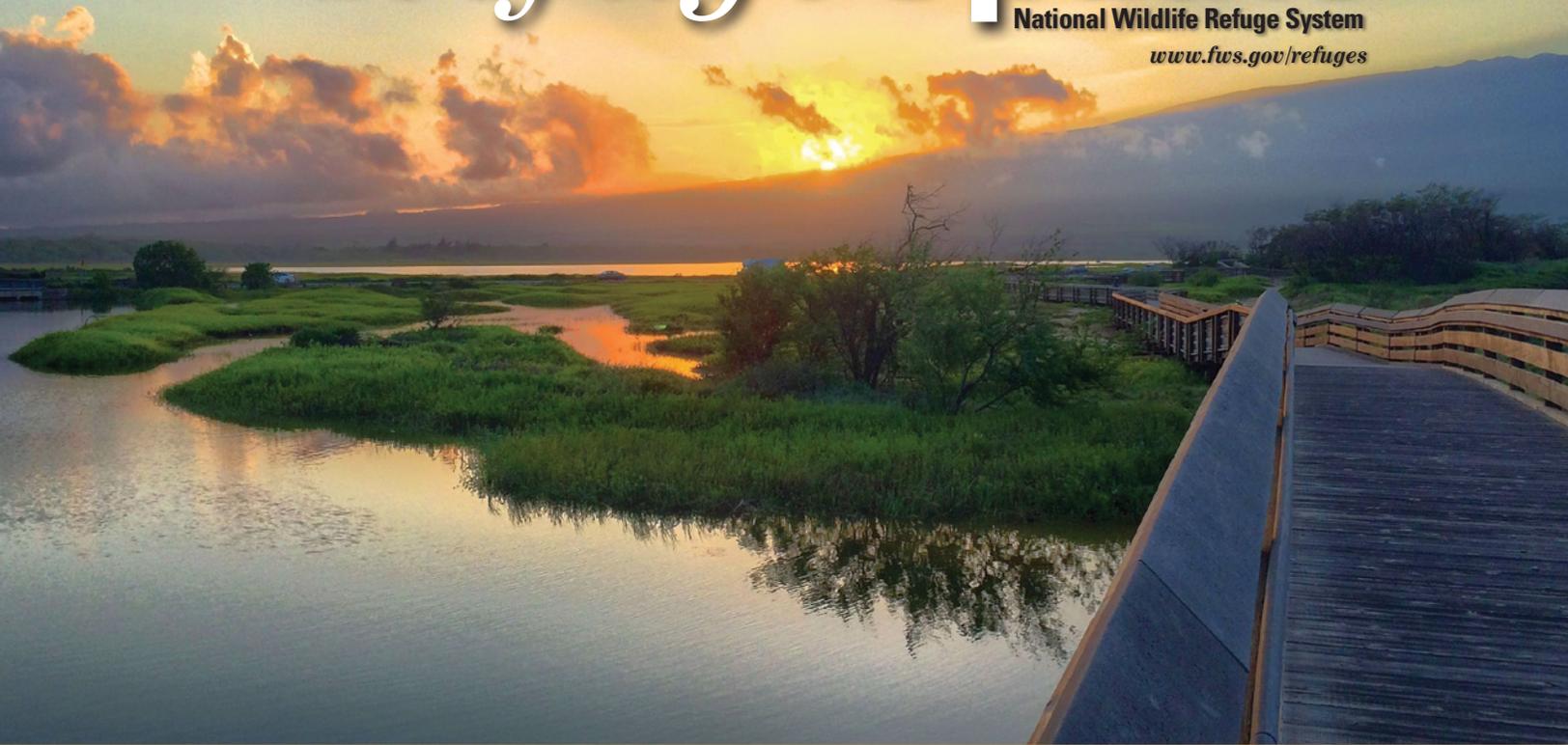




RefugeUpdate

National Wildlife Refuge System

www.fws.gov/refuges



INSIDE: The universally accessible boardwalk at Kealia Pond National Wildlife Refuge is a wonderful place for nature lovers who want to veer slightly off the beaten path on the Hawaiian island of Maui. Kealia Pond is one of 31 refuges and four marine national monuments in the Pacific and the Caribbean. See the Focus section, which is titled "Tropical Island Habitats" and begins on page 6. (Rick Long)

Urban Wildlife Refuge Partnership Gives Connecticut Students a Taste of Science

By Erik Lopez, Taylor Pauls and Kathiana Torres

Over the past three years, the three of us and 15 other students from our high school, Common Ground, have collected vegetation and invertebrate data from six habitat restoration study plots at two sites in our hometown, New Haven, CT.

All told, we have planted approximately 100 native plants and collected and identified 5,148 insects at the study plots. We've used 13 pairs of tweezers, 10 microscopes and a range of skills and academic disciplines to do it.

We are members of the nonprofit Common Ground Green Jobs Corps, which is conducting a three-year study at two sites – West River and Beaver Pond – to better understand the effects of habitat restoration in the city.

It's all part of the New Haven Harbor Watershed Urban Wildlife Partnership, one of 17 U.S. Fish and Wildlife Service-led public/private partnerships across the country designed to connect city residents with nature (<http://www.fws.gov/urban/partnerships.php>).

Within the New Haven city limits, Common Ground (<http://commongroundct.org/>) includes an urban farm, an urban forest, an environmental center and our high

continued on pg 18

The Revival Of Washington's Willapa Bay

By Bill O'Brian

By 2003, almost 30,000 acres of invasive *Spartina alterniflora* were choking avian and aquatic life in Willapa Bay on Washington's Pacific Coast. Today, after a massive eradication effort led by Willapa National Wildlife Refuge, just .7 acres of spartina biomass remain in the bay.

"It's probably one of the largest, most successful invasive species eradication programs in the entire country, could be the world," says refuge project leader Jackie Ferrier. "I didn't start it, but I sure want to be here to finish it."

The person who started it, essentially, is Ferrier's predecessor, Charlie Stenvall, Willapa Refuge project leader from 1997 to 2011.

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Chief's Corner

Marine National Monuments: Singular Achievements



Soldierfish cruise a coral reef at Baker Island National Wildlife Refuge, which is part of Pacific Remote Islands Marine National Monument. (Jim Maragos/USFWS)

It's mind-boggling to think about the range of habitats and wildlife that the Refuge System protects – and how they are spread nearly around the globe. The sun almost never sets on the National Wildlife Refuge System.

Maybe nothing illustrates that better than this issue's focus on tropical islands – from 22 refuges and four marine



Cynthia Martinez

national monuments in the Pacific Ocean to nine refuges in the Caribbean Sea. The marine national monuments are: Marianas Trench, Pacific Remote Islands, Papahānaumokuākea and Rose Atoll.

Perhaps you think that the marine national monuments are so distant from the continental U.S. that their significance is limited. After all, the marine national monuments are dots in the vast Pacific Ocean. Wrong! In fact, they are some of the most important, intact, functioning marine ecosystems on Earth.

The marine national monuments are essential for the conservation of critical species as we work to conserve a natural world for future generations.

President Obama expanded the Pacific Remote Islands Marine National Monument in September 2014. That monument alone protects nearly 490,000 square miles around the islands and atolls that are also protected as national wildlife refuges. That monument is one of the last havens for fish and wildlife in the world – home to one of the largest and most pristine collections of coral reef, seabird and shorebird protected areas on the planet. Millions of seabirds forage in the monument's waters and raise their young on the islands and atolls.

Renowned oceanographer Sylvia Earle, named by *Time* magazine in 1998 as its first Hero for the Planet, has called the ocean the “blue heart of the planet.” She has called the marine monuments “hope spots” – places that not only feed the world, but are also critical to the life and health of the Pacific Ocean.

And they are places that inspire us. The mystery of the Marianas Trench – the

Refuge Update

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Does your refuge have a bunch of trail-camera photos that need to be catalogued? There's an app for that. Page 5

Focus: Tropical Island Habitats

The refuges of the Pacific and the Caribbean – and the marine national monuments of the Pacific – provide habitat for some of the most distinctive species in the Refuge System. Page 6-13

Fire, Fire Everywhere

2015 was a record season on public lands in the United States. Page 14

Correction

The name of Julia Butler Hansen Refuge for the Columbian White-tailed Deer was incorrect in a September/October article about the endangered deer.

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Rue Mapp, the founder and CEO of Outdoor Afro: “The act of getting outdoors in the wild involves taking risks, acknowledging a history and a culture that haven’t always been welcoming to all groups.” (OutdoorAfro.com)



Celebrating African-American Participation in Nature

By Bill O’Brian

Growing up in Oakland, Rue Mapp spent a lot of time with her family in Northern California woodlands, where she learned to fish and hunt. With Girl Scouts and Outward Bound, she experienced camping, mountaineering, rock climbing and other outdoor activities.

“In the more remote areas,” she says, “I realized that there weren’t enough people who look like me who were participating in those activities, and I wanted to create a platform where people could have a wide range of opportunities to have those experiences but to also see themselves in those experiences.”

So in 2009, Mapp, now in her forties, founded Outdoor Afro.

“Outdoor Afro celebrates and inspires African-American participation and leadership in nature so that people can take better care of themselves, their communities and the planet,” Mapp says. “We do this through a national network of leaders. We have 30 leaders around the country who invite people to get out and do a range of outdoor activities. People of all ages and all abilities are always welcome.”

Outdoor Afro, which started as a blog, is a national community of about 7,500 core members who regularly participate in

events and meetups in outdoor settings. It has about 13,700 followers on Facebook and 6,200 on Twitter. It is a nonprofit with no paid membership. It exists primarily to get people outdoors.

“We don’t spend time talking about why African-Americans don’t have a relationship with nature,” Mapp says. “Instead, we talk about how *we do*. And we hold up historical examples. We ask people to share experiences in their families, and we use social media to help shift the view or narrative, in a certain sense of the word.”

Outdoor Afro’s 30 leaders nationwide are volunteers selected via an application process. Last spring the organization convened those leaders for training at the U.S. Fish and Wildlife Service’s National Conservation Training Center in West Virginia. The three-day training, which was facilitated by NCTC’s Ora Dixon and a dozen other Service employees, covered a range of topics, including risk management; healthy life balance; camping/campfire tips; and best practices for connecting black people to nature.

“The way they bring people together is fascinating to me,” Dixon says of Outdoor Afro.

“We want to see people – all people – out and enjoying the outdoors in proportion to their population and what they have

available to them,” says Mapp. “It’s a way that people can take better care of themselves. We know that there are better physical and emotional and spiritual outcomes that come from connections with nature. It’s also important as we think about the future of conservation in this country.”

Mapp thinks often about the future of conservation. She believes that if a diverse range of people have relationships with wild places, they will protect those places – and benefit from them.

In a June 2015 *High Country News* essay after a visit to Alaska, Mapp wrote:

“The Arctic National Wildlife Refuge inspires us because it reveals an elemental connection between people and nature. That connection is more important today than ever before in our wired world ... Through my work to reconnect African-Americans with the outdoors, I’ve seen the benefits of tapping into the power of nature. The act of getting outdoors in the wild involves taking risks, acknowledging a history and a culture that haven’t always been welcoming to all groups ... When I think back to my visit to the Arctic National Wildlife Refuge, I realize I may have been one of the first African-American women to gaze upon the coastal plain in its wild state. I fervently hope I am not the last.”

Science Applications + Refuges = Landscape-Scale Progress

By Paul Souza

I am a firm believer in the “One Service” philosophy, which means that we in the U.S. Fish and Wildlife Service can do more for our mission when we set shared priorities across programs, roll up our sleeves and use our distinctive talents for a common purpose. Collaboration between landscape conservation cooperatives (LCCs) and national wildlife refuges embodies that concept.

LCCs, the national network of 22 public-private partnerships that receive funding and support from the Science Applications program, are helping Service land managers do amazing work.

Examples abound.

The North Atlantic LCC is working with Silvio O. Conte National Fish and Wildlife Refuge in New England to prioritize conservation actions, addressing terrestrial and aquatic ecosystems and 14 species – including brook trout, black bear and woodcock – that represent needs of hundreds of others. Together with information about climate change and future development, the resulting landscape conservation design will help refuge staff make strategic decisions for acquisition, forest management, fish passage and more.

“Through this collaborative process, we have generated products grounded in science that illustrate the relevancy of the refuge and reinforce our conservation priorities,” says Conte Refuge manager Andrew French.

Refuges in Alaska play an important role in maintaining landscape connectivity. By working with the Northwest Boreal LCC, Kanuti and Yukon Flats National Wildlife Refuges see how they contribute to a network of protected lands. LCC and refuge staff members are incorporating landscape conservation design into the comprehensive conservation plan (CCP) for Yukon Flats Refuge, which provides important habitat for lesser scaup, white-winged scoter, chinook and chum salmon, among other priority species.

The California LCC is evaluating the impact of sea-level rise on tidal marshes along the Pacific Coast. The LCC has held workshops for Service staff at San Diego National Wildlife Refuge Complex, Don Edwards San Francisco Bay Refuge and Humboldt Bay Refuge. The meetings enabled local partners to talk directly with scientists about individual sites.

It has been important for the California LCC to work directly with refuge leaders, not only because individual wetlands respond differently to sea-level rise – and thus management needs vary – but also because the LCC team members help managers bring projected future climate conditions into their work.

The Southern High Plains region of Texas and New Mexico supports a community of ranchers and farmers who enjoy their rugged lifestyle and work hard to make a living on the arid landscape. The region is also home to the Muleshoe-Grulla-Buffalo Lake National Wildlife Refuge complex, managed for waterbirds that depend on playa wetlands and saline lakes.

Complex project leader Jude Smith understands that long-term success requires the Service to think bigger than

existing refuges. Sandhill cranes are the focus – a species that signals the health of the ecosystem. With help from Southwest Region zone biologist Bill Johnson, Smith is working with the Great Plains LCC and others to understand how cranes use this landscape and to evaluate how lands can be better managed [see *September/October 2015 Refuge Update*: <http://1.usa.gov/1OgAtvZ>].

A growing list of joint successes between the Refuge System and Science Applications is evidence that our complementary capacity can get more for our mission. All LCCs are committed to completing landscape conservation designs that by definition can help refuge planning. Other science investments can help refuge field leaders effectively manage precious resources. In turn, the engagement of Refuge System brainpower in the development of these tools ensures they will meet the needs of managers and be refined over time, helping the Service and the broader conservation community get better each day. 🦋

Paul Souza is the U.S. Fish and Wildlife Service's assistant director for science applications.



The California Landscape Conservation Cooperative (LCC), funded in part by the Science Applications program, is evaluating the impact of sea-level rise on tidal marshes along the Pacific Coast. Such marshes provide critical habitat for the federally endangered light-footed Ridgway's rail and other marsh bird species. A list of all 22 LCCs is at <http://lccnetwork.org/lcc-staff> (Rinus Baak/USFWS)



U.S. Fish and Wildlife Service remote trail cameras capture a steady stream of images of wildlife, such as this one of a coyote chasing pronghorn at Sevilleta National Wildlife Refuge in New Mexico. The Southwest Region inventory and monitoring team has developed a crowd-sourcing app to help sift through and label the images. (USFWS)

New App Helps Sort Millions of Trail Camera Images

By Grant Harris

Remote trail cameras capture millions of images of ocelots, bighorn sheep, elk, pronghorn, birds and other wildlife sparring, visiting water, foraging, marking territory and more within the National Wildlife Refuge System. But before those images can be useful for scientific purposes, they must be sorted and labeled.

Thanks to the U.S. Fish and Wildlife Service Southwest Region inventory and monitoring team, there's an app for that.

It's called Moniker, and it's available free at the App Store for iPhone and iPad users.

At New Mexico's Sevilleta National Wildlife Refuge alone, 36 cameras amassed 2.7 million images in four years. Typically, sorting that mountain of imagery for scientific analysis means bribing family, friends, volunteers and neighbors. Meanwhile, more cameras are positioned and the imagery backlog mushrooms.

The Moniker app allows anyone, anywhere to sort camera-trap imagery. The crowd-sourcing approach helps manage the imagery backlog, while the app helps generate public appreciation of America's wildlife that the Service manages and conserves. In return, the Service obtains sorted images

useful for addressing management and conservation priorities.

"Biologists often depend on those photographs to help them understand what is happening on the ground," says Southwest Regional Director Benjamin Tuggle. "Trail camera images actually help them make better decisions about wildlife and habitat management because they provide a definitive snapshot record of the species that are out there ... Staff can spend their time in the field doing more hands-on conservation and still have the information support they need from the images."

The app operates by downloading 15 still (not video) images at a time to an iPhone or iPad. The app pulls up each image individually, and the user classifies the species captured via a scrolling wheel. The user then identifies the number of individual animals. Because most images contain one or two individuals, the app has buttons for these. Otherwise, the number of individuals is keyed in. If something, say blowing grass, triggers the camera without capturing a wildlife species, the code "ghost" is used. Ultimately, this process sorts the images and stores them on a remote server, where they are ready for project use. To ensure data quality, each image is sorted multiple times and majority opinion prevails. The final sort is subsampled and checked for accuracy before analysis.

The app was designed this year by Jason Baird, a 22-year-old whiz kid from Trinity College in Connecticut interning at the regional office in Albuquerque. He developed Moniker for roughly two-thirds the cost of conventional app design.

To try the app, go to the App Store on your iPhone (model 4, OS version 8.4.1 or newer) and iPad (model 2 or newer) and search for "Moniker." Moniker may not immediately pop up in the suggestions, so hit the Search tab again and it will.

Even after sorting, analyzing millions of images still is a lot of work. Fortunately, there is a solution for this, too. Since 2010, the Service has been collaborating internationally with camera trapping experts, designing a process that simplifies analysis and information sharing. The approach relies on generating a text file for every image that includes camera location, date and time, species and number captured. The text file, and not the image, is then analyzed and shared across projects to encourage meta-analyses. 

Grant Harris is chief of biological services for the Southwest Region. For more information on how the app can be used for scientific analyses, contact him at Grant_Harris@fws.gov.

From the Pacific to the Caribbean, Island Refuges Are Distinctive

By Christopher Eng

Island ecosystems are of disproportionate ecological importance to conservation. While islands make up less than 5 percent of Earth's land, they are home to 40 percent of the species at risk of extinction. Historically, 80 percent of extinctions have occurred on islands.

The U.S. Fish and Wildlife Service manages islands at more than 200 national wildlife refuges, where up to 161 threatened and endangered species are protected. There are 31 refuges in the Caribbean, the Pacific and Hawaii – and four marine national monuments in the Pacific. This *Refuge Update* highlights tropical island habitats at a few of them.

Island habitats are distinctive for a number of reasons.

Some islands' native species do not naturally occur anywhere else on Earth. For example, Desecheo National Wildlife Refuge off Puerto Rico is home to three lizard species, two spiders and a scorpion found only there. Higo chumbo cactus is found only there and on two nearby islands. Hawaiian Islands Refuge alone supports Nihoa finch, Nihoa millerbird, Laysan finch, Laysan ducks and Nihoa loulou palm. Culebra Refuge off Puerto Rico hosts *Leptocereus Gratianus*, an almost spineless cactus [see page 9].

“Islands are special because of the sheer numbers of individuals within a species that they help support and the diversity of species as well,” says John Klavitter, the Refuge System's invasive species coordinator who has worked within at least nine island ecosystems during his career, including 11½ years as biologist or deputy manager at Midway Atoll Refuge. “Aesthetically, they're really amazing places for people to see. Many of them are remote. Sometimes just traveling there [often many days on a ship] is part of the experience, and once you arrive the island's physical and biological uniqueness compared to the mainland is most impressive and memorable.” Remote island refuge visits usually require special permits.

Island habitats can be challenging for conservationists.

An island's typically small size and isolation leaves its native species particularly vulnerable to ecological stressors, including climate change, development, pollution, invasive species and storms.

Island ecosystems may be less resilient, relative to the mainland, because some species have less room to migrate. Invasive species are a leading threat because island native species often have evolved with few competitors or predators and are not adapted to fierce competition.

Projects on remote islands can be expensive and logistically complicated. Island ecosystems can be delicate, so restoration specialists must take care not to disturb fragile habitats or introduce invasive species.

Some things that make islands vulnerable also create an unmatched opportunity to save unique habitats and imperiled species.

An island's size may make it easier to identify such opportunities and address the ecological problem(s). An island's isolation may make it



Above: Many islands' native species do not naturally occur anywhere else on Earth. For example, higo chumbo cactus is found only at Desecheo National Wildlife Refuge and two nearby islands off Puerto Rico. (Jan P. Zegarra)

Below: Green sea turtles are common in the waters and reefs surrounding Palmyra Atoll National Wildlife Refuge about 1,000 miles south of Honolulu in the Pacific Ocean. (Kydd Pollock)



easier to maintain restored habitat or established species. The surrounding waters act as a natural barrier against reinvasion once invasive species have been eradicated. Restoration may yield a higher return on investment, compared to the mainland, because of island ecosystems' high biodiversity.

Moreover, after invasive rat eradication efforts, says Klavitter, some tropical island native ecosystems “recover quickly without major hands-on restoration. That translates into lower costs over the long term to achieve full restoration on a small atoll versus the mainland, where complete eradication may be unachievable or require decades or longer to totally restore what was once there.”

The Service’s voluntary habitat conservation programs, including the Coastal Program and the Partners for Fish and Wildlife Program, provide technical and financial assistance to partners interested in restoring and protecting island habitat. “Restoring Island Ecosystems Report: Benefits to Native Plants and Animals” (<http://bit.ly/1MaNEil>) highlights some of the programs’ work.

Recognizing the invasive species threat, the Service and the nonprofit Island Conservation have adopted an Island Restoration Memorandum of Understanding (MOU) to promote invasive species removal on islands. The recent eradication of rats from Palmyra Atoll Refuge is one result of the MOU. Other conservation agencies and organizations are welcome to sign onto the agreement. 🦋

Christopher Eng is a biologist in the Refuge System Branch of Habitat Restoration. For more information about the Island Restoration Memorandum of Understanding (MOU) contact John Klavitter (John_Klavitter@fws.gov) in the Refuge System Division of Natural Resources and Conservation Planning.



A red-footed booby chick nests at Johnston Atoll National Wildlife Refuge, one of seven refuges in the Pacific Remote Islands Marine National Monument. (Laura M. Beawegard/USFWS)

31 Refuges and 4 Marine National Monuments

There are 31 national wildlife refuges in the Caribbean Sea, the Pacific Ocean and Hawaii – and four marine national monuments in the Pacific.

Caribbean Refuges

Buck Island
Cabo Rojo
Culebra
Desecheo
Green Cay
Laguna Cartagena
Navassa
Sandy Point
Vieques

Pacific Refuges

Baker Island
Guam
Hakalau Forest
Hanalei
Hawaiian Islands

Huleia
Howland Island
James Campbell
Jarvis Island
Johnston Atoll
Kakahaia
Kealia Pond
Kilauea Point
Kingman Reef
Mariana Arc of Fire
Mariana Trench
Midway Atoll
Oahu Forest
Palmyra Atoll
Pearl Harbor
Rose Atoll
Wake Atoll

Pacific Marine National Monuments *

Marianas Trench
Pacific Remote Islands
Papahānaumokuākea
Rose Atoll

More about the Caribbean: <http://www.fws.gov/caribbean/refuges/default.htm>
More about the Pacific and Hawaii: <http://www.fws.gov/pacific/>

** A marine national monument is designated by Presidential Proclamation under the authority of the Antiquities Act. Each marine national monument has a unique partnership arrangement, but all monuments are managed by the U.S. Fish and Wildlife Service in partnership with other federal, state and/or territorial agencies.*

Did You Know?



Sandy Point National Wildlife Refuge in the Virgin Islands is a globally important nesting site for endangered leatherback sea turtles, left. Midway Atoll National Wildlife Refuge in the Pacific Ocean supports the world's largest albatross nesting colony, right. (Left photo by Claudia Lombard/USFWS; right by Dan Clark/USFWS)

In terms of plants, fish, wildlife and culture, the national wildlife refuges of the Pacific and the Caribbean are vastly different from mainland refuges. They are exotic, unusual, even mysterious.

Did you know that ...

- ... Sandy Point National Wildlife Refuge on St. Croix in the Virgin Islands is a globally important nesting site for endangered leatherback sea turtles? In 2014, 84 individual female leatherbacks made more than 374 nesting activities that produced at least 12,526 hatchlings at the refuge.
- ... Midway Atoll National Wildlife Refuge is home to the world's largest albatross nesting colony? From Dec. 11, 2014, through Jan. 2, 2015, 19 volunteers systematically covered the atoll's three small islands, counting active nest sites. They estimated more than 1.39 million individual birds. They recorded 666,044 Laysan albatross nesting pairs and 28,610 black-footed albatross pairs.
- ... in spring 2014, for the first time since at least the 1700s, a pair of endangered Hawaiian geese nested and successfully hatched goslings on Hawaii's most populous island, Oahu? The pair and their goslings were first seen at James Campbell National Wildlife Refuge about

40 miles from Honolulu. Hawaiian geese are also known as nene.

- ... the warm, shallow waters surrounding Vieques National Wildlife Refuge off Puerto Rico include healthy sea grass prairies that support large numbers of Antillean manatees? Also known as West Indian manatees, they are particularly susceptible to water colder than 60 degrees.
- ... in Hawaiian legend Hawaiian common moorhens were thought to have brought fire from the gods to the people? A sizable population of the secretive birds, also known as 'alae 'ula, is found at Hanalei National Wildlife Refuge on Kauai.
- ... Green Cay National Wildlife Refuge in the Virgin Islands is the easternmost unit in the Refuge System on the North American side of the International Dateline? The 14-acre island refuge provides critical habitat for one of only two remaining natural populations of the endangered St. Croix ground lizard.
- ... the deepest point within Marianas Trench Marine National Monument, at 35,210 feet below sea level, is deeper than the height of Mount Everest is above sea level? The monument is east of the Mariana Islands and Guam.
- ... the Caribbean island that is Navassa National Wildlife Refuge, 35 miles west of Haiti, was discovered by Christopher

Columbus in 1498 and then rediscovered in the 1856 Guano Rush? More than one million tons of bird guano were removed from the island from 1865 to 1901.

- ... the Hawaiian name for Midway Atoll is Pihemanu, which means "the loud din or sound of birds?" Midway Atoll National Wildlife Refuge is home to 21 breeding seabird species – about 3 million individual birds all told.
- ... more than 90 percent of the threatened green sea turtles living in the 1,500-mile-long Hawaiian archipelago nest on just a few beaches at French Frigate Shoals in Hawaiian Islands National Wildlife Refuge?
- ... the endangered yellow-shouldered blackbird, once common in lower elevations of Puerto Rico, is present at Laguna Cartagena and Cabo Rojo National Wildlife Refuges?
- ... each day the sun first rises on the National Wildlife Refuge System in the Pacific Ocean and it last sets on the Refuge System in the Pacific, too? On any given day, the first refuge to see dawn is Wake Atoll National Wildlife Refuge, which is part of Pacific Remote Islands Marine National Monument. The last to see dusk is Midway Atoll National Wildlife Refuge, which is part of Papahānaumokuākea Marine National Monument. 🦅

Culebra Refuge: Seabirds, Endangered Cactus and More

By Bill O'Brian

A *Washington Post* headline about Culebra Island and its refuge read: “A relatively undeveloped island off Puerto Rico mainland offers solitude (amid unexploded bombs).”

Culebra National Wildlife Refuge is more than solitude and unexploded ordnance, though. Its 1,510 acres on the main island and 22 cays provide habitat for the Caribbean’s largest seabird nesting colony and an endangered cactus that doesn’t naturally occur anywhere else on Earth.

From 1936 until the mid-1970s, the U.S. military used Culebra and some cays for bombing practice.

Now, the refuge monitors the seabirds with help from the Refuge System Inventory and Monitoring Program, the U.S. Fish and Wildlife Service Migratory Bird Program, the Puerto Rico Department of Natural and Environmental Resources (DNER) and others.

The refuge contributes to the cactus’s recovery with help from the Caribbean Ecological Services Field Office, the DNER, Youth Conservation Corps

interns, volunteers and at least one private landowner.

About 40,000 sooty terns inhabit the seabird colony. So do more than a dozen other avian species.

“The most beautiful aspect of the seabird colony in Culebra is the view from the boat,” says refuge biologist Ricardo Colon-Merced. “You can see this cloud over the colony area. The cloud consists of thousands and thousands of birds flying over; looking for food or advising others of the presence of a predator. You can see the movements of this cloud like one organism, all moving at the same time like a school of fish.”

By boat and by land, the refuge monitors the colony monthly from February to July. Monitoring helps biologists understand seabird nesting activity, population trends and habitat use. Monitoring has documented predation on seabird eggs, chicks and adults by non-native mammals, such as rats, goats, deer, cats and dogs. So, the refuge is planning a predator control program and expects to repair a key fence before the 2016 sooty tern breeding season.

Regarding the cactus, *Leptocereus grantianus*, only one population of 50

individual plants was known to exist when it was listed as endangered in 1993. Now the refuge has six natural populations of about 250 individuals and six introduced populations, also of about 250 individuals. A five-year review this year listed the cactus’s status as improving.

“The refuge has been a key player” in propagation, planting, outreach and logistics related to the recovery effort, says Ecological Services biologist Carlos Pacheco.

Leptocereus grantianus is a sprawling, nearly spineless green cactus with white flowers. It grows best beneath the canopy of a dry, subtropical forest. It is iconic to Culebra, an 11-square-mile island with about 1,800 residents 17 miles east of Puerto Rico. Major threats to *Leptocereus grantianus*’s survival are habitat loss to development and predation by wild goats and deer, for which the cactus is a rare source of freshwater on the arid island.

The refuge propagates new plants in a nursery. Ecological Services, the refuge and volunteers planted 67 cacti on the refuge this year and hope to do the same next year. A private landowner, who is developing a 100-acre parcel nearby, has

continued on pg 12



Culebra National Wildlife Refuge, on an island east of Puerto Rico, provides habitat for the Caribbean’s largest seabird nesting colony. By boat and by land, the refuge monitors the colony monthly from February to July. (Ricardo Colon-Merced/USFWS)



Leptocereus grantianus, an endangered cactus, grows naturally only at Culebra National Wildlife Refuge. There are six natural populations of about 250 individuals and six introduced populations, also of about 250 individuals, at the refuge. (USFWS)

Guam Refuge Preserves 4,000-Year-Old Cultural Legacy

By Ben Ikenson

So lush is the jungle on Guam, a Japanese soldier who fought in World War II was able to conceal himself within it until 1972, nearly 28 years after the United States regained control of the Pacific island. Last summer, Guam National Wildlife Refuge maintenance worker Brian Leon Guerrero and University of Guam visiting archaeology professor Mike Carson came upon evidence of human habitation that far precedes 20th-century warfare.

After exploring a cave in a closed area of the refuge near Ritidian Point, the pair were poking their way through the jungle when Carson spotted a large black mound, a possible indication of a site used for burning by the island's ancient Chamorro people. With scattered pottery shards on the surface, they soon found the remains of a significant village completely overgrown with vegetation.

"It was really exciting," says Guerrero. "Almost immediately, within 30 to 40 feet of the mound and completely buried by jungle, we started finding 'latte' sites." Lattes refer to stone pillars that the Chamorro erected to support their dwellings above the jungle floor.

Long before Spanish galleons appeared on the horizon, the Chamorro people flourished throughout the Marianas archipelago. Ferdinand Magellan landed on Guam in 1521, bringing an era of prolonged colonialism to the entire region. The site at Ritidian, which included at least 15 homes, would have been the first village the Spaniards saw after three months at sea. Artifacts scattered throughout the island suggest that the original Chamorro community there was the very first to settle in the Pacific islands of Oceania, some 4,000 years ago.

Guam is home to many remnants and ruins of these ancient people, and the site Guerrero and Carson found, in fact, had been previously discovered in the 1920s by Hans

Artifacts scattered throughout the Pacific island suggest that the original Chamorro community there was the very first to settle in Oceania.

Hornbostel, an anthropologist with the Bishop Museum of Hawaii. A former Marine, Hornbostel was also covertly gathering information on Japanese activities in the Northern Mariana Islands for the U.S. Office of Naval Intelligence. While he did document 3,000-plus-year-old Chamorro artwork in nearby limestone caves, he didn't conduct a thorough inventory at the Ritidian latte site, which was soon swallowed by time and the jungle.

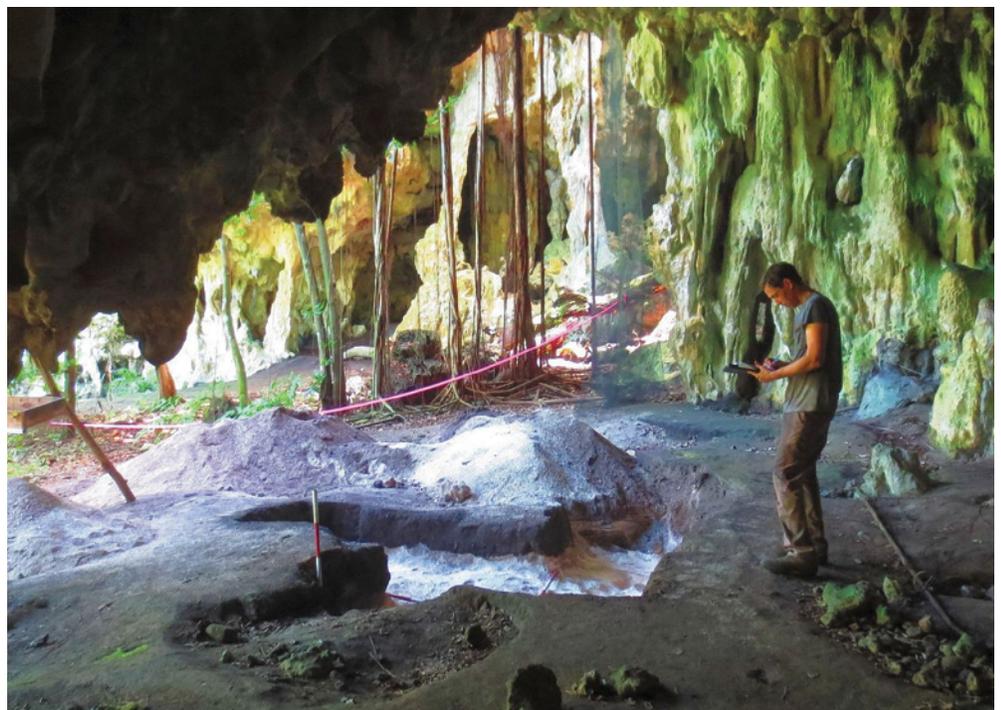
After rediscovering the latte site, refuge staff cleared some surface vegetation and

contracted a cultural resources inventory with Carson, who spent several months diligently documenting, collecting and cataloging items.

"We knew the site existed, and it was exciting to come across it, but what really makes it special is that these 15 home sites are amazingly intact," says Carson. The site "contains the remains of an entire village complex, dating to the last time when a native Chamorro village system was operating in the region. The Spanish-Chamorro wars of the late 1600s concluded with the forced re-location of survivors into a few easily controlled villages under Spanish colonial authority, and original villages, like at Ritidian, were abandoned as places of residence and cultural life."

The refuge hopes that the site, which is sacred to the local Chamorro people, soon will be listed on the National Register of Historic Places. The refuge is currently developing a guided tour program for island residents, among

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Archaeologist Mike Carson documents an excavated site believed to have been inhabited by ancient Chamorro people at what is now Guam National Wildlife Refuge. (Laura M. Beauregard/USFWS)



Kealia Pond National Wildlife Refuge is a wonderful place to see Hawaiian stilts, left, and other shorebirds. The refuge's wetlands "are extraordinarily important, special and rare in today's Hawaiian ecosystem," says visitor services manager Courtney Brown. From December to March, Hawaiian coot chicks, with their orange/red head feathers, are easy to spot with binoculars at the refuge on Maui's south-central coast. (Rick Long)

Kealia Pond Refuge: "A Hidden Gem of Maui"

By Bill O'Brian

Almost 2.5 million people visited the Hawaiian island of Maui last year. Typical destinations were beach resorts, scenic Hana Highway and volcanic Mount Haleakala.

Visitors might want to add Kealia Pond National Wildlife Refuge to the mix. The refuge "is a hidden gem of Maui," says Courtney Brown. "Avid bird watchers and nature enthusiasts alike can find peaceful moments away from the hustle of the island. From observing close up the endangered Hawaiian coot building a floating nest or endangered Hawaiian stilt chicks foraging in shallow water for insects or dragonflies on the hunt in funnels of insects careening like helicopters to snag their prey to observing colorful butterflies pollinate native plants, it is often the little things that make Kealia Pond so special."

Brown is visitor services manager at the 700-acre refuge on Maui's south-central coast eight miles from the island's main airport. The refuge, which attracts about 35,000 visitors annually, is a natural basin for a 56-square-mile watershed.

Brown has tips for those who want to veer slightly off the beaten path and visit the refuge:

"Arrive early in the morning. The wind is calm, lighting favorable and birds more active. Check in at the visitor center and

get oriented. Enjoy walking through the exhibit hall that highlights the uniqueness of the refuge and its history. Talk with volunteer docents and staff, get a brochure and borrow binoculars and bird ID cards to enhance your refuge experience."

Then, Brown suggests, go one-third of a mile to the Kanuimanu Ponds parking area and walk the .75-mile loop dirt path leading to Maui's largest lowland wetland – Kealia Pond – and its distinctive wildlife.

"Lastly," she recommends, "drive to the Kealia Coastal Boardwalk, a 2,200-foot elevated boardwalk over ephemeral ponds and mudflats with self-guided interpretive panels about the native and visiting birds at the wetlands. The boardwalk is in the coastal dune environment that supports nesting habitat for the endangered hawksbill sea turtle."

Kealia (kay-AHH-LEE-ah) means "salt-encrusted" in Hawaiian. In summer, the dry season, the pond's salt-encrusted soil and brackish waters glimmer. From April through July, nesting Hawaiian stilts and stilt chicks generally can be observed. In winter, the wet season, the pond is teeming with life as migratory birds rest and feed. From December to March, Hawaiian coots build floating nests to deter predators. Coot chicks, with their orange/red head feathers, are easy to spot with binoculars, but the paths can be

muddy. The universally accessible coastal boardwalk is a wonderful place to see Hawaiian stilts and other shorebirds.

The wetlands "are extraordinarily important, special and rare in today's Hawaiian ecosystem," Brown says. "They allow for natural zones between the ocean and mountains. They foster incredible biodiversity and unique wildlife that depends on them. Additionally, Kealia Pond is a large sediment basin that acts as a buffer zone protecting the near-shore coral reef habitat from storm water runoff and silt that can damage the fragile near-shore ecosystem."

The refuge, with a staff of two – Brown and maintenance worker Calvin Willis – relies on volunteers to assist visitors and help manage habitat. For instance, volunteers and partners (such as the Hawaii Department of Land and Natural Resources and the Hawaii Wildlife Fund) help monitor key beaches each summer to increase hawksbill sea turtle nesting success. They also helped build a fence along five miles of highway to protect the turtles.

Brown has one final piece of advice if visitors have a question and can't find her or a volunteer: Ask Willis. "Every day," she says, "Calvin impresses me with his dedication to the birds, habitat, wetland management and making meaningful connections with visitors and volunteers." 🦋

Guam Refuge — continued from page 10



Until it was rediscovered last summer by Guam National Wildlife Refuge maintenance worker Brian Leon Guerrero and archaeologist Mike Carson, this site was buried under dense jungle vegetation. It includes the remains of at least 15 homes in an ancient village. (Laura Beauregard/USFWS)

other visitors, to learn more about the important cultural legacy left behind by their ancestors.

“When you pick up a piece of pottery, you can’t help but imagine that last person to use it. What a different world they lived in,” says Laura Beauregard, manager at the Mariana Islands Refuges & Monument Complex, which includes Guam Refuge.

Adds Carson: “Now, after more than 300 years of shifting foreign colonial regimes, these ancient village sites in the jungle are ... reminders of an older heritage prior to the transformations of colonial rule, [and] the ability for people to reconnect with an ancient Chamorro village is priceless.”

Ben Ikenson is a New Mexico-based freelance writer.

Desecheo Refuge To Receive Invasive Species Allocation

Desecheo National Wildlife Refuge will receive the \$1 million National Wildlife Refuge System Large Invasive Species Project Allocation for fiscal year 2016.

The refuge will use the funding for a second try at eradicating black rats and restoring the native island ecosystem. Successful eradication would have wide applicability for other island refuge managers who are battling invasive species.

The first attempt to eradicate black rats from Desecheo Refuge by using aerially broadcast rodenticide in 2012 appeared to be successful, but eight months later rats were observed. An independent review of that work identified factors that may have contributed to the inability to achieve complete eradication. All of these factors will be addressed in the 2016 attempt, according to Refuge System invasive species coordinator John Klavitter.

Culebra Refuge — continued from page 9

agreed to set aside 36 acres and, with Service and volunteer help, plant 100 cacti on the property.

Pacheco would feel confident about *Leptocereus grantianus*'s recovery if there were three more populations containing at least 50 individual cacti thriving and flowering on the refuge. “That’s just my gut feeling, though,” he says, “not a scientific measure.”

Culebra Refuge is not just seabirds and cactus. Some of the refuge is open to the public via a visitor contact station and boat. Within the refuge’s small boundary, manager Ana Roman points out, are white sand beaches, mangroves, lagoons, dry forest and grasslands – habitat for land birds, wading birds, shore birds, marsh birds, waterfowl, four species of sea turtles, snakes, lizards, toads, coquis (tree frogs) and at least six species of bats.

“This arrangement of natural resources, plus the whole history of a habitat that has been recovering from past land uses – agricultural practices, military practice activities, development – and hurricanes and storms, makes the Culebra Refuge a very special place to me,” Roman says.

Intrepid Biologists vs. Crazy Ants at Johnston Atoll Refuge

By Justin Jacques

Johnston Atoll National Wildlife Refuge – part of Pacific Remote Islands Marine National Monument – is remote indeed.

The refuge is surrounded by a 400-mile-wide circle of marine conservation – co-managed by the U.S. Fish and Wildlife Service and the National Atmospheric and Oceanic Administration – in which commercial fishing is prohibited. The refuge is a three-day boat trip from Honolulu. Before 2010, staff members made trips to Johnston Atoll only every two to three years. On one such trip, refuge biologists found that Johnston Island, the 50-square-mile atoll's largest land mass, was infested with invasive yellow crazy ants.

Since 2010, groups of volunteer biologists called Crazy Ant Strike Teams (CASTs) have made great progress in controlling the ants, which are a menace to Johnston Atoll Refuge seabirds, including what is likely the world's largest red-tailed tropicbird colony.

Once yellow crazy ants arrive in an isolated place like Johnston Atoll – usually by boat or driftwood – they expand their territory by forming super-colonies around hundreds of queens, not just one. The ants overwhelm indigenous wildlife by spraying corrosive acid. Red-tailed tropicbirds suffer burns to their beaks, feet and eyes. The ants often overrun nests and force tropicbirds to sea.

In 2010, with no natural predators present, yellow crazy ants had occupied one-fifth of Johnston Island. Since then, 10 CASTs have spent six months each experimenting with baits and insecticides to develop an effective formulation. During CAST 3's stint in 2011-2012, yellow crazy ant numbers dropped by 99 percent.

“One day there were carpets of ants crawling across roads, and within 48 hours it was difficult to find a single



Since 2010, a series of small groups of volunteer biologists called Crazy Ant Strike Teams have made great progress in controlling the invasive yellow crazy ants at Johnston Atoll National Wildlife Refuge. Here, a red-tailed tropicbird rests in an ant-free nest. (Sheldon Plentovich/USFWS)

ant, unless you were looking really hard for one,” says Stefan Kropidlowski, the CAST field operations and logistics manager.

In 2014, Johnston Atoll Refuge received the National Wildlife Refuge System's \$1 million Large Invasive Species Project Allocation, which funded strike teams for two more years.

The allocation funded an agreement with the U.S. Geological Survey to generate new eradication methods. CAST 10, currently on the island, is the first team to use a technique developed with USGS support. It mixes effective pesticides with sugar. The solution is absorbed into polyacrylamide crystals, and the resulting bait is distributed to ants by hand.

“CAST 10 results have been promising, with another 99 percent yellow crazy ant decline in all treated areas,” says Kropidlowski. “Only time will tell if this new method will be the magic bullet to nail that last 1 percent and eradicate yellow crazy ants from Johnston Atoll.”

Being a CAST member takes grit. “There's no freshwater source or plumbing on Johnston, no indoor

toilets, and no option for bathing or doing laundry other than the ocean, where sharks are a given,” July/August 2015 *Audubon* magazine noted. Team members, often entry-level biologists, undergo a rigorous evaluation process before deployment to Johnston Atoll.

In 2010, Kropidlowski and CAST 1 estimated that 12 red-tailed tropicbird nests existed in Johnston Atoll's infested areas. After CAST 3's work in 2011-2012, a two-week census counted 5,756 active red-tailed tropicbird nests across the island, 80 in the infestation area.

“Tropicbirds nest year-round, so the actual number will be even higher,” says Amanda Pollock, deputy superintendent of the Pacific marine national monuments and CAST project leader. “There are an estimated 32,000 red-tailed tropicbirds in the global population. If that is the case, then it is possible that 36 percent of the world's population was breeding on Johnston Island in just that two-week period in which the census was conducted.” 

Justin Jacques is a senior at George Washington University in Washington, DC.

Chasing Fire: Protecting Refuges and Beyond

By Karen Miranda

A record wildfire season hit public lands in the United States in 2015. There were more than 50,000 fires on more than 9 million public acres, far exceeding the 10-year average for acres burned, according to the National Interagency Fire Center.

At season's peak, from Aug. 10 to Sept. 10, the U.S. Fish and Wildlife Service deployed more than 220 staff members to support other agency incidents.

However, the number of fires and acres burned on national wildlife refuges this season was average.

That doesn't mean there was not a lot of activity this year.

The season began with a 450-acre fire at Hawaii's Oahu Forest National Wildlife Refuge (the first ever there), a 140-acre fire at Grand Bay Refuge in Alabama and Mississippi, and smaller fires at refuges in Oklahoma, Georgia and Kansas. Southwest fire starts continued through the winter in Oklahoma and Texas; nearly 4,700 acres burned at McFaddin Refuge, TX.

In early spring, refuge fires spread across the South and Puerto Rico, and began farther north, from California to Kansas, North Dakota, South Dakota and Minnesota, as well as Alaska. In May, a smoldering hotspot from the 2014 Funny River Fire at Alaska's Kenai Refuge re-ignited. Thirteen Alaska refuges were hit by fire this year, burning at least 1.5 million acres of refuge lands, the most since 2004.

In early June, drought conditions led managers on Inland Northwest refuges to pre-position firefighters and engines, while refuges in northern California increased fire staffing for several weeks. In July, refuges in Florida battled wildfires, the largest at Arthur R. Marshall Loxahatchee Refuge, nearly 13,000 acres. Fires continued on refuges throughout the Southeast and Southwest.



U.S. Fish and Wildlife Service fire specialist Beau Brice working the Belle Fire at Charles M. Russell National Wildlife Refuge in Montana last summer. Despite a record wildfire season in 2015, the number of fires and acres burned on refuges this year was average. (Mike Granger/USFWS)

By August, Montana refuges had also fought several large fires, and refuges in Puerto Rico were at high danger, with Cabo Rojo Refuge alone containing 10 small wildfires.

Firefighters saved headquarters buildings at two refuges: Marais des Cygnes Refuge in Kansas, from an arson-caused fire, and Wichita Mountains Refuge in Oklahoma, where firefighters used burnouts and recent prescribed-burn areas to limit fire spread from neighboring lands.

In mid-September, refuge staff from Sand Lake Refuge in South Dakota worked with several volunteer fire departments they had trained to control a large nearby wildfire sparked by a hunter.

The height of fire activity in the Pacific Northwest occurred in August and September. With firestorms raging nearby, 10 refuges in Oregon and Washington managed to sustain just limited damage, mostly a 135-acre fire on William L. Finley Refuge, OR, and a 14,000-acre fire on Hanford Reach National Monument, WA. Earlier in the

year, Northwest refuges had reduced fire risk and limited potential damage with fuels management. Malheur Refuge, OR, conducted a 7,000-acre prescribed burn to remove decadent vegetation; Mid-Columbia River Refuge Complex, WA, built 75 miles of fuel breaks and Sheldon-Hart Mountain Refuge Complex, OR/NV, thinned more than 7,000 acres of invasive Western juniper.

Malheur Refuge project leader Chad Karges feels lucky the refuge avoided a potentially devastating season.

"We were in drought conditions, and prepared for the worst," said Karges, who has worked at the refuge for 16 years. "There were wildfires on lands around the refuge, but we didn't get the ignitions here to start fires."

Even while their numbers are shrinking because of budget cuts, Service firefighters continue to protect more individual units across the most widespread land base of any federal agency. 🦋

Karen Miranda is a public affairs specialist in the Refuge System Branch of Fire Management in Boise, ID.

NCTC Video Series Engages Students

By Brett C. Billings

U.S. Fish and Wildlife Service education and outreach specialist Chelsea McKinney is always up for an adventure. She has helicoptered into the Grand Canyon in search of endangered fish, toted a drip torch as a wildland firefighter and braved lightning storms to observe manatees. Now, she's on a different adventure: *Conservation Connect*, a web-based series to introduce children to the Service, its people and its mission. In the process, McKinney shows off national wildlife refuges.

In her third year as host and writer for the online series, McKinney focuses each video episode on a specific animal, a conservation career related to that animal and a technology used to study it. The series' videos, which typically are six to eight minutes, target middle-schoolers.

"Technology is a large part of that generation," says McKinney. "It's using technology as the 'hook' to get kids outside, becoming biologists in their own backyards."



Directorate Fellowship Program student Ariel Elliott, left, and Chelsea McKinney at Sevilleta National Wildlife Refuge in New Mexico. McKinney was there to film a *Conservation Connect* episode about Elliott's summer 2014 work with a Gunnison's prairie dog study, which involved trapping woodrats and other small animals. (Brett C. Billings/USFWS)

One episode took McKinney and crew to West Virginia's Canaan Valley National Wildlife Refuge, where she and her youth co-hosts went in search of the endangered Cheat Mountain salamander.

"I feed off of children's energy," McKinney says, "seeing their passion through their eyes rejuvenates me, and I think that shows in each episode."

Conservation Connect also has spotlighted J.N. "Ding" Darling Refuge in Florida and Sevilleta, Bosque del Apache and Valle de Oro Refuges in New Mexico.

It's no wonder McKinney is a fan of refuges. Before coming to NCTC, she spent the early part of her 11-year Service career at several refuges. After helping to restore tern colonies at Maine Coastal Islands Refuge, she monitored loons at Umbagog Refuge in New Hampshire and helped with prescribed burns at Blackwater Refuge in Maryland. In 2014, she was able to revisit Blackwater Refuge to produce a *Conservation Connect* episode about the Delmarva fox squirrel.

Conservation Connect provides a way to reach underserved audiences. The series uses an interdisciplinary, blended-learning approach. Science and technology are explored through distance learning, while hands-on and virtual experiences are offered via online resources posted with each episode.

The series has gained attention beyond the Service. The National Science Teachers Association, which reaches 55,000 members, is working closely with NCTC to develop content and resources for *Conservation Connect*. The organization can get the program into classrooms as part of middle school science curricula nationwide.

Matt MacGregor, a biology and marine science teacher at Escambia High School in Pensacola, FL, finds *Conservation Connect* useful beyond middle school.

"The programs help my students make the connection between what they are studying in class and various ecosystems around the United States," says MacGregor, whose students are working on a project called Turtle T.H.I.S. (Teens Helping in the Seashore) with the National Park Service at the Gulf Islands National Seashore.

The project, which trains local students to operate atmospheric light-monitoring equipment to record and analyze data for turtle nesting locations, ties in with *Conservation Connect*, MacGregor says. "This will ultimately help me to foster my students' desire to learn about the environment and become good stewards of our natural resources."

This year, *Conservation Connect* features 10 new episodes showcasing monarch butterflies, black-footed ferrets, freshwater mussels, brook trout, salamanders, roseate spoonbills and more. The new shows, past episodes and an educator's overview are available at <http://nctc.fws.gov/conservationconnect/>. 

Brett C. Billings is senior video producer at the National Conservation Training Center and videographer for *Conservation Connect*.

Around the Refuge System

Alaska

- U.S. District Court Judge H. Russel Holland dismissed a lawsuit regarding the Department of the Interior's refusal to allow a road to be built through Izembek National Wildlife Refuge wilderness. In 2009, Congress passed legislation directing the Secretary of the Interior to analyze a land exchange for a single-lane gravel road between the villages of King Cove and Cold Bay primarily for medical evacuations. In 2013, Secretary Sally Jewell rejected the proposed land swap. The dismissed lawsuit, which would have allowed construction of the road, was filed last year by the city of King Cove and others – and joined by the state of Alaska. An Alaska Department of Law spokeswoman told the Associated Press in September that the state was evaluating its appeal options. Izembek Refuge's lagoons form an ecosystem that contains one of the largest eelgrass beds in the world, providing food and habitat for brant and other migratory birds from several continents.
- Staff members from two refuges met President Obama during his late-summer visit. In Dillingham in southwestern Alaska, Togiak National Wildlife Refuge deputy manager Allen Miller helped the Secret Service conduct a boat patrol, and seven refuge staff members helped greet the President at the airport. "I got to shake the President's hand and thank him for taking the time to come to rural Alaska," refuge manager Susanna Henry said. "It was thrilling." In Kotzebue, in northwestern Alaska, Selawik Refuge staff members helped greet President Obama and supported Secret Service patrols. All staff members had the opportunity to attend the President's speech in the local school gym. Outreach specialist Brittany Sweeney's 9-year-old son, Finnian, and refuge manager Susan Georgette shook the President's hand. "I was surprised to

learn at the event that I was selected to sit behind the President during his speech," said Georgette. "It was such a remarkable day." During this three-day visit, President Obama stressed the importance of addressing climate change.

Wisconsin-Michigan

The U.S. Fish and Wildlife Service and The Nature Conservancy announced the expansion of Green Bay National Wildlife Refuge to include most of St. Martin Island and all of Rocky Island in Lake Michigan, adding 1,290 acres to the 330-acre refuge. The islands are part of the Grand Traverse chain, which extends from Wisconsin's Door Peninsula to Michigan's Garden Peninsula. Green Bay Refuge was established in 1912 as habitat for migratory birds. St. Martin Island is part of the Niagara Escarpment, and rare native snails and plants are

associated with its bluffs. The island also supports forests, wetlands and a cobblestone beach. St. Martin and Rocky islands provide important stopover habitat for migrating birds each spring and fall. On St. Martin, 43 neo-tropical migrant birds and 26 species of greatest conservation need in Michigan use the island. More than 400 plant species, including the federally threatened dwarf lake iris, have been found on St. Martin.

Hunting and Fishing Expanded

Service Director Dan Ashe announced in August that fishing and hunting opportunities will be expanded at 21 national wildlife refuges. The final hunting and sport fishing rule also modifies existing refuge-specific regulations for more than 100 refuges and wetland management districts. Hunting will be available for the first time at Tualatin River Refuge in Oregon.



President Obama shakes hands with Selawik National Wildlife Refuge manager Susan Georgette after a speech during his late-summer visit to Alaska. (Jim Magdanz)

Fishing will be offered for the first time at four North Dakota refuges: Ardoch, Lake Alice, Rose Lake and Silver Lake. Hunting, within specified limits, is now permitted on 336 refuges. Fishing is now permitted on 275 refuges. Details are at <http://1.usa.gov/1U4B9JM>.

California

Less than a decade after a levee was intentionally breached to create tidal marsh at a habitat restoration area known as Pond A21 at Don Edwards San Francisco Bay National Wildlife Refuge, at least two endangered species have moved into the new habitat. Efforts started to pay off in July 2014, when the first endangered Ridgway's rail was spotted in Pond A21. Then, during the first surveys for salt marsh harvest mice in July 2015, biologists heard the call of the first breeding pair of Ridgway's rails. And, after setting more than 100 live-traps over three nights, biologists caught, examined and released four salt marsh harvest mice among a total of 63 unique small mammals at Pond A21. "Everyone was extremely excited; it was well above our expectations for how quickly this would happen, being less than 10 years since the area was breached," said Service biologist Rachel Tertes, who heads the survey efforts for the refuge. "This shows that we're accomplishing what we're trying to accomplish, that if we provide habitat, the species will come."

Michigan

More than 170 visitors attended a mid-August stargazing event at Shiawassee National Wildlife Refuge. Many visitors left astonished because it was a peak time for a meteor shower. The visitors saw about one meteor per minute as the night progressed. Satellites, including the International Space Station, also were visible. "This event is another great example of *other recreation* that occurs outside of the very popular big six – hunting, fishing, wildlife observation, photography, environmental education and interpretation," said refuge visitor services manager Lionel Grant. "This was truly a special occasion in itself



A green sea turtle hatchling makes its way to the sea at Florida's Archie Carr National Wildlife Refuge, where a record 14,141 nests were documented this year. (Keenan Adams/USFWS)

because it was organized through summer intern Kelly Escarcega. Kelly was finishing up her last week with the Career Discovery Internship Program, which partners exclusively with the Student Conservation Association to expand our recruitment reach to diverse audiences."

New Mexico

More than 25 volunteers took part in the first-ever butterfly count at Sevilleta National Wildlife Refuge in mid-August, despite temperatures approaching 100 degrees. "I thought it went pretty well," said John Wilson, a member of the board of Amigos de la Sevilleta, the refuge Friends group that led the effort. "We counted 19 species." The most common butterfly found was the western pygmy blue butterfly; others included the goatweed leafwing butterfly and the bordered patch butterfly.

Wisconsin-Minnesota

The Service has joined more than 60 public and private organizations in support of monarch butterflies and other pollinators via the St. Croix Valley Pollinator Partnership. Participants have committed to educating the public about pollinators and improving pollinator habitat on public and private land in the St. Croix River watershed and adjacent counties in Minnesota and Wisconsin. St. Croix Wetland Management District in Wisconsin is providing much of the expertise for working with private landowners and companies. "We are using

monarch butterflies as the species that connects us on a landscape level and, more importantly, engages the public and many partners in conservation," says St. Croix WMD manager Tom Kerr. "The fact that over 110 people attended the inaugural event speaks volumes about the amount of interest there is in pollinators."

Delaware

The U.S. Mint in mid-September launched a 2015 quarter featuring Bombay Hook National Wildlife Refuge. It is the first America the Beautiful quarter to showcase a national wildlife refuge. The design of the reverse (tails) side of the coin includes a depiction of a great blue heron with a great egret in the background.

Florida

Archie Carr National Wildlife Refuge on the state's Atlantic coast set a record for endangered green sea turtle nests documented in one season. As of mid-October, 14,141 green turtle nests had been counted along the refuge coastline. That broke the record of 12,846 nests counted in 2013. The refuge is the most significant area for green turtle nesting in North America. It is also the most significant area for loggerhead sea turtle nesting in the Western Hemisphere. As of mid-October, 14,113 loggerhead nests had been counted on the refuge and 58 leatherback sea turtles nest had been counted. The total of 28,312 nests was a record, too. 🐢

Partnership Gives Connecticut Students a Taste of Science — *continued from page 1*



Connecticut high school students Michael Bruno and Loc Nguyen identify invertebrates as part of a New Haven Harbor Watershed Urban Wildlife Refuge Partnership project. Working alongside biologists and land managers, 18 students have identified 5,148 insects in three years. (Joel Tolman/Common Ground)

school, the nation's longest-running environmental charter school. Common Ground's mission is to "cultivate habits of healthy living and sustainable environmental practice among a diverse community of children, families and adults."

We are doing this study to see if habitat restoration at the urban sites is working. We're being scientifically rigorous as we monitor the sites, help analyze data and produce reports about the results. We hope that by increasing the diversity of

native plant species we will also increase invertebrate diversity and abundance and create better habitat for wildlife in New Haven.

For instance, in 2014 when vegetation at the Beaver Pond site was 32 percent native plants, 55 percent mulch, 4 percent turf and 4 percent invasive plants, we noticed a drop in insect diversity and abundance. We brought that information to our urban wildlife refuge partners and asked them to use less mulch and more native plants. It worked! In summer

2015, the vegetation was 70 percent native plants, 25 percent mulch and 5 percent invasive plants. Invertebrate abundance and diversity more than tripled compared to 2014.

This project is important to us. It has given us meaningful summer employment. We've learned job skills like being responsible, showing up on time and planning for the day ahead. We've learned life skills, discovered career interests and seen how hard work can result in real outcomes for the environment and our community.

Each of us likes the project for slightly different reasons.

Erik's favorite part has been seeing the spiders under the microscope. For the first time ever he was able to see all the little parts of the body. The thing he will remember most about the project is the long hours looking into the scope and having to check carefully to see if the insects were the same or different.

Taylor loved looking at the insects under the microscope, too. "It was as if they came alive and we could see all the detail in their body structure. The biggest lesson I will take away from this experience is learning all the orders of insects, like *Homoptera*, *Hemiptera*, *Diptera*, *Hymenoptera*," she says. "Being involved in this project made me even more passionate about working in a scientific field; I really enjoyed collecting and analyzing the data and discussing the results."

For Kathiana, the coolest part was seeing the results of the work that she and her co-workers did in planting and taking care of the habitat restoration sites. "Realizing that the work we did is actually making an impact is really great," she says. 🦋

Erik Lopez, Taylor Pauls and Kathiana Torres are members of the Common Ground Green Jobs Corps. U.S. Fish and Wildlife Service biologist Georgia Basso and Audubon Connecticut biologist Corrie Folsom-O'Keefe contributed to this report.

Chief's Corner — *continued from page 2*

deepest part of the world's oceans, where darkness is punctuated by bioluminescent organisms – is a wonder and no less iconic than the Grand Canyon or Mount Everest.

The Pacific Ocean may be our last great frontier, a place less understood than the moon. Because we have protected these marine national monuments, our chance to expand the world's knowledge and to improve the quality of life is still intact. That's always the benefit of conservation. 🦋

The Revival of Washington's Willapa Bay — *continued from page 1*

Stenvall says that “the amount of plant biomass covered solidly 9,000 acres, but it was spread out over 20,000 to 30,000 acres” – a logistical nightmare.

Spartina, a cordgrass, was introduced into Willapa Bay in the 1890s, likely via oyster shipments. Eventually, spartina overwhelmed native vegetation, ruined mudflats and clogged tidal guts (straits) along the bay. It was seven feet tall in some dense meadows. Shorebirds, fish and oysters suffered.

Efforts to eradicate it began in 1997. The first order of business, says Stenvall, was to understand the magnitude, “which was huge.” Second was to quantify the impact on shorebirds. Willapa Bay, when healthy, provides habitat for millions of migrating shorebirds annually. “But at the peak of the spartina, it was just a dead zone out there. You hardly saw shorebirds.” Third was for the U.S. Fish and Wildlife Service, Washington Department of Agriculture, Washington Department of Fish and Wildlife, oyster industry, several universities and others to devise a strategy to tackle the problem. “That was a fairly chaotic, messy process,” he says, but it produced lasting partnerships.

Funding came from various sources, including Congress. “We got seven years of Congressional support to address spartina in Willapa Bay because not only was the threat there but we had a solution for it,” Stenvall says. “We had a way of making progress, and we demonstrated that progress every year.”

Willapa Bay is divided into five zones of ecological responsibility among the Service, the Washington Department of Natural Resources, Pacific County, the Washington Division of Fish and Wildlife, and the Shoalwater Bay tribe. At first, they collectively attacked spartina mechanically – mowing, weed-whacking, tilling – but that didn’t kill the invasive cordgrass.

“Really what turned the tide,” says Ferrier, “was actually starting to spray” with imazpyr. With Environmental



Above: Invasive Spartina alterniflora suffocates Willapa Bay in Washington state in 2002. Below: Healthy salt marsh thrives (in a different part of the bay) after a massive spartina eradication effort led by Willapa National Wildlife Refuge. (USFWS)



Protection Agency help, aerial and ground application of that herbicide was approved in 2004.

“We brought in and devised equipment that didn’t exist anywhere else – these amphibious spreaders with infrared seekers that would spray herbicide only on spartina. We did some things that were pretty unheard of at the time,” says Stenvall. The refuge had “one of the largest crews out there. At our peak we had 30 small-craft operators. We had airboats and amphibious craft, and we had helicopters. Sometimes, we worked seven days a week and 24 hours a day. We ran on shifts to work on favorable tide cycles.”

The effort required years-long help from partners like The Nature Conservancy and private landowners along the bay who consented to the spraying and volunteered help.

Now, shorebirds have returned in great numbers. Salt marsh habitat for other

migratory birds and waterfowl, salmonid fish, sturgeon, oysters and shellfish is thriving.

“There are times when I want to pinch myself to make sure I’m awake and this is really happening,” says Kathleen Sayce, a landowner, coastal Washington native and botanist who for decades has contributed expertise to the effort. “When all the pieces are still in place, when the ecosystem is working as it should, it’s a very good feeling.”

State-of-the-art technology indicates that 1,700 spartina plants remain in Willapa Bay. “Now it’s a little hunt and peck” to find individual plants, says Ferrier. Walking “every square inch of the refuge” twice a year and using GPS technology to pinpoint spartina location, “we’re going to find every plant,” says Ferrier. “Eradication is still possible. We can’t let it go now. To have 99.9 percent eradication and stop? You can’t do that.” 🦋



RefugeUpdate

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A Look Back ... Herb Dill and Howard Thornsberry

Herb Dill was described in *The Saturday Evening Post* in 1951 as a man who “has a rather unconventional liveliness and likes to get a bit more than his job done.” The same article – a color spread in what was then a major national magazine – described Howard “Hawkshaw” Thornsberry as the “young mechanical genius of the refuge.”

That would be Swan Lake National Wildlife Refuge in Missouri, where manager Dill and maintenance worker Thornsberry invented the cannon-projected net trap in 1948.

They made the trap in the refuge shop using less than \$70 in salvaged and new materials. They did it despite various ballistics challenges and, after writing Washington for advice, getting what they once termed “a stiffish reply to the effect that it might be better to stick to more conventional methods.”

Dill and Thornsberry devised a cannon-projected net that enabled the capture of many geese at once. It worked like this: Charges of potassium chlorate and sugar were activated in tubes attached to



In 1948, Swan Lake National Wildlife Refuge manager Herb Dill and maintenance worker Howard “Hawkshaw” Thornsberry invented a cannon-projected net that allowed for the capture of many geese at one time. They are shown here in the March 10, 1951, issue of The Saturday Evening Post. (Gus Pasquarella/The Saturday Evening Post)

the edges of a large net, projecting the leading edge of the net into the air and over geese and other waterfowl drawn

to the area with bait. The captured geese were then examined, banded and released. A *Post* reporter invited to watch the net in action wrote that the “net whisked out like a banshee in a hurry.”

On Dec. 10, 1948, 20 geese were caught in the first cannon-projected net trap. In the first eight attempts, 226 geese were caught. The refuge’s historical notes indicate that “Washington repented of its original stand and gave the men an Award of Merit.”

By the late 1970s, the Dill-Thornsberry cannon net had been used to catch more than 100,000 geese at Swan Lake Refuge and countless more geese and other waterfowl around the world.

The Saturday Evening Post explained that before this innovation only a few geese could be caught in baited cages because, “with the uncooperative patience of wild things, the geese would stand and stand, talking it over dubiously while the man waiting nearby would slowly and blasphemously freeze to death.” 

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