U.S Fish & Wildlife Service
National Wildlife Refuge System

RefugeUpdate

November/December 2004 Vol 1, No 5

Inside

Regaining a Presence

Established in 1994, Canaan Valley NWR, WV, helps protect the threatened Cheat Mountain salamander. Success has been well documented.

- In August 2003, 41 Cheat Mountain salamanders where counted across 138.5 acres, including one group that had not been previously documented.
- 859 salamanders of nine other species were documented. The most abundant was the red-backed salamander.

Glacial Ridge Refuge Joins System

Preserves Tallgrass Prairie and Wetlands in Northwest Minnesota

The nation's 545th national wildlife refuge – Glacial Ridge NWR in northwest Minnesota – was officially created Oct. 12, culminating four years of work.

Launched with the donation of a 2,000-acre parcel by The Nature Conservancy (TNC), the refuge eventually will cover 35,000 acres, advancing the largest tallgrass prairie and wetland restoration project in U.S. history. Less than 1 percent of Minnesota's original tallgrass prairie habitat still exists. TNC formally transferred the property Oct. 26.

The new refuge, designated just before National Wildlife Refuge Week, will become a major waterfowl breeding and nesting area. It provides critical habitat for declining grassland birds, greater prairie chickens, sandhill cranes, as well as the endangered western prairie fringed orchid, among other species.

Funding for additions to the refuge, estimated to be $3 million-$4 million over the next decade, will come from fees generated by Federal Duck Stamps, purchased by waterfowl hunters.

"Today's action reflects our commitment to work with partners so wetlands are preserved and wildlife protected," Interior Secretary Gale Norton said. "More outdoor enthusiasts will be able to enjoy the unique landscape Glacial Ridge has to offer."

"It has been one of the finest examples of partnership I've ever been associated with," said Ron Nargang, TNC state director in Minnesota. "More than 30 entities have contributed to its success."

In addition to The Nature Conservancy, project partners include the Minnesota Department of Natural Resources, Ducks Unlimited, Pheasants Forever, the

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Interior Secretary Gale Norton and Minnesota Governor Tim Pawlenty unveiled the entrance sign to the new Glacial Ridge NWR during a press conference at the state capitol Oct. 12. (Chuck Traxler/ USFWS)

From the Director

Water, Water — Not Everywhere.

Clean and plentiful water to nourish abundant and healthy wildlife is indespensable. As urban areas burgeon and industry continues to look for new sources of water, we face vexing issues as we seek to secure and protect water rights for wildlife.

Fulfilling the Promise calls for a comprehensive assessment of water rights and how much water is needed in each region. While we hope for progress on such a national assessment, for now, we encourage refuge managers, where time and staff allow, to do their own assessments on refuges.

In fact the International Association of Fish and Wildlife Agencies took up the issue of water quantity when it considered the Parks and Wildlife Department's proposal that any compilation of national conservation needs must make water for fish and wildlife a top priority. The Texas proposal notes that we have to maintain instream flows into our rivers and streams and freshwater inflows into our bays and estuaries to maintain ecological health.

That same message came through loud and clear at the Refuge System's "Conservation in Action Summit," when 250 people who represented our partners, supporters, Friends and Service staff identified as a top priority the need for clean and plentiful water.

In the six years since *Fulfilling the Promise* was adopted as a guiding blueprint for the Refuge System, the issues of water quality and quantity have become more challenging. Across the country, you can find the ecological and economic consequences of the failure to incorporate wildlife's need for water into land management practices. For example, more than $10 billion will be spent in Florida to replumb the Everglades. The once mighty Rio Grande River, so important to our national wildlife refuges in southern Texas, has been sadly depleted by drought and water withdrawals.

That's why Interior Secretary Gale Norton launched *Water 2025*, an initiative that will help. It seeks to encourage voluntary water banks and other market-based measures, improve technology for water conservation and efficiency, and increase cooperation and collaboration among federal, state, tribal and private organizations. The plan gives us a basis for public discussion by setting out a framework to meet the water supply challenges of tomorrow.

The Service will continue to cooperate with states on all matters related to water use and water rights. We will seek to resolve conflicts through negotiation while working towards the goal of healthy watersheds vital to the future of fish and wildlife conservation and the Refuge System.

— Steve Williams

Chief's Corner

We Make A Difference in the Lives of Americans

If organizations are only as strong as their weakest link, then it's no wonder the National Wildlife Refuge System is one of the strongest and most effective federal government bureaus. After almost two years as Chief of the Refuge System, having visited scores of refuges, I have found no weak links. I've found just the opposite.

The Refuge System is composed not only of passionate people driven by their common devotion to conservation, but by a sense of family that links our 3,000 employees to our mission and to one another. That was brought home in late September with the too-early death of John Taylor, wildlife biologist at Bosque del Apache NWR, NM.

I did not know John well. I wish I had. I do know that he was quiet, capable, well liked and recognized for his many talents. He had an encyclopedic knowledge of the Rio Grande River and its habitats.

Refuge System employees wrote to me and to one another, recalling how John contributed to the Refuge System. They detailed

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*Refuge*Update

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Hurricane Ivan made landfall at Bon Secour Refuge, AL, in the early morning hours of September 16. (Jereme Phillips/USFWS)

In the Eye of the Storm

By Jereme Phillips

The name, Bon Secour, means "safe harbor." French explorers first used it to describe a sheltered cove near the eastern shore of Mobile Bay, AL.

Just to the south, Bon Secour NWR lies at a much more precarious location on a narrow, 22-mile long peninsula that juts into the Gulf of Mexico. For our refuge staff, the name gained new meaning after Hurricane Ivan tore through the refuge in September.

Hurricane Ivan made landfall at Bon Secour Refuge in the early morning hours of September 16. The center of the storm's eye, as estimated by the National Hurricane Center, passed directly over the Perdue Unit of the refuge. The hurricane's projected path was consistent for several days prior to making landfall, and the predictions proved to be accurate.

During final preparations for the storm, our staff of four permanent employees and two interns remarked that at least we had some time to get things ready. When the governor issued a mandatory evacuation order, we left the coast with the same expectation that our neighbors did – that we may not find much left when we returned.

Just hours after the hurricane passed, USFWS law enforcement personnel were on the ground at Bon Secour and their report was, for the most part, better than expected. Most of our homes and structures on the refuge were intact – but we had a huge mess on our hands. Many homes in nearby Gulf Shores were destroyed. The massive storm surge pushed the wall of debris onto the refuge. Boats, propane tanks, gas cans and lumber stretched as far as the eye could see around Little Lagoon, Gator Lake and remote marshes on the refuge.

The Team Was Remarkable

For the next two weeks, FWS Incident Management Team #2, assembled to respond to Hurricane Frances and then reassigned to Ivan, worked tirelessly to restore the refuge infrastructure. The efforts of this team were remarkable. Among their many accomplishments, the crews cleared four miles of refuge roads and trails, collected 1,200 containers of hazardous materials and removed more than 800 cubic yards of debris.

Even with 14-hour shifts and the hard work of approximately 60 team members, the debris removed may only represent 20 percent of the total deposited on the refuge. USFWS Director Steve Williams and Regional Director Sam Hamilton visited the refuge in October and expressed their support and appreciation to all who contributed to the cleanup.

The public concern about the refuge has been overwhelming. Our office immediately began receiving calls from the Friends of Bon Secour National Wildlife Refuge, Boy Scout troops and individuals who just wanted to offer their support and ask how they could help. We regretted to tell them that right now the refuge is too hazardous even for volunteer cleanup crews. Visitors and the local community have understood that, at least for the near future, the refuge is closed to protect public safety. However, we hope that portions can be reopened as we work at removing hazardous materials from the areas with the highest visitor use.

Besides the challenges associated with cleaning up the refuge, some refuge wildlife populations were severely impacted. The refuge is home to several endangered species, containing the largest contiguous tract of Alabama beach mouse habitat and nesting beaches for the loggerhead sea turtle. Both species suffered significant habitat loss on the refuge as a result of the storm. Bon Secour is also an important stopover site for neotropical migratory birds and, to a lesser extent, some loss of their maritime forest habitat also occurred.

While many wildlife species were hit hard by Ivan, the ecosystem – along with the community of Gulf Shores – slowly begins to rebuild. Amidst the moonlike landscape left behind where impressive dunes once stood, you can find solitary clumps of sea oats here and there, defiantly standing after the storm to provide a seed source for the next generation and to prove that Bon Secour is indeed a safe harbor. ◆

Jereme Phillips is the wildlife biologist at Bon Secour NWR, AL.

Four Are Honored by NWRS

For Outstanding Contributions

The National Wildlife Refuge System bestowed four major awards during National Wildlife Refuge Week in October on four individuals whose work has benefited both the Refuge System and the nation's wildlife resources.

David Sibley of Concord, MA, noted author and illustrator, was honored for his outstanding support of migratory bird conservation through public education and the promotion of wildlife recreation. He is the author of several birding guides, including the *Sibley Guide to Birds*, published in October 2000 after more than 12 years of work. Sibley writes, edits and illustrates his books.

The guide book has been followed by four other books, including *Sibley's Field Guide to Birds of Eastern North America* and *Sibley's Field Guide to Birds of Western North America*, both published in April 2003.

"His passion is evident in his magnificent illustrations," said Deputy Interior Secretary J. Steven Griles. "Expanding on the heritage of such greats as Roger Tory Peterson, David Sibley has inspired in millions of Americans a fascination for birds – and a concern for their habitats."

Martin MacDonald, director of corporate public relations, conservation and youth development for Bass Pro Shops, was honored as a Centennial Champion for helping to build awareness of the Refuge System. MacDonald provided outstanding support to the USFWS Centennial Commission as it worked to honor the Refuge System's 100th anniversary.

He conceived of programs that provide funding for habitat restoration on national wildlife refuges. "In community after community, national wildlife refuges bear the fruits of Martin's towering commitment," said Griles. "His legacy will endure for all time in the land that he has helped protect."

Dr. Leigh Frederickson, retired after serving more than 36 years as Director of the University of Missouri Gaylord Memorial Laboratory, was honored for a lifetime of achievement in support of the National Wildlife Refuge System.

Dr. Frederickson and his graduate students conducted about 40 formal research programs on national wildlife refuges across the country. More than any other single individual, Dr. Frederickson has influenced the management of wetlands on wildlife refuges. Dozens of his graduate students today work for the Refuge System as refuge managers and biologists.

"Even today, you'll find Leigh in the marshes, bottomland forests and prairies of national wildlife refuges from Alaska to Florida, from Hawaii to Louisiana," said Dean Rundle, a former student and now manager of Rocky Mountain Arsenal NWR, CO. "No other research biologist has learned more about the Refuge System and the resources we manage. Leigh is a true hero of the Refuge System and a giant in the field of conservation."

Rep. Jim Saxton (R-NJ), a member of the House of Representatives for more than two decades, was cited for outstanding support of the National Wildlife Refuge System through legislative leadership. A senior member of the House Resources Committee's Fisheries Conservation, Wildlife and Oceans Subcommittee, Rep. Saxton was one of the authors of the National Wildlife Refuge System Improvement Act of 1997, considered the governing legislation for the Refuge System.

He has sponsored bills that protect dolphins, sea turtles, sharks and other marine mammals, domestic coral reefs and marine sanctuaries. He has provided vital support for the E.B. Forsythe NWR, established on the New Jersey coast in 1939.

Author and illustrator David Sibley was honored for his outstanding support of migratory bird conservation through public education and the promotion of wildlife recreation. (Debbie McCrensky/USFWS)

Martin MacDonald, director of corporate public relations, conservation and youth development for Bass Pro Shops, was cited for outstanding support to the USFWS Centennial Commission as it worked to honor the Refuge System's 100th anniversary. (Debbie McCrensky/USFWS)

Retired Professor Leigh Frederickson, left, was honored for a lifetime of achievement in support of the National Wildlife Refuge System. Presenting the award are Dean Rundle, center, one of Dr. Frederickson's former graduate students and refuge manager at Rocky Mountain Arsenal (CO), and Deputy Interior Secretary J. Steven Griles. (Debbie McCrensky/USFWS)

More recently, he was a sponsor of the Volunteer and Community Partnership Act, signed into law by President George W. Bush in late October. The act gives citizens enhanced opportunities to contribute to conservation.

"Congressman Saxton has long been a tireless advocate of the Refuge System," Griles said. ◆

Looking Beyond the Ecology to the Human History

Archaeological Field School Students Survey Fish Springs Refuge

By Jay Banta

University of Utah students at Fish Springs NWR eschew studying wetlands, wildlife, ecology and a myriad of natural history topics to uncover instead the story of past human use.

For all but one year since 1998 and under the auspices of a challenge grant, the university's Archaeological Field School has conducted investigations into the site of a Pony Express station, uncovered evidence of Fremont culture occupation, documented hundred of acres used by tribes of Shosonean cultures, and confirmed some important geological events associated with the vast prehistoric inland sea known as Lake Bonneville.

Under the guidance of Duncan Metcalfe, curator of the university's Museum of Natural History, student learn state-of-the-art field inventory techniques while the refuge and the scientific community gain new information about the still unfolding story of human occupation of the area.

So far, more than 40 students, ranging from high school pupils to those in college graduate studies, have each spent a grueling 10 days surveying for refuge archaeological sites.

Field research at numerous locations on the refuge has uncovered a treasure trove of both historic and prehistoric artifacts. For example, work at the site of the Fish Springs Pony Express Station, which operated from April 1861 to November 1862, revealed buttons, glass fragments, earthenware shards, cartridge casings and horseshoes. Other inventories have uncovered a wealth of prehistoric artifacts, including pottery shards, projectile points,

Students from the University of Utah Archaeological Field School have uncovered a treasure trove of historic artifacts at Fish Springs, NWR. (Fish Springs Staff/USFWS)

bifacial stone implements and drills. All unearthed artifacts are being maintained according to federal standards at the Utah Museum of Natural History.

"Archaeological field techniques typically are best taught in outdoor locations where a variety of sites can be located and

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2005 Friends Conference Expected To Draw Record Crowd

Ron Tillier with Friends of Blackwater NWR, MD, never fully understood the incredibly complex federal budget process until he attended the National Conference for Friends of the National Wildlife Refuge System in 2003.

Not only did that learning process persuade the group to send a representative to the 3rd National Friends Conference in Washington, DC, February 4-6, 2005. So did the chance to cement relationships with members of Congress. "I never thought national leaders would be as accessible as they are," Tillier said. "We could never have built the relationships without the conference."

More than 300 leaders of the Refuge Friends movement are expected to gather for the "Friends in Action Conference" that will build on the "Conservation in Action Summit" and expand the groups' knowledge and organizational know-how.

The "Friends in Action Conference" will offer more than a dozen educational workshops, including fundraising and board development techniques. Sessions on community partnerships, the federal appropriations process and media relations will be offered as well.

Moreover, the conference is a singular opportunity to meet with Friends representatives from across the country. "Our goal is to provide Friends groups with essential skills and information to build a stronger National Wildlife Refuge System for the benefit of the public and wildlife resources," National Wildlife Refuge Association President Evan Hirsche noted.

The Association and the National Wildlife Refuge System are sponsoring the conference.

For more information, contact Max Schenk, director of Friends and constituent outreach for the Association,

Nearly 300 Friends leaders attended the National Friends Conference in 2003. A full day was devoted to visiting Congressional representatives. (NWRA)

800-996-6972; or Trevor Needham, Refuge System national Friends coordinator, 703-358-2392. You can also visit http://www.refugenet.org/new-events/announce.html. ◆

Cactus Moth Infestation Spreading North

By Jennifer Koches

First detected in South Carolina in 2002, the cactus moth has spread onto Cape Romain NWR, one of South Carolina's premiere national wildlife refuges, even as the determination to learn and do more about invasive species is spreading quickly.

If not eradicated, the cactus moth could wipe out a rare South Carolina cactus that is on the state endangered list. The Mexican government fears the cactus moth could harm its agricultural yield of native cacti.

Knowing that cactus moth was on Folly Beach, SC, a mere 50 miles from the refuge, USFWS personnel conducted some sporadic searches Aug. 10 for signs of the moth on Bull Island within Cape Romain Refuge. Much to the crew's dismay, signs were found.

Within days, Randy Westbrooks, U.S. Geological Survey invasive plant coordinator, was on the refuge to collect specimens for identification. By mid-September, scientists had concluded that cactus moth had invaded the refuge, verifying that the range of the cactus moth had extended up the coast of South Carolina for the first time. A week later, Dr. Westbrooks, USFWS personnel and volunteers who surveyed Cape Island, another island within the refuge, found its 300-plus acres of native cactus to be free of cactus moth.

Dr. Westbrooks has since surveyed several sites north of Cape Romain Refuge and found them free of cactus moth signs. It appears that Cape Romain Refuge is the northernmost edge for this invasive.

On Sept. 29, USFWS personnel returned to Bull Island to manually remove infected cladodes (leaf pads) from the one verified infestation site. A field survey of other cactus locations on Bull Island was conducted to build a database about infestation.

Despite the monumental work that will be involved in addressing the spread of the cactus moth, USFWS personnel will continue to work diligently with USGS to develop a monitoring and control network for this species.

Sharing an Appreciation for Nature

"Sound Safari" Reaches Those Who Are Visually Impaired

A killdeer sounds a distracting alarm as it swoops away from its nest. The call of ducks and geese – as many as 100,000 birds during late summer and early fall – wafts across Minidoka NWR, which extends 25 miles along both shores of the Snake River in Idaho. The refuge is alive with the songs of meadowlarks, orioles, robins and many other songbirds.

Refuge Manager Steve Bouffard led a group of participants June 18 on Minidoka NWR, ID. Usually, about 15 people join one of the "Sound Safari" walks. (Kathi Stopher/USFWS)

More than 100 years ago, settlers on the Oregon Trail passed just south of the refuge where it split into the Oregon and California Trails. An alternate route that ran through the refuge, north of the Snake River can still be seen today. Thousands of visitors come to Lake Walcott State Park, within the refuge's boundary, to camp, picnic, hike, observe wildlife, hunt waterfowl, boat and fish.

Now, a new group of visitors, those who are visually impaired, are also finding their place on the refuge.

In partnership with L.I.F.E., Inc. (Living Independently For Everyone) and Lake Walcott State Park, the refuge adapted its traditional bird walk in 2002 into "Sound Safari." So far, the refuge has had about a half dozen springtime walks, attracting as many as 15 people each time. The walks are also offered at nearby refuges.

L.I.F.E., Inc., which helps coordinate the walks, provides lunch and transportation for participants, including some in wheelchairs. Because they work with the disabled daily, they contact the participants. Lake Walcott State Park, with miles of paved trails suitable for wheelchairs, offers refuge staff a safe and quite place for the tours. Both L.I.F.E., Inc. and the park have provided funding for benches and other features that participants need.

Recently, L.I.F.E., Inc., translated the Idaho state bird list into Braille, another step in opening the natural world to the visually impaired. Refuges across the country may want to work with local groups to get region-specific bird lists, recommended Minidoka Refuge Manager Steve Bouffard.

"These programs are fun and rewarding to lead," Bouffard said. "The whole program is about sharing your

In addition to his work on the cactus moth, Dr. Westbrooks has provided a steady stream of information on invasive species issues to USFWS personnel in South Carolina. He has worked diligently on beach vitex in South Carolina, an invasive species now dubbed the "Kudzu of the Beaches" for its prolific growth.

Identification of the cactus moth can be tricky since there are native moths that also breed on and eat cactus. Submit any suspected cactus moth adult or larvae to Dr. Richard Brown of Mississippi State University, 662-325-2085. A description of the adults and larvae are available at http://creatures,ifas,ufl,edu/bfly/cactus_moth.htm. Report any infestation to Michael Lusk, 703-358-2110, who is working with USGS to create a national monitoring network. ◆

Cactus moth has spread from Folly Beach, SC, to Cape Romain NWR, establishing a new northern edge up the South Carolina coast. (Jennifer Koches/USFWS)

Jennifer Koches is the USFWS public affairs specialist at the Charleston (SC) Field Office.

appreciation and awe for nature with others and enriching the lives of people who are usually left out of outdoor experiences."

The "Sound Safari" walks take visitors to the refuge's accessible viewing and fishing platform. Bouffard and Chuck Trost, a retired ornithology professor from Idaho State University, led the first walks, also held at Camas NWR, ID.

Adapting birding programs for the visually impaired is a "natural," according to Bouffard, who notes that many more birds can be detected by sound rather than sight. He suggests a few easy-to-emulate steps:

- Partner with a nonprofit group or government agency accustomed to working with people with disabilities. They can locate participants and help with special needs and transportation.
- Start each trip by introducing staff and orienting participants to the location. Then provide an overview about why birds call, what calls they make and what participants likely will hear. Some of this information can be shared on the ride to the walk site.
- Select a location with smooth walking trails. Lawn and paved or gravel paths also work. Avoid paths with uneven ground as well as noisy sites or those you will have to share with bikes, in-line skaters and others. Pick up limbs, stones and other impediments along the path before participants arrive.
- While the dawn chorus is glorious, there are too many birds calling then to pick out individual species. Later morning is a better time, and more convenient for the majority of participants.
- Limit walks to a quarter-mile each way. Participants usually cannot endure longer hikes. Have benches or picnic tables scattered along the path for rest stops. Many visually impaired persons also have other health problems, such as diabetes. Be prepared to handle diabetic shock cases and similar problems. Make sure suitable restrooms are available.
- The blind seldom have a concept of distance. Therefore, tell participants how long it will take to walk the path, rather than how many miles it is.
- Point out birds with phrase such as "the singing bird is above your head" rather than with gestures or phrases such as "on the third branch on the left side of the maple tree". Bring CDs or tapes to demonstrate what, for example, a yellow warbler sounds like. That makes it easier to pinpoint a species when they hear species calling simultaneously.

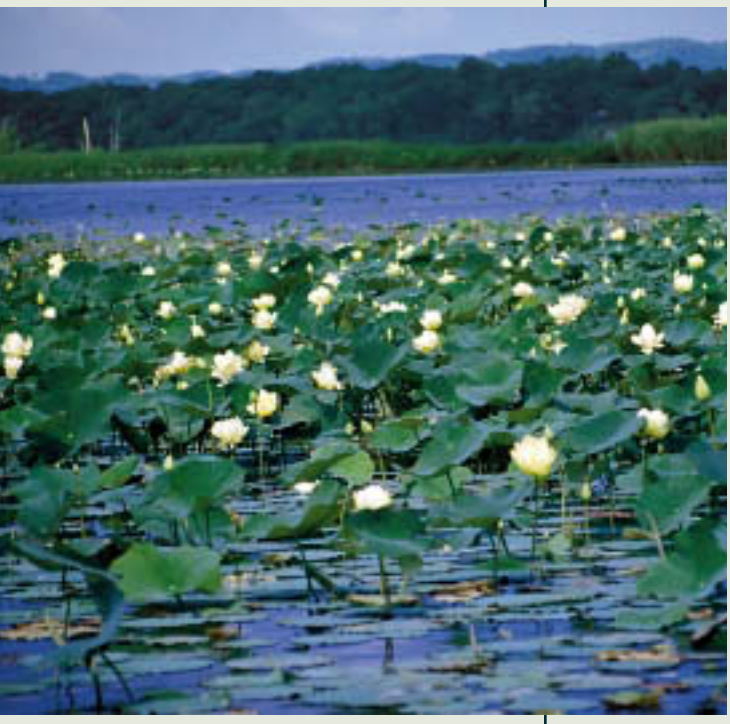
"You don't have to be an expert in bird songs," Bouffard concluded. "All you need is an appreciation for nature, a willingness to share, good partners and a little preparation. I hope we can spread this program nationwide. We could reach so many more people if every refuge starts a similar program." ◆

FOCUS ...Water and Its Impact on

Got Water?

By John Trawicki

Water shapes the landscape and is essential for all ecological processes that enable the Refuge System to conserve a wide range of wildlife species. Water is both wildlife habitat and a tool to manage wildlife habitat.



Upper Mississippi National Fish and Waterfowl Refuge is just one place where flood flows maintain habitat. (USFWS)

With drought conditions continuing in the West and demand for surface and groundwater supplies growing, Refuge System managers well know that maintaining adequate water supplies is a daily challenge. In fact, employees of the Fish and Wildlife Service who attended the "Conservation in Action Summit" in May voted "water: assess resources and needs" as the top wildlife and habitat priority.

Indeed, water management is not new to the USFWS. In the Dust Bowl of the 1930s, when water in the prairie potholes of the Midwest were at their lowest levels and the duck population was severely low, J. Clark Salyer, the first chief of the Division of Refuges, sited many early refuges by looking first for bodies of water. He knew that any place with water could become a migratory bird refuge via land acquisition with the Migratory Bird Commission. More importantly, he knew that water is habitat.

Each day, hundreds of national wildlife refuges either divert surface water or pump groundwater to create impoundments, manage water levels within impoundments, or irrigate agricultural units, nesting habitat and other areas whose wildlife habitat potential would be limited unless water was available. Protecting the water supply and applying it to Refuge System lands that manage for aquatic and migratory species is vital.

Flood flows are also extremely important in maintaining waterfowl and migratory bird habitats. They are also a physical force that shapes the landscape, restores nutrients to riparian areas, recharges wetlands, flushes sediment from the channel, and brings nutrients and habitat forming debris into the river channel and associated wetlands.

Flood flows maintain habitat in places like the Platte River and Rainwater Basin wetland management districts in Nebraska, the Upper Mississippi National Fish and Waterfowl Refuge in Minnesota and Wisconsin, the White River and Cache River refuges in Arkansas. Malheur NWR, OR, for example, has been using flood flows of the Donner und Blitzen River to maintain habitat for redband trout.

Water Challenges Face Refuge System

The Klamath Basin in Oregon and northern California is one place that illustrates the spectrum of water issues and complexities that challenge the Refuge System. This troubled ecosystem has many difficult and compounding issues – inadequate water supplies for agriculture, and wildlife and fisheries; endangered and threatened fishery resources; salmon die-offs; water quality and pesticide issues; different state water law: and tribal treaty rights conflicts. Water shortages are affecting basin economies and causing social and cultural change. Resolution is challenging.

As the demands on the nation's water resources increase, so does the cost and complexity of water management for the Refuge System. In the West, the USFWS must secure and defend water rights in a highly competitive and political arena. In

the East, where water is plentiful, growing population puts an increasing strain on water availability.

Overall, national wildlife refuges find it increasingly important to work with the municipalities, state water managers, local water users, tribes, partners and Friends groups to protect the water resources necessary to manage the Refuge System.

The Silvio O. Conte NFWR, MA, is an excellent example of the collaborative process. Refuge staff worked with Smith College and the University of Massachusetts to collect information about history, water quantity, water quality, and land uses in the Mill River watershed. They shared the information with residents to help them better understand and manage the river system where federally-endangered dwarf wedge mussels are found. The information was critical in informing the state withdrawal permitting process to protect flows for the mussel.

Klamath Basin illustrates the spectrum of water challenges. (USFWS)

The mix of science, policy and law can make water resource management a vexing issue. The Pacific, Southwest, Mountain-Prairie and Alaska regions (Regions 1, 2, 6 and 7) have water resource programs. The Great Lakes-Big Rivers, Southeast and Northeast regions (Regions 3, 4 and 5) have individuals working as water resource coordinators.

To address water resources management, water resources coordinators have enumerated several steps as "best practices":

- Identify the role of water in the ecological processes and as habitat.
- Identify water requirements, including quality, quantity, timing and source.
- Measure and document the use, source, timing and quality of water.
- Secure rights or permits under state water law.
- Identify water users other than the USFWS and partners.
- Monitor proposed new water users and file objections in state forums when necessary.
- Assert federal reserved water rights as required.

Water is critical to the mission of the Fish and Wildlife Service. Water resource coordinators work to assist refuges in obtaining and protecting the water resources needed to fulfill individual refuge purposes. ◆

John Trawicki, supervisory hydrologist for refuges in Alaska (Region 7), worked with the regional water resource coordinators to produce this article.

Regional Water Resource Coordinators

Region 1	Michael Eberle, Chief, Water Resources Branch
Region 2	Steve Cullinan, Chief, Water Resources Branch
Region 3	Jon Kauffeld, Regional Refuge Supervisor, Iowa, Missouri, Illinois
Region 4	Robert Kelsey, Biologist, Refuge Program
Region 5	Beth Goettel, Refuge Manager, Silvio O. Conte NFWR, MA
Region 6	Cheryl Williss, Chief, Division of Water Resources
Region 7	Warren Keogh, Water Rights Coordinator, Water Resources Branch
Washington Office	Contact Branch of Wildlife Resources, 703-358-2043

FOCUS ...Water and Its Impact on

South Texas Refuges Battle Drought

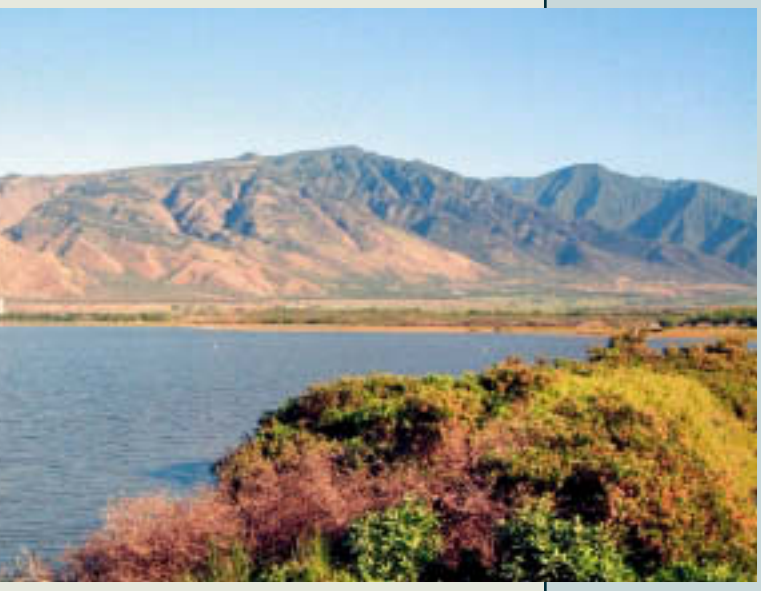
By James Broska

Recovering from five years of droughts more severe than any seen since the 1950s, the Lower Rio Grande Valley, Santa Ana and Laguna Atascosa national wildlife refuges of south Texas have battled a host of water resource and management problems in recent years, including water availability, water rights and the costs of water delivery and conveyance.

Most water accessible to the Lower Rio Grande Valley and Santa Ana refuges comes directly from the Rio Grande River with releases from Falcon Reservoir. In the aftermath of drought conditions, water allocations have often been only a fraction of adjudicated amounts and are controlled and managed by the Rio Grande Water Master. The resulting shortage of useable water can make it very difficult for managers to balance water use in cooperative farming agreements and habitat rehabilitation projects.

Under Texas state law, water rights designate "place of use" and categories of use. More than 100 land tracts make up the Lower Rio Grande Valley Refuge; many have associated water rights that contain very specific language regulating the type and "place of use" permitted.

To better manage the whole issue of water rights for the refuge, many water rights have been amended into a single right that allows greater flexibility and partitioning that use over individual land tracts. Moreover, by having the State of Texas officially recognize "uses" to include recreation and wildlife in addition to agricultural and irrigation, managers can use water for habitat while still meeting "beneficial use" standards.



Kealia Pond NWR, a 700-acre wetland refuge on Maui, is the largest lowland wetland area remaining on the island. (Tim Mayer/USFWS)

Water Resource Challenges in an Urban Setting

Kealia Pond Refuge Struggles with Water Issues

By Tim Mayer

Kealia Pond NWR, a 700-acre wetland refuge on Maui, is using the emerging field of ecohydrology – studying how hydrological factors affect the distribution, structure and function of ecosystems – to better understand the impacts of the seasonal water levels on invertebrates, fish and birds.

As the largest, naturally formed wetland remaining on the island, the pond has long been a settling basin for sediment and nutrients from the 56-square mile watershed of the West Maui Mountains. It provides habitat for endangered Hawaiian stilts and Hawaiian coots.

Water coverage fluctuates by season. The highest levels come during the rainy season, December to March. The lowest levels are in October to November. The range in water chemistry can be extreme, from low salinity and moderate temperatures when the wetland is completely full, to salinity much higher than seawater and high temperatures when water coverage is low.

This wet-dry cycle can be beneficial for the breakdown of organic material and growth of vegetation (sedges). However,

Although Laguna Atascosa Refuge, which is not adjacent to the Rio Grande River, would like to purchase water, it cannot afford to do so. (James Broska/USFWS)

Finally, the costs of water delivery and conveyance have been especially difficult. For land tracts adjacent to the Rio Grande River, most costs are associated with the infrastructure needed to pump water directly from the river. Pumps, power lines, piping networks and ditch maintenance are costly items that need to be in place before water can be routed to wetlands or used for irrigation.

For Laguna Atascosa Refuge and other land tracts in the Lower Rio Grande Valley system that are not adjacent to the Rio Grande River, water must be purchased and routed through one or more irrigation districts that control water delivery. Most irrigation districts charge between $10 and $30 per acre foot of water plus an "accounting" loss of up to 25 percent of the water request, which is removed from the Falcon Reservoir Storage Account at the Water Master's office for each delivery. While the refuge receives the requested water, it also faces the accounting loss.

Laguna Atascosa Refuge well shows how such costs can hinder management. Because Laguna Atascosa is far from the Rio Grande River, purchased water must be routed through two irrigation districts. Both districts charge a delivery fee and an accounting loss to the irrigation system. At $25 per acre foot, the cost for a small order of 1,000 acre feet of water can cost as much as $50,000. During the summer, when evaporation rates are high, 1,000 acre feet of water would only last a few weeks in the refuge's ponds and wetlands.

Because this has been a year of high rainfall and natural recharge to many wetlands, ponds and lakes in South Texas, refuges do not need to purchase water for many land tracts. That situation may not last. With Falcon Reservoir at only 60 percent capacity as of August, the drought is not yet over yet. The feast may yet prove to be a famine. ◆

James Broska is a senior hydrologist in the Southwest (Region 2).

the cycle may compound, to varying degrees, a host of issues that are a nuisance to neighboring condominium owners, such as large emergences of aquatic insects (midges) in winter, fish die-off as water recedes, and windblown sediment as the pond edges dry.

Attempts to resolve these issues are difficult because of the varied factors that must be considered: nutrients, phytoplankton, aquatic insects, fish, waterbirds. If one link is controlled to minimize the nuisance to neighbors, then it often impacts another link. To evaluate control measures, data on the hydrology, other abiotic factors and biology are needed.

In 2001, a multi-disciplinary team of biologists, managers, soil scientists and hydrologists met to evaluate the short- and long-term control measures for midges and fish – both invasive species – yet maintain quality habitat and food resources for endangered and migratory birds. The team also identified what information and research projects are needed to provide data to evaluate management strategies.

Because hydrology is the primary factor driving the ecology of the wetland, a comprehensive monitoring program was established in 2001 to record surface water and groundwater levels, stream flow, temperature, salinity, dissolved oxygen, alkalinity, water quality (nutrients), and phytoplankton.

In addition, research studies on aquatic insects (including midges), fish, waterbirds and aquatic insect responses to mechanical control of invasive vegetation, and contaminant analyses are either completed or in progress. Researchers are working on draft reports for some studies, while other studies are just being launched. The hydrological monitoring will continue at least for another year. After that, the team will continue to monitor, although not as intensely.

The studies will give the multi-disciplinary team the knowledge base to evaluate trends between the hydrology and responses of the nutrients, algae, aquatic insects and fish to the seasonal fluctuation of water levels. The long-term solution is to manage water levels to improve biodiversity for endangered and migratory bird species, and attempt to achieve a more "balanced" wetland system while reducing those issues the neighbors feel are nuisances. ◆

Tim Mayer is a hydraulic engineer in the Water Resources Branch of Region 1.

FOCUS ...Water and Its Impact on

One Man's Fight for Water Rights

A Historical Perspective

By Megan Estep and Cheryl Williss

Access to water has been a predominant factor throughout history in determining where people settle. Indeed, water has shaped the development of the West.

The "prior appropriation" doctrine was developed early in Americans' settlement of the West to govern how water is allocated: The first user to make claim to water and put it to beneficial use has the most senior right to it. In times of shortage, the most senior water right holder can take what he needs before those who perfected their rights after him.

Even in the 1930s, when loss of wetland habitat played a primary role in the plummeting number of waterfowl, wetlands were being drained to provide more farm acreage. The fledgling Bureau of Biological Survey, then under the Department of Agriculture, was tasked with establishing waterfowl refuges. Much of the work focused on the prairie pothole region of North and South Dakota – contained in today's Mountain-Prairie Region (Region 6) – because prairie potholes serve as prime breeding grounds for North America's ducks, geese and other migratory waterfowl.

To produce waterfowl, you need water. Enter Brice McBride, a hydraulic engineer, who worked from 1934-46 to secure water rights for national wildlife refuges to ensure they would be able to produce waterfowl. Most of the projects were established on river systems in North and South Dakota, including Upper Souris NWR, J.Clark Salyer NWR, Des Lacs NWR, Tewaukon NWR, Arrowwood NWR and Sand Lake NWR.

The significance of McBride's work becomes apparent in the context of the drought that currently grips many

Stream Gaging in Alaska: Extraordinary Conditions

Hydrologists working in Alaska endure weather extremes, including the need to drill through six feet of ice on the Matogak River on the Togiak NWR. Temperatures can drop to 30° F below zero. (USFWS)

By Erik Tomsen

Field hydrologists working in Alaska's Water Resources Branch endure weather extremes to conduct water studies and learn more about northern rivers as the USFWS seeks to secure senior instreamflow water rights with the State of Alaska's Department of Natural Resources in light of the 20 million acres protected by the Refuge System and the low demand for water by other entities.

A senior right will give the USFWS priority over future water right holders, ensuring an adequate supply of water for important aquatic habitats and the resident and migrating species that use water on Alaska's 16 refuges.

The Water Resources Branch operates 36 stream gaging stations on four refuges: Togiak, Tetlin, Kodiak and Becharof. Hydrologists make six to seven trips annually to each gaging station to maintain instruments, download data and measure river depth and volume of flow. Hydrologists also monitor the physical and chemical characteristics of the water to establish a baseline for water quality.

Blue-winged teal are just one of the waterfowl species that rely on the waters of the J. Clark Salyer NWR, ND, helped by Brice McBride. (John and Karen Hollingsworth)

western states and the growing number of conflicts from an ever-increasing demand for water resources.

Assuring Water for Refuges

By spending hundreds of hours surveying projects, quantifying water needs, submitting documents to state agencies, and following up on water right conflicts, McBride ensured that wildlife refuges in the area had adequate water resources and the legal rights to use those resources.

Water rights belong to the United States and are protected under state law, as are the water rights of any other user. In many cases, they are some of the most senior water rights claimed in a river system, giving the USFWS virtually guaranteed supplies of water for wildlife.

Regional files indicate that McBride was involved in securing and protecting water rights for refuges in North Dakota, South Dakota and Montana, and investigated water resources in Colorado and Utah. McBride covered a vast amount of territory. What he accomplished for the National Wildlife Refuge System is astounding given the technology of the time.

Brice McBride died in a hotel fire in Chicago. There is no record of letters signed by Brice after 1946. We have no idea how old he was or who he left behind. But he remains an inspiration to the water rights specialists, hydrologists and engineers who continue to work to protect the water resources so vital to the integrity of the Refuge System. ◆

Megan Estep is the Mountain-Prairie Region's refuge/private lands hydrologist. Cheryl Williss is chief of the Region 6 Division of Water Resources.

While those operations may be standard for USFWS hydrologists, the challenges faced in Alaska are anything but standard.

Just getting to work is complicated. Only two refuges are accessible by road. A fixed wing airplane flight is required to reach most refuge headquarters. Once on the refuge, hydrologists usually reach a gage sites by helicopter. Fog, snow or clouds can move in abruptly, restricting landings or takeoffs.

Short winter days also complicate work since return flights must be completed before twilight. Fortunately, the long summer days and their long working hours make up for lost winter daylight.

Once in the field, environmental conditions play a huge role. Winter temperatures reach 30° F below zero and freeze most rivers. Ice augers are needed to drill down to flowing water for measurements.

Hydrologists Alan Peck and Jasper Hardison recollect drilling 30 holes in jumbled river ice that refroze 30 minutes later. "Slush freezes on everything," Jasper observed, recounting how he had to break the ice off his chest waders just to bend his knees.

Spring and summer bring their own challenges. During spring breakup, ice dams break free; sheets of ice ranging in size from tabletops to football fields float down the rivers. Unpredictable flow conditions combined with millions of buzzing mosquitoes and other pesky insects mark the summer season.

Then there's the challenges posed by wildlife – from bears that destroy, rip, or eat instruments, to foxes and ground squirrels that chew through wiring. Innovative solutions are sought to protect equipment. Data loggers, for example, are housed in protective metal boxes that are painted to blend with the landscape and avoid wildlife encounters.

But challenges come with rewards. Just being in this awe-inspiring land is certainly one of them. Adverse conditions provide for constructive solutions as progress moves forward in the preservation of Alaska's natural resources in the interest of the generations to come. ◆

Erik Tomsen, a senior at Chugiak High School in Eagle River, AK, worked for the Alaska (Region 7) Water Resources Branch as a Youth Conservation Corps student.

Ohio River Refuge Reaches Beyond Borders to Conserve Freshwater Mussels

"Stable, diverse mussel populations indicate clean water and a healthy river."

The Ohio River is home to 50 species of mussels. (USFWS)

While nearly 300 kinds of freshwater mussels inhabit the country's waterways, many are at risk of extinction.

This diversity of species – found nowhere else in the world – has been harmed by habitat loss, lack of fish hosts for reproduction, pollution, and competition from such non-native species as the zebra mussel, which has invaded waters throughout the eastern U.S. since its introduction from Europe in the 1980s.

The Ohio River Islands NWR is one of the several organizations working along the upper Ohio River in Kentucky, Pennsylvania and West Virginia to conserve imperiled mussels, including the endangered pink mucket and fanshell and two additional species that are candidates for listing as endangered or threatened. The Ohio River is home to 50 species of mussels.

"If we hope to conserve mussels in the watershed, we must continue to extend our work well beyond the refuge's boundary signs," said Refuge Manager Dean Rhine. "We collaborate with numerous agencies and organizations toward a common goal of restoring and protecting native mussel populations. These partnerships achieve results that far surpass what we at the refuge could do alone."

Monitoring populations over time

Zebra mussels boomed in the mid-1990s, causing the death of many native mussels, according to Refuge Biologist Patricia Morrison and Outdoor Recreation Planner Janet Butler, members of a scientific dive team that has monitored mussel populations in the Ohio River since 1994. Although the team has seen fewer zebra mussels in 2000-2002, data from the 2003 survey indicate the population may be on the rise again.

Because zebra mussels do not need a fish host to reproduce, they propagate rapidly, eliminating native mussels by beating them out for food.

Natural resource agencies in Indiana, Kentucky, Ohio and West Virginia are among the partners participating in long-term mussel monitoring in the Ohio River along with Ohio State University, U.S. Army Corps of Engineers, Environmental Protection Agency, Muscatatuck and Patoka River national wildlife refuges in Indiana, and the Service's divisions of ecological services and fisheries.

Ohio River Islands Refuge and the Kentucky Ecological Services Field Office earlier this year received a $150,000 Cooperative Conservation Initiative grant to support ongoing restoration and enhancement of rare mussel populations in the river and its tributaries. Project partners collect mussels for propagation and genetics analysis at state-of-the-art facilities operated by the Kentucky Department of Fish and Wildlife Resources and the Columbus Zoo in Ohio. Refuge biologists select locations to reintroduce the juvenile mussels and monitor the success of the recovery.

Conducting scientific studies

Seeking to involve national fish hatcheries in holding and propagating freshwater mussels, researchers at the Leetown Science Center are studying the potential for disease transmission between fish and mussels. Refuge personnel collect common species of mussels, which can act as surrogates in the reproduction of endangered species. To prevent further spread of zebra mussels, the collected mussels are quarantined before they are transferred to the science center. The refuge's quarantine facility is one of only four in the Ohio River valley approved by the Service to hold both common and endangered mussels.

According to Rhine, the conservation of freshwater mussels will remain a priority for the Ohio River Islands Refuge, which spans more than a third of the length of the upper Ohio River, protecting 22 islands and three mainland properties in the tri-state region.

"Our efforts to conserve freshwater mussels contribute to the overall stewardship of fish, wildlife and other Ohio River resources," said Rhine. "Stable, diverse mussel populations indicate clean water and an environmentally healthy river." ◆

Before leaving the Ohio River, native mussels destined for the Ohio River Islands NWR are scrubbed to help dislodge zebra mussels that may be attached. Pictured from left are Refuge Biologist Patricia Morrison; Wayne Davis, Kentucky Department of Fish and Wildlife; Rich Henry, USFWS Division of Endangered Species; and Dick Esker, a volunteer. (Janet Butler/USFWS)

FOCUS ...Water and Its Impact on

Sonny Bono Salton Sea NWR: An Oasis at a Crossroads

The Salton Sea is a magnet for water birds, especially waterfowl, shorebirds and gulls. President Herbert Hoover recognized the value when he established the Salton Sea NWR in 1930, now called the Sonny Bono Salton Sea Refuge. (USFWS)

By Chris Schoneman

Lying between the heat-blasted mountains of the Colorado Desert, California's largest lake – Salton Sea – is a paradise for wildlife. Located in the Imperial Valley about 120 miles east of San Diego, in one of the hottest and driest places in the U.S., the Salton Sea is 227 feet below sea level. The area receives less than three inches of rainfall a year.

The Salton Sea is part of the historic Colorado River delta. In prehistoric times, the Colorado River periodically flowed into the Salton Sink, evaporating every time. The present Salton Sea was created accidentally in 1905 when a levee along the river broke and caused water to flood the enclosed basin. After flowing unchecked for nearly 18 months, the Salton Sink became the Salton Sea, 35 miles long and 15 miles wide.

The ensuing development of 572,000 acres of agriculture lands – irrigated with about 2.5 million acre feet of Colorado River water each year – guaranteed a steady supply of drainage water to maintain the sea.

The Salton Sea became a magnet for water birds, especially waterfowl, shorebirds and gulls. President Herbert Hoover recognized the value when he established the Salton Sea NWR in 1930, now called the Sonny Bono Salton Sea Refuge. Currently, a large portion of the sea's southern half constitutes part of the refuge.

Magnificent Oasis

The refuge forms a magnificent oasis. The sea itself provides a hugely productive feeding area for birds. Additionally, part of the refuge on the edge of the sea provides freshwater wetlands. Finally, birds find tremendous feeding in the surrounding agricultural lands.

Some numbers demonstrate the importance of the Salton Sea area and the refuge:

- At least 500,000 waterbirds each year rely on the refuge and the Salton Sea. Ninety percent or more of North America's eared grebes – as many as 3.5 million birds – depend on the area.
- About 30 percent of the breeding population of American white pelicans lives here.
- The area supports the major western North America wintering population of 16,000-19,000 white-faced ibis.
- About 40 percent of the endangered Yuma clapper rail population in the U.S. lives in the area.
- More than 100,000 shorebirds are regularly seen each spring and fall
- The Salton Sea area supports the largest population of wintering snowy plovers in the interior of western North America.

- About 30-38 percent of the entire population of mountain plovers relies on the area in winter, as do more than 200,000 ruddy ducks.

The refuge also is magnet for birders. About 45,000 people come to this birding hot spot each year. The refuge has documented 407 bird species, including more than 100 species that breed on the refuge.

Maintaining a Watery Paradise

The water that brought so much life to the desert eventually brought problems. With no natural outlet, the sea is 25 percent saltier than the Pacific Ocean. The salinity level continues to rise. As a result, some fish species are already showing signs of reproductive stress. Sport fish like Gulf Croaker and Orangemouth Corvina, for example, appear no longer able to reproduce.

Additionally, excessive accumulation of nutrients creates dense algal blooms that rob the water of oxygen. Fish kills can be expected during summer months, and refuge staff regularly monitors for sick and dead birds to minimize outbreaks of naturally occurring avian diseases.

Momentum for the sea's restoration came in 1998, when Congress passed the Salton Sea Reclamation Act, directing the Department of the Interior to study restoration options. In early 2004, the Salton Sea Authority, composed of members from local water districts, tribes and counties, satisfied DOI and Reclamation Act requirements by announcing a restoration plan to create an outlet for the closed Salton Sea. The north end of the sea would be transformed into a healthy ocean-like lake by constructing a dam mid-way across the current sea.

Outflow from the north end would flow into an extensive shallow water wetland system at the south end, providing invertebrate-rich habitat for waterfowl, shorebirds and wading birds. Outflow from the shallow wetlands would then flow into a hypersaline pond.

Much of the ground surrounding the ponds would dry up, and salt-tolerant vegetation would be planted to minimize wind-generated dust. The idea has been deemed feasible, based on current water quality data.

Although the plan, still being studied by the refuge, seems to fulfill the requirements of the Restoration Act, it must be approved by the State of California, as required by the Quantification Settlement Agreement of 2003. That agreement, signed by DOI and the local water districts, will also reduce inflows into the Salton Sea from 1.3 million-acre-feet per year to 930,000-acre-feet per year over the next 15-20 years. As a result, the Salton Sea will fall by about 20 feet and salinity will double in 20 years. The potential impacts to wildlife could be devastating.

The issues, laws and agreements surrounding restoration of the Salton Sea are immense and complicated, including questions of biological integrity on the refuge, endangered species, personal property interests, air and water quality concerns, restoration cost and recreational opportunities, among others. After 40 years of talking about Salton Sea restoration with relatively little action, many individuals remain cautious about its future.

For our wildlife customers, there is a lot at risk.

However, through smart planning and continued open communication with partners like the Salton Sea Authority and the State of California, the refuge hopes to keep its watery habitats a wildlife paradise. ◆

Chris Schoneman is project leader at Sonny Bono Salton Sea NWR.

Black skimmers nest on islands near the Sonny Bono Salton Sea NWR, CA, headquarters. (USFWS)

FOCUS ...Water and Its Impact on

Keeping the "Wet" in Wetlands

Rare among Western rivers because it does not empty into an ocean, the Bear River flows through Utah, Wyoming and Idaho in a 500-mile-long meandering channel before spreading over its delta in the Bear River Bay of the Great Salt Lake. Flows are erratic depending on the season and the year, averaging 1.2 million acre-feet.

Before Western settlement, the Bear River delta supported vast amounts of bird life. Early explorers reported birds so numerous that they made the sound of "distant thunder" when taking to the wing.

Through the second half of the 19th century, early settlers utilized the abundant bird life for food and commercial meat sale. Still, the delta remained a haven for migratory birds. The abundance and diversity of bird life was supported by incredibly productive marshes, fed by freshwater inflows that interface with vast saltwater flats of the Great Salt Lake.

In the late 1800s, summer irrigation to support agriculture pulled large amounts of water from the upstream areas of the Bear River. All but a fraction of the delta wetlands dried up. By the early 1900s, waterfowl began dying by the millions from "alkali sickness," a disease later diagnosed as botulism. Local people and conservationists became alarmed and petitioned Congress to establish a refuge area.

An Act of Congress established Bear River Migratory Bird Refuge,UT, in 1928 to improve conditions for migratory birds. A complex system of dikes, canals and water control structures was developed to manage and maintain the 46,000 acres of wetlands encompassed by the refuge.

The improved water management system helped offset the upstream storage and diversion that decreased the natural flow into the delta area. The refuge and its adjacent wetlands became recognized for their international importance to migratory birds.

Construction of 45,000 acres of wetlands, almost complete, combined with implementation of best management practices on agricultural lands has already cut by more than half the amount of phosphorus in agricultural runoff from the 700,000-acre Everglades Agricultural Area. The Arthur R. Marshall Loxahatchee NWR and Everglades National Park are the bookends of the remnant Everglades that is home to a variety of species. (Nicholas Aumen/USFWS)

Refuge Water Quality is Central to Everglades

As some of the nation's best scientists work cooperatively to restore the Florida Everglades in what may be the largest wetlands restoration ever undertaken, the quality of water in and adjacent to the Arthur R. Marshall Loxahatchee NWR is pivotal.

The issue of water quality stretches back to the 1980s, when scientists and resource managers became concerned about changes in the Everglades plant communities just downstream from the 700,000-acre Everglades Agricultural Area – where much sugarcane is grown. The area is south of Lake Okeechobee and adjoining the wildlife refuge.

Loxahatchee Refuge and Everglades National Park essentially are the bookends of the remnant Everglades that exist today.

Agricultural runoff had increased the flow of pollutants, especially phosphorus. As a result, areas in the path of this runoff became overgrown with cattail, crowding out other wetland plants and habitat suitable for Everglades fish and wading birds. In fact, the areas next to the refuge's rim canal were particularly affected.

As a result, the federal government sued the State of Florida in 1988 for violating

The marshes of Bear River Migratory Bird Refuge have been an oasis for water birds. (USFWS)

Then The Floods

In 1983, floodwaters from the Great Salt Lake extensively damaged refuge facilities, halting all management. After the water receded, refuge staff completed an Environmental Assessment in 1991, evaluating a range of alternatives, from abandoning the site to full restoration.

With overwhelming public support, the USFWS opted for restoration and enhancement of flood-damaged facilities. Recognizing the need to conserve water and optimize its use, the USFWS worked with the Bureau of Reclamation to redesign the refuge water management system, creating a mosaic of habitat areas to support a wide variety of bird life. A more intensive and specific annual plan of water use has been implemented.

Hydrologists and refuge biologists developed a species-based approach to management. Refuge-dependent species were ranked in order of importance; specific habitat requirements were identified. Habitat types were then correlated to water depth. Refuge staff and hydrologists set annual target pool depths and made other water management decisions.

During recent drought years, the refuge staff used the model to make informed decisions about which habitat areas should be dried up because not all areas could be maintained in low flow conditions. The water management plan has been expanded to a Bear River Refuge Habitat Management Plan, which serves as the standard for the Mountain-Prairie Region (Region 6).

Additionally, Bear River Refuge will soon defend its water rights in the Lower Bear River general stream adjudication. This process includes reviewing the proposed decree to determine if the USFWS should object to other water rights and preparing to defend refuge rights if challenged. Proposed new uses are also reviewed to determine if they would adversely impact the refuge's water supply.

As residential and commercial development grows around the Great Salt Lake and throughout the Bear River Valley, refuge wetlands could become an isolated island of wildlife habitat. The most efficient use of the available water supply, along with defense of the legal rights to that supply, is critical to ensuring that this wetland habitat remains productive. ◆

This article is the work of the Bear River Migratory Bird Refuge staff.

state water quality standards and intergovernmental agreements. The resulting 1992 consent decree required the South Florida Water Management District to reduce nutrient runoff from agricultural lands.

The lawsuit settlement led to establishment in 2000 of the Department of the Interior Everglades Program Team, with representatives from the National Park Service and the Fish and Wildlife Service. The team, located at the refuge, assesses how south Florida restoration work could impact Loxahatchee Refuge, Everglades National Park and other federal trust resources.

The Team Approach

The team evaluates progress, provides scientific advice and works to ensure that progress is being made in meeting responsibilities under the consent decree, noted Nick Aumen, team leader and water quality branch chief of Everglades National Park's South Florida Natural Resources Center.

"The team addresses two critical factors," Dr. Aumen said. "First, we want to assure that all of our efforts are the best possible to achieve the lowest phosphorous levels. Second, we must conduct the appropriate monitoring and research efforts to understand how the refuge and park are responding to these efforts."

Changes have slowly become evident. Begun in 1994, construction of 45,000 acres of wetlands is almost complete. Combined with implementation of best management practices on agricultural lands, the wetlands have cut by more than half the amount of phosphorus in agricultural runoff. Most of the constructed wetlands, called Stormwater Treatment Areas, reduced interim phosphorous concentrations to about 50 parts per billion (ppb) by 2003. Florida is expected to get phosphorus level down to approximately 10 ppb by 2006.

Research is still ongoing to determine what enhancements to the Stormwater Treatment Areas or other approaches will be required to achieve 10 ppb or less. The Everglades Forever Act, passed by the State of Florida in 1994, extends the commitment to clean up and restore all of the Everglades beyond federal areas.

The Everglades Program Team continues to work with federal, state, and tribal parties, local governments, environmental groups, and the public to achieve the water quality goals needed to ensure successful restoration of America's Everglades. ◆

Inmates from the Georgetown facility of the Delaware Department of Corrections – generally parole violators – have given more than 6,000 hours to Prime Hook NWR, DE, providing labor equal to three full-time equivalent staffers. (Martha Nudel/USFWS)

Tapping an Unconventional Work Force

Inmates Help Maintain Prime Hook Refuge

They arrive at Prime Hook NWR, DE, in electric blue jumpsuits – men of varying ages and ethnicities – accompanied by a uniformed man cloaked with the focused look of someone in charge. They set to work, a seemingly congenial group.

Over the past two years, the men – inmates from the Georgetown facility of the Delaware Department of Corrections and generally parole violators – have given more than 6,000 hours to the refuge, providing labor equal to three full-time equivalent staffers.

In mid-September, for example, the crew removed 28 old deer stands from the refuge and rebuilt five duck blinds and four deer stands. In the process, they saved the refuge more than $2,000 by allowing it to reuse the lumber.

"We had one man, a carpenter who served two months in the correctional facility, who did great work for us," Refuge Manager Jonathan Schafler noted. "We've never had a complaint, and they do essential work." Schafler initiated much the same program when he worked at Crab Orchard NWR, IL.

Typically, a group of 13 prisoners arrives in a single detail and on a routine basis, usually weekly. Their assignments are outlined well in advance. A special detail can be assigned for specific duties.

"These are not hardened criminals," Schafler stressed. "For most of them, this is their step before total freedom."

Prisoners have power washed the exterior of the office/visitor center, mowed portions of the refuge, provided carpentry and painted. They have dismantled unused sheds and loaded a dozen piles of waste into dump trucks. They have completed a range of maintenance work that otherwise may have languished.

The refuge provides lunch and other food, costing no more than $1,000 per year, according to Schafler. Indeed, the food – pizza, barbeque sandwiches, soda, hamburgers – is part of the draw for prisoners, who consider the Prime Hook Refuge detail a privileged assignment.

So is the work. They work outside, refreshed by the sunshine and the same wildlife habitat that the refuge's thousands of visitors relish. Indeed, some have applied to work for the Refuge System after they served their time.

Near the western shore of Delaware Bay, the 10,000-acre Prime Hook Refuge has 6,000 acres of wetland habitats that are home to a diversity of species, including large numbers of wintering waterfowl. The refuge is considered to have one of the best wetland habitat areas along the Atlantic Coast.

"The inmates have made real improvements on the refuge – improvements we may not have been able to afford otherwise," noted Schafler. "I think they get satisfaction from knowing that. It's a program that's a 'win-win' for both the prison system, which is very strict in Delaware, and for the Refuge System." ◆

Glacial Ridge – *from pg 1*

Natural Resource Conservation Service, the Minnesota Department of Natural Resources and the Minnesota Waterfowl Association. The new refuge has the strong support of Minnesota Governor Tim Pawlenty, Senators Norm Coleman and Mark Dayton and Representative Collin Peterson, as well as numerous Minnesota, Polk County and local leaders.

Crookston officials supported establishment of the refuge, adjacent to the city's drinking water wells. The refuge's management will help protect the city's water quality. In addition, both Red Lake and Sand Hill River watershed districts supported the refuges, which will contribute to flood control along the Red River.

Over the last 30 years, much of the proposed refuge area has been drained or converted for agricultural purposes. The refuge seeks to restore up to 12,000 acres of wetlands and 14,000 acres of tallgrass

First Nest Signals Cross-Program Partnership Success

Restores Nesting Habitat for the Threatened Snowy Plover

By Susan Saul

The first western snowy plover nest of the year at Willapa NWR, WA – discovered in late April at Leadbetter Point on the southwest Washington coast – highlights the success of a cross-program recovery partnership launched in 2002 between Ecological Services' Western Washington Fish and Wildlife Office (FWO) and the refuge.

That first nest was found in a 16-acre restoration area where invasive European beachgrass was removed in Winter 2003. The site was further prepared in early spring by loosening the sand to inhibit beachgrass regrowth and spreading donated oyster shells to stabilize the sand and create natural camouflage for the nests.

Ecological Services funded the recovery project with $14,700 for the beachgrass removal contract and new, triangular signs that prevent raptor perching. Refuge staff and volunteers handled the remainder of the work.

Leadbetter Point normally has 15-30 snowy plover nests each year, but nest failure has been high. This year, three nests in the restoration area each hatched three chicks. Five nests outside the restoration area failed due to predation or burial by blowing sand.

Leadbetter Point is at the northern edge of the western snowy plover's Pacific Coast range. A threatened species, the snowy plover nests on the ground in flat, open, sandy areas or native dunemat vegetation. It is adapted to its habitat: its back feathers are the color of beach sand and it reacts to predators by crouching against the sand, blending in with the beach.

Aggressive Colonizer

Introduced to the Pacific coast more than a century ago, European beachgrass is an aggressive colonizer of sand dune areas. It grows in thick mats that snowy plovers cannot walk through or nest in and is one of several factors in the plover's population decline.

At Leadbetter Point, beachgrass has taken over most of the open dune habitat, forcing the plovers to nest on open sand in front of the foredune. There, the nests are more likely to be covered by blowing sand.

Willapa Refuge and Western Washington FWO will continue the habitat restoration partnership next year. Taylor Shellfish Company has committed to provide all the oyster shells and labor for spreading them – a significant donation since oyster shells are reused by the industry. Biologists expect that continued restoration work will improve nest success in future years. ◆

Susan Saul works in External Affairs in the Pacific Regional Office as outreach specialist for refuges.

A threatened species, the snowy plover nests on the ground in flat, open, sandy areas or native dunemat vegetation. (USFWS)

prairie upland habitat. To date, the federal Wetland Reserve Program has provided funding to restore 13,000 acres of wetlands.

The Nature Conservancy owns 24,140 of the 35,000 acres that will eventually make up the refuge. The remaining acres are owned by private landowners and/or managed by the State of Minnesota. The Nature Conservancy will donate most of its property to the USFWS.

Efforts to preserve the area began in August 2000 with The Nature Conservancy's purchase of the 24,140 acres and continued when the USFWS issued a Preliminary Project Proposal that authorized the Service to study the area.

For now, Glacial Ridge Refuge will be managed by staff from Rydell NWR, just eight miles south.

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Vegetation Mapping Project Illustrates Benefits of Teamwork

By Ken Sturm

Canaan Valley National Wildlife Refuge, WV, is developing the Northeast Region's first base map of dominant plant communities using eCognition, a computer segmentation program, under the protocol established by the National Wildlife Refuge Remote Sensing Lab in the Southwest (Region 2).

Todd Sutherland of the National Conservation Training Center, WV, used a hand-held Trimble GeoXT to collect field data. (Ken Strum/USFWS)

The base map is a critical step for the refuge's inventory projects, development of habitat management plans and the Comprehensive Conservation Plan process that will start in two to three years. The upland map of the refuge will be completed in Winter 2005; the wetland portion of the map will be completed a year later.

At the same time, the pilot vegetation mapping will test how well the protocol and software used in Region 2 function in mapping plant communities in the Northeast (Region 5), which can then determine if the program should be adopted as a preferred method for vegetation mapping throughout the region.

Southwest (Region 2) Remote Sensing Scientist Patrick Donnelly and his staff are giving technical assistance, information and project support. Donnelly and the crew at the National Wildlife Refuge Remote Sensing Lab in Albuquerque, NM, are acting as the project's mentor. Todd Sutherland of the National Conservation Training Center, WV, has also provided important technical assistance.

Promises and Vegetation Mapping

Canaan Valley Refuge's vegetation mapping is being developed within the National Vegetation Classification System (NVCS), which was identified by the Promises Baseline Inventory Team (WH-8) as most suitable for refuges.

NVCS is a hierarchical classification system, which allows detailed vegetation mapping on refuges that can be aggregated into more general categories. Aggregated classes can be applied to state or national mapping efforts and support analysis at the ecosystem level.

Mapping vegetation on a refuge to the NVCS level (alliance, association) can cost $20,000-$120,000 for a 15,000-45,000-acre refuge, depending on the level of remote sensing and vegetation mapping expertise that regions have developed.

The National Wildlife Refuge Remote Sensing Lab is supporting vegetation mapping pilot projects beyond its Region 2 home, demonstrating both vegetation mapping methods and applications, and the large cost savings that can ensue when a region invests in personnel with remote sensing skills.

Endangered Laysan Ducks Find New Home

Midway Atoll Wildlife Biologist John Klavitter, right, and Mark Vekasy, USGS wildlife biologist from the Kilauea Field Station, HI, attached radio transmitted to track the Laysan ducks. (USFWS)

Twenty endangered Laysan ducks now call Midway Atoll NWR home. Wildlife biologists on Oct. 3 transported the young ducks from Laysan Island in the Hawaiian Islands NWR as part of the Laysan Duck Translocation project.

Laysan ducks have been listed as an endangered species since 1966. Until the move to Midway Atoll Refuge in the Hawaiian Island Chain, the Laysan duck, with a population of just 500 birds, had the smallest geographical range of any duck species in the world. It was only found on the remote Laysan Island.

Midway Atoll was chosen as a reintroduction site because it lies within the presumed prehistoric range of the species and is free of rats and other predators. A team of scientists selected 20 of 27 captured birds to make the two-day boat ride to Midway Atoll. The birds were selected after six months of

Staff from both Canaan Valley NWR, WV, and Prime Hook NWR, DE, were trained in using the Geo XT Trimble to collect spatial information. Pictured from left are Susan Talbott and Laura Mitchell, staff members from Prime Hook NWR, DE, Todd Sutherland of the National Conservation Training Center, WV, and Leah Ceperley and Kelly Warren, Canaan Valley NWR biologists. (Ken Strum/USFWS)

The computer segmentation program eCongition analyzes color infrared aerial photographs pixel by pixel. The program analyzes each image, based on color, texture and other features. The software then develops polygons around areas with similar characteristics.

Once a sampling design is identified, the refuge's biologist collects field data on a subset of the polygons to identify the plant communities they represent. Using a hand held Trimble GeoXT, a combination GPS unit and computer, spatial information is gathered "on the fly". Biologists can then locate the perimeter of the field polygon and enter field data directly into a GIS. Back in the office, the field data are integrated into the refuge's GIS base map.

The program then is used to correlate known plant communities identified in the field to plant communities within the remaining polygons. Ultimately, a dominant plant community map can be created, based on field surveys and analysis using the segmentation program.

Although this method has been successfully applied to forested habitats on eastern Oklahoma and Texas refuges, it has not been applied to wildlife refuges in the Northeast. Canaan Valley NWR was the perfect place to test the software and field collection process because the plant communities in the Appalachians and, particularly in Canaan Valley, are diverse and will truly test the ability of the segmentation software.

Additionally, the refuge recently acquired a LiDAR data set along with the color infrared aerial photography necessary to run eCognition. The LiDAR information is being used to develop vegetation height data that will help define plant communities.

Overall, the project demonstrates how teamwork among refuges and with the support of the USFWS Region 5 Office can create a project that will have applications elsewhere. ◆

Ken Sturm is the wildlife biologist at Canaan Valley NWR, WV.

monitoring. Each bird had its own transport cage. The ducks had a private cabin aboard the vessel.

The young ducks have adapted well. They were released with their aviary mates in groups of two. They are eating such local foods as emerald beetle grub and button sedge seeds.

USFWS staff and volunteers at Midway Atoll NWR spent 18 months preparing for the ducks' arrival, removing non-native ironwood trees and Verbesina plants. They also planted 1,400 native bunch grass plants, used by the ducks for nesting. Two separate aviaries were built, complete with 100-square-foot compartments that each housed two ducks.

Radio transmitters have been attached to each bird so they can be easily tracked after their release from the aviary. The birds will be closely monitored with spotting scopes and radio telemetry. Translocation of 20-30 young ducks is planned for 2005.

The U.S. Fish and Wildlife Service and U.S. Geological Survey collaborated on the project. ◆

Laysan ducks have been listed as an endangered species since 1966. There are currently about 500 birds. (USFWS)

Chief's Corner – *from pg 2*

how John led the meticulous and methodical evolution of Bosque del Apache from a salt cedar infestation to what the early conquistadors may have seen – a riparian habitat of willows, cottonwood, and cattail meandering through the Chichuahuan Desert.

As important as John was to all who knew him, equally important was the sense of loss among Service employees who did not know him. We were all saddened by John's passing. After Sept. 27 – the day John died – the Service family was one member shy. We all felt the void.

We all feel exuberance when someone succeeds, when a refuge is expanded, when a new Friends group is organized, when a new partnership brings habitat restoration to one of the units of the Refuge System. We feel uplifted because we are a family in pursuit of a unifying goal.

John Taylor and his kind – all the people who work for the National Wildlife Refuge System – are why I show up to work with a smile on my face each day. John and the rest of the Service family make a difference in the lives of Americans.

Beyond the Ecology – *from pg 5*

documented," Dr. Metcalfe observed. "Fish Springs is an ideal site for a host of reasons."

Because of the paucity of water in Utah's west desert, people for thousands of years were drawn to the wealth of wild resources at the refuge marshes. Therefore, students have documented a broad range of sites, ranging from small rock scatters to large historic settlements.

Additionally, the refuge provides the logistical support absent at many field stations: electricity, Internet access, classroom setting for lectures and emergency support if needed. Finally, the refuge can be extremely rugged and harsh, "stripping the students of any romantic notions about the nature of field work," said Dr. Metcalfe.

Research into the geological history of Lake Bonneville by the late Donald Currey, a professor in the university's School of Geography, and Field School students has documented that this great inland sea, once more than 800 feet deep, receded to the point where the present emergent marsh began about 11,400 years ago. Dr. Currey, who died this year, was widely regarded as the nation's foremost expert on the pre-historic Lake Bonneville.

Studies on the refuge shepherded by Dr. Currey have added substantially to the knowledge of this geological wonder. Clues to the lake's ancient history are particularly well preserved at the refuge, especially at the gravel pit and a lower site, known as Trapper Jim's. Understanding when Lake Bonneville evaporated to the point that the area became a spring-fed emergent plant marsh has helped estimate when humans first began using the rich resources seen on the refuge today.

Based on such information that documents the age of the wetlands, Dr. Metcalfe speculates that human occupation likely extended back at least 11,000 years. That would make Fish Springs the oldest known site of human occupation in Utah.

That part of the puzzle is yet to be solved, perhaps by future students of the Field School. ◆

Jay Banta is the refuge manager of Fish Springs NWR.

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