Focus...Wildlife Biology in the 21st

Sharing Rigorous Science Is the Key to Success

By Grant Harris

Novel technologies such as LiDAR (light detection and ranging) and unmanned drones will advance wildlife management on national wildlife refuges in coming years. Despite these innovations and other trends in wildlife biology, I am pulled back to the basics. If refuges truly seek targeted and lasting management impacts, scientific processes must lead. Embracing science is theme number one.

Committing to science means increasing scientific capacity and following scientific approaches. For this, the Refuge System raised the bar with its Inventory and Monitoring (I&M) initiative. I&M boosts project design, implementation, analysis and reporting. We use transparent and defensible approaches. Science guides management, building iterative and adaptive processes. We identify knowledge gaps, define research agendas, and describe why our work is important. Instead of data mothballed in closets, they are stored electronically in intuitive, accessible formats.

As a result, we make better decisions and fewer mistakes. We reinforce our reputation as the world's most effective and credible wildlife management agency.

Our commitment to science links four related themes: landscape-scale perspectives, relevancy, triage and collaboration. Let's take each in turn.

First, refuges strive to conserve species and habitats. Many refuges are small. The ecological drivers determining the status of species and habitats occur outside them. Conserving refuge resources requires landscape-scale perspectives and building an ecosystem context. This means understanding the status of species and habitats on and off refuges. Such information helps refuges identify ways to make the greatest contributions to the ecosystem's most pressing issues.

In the process, refuges gain a clearer understanding of threats to the resources they manage, and how to react. The stressors include habitat fragmentation,

Could what the Refuge System learns about deterring mountain lion predation benefit leopards and lions in Africa? (Larry Moats)

transportation corridors, energy extraction, urbanization and sprawl. Appropriate responses involve preserving large areas, minimizing fragmentation, building landscape connectivity and generating biological redundancies. These approaches inform refuge planning and realty acquisitions. They also abate the effects of climate change.

Second, the Refuge System must increase relevancy and reach. Our work should incorporate other agencies, international issues and public engagement. For instance, the National Park Service performs I&M in parks, where land is rarely altered. These data could form controls for I&M on refuges, where land is actively managed. In such an arrangement, the Park Service gains greater knowledge of which variables drive ecosystems and how they operate. Meanwhile, our I&M increases in scope and influence.

Refuge efforts can advance international conservation. For example, we're using new techniques to estimate the abundance of animals without marks. Such species lack unique patterns of spots or stripes, making them hard to identify. These techniques estimate numbers of elk, and apply to endangered Andean cats or duikers elsewhere. Similarly, we're exploring ways to deter mountain lions from unwanted predation, such as killing livestock. If successful, these methods could reduce deaths of African lions and leopards.

Our efforts will fail if they lack public support. Refuges must increase exposure and engagement. One approach is to work where people already are. Imagine McDonald's endorsing endangered species on Happy Meals. Pretend that picturesque murals of refuges adorn the walls in Wal-Mart's sporting goods section. Refuges have neat stuff. Let's show it.

Third, the U.S. Fish and Wildlife Service tries to save everything. I worry that it can't. Hence, I see many species on life support. We have to triage. This means addressing fixable issues and abandoning losing bets. Does triage admit failure? No. It addresses reality.

Lastly, collaborations are key. Building them is akin to assembling a puzzle. The Service and partners are the pieces. Be it inventory and monitoring, landscape-scale conservation, relevancy or triage, the pieces must assemble for efforts to be targeted, effective and lasting. The days of separate agencies, or units within an agency, holding small, umbrella management plans are over. I welcome the time when everyone shades under one canopy plan covering ecosystem-wide issues. Each partner has a hand holding up the awning—working together—making genuine, on-the-ground advances.

Grant Harris is chief of biological services for the Southwest Region.

Two LCCs Help Gauge Sea-Level Rise at Five Refuges

By Bill O'Brian

Five national wildlife refuges, the Refuge System Inventory and Monitoring program, the U.S. Geological Survey, NOAA's Tijuana River National Estuarine Research Reserve, a handful of other partners and two landscape conservation cooperatives are collaborating on a project along the California coastline that illustrates how LCCs might routinely work on a practical level in the not-too-distant future.

With guidance from Pacific Southwest Region Refuge System I&M specialist Giselle Block, the California LCC and the North Pacific LCC are teaming up on a sea-level rise modeling project at points roughly 800 miles apart along the Pacific Coast—from Humboldt Bay National Wildlife Refuge on the north to Tijuana Slough Refuge on the south, with San Pablo, Seal Beach and San Diego Bay Refuges in between.

The project, which runs through September 2013 and is expected to cost roughly $300,000, is designed to foster "a bottom-up approach to evaluating sea-level rise effects" at a local scale relevant to the landscape level. It is doing so by developing high-resolution digital elevation models (DEMs); monitoring water levels and tidal cycles to assess local-level inundation patterns; inventorying vegetation species composition and relationship to elevation and tides; and quantifying sensitive wildlife use at all five refuges.

It would have been difficult to pull off without the two LCCs, which are part of the national network of 22 public-private partnerships designed to transcend jurisdictional boundaries and provide a holistic, collaborative, adaptive approach to conservation that is grounded in science.

Without the LCCs, "it is unlikely that we would have obtained funding to conduct work at such a broad spatial scale," says Block. "Because LCCs work at larger spatial scales, we were able to work at sites that span the Pacific Coast using a consistent set of methods and an analytical approach."

To the endangered California least tern—which nests on beaches at San Diego Bay National Wildlife Refuge—minor sea-level rise could mean major habitat disruption. (Mark Pavelka/USFWS)

That consistency will provide refuge managers with information that is relevant to their immediate locale and also is applicable on a landscape level. It will permit valid ecosystem comparisons up and down California.

LCCs will help create "a common base."

"By working with the LCCs," says Block, "we are able to examine tidal marsh ecosystems along the entire coast, allowing us to identify major similarities and differences in elevation, plant communities and vulnerability to sea-level rise and extreme flooding events."

Mary Mahaffy—interim coordinator of the North Pacific LCC, which is funding the Humboldt Bay Refuge portion of the project—says the LCC concept is "important because it's a different way of doing business than we've done in the past."

LCCs, she says, "allow parallel efforts among agencies to work together on environmental stressors that are too great for any one agency or organization to do alone." LCCs will help create "a common base" and deliver science information and tools to managers so they can make more informed decisions 10 to 25 years out.

Two major benefits of this project, according to San Diego Bay Refuge manager leader Andy Yuen, are its level of detail and its permanence. Unlike SLAMM (Sea Level Affecting Marshes Model), which Yuen called "more of a broad brush" that uses existing data, this study is collecting new data and "taking it down to a new level of detail"—to an individual-parcel scale. Furthermore, he says, this project is "putting in

continued on pg 18

Focus...Wildlife Biology in the 21st

Adaptive Management = Science + Decision-Making

By Bill O'Brian

The language of the cutting-edge decision-making process known as "adaptive resource management" is confusing. Many terms involved—"16x16 transition matrices," "utility functions," "iterative phase" and "Bayes Theorem"—can be downright intimidating to the uninitiated.

But adaptive resource management is increasingly popular as a framework for projects on national wildlife refuges and elsewhere, so it's probably high time to let Sara Vacek demystify the concept.

Vacek—a wildlife biologist at Morris Wetland Management District in Minnesota for her entire 10-year U.S. Fish and Wildlife Service career—echoes what an instructor once told her: Adaptive resource management is "learning through management and adjusting management action based on what you learn."

Imagine a continuum, Vacek says. On one end is trial-and-error problem-solving. On the other end is scientific research in which the whole point is simply to learn. "Adaptive resource management is right in the middle between those two," she says. "It's a way to combine science and management effectively."

Vacek, several other Service staff members and U.S. Geological Survey scientists are utilizing the technique on a massive native prairie management project. The conservation effort, which involves 20 Refuge System field stations and 120 management units in the Prairie Pothole Region, is aimed at controlling two invasive grasses—smooth brome and Kentucky bluegrass—using various forms of disturbance, including prescribed fire, grazing and haying.

Vacek and Service employees Kim Bousquet, Pauline Drobney, Vanessa Fields, Bridgette Flanders-Wanner and Todd Grant displayed a science poster about the project at last summer's *Conserving the Future* conference. The poster's title is a mouthful—"An Adaptive Approach to Invasive Plant Management on Fish and Wildlife Service-Owned Native Prairies in the Northern Great Plains: Decision Support Under Uncertainty."

An adaptive resource management approach is helping native plants like these at Morris Wetland Management District in Minnesota thrive in the Prairie Pothole Region. (J.B. Bright/USFWS)

Its content is a bit technical. However, it gets to the essence of adaptive resource management—which is to use probability models to forecast outcomes of various conservation options.

The adaptive management framework requires a conservationist to make a systematic prediction of what's likely to happen *before* acting. It also requires conservationists to periodically reexamine and revisit decisions within an established time frame.

The adaptive management pattern is: action, monitor, model … possibly new action, re-monitor, re-model … repeat. The result, says Vacek, is more certainty than with traditional trial and error.

"The thinking is that the less blind flaying around that you do, the more efficient you'll be," says Vacek, who appreciates the Prairie Pothole invasive grasses project's adaptive management approach. "I hope I'm not biased, but I feel that this is the first one where we're kind of getting it right."

USGS scientists and Service biologists in the field have been working together from the start, and communication among them has been an ongoing conversation rather than periodic one-way communication. In addition, Vacek says, adaptive management is "a good way to be more transparent—transparent to my boss, to his boss and to the American public."

Adaptive management can be challenging, she acknowledges, "but mostly because it's a new way of thinking that we're not used to."

At the moment, there is another minus from the Service perspective: a dearth of statistics-savvy personnel capable of building probability models. The invasive grasses project model, for instance, was developed by the USGS.

Still, Vacek sees adaptive resource management as a wave of the future because it merges science and management to the benefit of both.

"I always hear a lot of talk about refuge managers making science-based decisions," she says, "but this actually *is* incorporating science into our decisions."

To see a depiction of the Prairie Pothole Region invasive grasses project, go to http://AmericasWildlife.org/conference/science *and look for poster No. 16.*

Using DNA Barcodes to Inventory Insects

By Matt Bowser

On four gloriously sunny days in June, a small team of entomologists convened at Kenai National Wildlife Refuge to do what entomologists do best: collect insects.

They had come to take part in a rapid ecological assessment of arthropod biodiversity in which as many species as possible are collected in a short time. The goals were twofold: to augment the list of arthropods known to live on the refuge and to build a corresponding library of DNA barcodes for those species. The project blends old-fashioned collecting in the spirit of 19th-century explorers with modern DNA work.

The whole idea is to work myself out a job.

Though the ecological importance of insects is plainly evident and their quick responsiveness to environmental change makes them ideal candidates as indicators of habitat quality, the trouble with insects is that they are hard to identify.

It took years to sort through more than 15,000 specimens collected from 2004 to 2006 as part of the refuge's Long Term Ecological Monitoring Program, and many remain unidentified today. If insect diversity is to be monitored feasibly, this identification problem must be surmounted.

Our plan at Kenai Refuge is to take bulk samples of hundreds of insects, liquefy them in a blender, extract the insects' DNA from the slurry, and—using a next-generation DNA barcoding method—obtain a list of species present in the sample.

DNA barcoding is the use of a short section of DNA for species identification, not unlike recognizing products in a store by their barcode labels. This method will make monitoring of insects much more manageable by eliminating the tedious task of sorting and identifying them using forceps, microscope and identification keys.

However, this next-generation method requires that a library of DNA barcodes from known specimens be established first. Otherwise, barcodes obtained from a slurry of pulverized insects are nothing more than barcodes. We began building this library last winter by sequencing specimens already in Kenai Refuge's entomology collection, but the collection included only 208 species, just a small portion of the refuge's arthropod diversity. In June, we sought to build on the collection.

Derek Sikes, curator of insects at the University of Alaska Museum, collects and records insects as part of a leading-edge project at Kenai National Wildlife Refuge. (Matt Bowser/USFWS)

All-Star Team

With help from an all-star team of four Alaska entomologists, we scoured the refuge, visiting as many habitats as possible in four days. We surveyed the forest, muskeg and lakeshore near refuge headquarters. We toured habitats along Skilak Lake's shore. At Emerald Lake, we sampled the subalpine thickets, meadows, waters and alpine habitats.

We employed various collecting methods (sweep nets, beat sheets, aerial nets, malaise traps, pan traps, sieves, aquatic nets, streamside washing) and searched by hand under stones, logs and bark. Each of us focused on the methods and insect groups we knew best.

I have since begun cataloging the many vials, bags and containers of insects we obtained. I don't yet have a reliable estimate of the number of specimens and species we collected. I can say it was at least thousands of specimens, representing probably hundreds of species. Incidentally, we found a northern holly fern near Emerald Lake, a plant species not previously recorded at Kenai Refuge.

The insect specimens will be sorted and mailed to specialists for identification. This winter, the specimens will be sent for DNA barcoding. Specimen data from this project is being posted on the Internet in near-real time via the Arctos database *(http://arctos.database.museum/knwr_ento)*.

As we obtain DNA barcodes, they will be deposited in the National Center for Biotechnology Information's GenBank, where they will be useful not only to Kenai Refuge but also to any study using DNA barcodes to identify insects. Our efforts will allow national parks, national forests and other refuges to rapidly assess insect diversity on their respective pieces of Alaska.

Matt Bowser is an entomologist at Kenai National Wildlife Refuge. This article originally appeared in the Peninsula Clarion *newspaper on Aug. 5, 2011.*

Focus...Wildlife Biology in the 21st

Cultivating the Human Dimension

By Natalie Sexton

Comprehensive wildlife management demands the integration of science across disciplines. To achieve its mission, the National Wildlife Refuge System requires an intimate understanding of ecology and coordinated monitoring of systems. Most biologists and managers are comfortable in this biophysical realm. However, refuge management requires an equally intimate understanding of the social and economic drivers of these systems—the "human dimensions."

Human dimension issues are not new. "Most game managers profess that wildlife management is also people management, with the human element possibly dominant," stated a 1971 North American Wildlife and Natural Resources Conference paper. "More research is needed on human behavior aspects of wildlife."

From isolated discussions in the 1960s and '70s about human-bear conflict to the front-and-center uproar over the northern spotted owl in the 1990s, human dimension issues have been evident. Today, the National Environmental Policy Act (NEPA) mandates that the human dimension be addressed when "economic or social and natural or physical environmental effects are interrelated." The National Wildlife Refuge System Improvement Act requires priority public uses and coordination with landowners.

Beyond the mandated "have to" of addressing human dimension issues, there are many good reasons to "want to."

Refuge managers should want to ask: Who are the key stakeholders using the refuge and interested in its management? What is the relationship between the refuge and the local community? How satisfied are users with current services and recreational opportunities? What are visitors' and residents' desire for future offerings or management changes? How well do visitors, residents and other stakeholders understand the refuge and its management? What are the refuge contributions to the local economy (from refuge staff/operational activities and visitor spending)? What is the overall economic value of the refuge to visitors and the public?

The Refuge System plays a special role in connecting future generations to America's rich natural heritage. Here, a curious girl and her mother enjoy J.N. "Ding" Darling National Wildlife Refuge in Florida. (Steve Hillebrand)

Surveys, stakeholder assessments and economic modeling/analyses can be used to better understand the human dimension. So can the Department of the Interior's Economic Contributions 2011 report and secondary data sources such as the Census Bureau; the Bureau of Economic Analysis; Service Banking on Nature reports; and the National Survey of Fishing, Hunting and Wildlife-Associated Recreation. And NCTC is planning a broadcast series about the human dimensions of natural resource conservation.

More than 40 million people per year visit refuges. Their needs, and those of community residents, can be overwhelming as refuges strive to provide quality wildlife-dependent public use.

But a public active in wildlife-based recreation represents an important pillar of the North American Model of Wildlife Conservation. Outdoor enthusiasts contribute to wildlife management through financial support, advocacy work and volunteer efforts. An involved citizenry championing for wildlife has been one of the greatest forces in our nation's conservation success story.

Additionally, the Refuge System plays a special role in connecting youth to America's rich natural heritage. A refuge visit can instill a lasting passion for wildlife and wild lands. A carefully designed set of amenities, services and recreational opportunities helps make these connections possible. To ensure continued public support, it is important to understand the characteristics, experiences and economic impacts of these contingents.

Consideration of the human dimensions of management and planning *does not* compromise the capacity to do what is best for wildlife. On the contrary, this information allows managers and planners to make more evidence-based decisions that are grounded in science so that the Refuge System mission can be accomplished *and* public support for these conservation lands can be ensured.

Natalie Sexton of the U.S. Geological Survey Policy Analysis and Science Assistance Branch in Fort Collins, CO, has worked with Refuge System staff on 20 comprehensive conservation plans (CCPs).

Sustainability Through and Through

By Mary Tillotson

For 25 years, since Tim Bodeen was a biology major at the University of Wisconsin-River Falls and Kelly Cain was a professor of environmental sciences and management, the two men have shared a passion for conservation.

Today, that shared passion is manifesting itself in how Malheur National Wildlife Refuge is being managed in the high desert of southeastern Oregon.

Bodeen is Malheur Refuge manager. Cain is still at the university in Wisconsin, where in 2007 he established the St. Croix Institute for Sustainable Community Development. Together, they are making sustainability a guiding principle of the refuge's comprehensive conservation plan (CCP).

Bodeen concedes "sustainability" is a short-hand term that may have "15 different definitions, depending upon who is doing the defining." And, he acknowledges, sustainability is incorporated to greater or lesser degree in many refuges' CCPs. But in the Malheur Refuge CCP—which is scheduled for public comment late this fall—sustainability is *central.*

To Bodeen and Cain, sustainability means setting conservation goals for the present that enhance the conservation goals of the future, and even enhance the sustainability of public support for the National Wildlife Refuge System itself.

In 1908, when Malheur Refuge was established by President Theodore Roosevelt as a preserve and breeding ground for native birds, conservation goals were relatively simple and localized: Establish boundaries within which native species are left alone to thrive. The best available modern science, says Cain, suggests much broader questions for conservationists—regional, national, even global questions about water control and allocation, reliance on imported fossil fuels, and climate change. Malheur Refuge's CCP attempts to address those questions insofar as one refuge can.

Malheur National Wildlife Refuge is making sustainability a guiding principle of its comprehensive conservation plan (CCP) from the start. Here, a birdwatcher enjoys the view on the refuge. (George Gentry)

For example, it will be the daunting goal at Malheur Refuge to produce *more* energy than maintenance of the property requires. Malheur Refuge encompasses 120,000 acres of wetlands, six dams and 1,000 water control structures by which water level is manipulated. In a refuge that stretches 70 miles from end to end, Bodeen says, "calling a staff-meeting may mean asking people to drive 45 miles to refuge headquarters." The biggest part of his budget is for energy—for utilities, transportation and equipment.

Innovative Ideas

A few simple fixes—more fuel-efficient vehicles, better insulated buildings—can help reduce energy consumption. But more innovative ideas are under review for inclusion in the CCP.

Bodeen and Cain say the refuge could possibly produce more energy than it currently consumes by generating solar power ("We have about 300 days of sunshine a year!" says Bodeen), by harvesting invasive carp to produce methane for fuel, and by macerating the solid-liquid carp byproduct of the methane production for local use as fertilizer.

The refuge is collaborating with numerous entities (the Burns Paiute Tribe, the Harney County Chamber of Commerce, local farmers, recreational groups to name a few) to craft its long-range plan for environmental conservation.

Too many people, says Cain, have supposed the Refuge System exists to benefit native animals and plants without equal consideration for the local communities ("stakeholders") in which the refuges exist.

"But we could send that carp fertilizer to local greenhouses, farmers," he says enthusiastically. "We could use profits to subsidize local education, training programs."

And it's not just Malheur Refuge that holds the promise of producing energy and profits for neighboring communities, he says. Refuges are rich in possibilities for wind and solar power, natural gas production. "They have phenomenal natural resource assets!"

"Unless the Fish and Wildlife Service demonstrates how it's relevant to solving the problems of the local communities in which it's embedded, it risks becoming irrelevant," says Cain.

In other words, it risks becoming unsustainable.

Mary Tillotson is a frequent contributor to Refuge Update.

"Patch-burn grazing" relies on cattle, coupled with prescribed burns, to target invasive plants while stimulating vegetation native to the prairie. (USFWS)

Patch-Burn Grazing vs. Invasive Plants

By Brad Dokken

In their never-ending battle against invasive plants, personnel at Glacial Ridge National Wildlife Refuge in northwestern Minnesota have pulled out some heavy hitters:

That's heavy, as in cattle—200 cow/calf pairs, to be precise.

The refuge last spring launched a four-year study to measure the effectiveness of a grazing-and-burning technique to keep invasive plants such as thistle, sweet clover and hybrid cattails at bay, according to Glacial Ridge Refuge manager Dave Bennett.

"We've used every technique we can think of to try and remove some invasives and give the upper hand to our lands seeded there—and all for the benefit of tallgrass prairie and wildlife fauna that would naturally occur," Bennett said. "This year, being that it's very wet, I would say the invasives have had the upper hand."

That's where the cattle come into play.

Bennett said the technique, known as "patch-burn grazing," relies on cattle coupled with prescribed burns to target invasive plants while stimulating native vegetation such as prairie forbs.

Bennett said Glacial Ridge Refuge, which was established in 2004, has implemented the technique on a 2,100-acre unit.

The idea, Bennett said, is that burning promotes green vegetation, which in turn attracts the cattle. Crews then burn another site, drawing cattle to the new area once it turns green.

Other sites are left untreated, Bennett said, leaving a patchwork of varying-height grasses and forbs that provide niches for different wildlife species. Species expected to benefit from this specialized management tool include upland sandpipers, marbled godwits, Wilson's phalaropes, greater prairie chickens, Richardson ground squirrels and numerous grassland songbirds.

"It's a double-whammy—burning with grazing behind it."

"It allows us to give a second dose of treatment to invasives and to give some advantage to prairie forbs that are having a hard time surviving when vegetation gets real dense," Bennett said. "It's a double-whammy—burning with grazing behind it."

Bennett said the U.S. Fish and Wildlife Service started the process with a public meeting at which local ranchers were invited to apply for the grazing program. Six ranchers applied, he said, and the Service awarded the permit to one from nearby Fertile, MN.

Before the cattle could be introduced, refuge crews had to fence the site, Bennett said. Cattle were released on May 20 and stayed on the refuge until late September.

Cattle will be on the land for the next three summers, and the refuge plans to burn one-fourth of the 2,100-acre area every year, Bennett said. He said the area is divided into 60 study plots, which refuge biologists are monitoring to see what's growing and whether the technique is reducing invasive plants.

"Our purpose at the refuge is to manage for the benefit of plant species and wildlife that are indigenous to our area," Bennett said, "so we have to show or prove that the techniques—whether burning, mowing, grazing or a combination of those—are in fact favoring the desired species."

Bennett said patch-burn grazing has been used quite extensively on federal lands in Kansas and Oklahoma and on a smaller scale in southern Minnesota. In northwestern Minnesota, though, the technique is fairly new.

"It's kind of an exciting tool to look at," Bennett said. "I know other people are watching over our shoulders, in the Fish and Wildlife Service and other agencies, to see the results."

Brad Dokken is a reporter for the Grand Forks (ND) Herald, *in which this article originally appeared on Aug. 14, 2011.*

Monte Vista Refuge's Pilot-less Project to Survey Cranes

By Floyd Truetken

A multi-agency project last spring at Monte Vista National Wildlife Refuge in southern Colorado pioneered the use of unmanned aerial drones to survey sandhill crane populations.

Sandhill cranes are large, spectacular, awe-inspiring birds. Many birders know of the cranes' migration through Nebraska each spring. A lesser-known migration occurs in the Rocky Mountains. Each spring as many as 24,000 cranes stop at Monte Vista Refuge, where they congregate in meadows to feed and replenish critical fat reserves en route to nesting grounds in Montana, Idaho, Utah and Wyoming.

To track the health of the species and establish guidelines for hunting season bag limits, the U.S. Fish and Wildlife Service measures the crane population using aerial and ground surveys.

At Monte Vista Refuge, the U.S. Geological Survey for the first time used a small, unmanned, hand-launched RQ-11A Raven aircraft to survey cranes. The Raven uses thermal, infrared or traditional daytime videography imaging to "film" low-level targets, such as flocks of birds on a refuge. USGS obtained the Raven from the Army under a memorandum of agreement. The project was overseen by a team of 20 individuals that included USGS staff, the Department of the Interior Aviation Management Directorate, current and retired Service biologists and refuge staff.

Before the experiment could begin, a major hurdle had to be cleared. The Federal Aviation Administration had never authorized drone flights for wildlife surveys. To enable the low-level, 400-foot-above-ground-level (AGL) flights to go forward, the FAA would need to waive its advisory requiring flights over refuges to be at least 2,000 feet in altitude. After months of planning by the team, the FAA approved "proof of concept" daytime-only flights.

Monte Vista Refuge then issued a special use permit authorizing the USGS to conduct flights to determine the Raven's suitability for use in crane population surveys. The team selected the peak period for cranes at the refuge, March 19-27, as the optimal time for flight operations. But two concerns remained.

Mark Bauer of the U.S. Geological Survey prepares an unmanned RQ-11A Raven aircraft for launch as part of a project to survey sandhill crane populations at Monte Vista National Wildlife Refuge in Colorado. (Floyd Truetken/USFWS)

The first was visitor safety. To minimize risk, Raven flights were conducted only in areas closed to the public; refuge law enforcement closely controlled access.

The second concern was for the birds. Because cranes react immediately to low-flying raptors and eagles, which are common in spring, biologists speculated that daytime low-level Raven flights would cause the cranes to flush. If such flights had consistently frightened birds from feeding and roosting areas, the project would have been a "no-deal." Fortunately, several mid-day test flights at altitudes from 100 to 400 feet AGL showed no consistent adverse crane reaction. The biologists were satisfied that potential benefits of the survey technique far outweighed minimal disturbance to the cranes.

After two days of more testing/operator training, early morning flights were conducted over crane roosting sites. Using the thermal-imaging camera, the Raven easily picked up heat signatures from roosting groups, and, in the dawn hours, the cranes showed absolutely no reaction to the drone. After software stitched imagery together, Raven crane estimates were compared to a ground count performed by Service biologists. At one roost, biologists counted 2,692 cranes, while the Raven imagery showed 2,567—a difference of just 4.6 percent.

The flights were successful on many levels. They were the first unmanned drones approved by the FAA for the Interior Department. They demonstrated the technology's potential to support highly accurate biological surveys in a safe, cost-effective manner. They laid the groundwork for refining survey techniques and securing future FAA approval to conduct flights at night, when cranes roost in tighter groups.

The Raven and similar unmanned aerial vehicles hold great promise not only for wildlife censuses but also for wetland delineation and easement enforcement, drug interdiction and detection, and monitoring of remote areas.

Floyd Truetken was refuge manager at Monte Vista National Wildlife Refuge until this summer. He is now refuge manager at Bitter Lake Refuge in New Mexico.

Two LCCs Help Gauge Sea-Level Rise at Five Refuges — *continued from page 11*

permanent benchmarks, so we'll be able to precisely measure sea-level rise" for years to come.

Beyond that, says Block, the Refuge System I&M program will use the project's data and findings "to support the needs of refuges relative to sea-level rise, specifically subjects such as adaptation planning and climate monitoring. They will also be used to identify how best to approach modeling in the future and at other estuarine refuge holdings along the Pacific Coast."

All of this is crucial because, says Yuen, many of his refuge's species—including the endangered California least tern, the endangered light-footed clapper rail and the threatened western snowy plover—live and nest on "on beaches that are inches to feet above sea level."

Humboldt Bay National Wildlife Refuge in northern California is taking part in a landscape conservation cooperative-facilitated study of sea-level rise. (Tupper Ansel Blake)

Two Individuals, One Group Honored in Three National Realty Awards — *continued from page 2*

corporations, public agencies and their employees or volunteers outside the Service, for contributions to land protection for fish and wildlife resources in partnership with the Service.

Elias helped pave the way for legislation that led to a memorandum of agreement between the Secretaries of the Navy and the Interior regarding the transfer of Skaggs Island to the Service. The legislation also allowed the Navy to utilize available state funding for removal of infrastructure to facilitate the transfer.

"Ms. Elias worked diligently with the Service, California Department of Toxic Substances Control, Bay Conservation and Development Commission, California Department of Transportation, nonprofit organizations and private landowners to ensure the cleanup was complete and that repairs to pumps and other infrastructure were accomplished prior to transfer," San Francisco Bay National Wildlife Refuge Complex project leader Mendel Stewart said. "Without her efforts, we do not believe this transfer would have been successful."

Land Legacy Award

The Service/Refuge System Cadastral Data Working Group received the Land Legacy Award.

The group, led by former Service chief cartographer Doug Vandegraft and current chief cartographer Sean Killen, is composed of a fluid roster of geographers, biologists, cartographers, surveyors and IT professionals. The names of the individuals who will be honored had not been finalized as *Refuge Update* went to print, but the group en masse was cited for developing and deploying the FWS Lands Mapper.

The Web-based Lands Mapper is designed for use by non-geographic information system (GIS) specialists. It provides detailed topographical, street and aerial views of refuge boundaries, trails and roads nationwide, complete with latitudinal/longitudinal coordinates. It also can display comprehensive acquisition information about individual refuge tracts.

The Lands Mapper is available to Department of the Interior employees using work computers at *http://gis.fws.doi.net/FWSLands_Mapper.*

After a Year's Delay, Marsh Project Is Completed

— *continued from page 7*

Potential recreational uses for the marsh will be outlined in the Bandon Marsh Refuge's draft comprehensive conservation plan (CCP), due out next spring, but a new 600-foot nature trail already gives pedestrians access to two small tidal channels leading into the marsh.

And for Lowe, the restoration is the crowning jewel of his 34-year Service career because, he says, "when you restore a tidal marsh, it's forever."

Karen Leggett is a writer-editor in the Refuge System Branch of Communications.