refuges. One fourth-grader came into the Discovery Lab and looked longingly at the book *America’s Wildlife Refuges: Lands of Promise*. “I’ve been waiting to read this book,” he said. “There are so many refuges, I don’t know how I’m going to get to them all.”

Sullivan and Greene collaborated with classroom teachers to incorporate refuge information, themes and activities into many curriculum areas, always making sure that they were helping teachers meet Virginia’s Standards of Learning curriculum objectives. As with most state standards, the objectives spiral through the grades, with children first learning about animals, then habitats and environments, then interactions among species.

“We could easily see that through the refuges, we could teach major concepts such as habitats, ecosystems, plants, animals, seasons and human impact on environments,” said Sullivan. “We could envision students learning about the jobs refuge managers and wildlife

biologists carry out. The students could replicate the science and mathematics skills that are used on the job, such as observation, data collection, data analysis and sharing results.”

One kindergarten lesson focused on two questions: What is a wildlife refuge? What is a habitat? Youngsters learned to use tally marks to track each piece of information they learned about an animal’s habitat (food, water, shelter, space). They learned about refuges from the Refuge System coloring book that was given to each child.

Kindergartners pretended to be whooping cranes migrating through the halls of Barrett Elementary – an iMovie of their frenzied fluttering is online.

Barrett Elementary students learned about the entire Refuge System, including Kilauea Point National Wildlife Refuge in Hawai‘i, as they received photos and information in response to their letter writing campaign.

First-graders learned what is happening to polar bears on Arctic National Wildlife Refuge. Second-graders used a Build-a-Bird application on iPads that required them to select the right beaks, wings, habitat and body for several specific birds. Third-graders are learning about energy and renewable resources. They will use their new knowledge to become “energy consultants” and suggest ways for refuges to use more renewable resources of energy.

Fourth-graders prepared presentations for second-graders, including video clips and PowerPoint and in one case, a puppet show with marionettes fashioned from the animals in the coloring book. The students evaluated each presentation, deciding whether it answered questions in a memorable way: What is a wildlife refuge? What wildlife can be found there? What habitats can be found there? What do people do on a wildlife refuge? Why are wildlife refuges important?

Fifth-graders, who traditionally produce a bound “treasure book” filled this year’s books with their own nature writing and photos.

Special Events

Special days and family activity nights also featured refuges at Barrett Elementary. National Fire & Emergency Response Advisor Fred Wetzel, marine specialist Brett Wolfe, and birding specialist Michael Carlo all attended Career Day from the Washington Office. Greene said there was a noticeable increase in the number of students who could envision working in nature- or science-related fields. One first-grader wants to be a mycologist because “she had learned the word and liked fungus,” explained Greene with a smile. A mother asked how to say “forest ranger” in Spanish.



Barrett Elementary School

The Rock the Refuge Celebration and Science Discovery Fair in February featured a chance to take a photo with Puddles, several participants from the Refuge System Washington Office, a live raptor show, a bird migration game in the gym, and animal and nature projects in the Discovery Lab and the library.

Flat Puddles

Librarian Frick used Flat Puddles as a springboard to help children and their families learn about refuges all over the country. Based on the Flat Stanley children's books, Flat Puddles is a flat paper image of the blue goose. In their science enrichment class, students mailed Flat Puddles with a standard letter to friends, family members and other refuges asking them to "Please take this picture of a Blue Goose to a wildlife refuge near you. ... Find a great spot to take a picture of Flat Puddles experiencing the outdoors." Students used both traditional postal mail (with \$176 worth of postage stamps!) and email with a specially created account for PuddlesBGoose@gmail.com. The response was tremendous and immediate.

More than 500 digital photos were sent from students' family and friends after they visited distant refuges or from refuges themselves. Refuges sent stamps, brochures and a promise to send Flat Puddles to another refuge. Frick used each email or letter as an opportunity to introduce the youngest children to research. They would locate the refuge in a state, find out a little bit of information about the state and learn about an animal that lived on the refuge.

Michael Carlo, a Refuge System visitor services specialist who participated in several events at Barrett Elementary, believes the year-long involvement with refuges "created continuity, not just a memory." Carlo especially liked the powerful and visible connection that was made when several Refuge

Third-graders wrote new lyrics to a popular song and danced during a pep rally to kick off a year-long celebration of national wildlife refuges at Barrett Elementary School.

System staffers showed up for a single event, like the science night devoted entirely to conservation. If the entire Barrett Elementary program seems overwhelming, Carlo recommends that a refuge work with a single school to identify five goals or activities to accomplish in a single year. Then evaluate the outcomes before deciding to continue for another year.

To get the kind of results seen at Barrett Elementary, Sullivan suggests that refuges contact the science lead teacher or the person in charge of the science curriculum for the entire district. Teacher meetings offer refuge staff a chance to speak about partnership opportunities or provide simple fliers: "Would your kids like to see deer antlers? We have a lesson that meets your curriculum standards." Simple, printed material is more likely to be read than emails, say the Barrett teachers.

"Make sure teachers have an opportunity to say what they would like to see as part of any project," advises Sullivan. "Teachers at every grade level at Barrett saw our proposal before it was submitted." She also mentioned the particular appeal of Puddles and small educational items – like pencils, calendars, stickers and all those coloring books – that children can take home. Barrett Elementary concluded the school year with a Rock the Refuge assembly showcasing students' refuge-related creations. "The Refuge System is a priceless gift, reflecting the great diversity of the tapestry of life and the commitment of the United States to wildlife conservation," wrote Sullivan in her grant application, quoting from the Smithsonian Book of National Wildlife Refuges by Eric Jay Dolin. "We hope as a result of this project that our students, parents, educators and the community will better appreciate this gift and care for it in the future."

To get the kind of results seen at Barrett Elementary, Sullivan suggests that refuges contact the science lead teacher or the person in charge of the science curriculum for the entire district. Teacher meetings offer refuge staff a chance to speak about partnership opportunities.



Barrett Elementary School



*A student learns by doing,
becoming comfortable in the
natural habitat around him.*

Building Environmental Literacy One Class at a Time

From 26 Students to 320 in Three Years

By Karen Leggett

For the past three years, every student in third- through sixth-grade at Imperial Beach Elementary School has come to units of the San Diego National Wildlife Refuge Complex in California twice a year – 320 students from an urban, predominantly minority, low-income school who receive rarely offered hands-on instruction about wildlife and habitat.

It all started with one teacher who wanted her fourth-graders to know about the natural world around them. “Students learn about how to take care of this habitat,” said Cheryl Evans. “It is literally in some of their backyards.” Gradually more grade levels began coming to the refuge and they came more frequently.

Third-graders come to Tijuana Slough Refuge and the Sweetwater Marsh Unit of San Diego Bay Refuge to learn about estuaries. In fourth-grade, they go to San Diego Refuge to learn about riparian habitats and the impact of upriver activity downriver. By fifth-grade, youngsters are learning about the water quality in the bay by visiting San Diego Bay Refuge and learning about oak woodland habitat at Crestridge Ecological Reserve (a state partner). They are also able to see that the coastal sage scrub they planted in fourth-grade is growing. By sixth-grade,

they are teaching each other: “Oh, don’t you remember when we went there and did this?” “I planted over here.” “This is where I learned to use binoculars.”

A curriculum has been created for each refuge or refuge unit. San Diego Refuge Complex environmental education specialist Chantel Jimenez worked with teachers to write the curriculum and update it to meet changing state objectives. This year for the first time, California teachers must meet specific requirements in environmental literacy. Third-graders, for example, must learn about “structures for survival in a healthy ecosystem;” sixth-graders are to learn about the “dynamic nature of rivers.” The curriculum also meets state standards and objectives in other subject areas, such as language arts and social studies.

Salt Marsh Bingo

The teacher’s guide for each refuge includes activities (with detailed procedures and required materials), a glossary and background information. One activity uses a specially made bingo game to teach salt marsh plant adaptations. Students receive a hand lens and a bingo card with pictures of different wetland plants. Some plants are excreters, some accumulators. The hand lens enables children to see salt crystals on any plants that are excreters. As they would for a scavenger hunt, students search the salt marsh for plants shown on the bingo cards. They have to identify three in a row and then show their classmates where they found the plants.

After the bingo game, students choose one salt marsh plant to observe more carefully, recording specific information on observation sheets that ask such questions as, “Where is your plant found? Is the soil wet or dry? Is your plant slender or bushy? Are the leaves thick or thin? Sticky, waxy or hairy? Children also have room on their observation sheets to draw a picture of their plant.

For the teachers, the guide explains words like halophyte (a plant that grows in salty or alkaline soil), excretor

Barren land becomes green one year after students plant coastal sage scrub.





By the time children come as sixth-graders, they are more engaged. Not only are they prepared to get wet, but they can also talk about cord grass and plankton, not just bugs and leaves. “Their hands come up quicker to answer questions,” says Jimenez. There is pride of ownership. “I heard a kid say that he brought his mom to water his plants in the summer.”

Value of Multiple Visits

“We need programs that don’t take much time, aren’t too expensive and build upon knowledge from previous years,” says Jimenez. Jimenez acknowledges the value of being at a refuge that is on a public trolley line as an important way to reduce transportation costs. Eventually, Jimenez hopes to train a cadre of volunteers or docents who can also be environmental educators on the refuge.

Each of the refuge’s educational experiences is available to any school. Teachers may choose Sweetwater Safari or Tijuana Estuary Explorers – or both. Typically, 12 to 20 classes come to the refuge each year to do a single program.

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A big key to success in initiating a school-wide program is to start small and have a champion at the school.

and accumulator with examples of each. Picklewood stores salt, sea lavender excretes salt. There is also a brief discussion of how plants survive in salt so that teachers have an understanding of the science their students are expected to learn. Both students and teachers can also learn the same information visually in the refuge exhibit hall.

Getting Started

A big key to success in initiating a school-wide program is to start small and have a champion at the school. “We started with one classroom of 26 students with one teacher and it grew from there. There were money issues, grants that didn’t come through. But it will happen if you have good people on your team. Take time to find those people,” advises Jimenez, adding that “to have a school that is dedicated to taking time out of the classroom says a lot about the value of this program. And it all started with one teacher.”

Teacher Cheryl Evans credits Jimenez as well. “This works because Chantel

and I work closely together and coordinate our efforts. She makes sure the refuge is ready for us and I make sure the teachers know what is expected of them.”

Jimenez provides a half-day of training for the teachers before students appear. “The teachers learn what the students learn,” says Jimenez. “What is a tidal salt marsh? What habitats and plants will kids see? What science objectives are they meeting?” Teachers often feel they don’t have the expertise to lead a field trip on their own, so Jimenez’ training is intended to enable them to answer a few questions without feeling as if they need to be the expert.

The San Diego Refuge education program is funded with grants from Sempa Energy Foundation and the California Wetlands Recovery Program, as well as smaller grants and help with transportation funding from the Friends of San Diego Refuge. Most of the instructors are contractors from the Earth Discovery Institute and paid by the refuge.

Jimenez has concluded that “multiple trips in a year and multiple visits over several years have had a greater impact on the students’ connection with nature and desire to be outside.” Jimenez is thrilled when children have an “awe” moment: doing science in the field, putting a plankton net in the water and realizing it is full of living creatures – creatures they didn’t want to touch at first.

By the time children come as sixth-graders, they are more engaged. Not only are they prepared to get wet, but they can also talk about cord grass and plankton, not just bugs and leaves. “Their hands come up quicker to answer questions,” says Jimenez. There is pride of ownership. “I heard a kid say that he brought his mom to water his plants in the summer.”

Evans also believes there is long-term value in helping children feel comfortable in the natural habitat surrounding them. “There are signs posted saying that we have planted in certain areas. Former students are always coming over to tell me what they see when they go over to the refuge. And one student always says, ‘this is the best field trip ever,’ each time we go.”

Field Lesson: Salt Marsh Plants

TEACHER'S NOTES

Duration
40 minutes

Location
Outside next to Salt Marsh Plants

Halophyte
(hal e fit) A plant that grows in salty or alkaline soil

Excreter
Releases or gets rid of salt

Accumulator
Holds in salt

Marsh succulents
like *Jaumea* and *pickleweed* store salt inside their tissues

Salt grass excretes salt onto its leaves

Alkali heath is another marsh grass that excretes salt

Cordgrass excretes salt

Sea lavender excretes salt

Overview

This activity uses a specially made bingo game to teach salt marsh plant adaptations. Students will choose one salt marsh plant to observe and record in their journal.

Objectives

Students will:

- Be able to distinguish how salt marsh plants adapt to a salty environment.
- Know the difference between accumulator and excreter; describe the physical characteristics of both.
- Learn two endangered bird species that are dependent on salt marsh plants.

Materials

- Salt marsh plant sign
- Explorer plant backpack:
 - Bingo cards
 - Bingo card pieces
 - Hand lenses
 - Explorer journal

Background

Salt marsh plants live in a very extreme environment. Salt marshes are places where salt water from the ocean fills up the marsh daily during the high tides. The plants that live here must deal with this daily influx of water and salt. They are unique in that they have special adaptations to living with high quantities of salt.

Procedure

1. Before explaining the rules of the bingo game, give a hand lens to each student. Explain that the hand lens will allow them to see salt crystals on the excreters or any other detail.
2. Explain the rules of the bingo game.
3. Each pair of students gets a bingo card (all the cards are the same). The cards have pictures of different wetland plants. Each plant is either an excreter or an accumulator.
4. One plant is not an excreter or accumulator (salt marsh bird's beak). This plant is located in the upper middle box on the bingo sheet.
5. Explain that this plant is endangered and therefore we are not allowed to be near it. This space on the card is a "freebie" for everyone. The green bingo card piece goes on the salt marsh bird's beak space.
6. The other bingo card pieces are to block out other squares on the card. Some pieces have a clapper rail and some have the Belding's savannah sparrow. Clapper rail pieces go on excreter plants marked "excreter." Savannah sparrows go on accumulator plants marked "accumulator."
7. Each pair of students tries to find the plants on the bingo cards on their own in the salt marsh like a scavenger hunt. They will have to get at least three in a row and be able to share with the class where they found them. Define the boundaries of where they can go.
8. After the plant bingo, each student picks one plant to observe and takes notes in a field journal using the provided observation sheets.



Lisa Cox

Students choose one salt marsh plant to observe more carefully – such as this salt marsh bird's beak plant – and answer such questions as, "Where is your plant found? Are the leaves thick or thin? Sticky, waxy or hairy?"



Environmental Learning = One Trail + Many Partners

By Heather Dewar

What does it take to teach the children of hard-pressed immigrant farm workers how to do science and feel at home in wilderness? At Florida Panther National Wildlife Refuge near Naples, FL, it takes a refuge trail and a carefully-crafted set of hands-on lessons in scientific fieldwork, designed in partnership with local teachers, the Florida Department of Environmental Protection (DEP), and the staffs of nearby parks and reserves.

Florida Panther Refuge and another Florida refuge, St. Marks National Wildlife Refuge in the Florida Panhandle, are among the field sites participating in 18 localized versions of the state's Learning In Florida's Environment (LIFE) program. Now in its eighth year, the program seeks to boost middle school students' science achievement and environmental awareness, placing priority on schools where poverty rates are high and scores on state achievement tests are low.

Participating schools work with the state and with educators from various outdoor sites to develop a yearlong environmental science curriculum, anchored by field excursions to several sites where the children collect, record and analyze basic ecological data. The Big Cypress Watershed Project, which includes Florida Panther Refuge as a field station, is one of the LIFE program's busiest sites. In November and December, some 550 seventh-graders from three Collier County middle schools take turns visiting the refuge for a day of field observations and a dollop of educational play.

Students learn how differences in elevation and plant life affect where panthers prefer to hunt.

Though Naples is known as a wealthy enclave, many students in the LIFE program have parents who work in low-paying service industries, or as migrant farm workers. Immokalee Middle School, for example, is in the heart of South Florida's winter vegetable belt, where the local radio station broadcasts in Spanish, Haitian Creole and two Mayan languages, and 40 percent of the population lives on incomes below the federal poverty line.

"Most of the students have parents who work two or three jobs to put food on the table," said Florida Panther Refuge ranger Sandy Mickey. "They can't afford family trips to the beach, so any chance to spend time in nature is a major life experience for them."

Customized Lesson Plans

The LIFE program's constant is hands-on data collection, centered on basics such as air and water temperature, humidity, wind speed, water depth and salinity. Customized lesson plans teach students how to use that data as another way of seeing the landscape, and understanding how plants and animals survive in it. For example, in one field exercise students propose a hypothesis about the role of soil moisture (or another abiotic factor) in determining what plants grow in a particular spot, and then measure soil moisture to test their hypotheses. In South Florida, where a few inches' change in elevation spells the difference between a pine-forested upland, a sawgrass prairie and a watery cypress slough, there are lots of possibilities.

As the only environmental educator on a refuge that is mostly closed to the public, Mickey recruits helpers from the refuge staff, the LIFE program, other environmental learning centers, and participating schools. "Even the school bus drivers get involved," she said.

Classes are split into two groups. Half gather data in habitats that support dozens of varieties of native orchids, bromeliads and other epiphytes. Many have never seen plants growing anywhere other than a field, and are astonished by the refuge's wild abundance of epiphytes, which in some places cover virtually every limb of every tree.

The others collect data in three different habitats – a wet prairie, a tropical hardwood hammock, and a pine flatwood. They learn how elevation determines the plant community; how plants create a microclimate; and how those factors combine to determine where panthers prefer to hunt for white-tailed deer and where they hide out with their cubs.

"We see panther tracks pretty often," Mickey said, and the children respond with "complete enthusiasm and awe... The really cool part of the program is getting them out on the trail and watching their eyes light up" when the data come alive.

After a morning of data gathering and lunch, the students set aside their data sheets "to blow off steam before they get back on the bus," Mickey said. For the afternoon's more rambunctious learning sessions, Mickey has tweaked the classic game of tag.

Role Playing

In one version half the children play the role of Florida panthers traveling through their home range, while the other kids play obstacles the children encounter on the way, such as highways, mercury contamination, prey shortages, or other cats defending their home ranges. By game's end the children have learned about threats facing the endangered panthers and the importance of wildlife corridors.

In the other activity, half the children play the part of fire, while the other half don red shirts to play wildland firefighters, who try to keep the "fire" confined in a marked-off square. The students experiment with various fire control measures to even out the game – moving pylons to simulate bulldozed fire lines or calling in an imaginary aerial water drop, carried out by a student who swoops across the field wearing a helicopter pilot's helmet. By the game's end, the children have learned about the principles of prescribed burning, Mickey said.

The games "have been really effective at getting the students to run around and burn off some energy but also to learn while they're playing," said David Graff, coordinator for the LIFE Big Cypress Watershed Project.

The LIFE program is flexible enough to accommodate sites as different as St. Marks Refuge, an environmental education powerhouse that offers programs to thousands of people each year, and Florida Panther Refuge, which has

limited public access and – aside from a few special events each year – offers fewer programs and recreational activities.

Each program shares common elements, said Misty Alderman, an environmental education specialist who coordinates the LIFE program for the Florida Department of Environmental Protection. Among them are:

- ✦ Multiple visits to outdoor sites, each with its own set of unique field labs;
- ✦ Localized content, collaboratively designed to mesh with teachers' curricula;
- ✦ Lesson plans that incorporate the fieldwork into science, math, social studies and even language classes;
- ✦ Pre- and post-visit testing to confirm that students have learned the key concepts; and
- ✦ Teacher training to implement the lesson plans and follow up on student outcomes.

Participating teachers spend two full days going over the field activities in detail, Graff said. At the start of the program, teachers walk through the field activities, either in a classroom or, if possible, at one of the sites their students will visit. The teachers collect the data, test the sampling equipment and note any changes in the lesson plans. When the semester ends the teachers



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Florida Panther National Wildlife Refuge participates in Florida's LIFE (Learning In Florida's Environment) program, in which students collect, record and analyze basic ecological data on the refuge.

go over the students' data sheets in detail, assessing which ones succeeded in their teaching objectives and which ones need to be modified.

What Does It Cost?

Start-up costs for LIFE programs vary, but a bare-bones price tag to establish the program in three middle schools is around \$5,000, not including the state LIFE program staffers' time. It costs about \$2,000 per year to sustain a LIFE program serving 150 students, with most of that money going to provide bus transportation, Alderman said.

In these days of lean school budgets, the state does not pick up the tab. The DEP's LIFE staff helps school districts obtain grants from various state and federal sources. NOAA's Bay Watershed Education and Training (B-WET) program has funded the LIFE program at Florida Panther Refuge for three years. Some sites receive one-year state grants.

The Florida DEP points to students' higher math and science scores in internal tests and, for some schools, on statewide achievement tests as well.

In a modified version of tag, half the children play the part of fire, while the other half play wildland firefighters trying to keep the "fire" confined in a marked-off square.



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“We see panther tracks pretty often,” Sandy Mickey said, and the children respond with “complete enthusiasm and awe. ... The really cool part of the program is getting them out on the trail and watching their eyes light up” when the data come alive.

Lesson plans incorporate science, math, social studies, language – and sometimes a canoe ride – into field trips to Florida Panther National Wildlife Refuge.

For example, in 2010, the year after the first group of Immokalee Middle School seventh-graders completed the program, about one-fourth of the school’s eighth-graders passed the state-mandated science achievement test. That might be considered a sad result, but it’s a 92 percent improvement over the school’s passing rate the year before.

There’s no proof of cause and effect, but Florida DEP surveys found that in 2010, 95 percent of the teachers participating in the LIFE program felt it boosted their students’ achievement test scores.

Students also give the program a thumbs-up. In 2010, 61 percent said the program made them more comfortable outdoors; 79 percent said the field work was fun; 80 percent said the field activities helped them understand their

science lessons better; and 81 percent agreed that “the outdoor field activities have made me more aware of how my actions affect the environment.” When asked for details, the students replied with specifics like, “turn off lights when I’m not using them,” “clean up dog poop even if it’s not my dog poop,” “plant some local flowers around my house,” and “respect Earth.”

Environmental educators at refuges and elsewhere can use the program’s free field lab outlines, which are site-specific, but can be adapted to other locations. To see the field labs, go to the LIFE program web page – www.dep.state.fl.us/secretary/ed/lifeprogram.htm – find the list of participating sites, and click each site’s links to see its unique content.



Nature in the City

The Garden that an EE Partnership Built

By Karen Leggett

Longstreth Elementary School teacher Chuck Lafferty, who grew up near Pennsylvania's Tinicum Marsh, now has a kindergarten classroom full of bugs and reptiles. It's all part of making the marsh and nearby John Heinz National Wildlife Refuge at Tinicum key parts of his kindergarten curriculum at the inner-city school where one father says most kids don't have anything to do with nature.

Central to Lafferty's curriculum is a pollinator garden at the refuge, which the students started and maintain. Lafferty calls the connection between the children and the refuge "a shining example of what is possible when a group of dedicated and devoted people get together." Refuge manager Gary Stolz agrees on the importance of partnering with "teachers who have the spark. Then help them get the materials they need any way they can. You need shared ownership in these projects."

In addition to the school and the refuge, others involved in the partnership have included the Refuge Friends organization, the Pennsylvania Horticultural Society, National Fish and Wildlife Foundation, Penn State University Master Gardeners and Project BudBurst. For example, Longstreth Elementary School had a partnership with the Pennsylvania Horticultural Society, which donated soil for a vegetable garden at the school that was used for native plants beds on the refuge.

It all started in 2000 in a vacant lot next to a Longstreth School annex, which Lafferty's students turned into a schoolyard habitat with \$122 they had collected – in pennies. In 2001, the

Children carried soil to the raised beds in buckets.

school received a Sea World Busch Gardens environmental award for the garden and that same year, Lafferty met Jean Diehl of the Friends of Heinz Refuge. The Friends offered to sell organic seeds from the schoolyard habitat and return half of the profits to the school's other environmental education programs.

Humanity for Habitat

Lafferty, who joined the Friends board, jumped at Diehl's suggestion that the Friends apply for a Nature of Learning grant from the National Fish and Wildlife Foundation so Longstreth Elementary students could construct a pollinator garden at John Heinz Refuge. The grant, awarded in late 2010, provided funds to purchase more than 2,000 native plants, nurtured in beds at Longstreth Elementary and transplanted to the refuge.

Pennsylvania is currently developing statewide standards for outdoor education. Lafferty says Longstreth Elementary will

Weeds and old plants went into a compost bin which later provided soil to fill the raised beds of the pollinator garden.

be one of the few schools with its own place to meet standards without leaving school grounds. Native plants grown in the Longstreth Elementary beds will be made available to other schools in Philadelphia.

The children came to the refuge in February 2011 to begin working on the project. They cleared everything out of an original habitat garden. "We had 30 kids and eight parents, including six dads," remembers Lafferty.

The native plants from the habitat garden on the refuge were taken back to the Longstreth Elementary Native Plant Nursery, where kindergarteners and their sixth-grade habitat buddies cared for them over the winter. Everything else went into a compost pile. On the second visit, raised beds were built to hold the composted soil. Parents, volunteers, Friends and refuge staff provided a three to one ratio of adults to kids. Even kindergarteners were proudly wielding their own shovels and rakes.

The Friends paid for bus transportation for six field trips and project t-shirts. Five-year-old Shanice Gonzalez drew



Sixth-graders produced a brochure on the benefits of using native plants in home gardening.

Learning from the Pollinators Longstreth Elementary School



Friends of Heinz Refuge

Native Plant Pollinator Garden

A Partnership Between
Friends of Heinz Refuge &
Longstreth Elementary School



Order: When I was at the garden, about how there are a lot of kinds of insects that were in the garden working in the garden was boring but it was so fun helping gardeners and watching them do selves.

Order: I learned that nature is very Our nature walk was nice. We sting plants and animals that we o see every day. It turns out I love

Order: Native plants will give us day where we can become aware ide world without teachers and

Order: Gardens allow us to explore he worms and bugs, the feel of the ne changes in the plants. We can't t information from the classroom.

Order: Kids should plant native ause they are use to the local his means the plants don't die eather is hot, cold, rainy, humid

Native Pl Providing Foo

Common Na

- Serviceberry
- Wild Columbine
- Common Milkweed
- Butterfly Weed
- Whorled Milkweed
- Smooth Aster
- New England Aste
- Aromatic Aster
- Creek Sedge
- Oak Sedge
- New Jersey Tea
- Redosier Dogwood
- Joe Pye Weed
- Hyssopleaf Thoro
- Boneset
- Common Sneezey
- Ox-eye
- Blue Flag Iris
- Spice Bush
- Cardinal Flower
- Great Blue Lobelia
- Blue Lupine
- Beebalm
- Wild Bergamot
- Evening Primrose
- Tall White Beardto
- Carolina Rose
- Sweet Azalea
- Eastern Coneflower
- Three-lobed Cone
- Elderberry
- Little Bluestem
- Wrinkle-leaf Golde
- Highbush Blueberi
- Arrowwood Viburn
- Blackhaw Viburnu
- Nannyberry Viburr

- Nannyberry Viburn
- Blackhaw Viburnu
- Arrowwood Viburn
- Highbush Blueberi
- Wrinkle-leaf Golde
- Little Bluestem
- Elderberry
- Blackhaw Viburnu
- Nannyberry Viburr



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Kindergarteners were accompanied on each trip to the refuge by a class of sixth-graders. Everyone had work to do in the garden.



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Longstreth Elementary School teacher Chuck Lafferty gathers children for an impromptu lesson on the refuge.

“Refuges are often isolated islands of habitat,” says Gary Stolz. “By encouraging and helping create schoolyard and backyard habitat partnerships, with pollinator gardens on refuges as models, we can help restore fragmented wildlife corridors beyond refuge boundaries for the benefit of all Americans.”

the winning design for the bright yellow shirts adorned with the phrase, Humanity for Habitat. “This project brings a smile to every face. It generates good will and a spirit of togetherness,” says Lafferty.

By spring, children were carrying soil to the raised beds in buckets, calling themselves “ants” as they formed a steady line between the mound of composted soil and the planting beds. Every time a youngster discovered a worm, snail or caterpillar, there was an excited announcement and all work stopped until a safe new home could be found. “Not one of them would squash a bug or deliberately harm any living creature,” wrote the Friends in their project report to the National Fish and Wildlife Foundation.

“With each visit, students became more eager to see how the garden was doing, how their plants looked and what pollinators were visiting the garden,” noted John Heinz Refuge ranger Mariana Bergerson. “There were also many unplanned teaching moments such as when the students assembled to take a picture and one little girl proclaimed, ‘I just sat on a turtle!’”

Kindergarteners were accompanied on each trip to the refuge by a class of sixth-graders. During each three-hour field trip, children split their time evenly between working in the garden and taking a guided walk. Lafferty uses lessons both in the classroom and on the refuge from the U.S. Fish and Wildlife Service Schoolyard Habitat Project Guide and the National Wildlife Federation’s Access Nature program.

Sixth-graders produced a brochure on the benefits of using native plants in home gardening. They also met a school requirement to complete a 20-hour service learning project.

On June 7, 2011, kindergarteners and sixth-graders put finishing touches on the garden as well as a small pond for wetland vegetation and fish. Students set landscaping rocks around the perimeter before celebrating with lunch and an award ceremony. A state legislator invited to the ceremony later invited refuge manager Gary Stolz to talk about the refuge on his radio program.

What’s Next?

Lafferty is now teaching first-grade, so about half the youngsters from his kindergarten class will continue going with him to the refuge. Lafferty’s students also will be collecting information for Project BudBurst, a citizen science phenology project through the

Cornell Lab of Ornithology. Lafferty will also conduct teacher workshops at Longstreth based on Access Nature and the Habitat Project Guide.

The pollinator garden is already having an impact on the refuge and the community. The Pennsylvania Horticultural Society honored the refuge and its pollinator garden with the 2011 Community Greening Award. Diehl, for whom the garden is the culmination of a 30-year dream, says “the garden has proved to be a magnet for guided butterfly and wildflower walks during the refuge’s annual Cradle of Birding Celebration. Kindergarten children have bonded with their natural world – a lesson that will not soon be forgotten.”

“Refuges are often isolated islands of habitat,” says Stolz, “By encouraging and helping create schoolyard and backyard habitat partnerships, with pollinator gardens on refuges as models, we can help restore fragmented wildlife corridors beyond refuge boundaries for the benefit of all Americans.”



“What Is Given in the Right Way Cannot Be Forgotten”

Connecting Children, Nature and Culture by Teaching Cooperatively with Native Elders

By Heather Dewar

Their grandparents moved across the land with the seasons, traveling by dog team in winter to find caribou, fishing in the Selawik River in fall, returning from their travels to sod houses in small, scattered settlements. But now Northwest Alaska’s Inupiat Eskimo people live year-round in permanent houses.

Many children in the community of Selawik, Alaska, spend months at a time without leaving their village of 900 souls, and have few chances to learn the skills that have been handed down through generations. For centuries the region’s tundra, lakes and rivers provided fish and caribou to support the village’s traditional subsistence culture. The land, which became part of the 2.5-million-acre Selawik National Wildlife Refuge in 1980, still provides abundant fish and game. But airplanes and satellite dishes now link the village to the wider world, and money is a necessity. Jobs are few, and Selawik’s people, 95 percent of whom are Inupiat, struggle with poverty, alcoholism, and the loss of young people, who leave to find work.

The village elders wanted to keep Inupiat traditions alive while strengthening family and community bonds. Staffers at Selawik Refuge shared that goal, said Susan Georgette, the refuge’s outreach specialist. The refuge, created in 1980, encompasses 2.15 million acres of Western Arctic wilderness where native people have lived for more than 10,000 years. Refuge staffers realize they are newcomers by comparison. They see the sharing of traditional knowledge as a powerful, appropriate and respectful way to connect children with nature – and also as a way of strengthening bonds between the refuge and the community.

Village elders teach older children how to set and haul nets for whitefish.

In 2003, with the refuge’s help, the village council and other partners founded the Selawik Science and Culture Camp, where elders work with refuge employees to teach the youngsters traditional hunting and fishing techniques, as well as scientific methods in wildlife biology.

Each year in mid-September when the caribou are migrating and wild berries are ripe, students take two days off from classes at the village’s 240-student, kindergarten-through-12th-grade school, traveling by boat to a traditional fishing site on the refuge. The camp is part communal harvest and part outdoor classroom, where all the lessons are hands-on and scientific learning is woven into traditional teachings.

Learning to hold an ulu and a scalpel
Village elders teach older children how to set and haul nets for whitefish, the staple fish that, like salmon in other parts of Alaska, is the essential protein in villagers’ diet. Meanwhile refuge staffers talk about ongoing research into the fish’s life cycle, or explore the waters for aquatic insects with the younger children.

Elders and other community members take the lead, tailoring activities to the weather and the day’s harvest from the land and sea. Refuge staffers consult with the elders, offering lessons and activities that support and supplement traditional teachings. For example, in a typical lesson a village woman demonstrates the use of the ulu, the woman’s knife, to scale and cut a fish for drying on an open-air rack. Then a Service staffer demonstrates how the fish’s gills extract oxygen from water, teaches the students how to tell its age from its scales and



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otoliths, and dissects the fish’s internal organs. “They love the heart and the eyeballs,” Georgette said.

Students travel by boat to a traditional fishing site on Selawik National Wildlife Refuge in Alaska.

By weaving the concepts of Western science into the framework of traditional knowledge, refuge staffers convey the message that these two ways of knowing need not conflict. The children are encouraged to feel equally comfortable holding an ulu or a scalpel.

The village of Selawik runs the camp, with funding and other support from the NANA (Northwest Alaska Native Association) Regional Corporation, the Northwest Arctic Borough, the Northwest Arctic Borough School District and Selawik Refuge.

Community members built an 18-by-30-foot framed tent that is the camp’s only indoor space. The U.S. Fish and Wildlife Service provided a \$10,000 Challenge Cost Share grant to the tribal council, which pays the salaries of a camp manager, cooks and boat drivers, and provides honoraria for the teaching elders. The grant also covers the cost of gasoline for the boats, which in 2011 cost about \$8 per gallon. The school system contributes additional labor and materials. About half of the refuge’s 11 staffers participate in the camp’s two-week run.



Susan Georgette

Villagers teach students how to scale and cut a fish for drying on an open-air rack. Then a Service staffer demonstrates how the fish's gills extract oxygen from water.

Inspiration, Interest and Dash of Chaos

The curriculum at the Science and Culture Camp is informal. "It's very unstructured and it can seem a little chaotic to someone from the Lower 48," Georgette said, "but it's how villages teach their youth. They believe that kids will learn when they're ready to learn."

The camp is broken into four two-day sessions with 20 to 40 children in each group. The youngest students attend the first session, followed by children in grades 4-6, junior high and finally the high school students. The village school has only one class for each of the elementary grades, so the younger students and their teachers attend camp together. Junior high and high school teachers are invited to come to camp if they wish – and each year several attend, often learning traditional skills alongside their students.

On a typical day, the students meet on the riverbank for a 15-minute boat ride to the camp site. There, one group accompanies two or three adults to check the fishing nets. Other students collect buckets and go berry-picking on the tundra, learning plant identification skills along the way. Another group listens to an elder talk about the link between subsistence skills and self-respect.

The refuge team helps ensure there is enough variety in the day's activities to keep the children engaged. For example, a refuge employee may pull out print-making materials and teach

the children how to make leaf prints. Refuge staffers continually try new activities. In the 2011 session, refuge employees brought along small aquatic nets and taught the elementary school students how to fish for invertebrates. Some children were fascinated and spent hours with their nets, while others quickly moved on to something different.

One activity that's always a favorite is a photo scavenger hunt, using digital cameras provided by the refuge. While snapping photos of an insect, a circle-shaped object found in nature, or a napaaqtuq (a spruce tree), the students are learning ecology, the Inupiaq language and field observation.

The unstructured approach allows the children to pursue their own interests, Georgette said. Keeping tabs on the campers is not a problem since plenty of grown-ups are on scene. With elders, teacher-observers, refuge staff, boat drivers, and cook, about 15 adults are usually in camp – and by custom, village children are allowed some freedom from constant, close adult supervision.

Being the Provider

When camp ends, community members, teachers and students gather for a potluck of caribou soup, baked and dried fish and a traditional Inupiaq dessert of whitefish eggs mixed with wild berries. The feast gives the children "the satisfaction of being the provider," Georgette said. "In northern Alaska there's a lot of cultural pride in getting food from the land."

The children who attend the camp miss two days of classroom lessons. In a district where all the schools are struggling to meet the tests' minimum academic standard, that can be a tough sell. Yet most local educators strongly support the camp, recognizing the importance of connecting students with their cultural heritage and the land.

Many of the teachers come from outside Alaska, and because of the remote setting, turnover is high. The teachers who spend time observing students and elders in the camp gain an understanding of village culture and a new insight into students' skills and learning styles, said Brittany Sweeney, Selawik Refuge's environmental education specialist. "Teachers get a chance to plug in to the outdoor classroom that is all around them, and to see how they can more effectively reach students who function better in this type of hands-on learning environment than in a classroom setting," Sweeney said.

The camp also builds understanding and respect between Selawik elders and refuge staffers as they learn from one another. "The refuge is the traditional homeland of Selawik people," Georgette said, "so in order for us to be able to do any kind of research, you have to have a good relationship with the community."

Selawik Refuge is working in other ways to support the village's effort to conserve Inupiaq culture. Georgette is compiling a list of the Inupiaq, English and scientific names for refuge songbirds. And the refuge has published two booklets researched and written by local residents. One booklet documents the historic range of the area's caribou; the other documents and explains traditional fishing methods.

As he described caribou hunting, Selawik elder David Nasragniq Greist spoke words that would make an ideal motto for Selawik's Science and Culture Camp: "What is given in the right way cannot be forgotten."

The Circle of Life

Several other Alaska refuges host or support camps that meld traditional knowledge and modern science. Since 1993, Alaska Peninsula Refuge on the state's southwestern tip has sponsored Spirit Science Camp for high school juniors and seniors from native Alutiiq villages. Using a former Bible camp as their base, as many as 10 students and five elders spend four days in September studying the mammals, birds, plants, aquatic life and geologic features of the wilderness surrounding remote Becharof Lake.

Spirit Science students learn to identify plants using the same dichotomous keys used in botany classrooms – and also learn the plant names in Alutiiq, the language of the Peninsula's native people, and their value as food and medicine. Students learn basic outdoor skills such as orienteering, the use of GPS and bear safety. "And they learn how their homeland connects to the

"When we grew up our father and uncles taught us how to protect the land and the animals, so those spirits would in turn provide food and lands for us. This is the circle of life," Orville Lind said. "That is being lost...We want to resurrect that spirit, that stewardship so we can have these resources for future conservationists years from now."

rest of the world," said camp co-founder Orville Lind. In a region that is one of the world's richest breeding ground for migratory seabirds, "we tell them that we have shearwaters that come here from Australia, and their jaws drop."

Lind, a refuge ranger at Alaska Peninsula Refuge and the son of an Alutiiq chief, said the camp has four goals: to integrate traditional and Western teachings; to increase students' ecological knowledge; to give the students outdoor experiences that build skills and confidence; and to foster a sense of stewardship for the land and the wildlife it supports.

By weaving the concepts of Western science into the framework of traditional knowledge, staffers at Selawik Refuge convey the message that these two ways of knowing need not conflict.



Susan Georgette



USFWS

Each year in mid-September when the caribou are migrating and wild berries are ripe, it's time for the Selawik Science and Culture Camp.



A Message from the Chief National Wildlife Refuge System



Our *Conserving the Future* vision, which will guide national wildlife refuges for the next decade, recommends improving and expanding environmental education. And for good reason. Environmental education is a tool to give people a deeper understanding of their ecological place in the natural world and an avenue to promote an ecological conscience in future conservationists.

Our education programs enable us to articulate nature's benefits and demonstrate tangible contributions to community schools. In these pages, you learned about school-refuge partnerships that have already succeeded in reaching children who don't usually connect with the outdoors. Often the collaboration initiated by one committed refuge employee or a single dedicated teacher can influence hundreds of children, year after year.

Today's conservation challenges are too big for any one agency or organization to surmount. As leaders, partners and role models in conservation efforts, we can inspire children, teachers, schools and school districts, so together we can leave a legacy of abundant and healthy wildlife and wild lands for future generations of Americans.

Jim Kurth

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