



# Saving Our Scrub

*A newsletter dedicated to sharing information about the Florida scrub ecosystem*



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## We're Finally Back!

*Dawn Zattau, U.S. Fish and Wildlife Service, Jacksonville, FL*

Well folks... it's been a long time since the last issue, and I won't even go into all the reasons why. Let's just say that after a long hiatus, I decided to take what I had in the way of articles and run with it. Hopefully new interest will be generated, new articles will come streaming in my way, and there will be no more glitches in our internet access for the next few years. For those of you who submitted articles eons ago, I apologize for taking so long to get them into print for the world to see. For all the readers who have been anxiously awaiting the next issue (since 2001!), if these articles don't seem quite up-to-date... oh, well. So be it. It's better to get this issue out just as it is so we can start over from scratch rather than let the articles linger that much longer until fresh material arrives to fill up the issue.

Let's let this new issue of Saving Our Scrub act as a stimulus to get you all cranked up to share with everyone what you've been doing out there in the scrub since 2001. I know you've all been as busy as I have... let's keep the momentum going. As long as I'm receiving articles, I pledge to try and get a new issue out every quarter. I'll send a reminder out about a month before the deadline as a nudge to get enough submitted for me to share with the group.

Until next time, keep on doing good things for scrub. With all of us pulling together, I know we can make great progress toward recovering this precious ecosystem.



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**Saving Our Scrub** is published regularly to provide a forum for sharing information about the imperiled Florida scrub ecosystem. The newsletter is distributed free to anyone interested in obtaining a copy. Comments, suggestions, and article submissions should be directed to the editor. The editor and the U.S. Fish and Wildlife Service assume no responsibility for information contained herein, or for injury or damage resulting from use of such information. Information herein will be used at the reader's own discretion and risk. Views and opinions expressed herein are those of the author or source of material and do not necessarily reflect the opinions, views, or endorsements of the U.S. Fish and Wildlife Service.

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Photo by Patti Murray

# Invisible Soil Organisms and Scrub Conservation

Christine Hawkes

*This article is reprinted by permission from The Nature Conservancy's Lake Wales Ridge Program "Ridge Rangers Volunteer News," Spring 2002 issue.*

Scientists are still uncovering some of the themes and patterns that govern the Florida scrub. So look closely the next time you are walking in the scrub... the allure of this habitat is in the details.

Soils, even the seemingly sterile sands of central Florida, teem with microscopic life. In a single gram of soil, there are as many as a billion organisms. And though invisible to the naked eye, soil microbes throughout the world are critical to decomposition and nutrient cycling that help maintain the plant communities we see.

## BIOLOGICAL SOIL CRUSTS

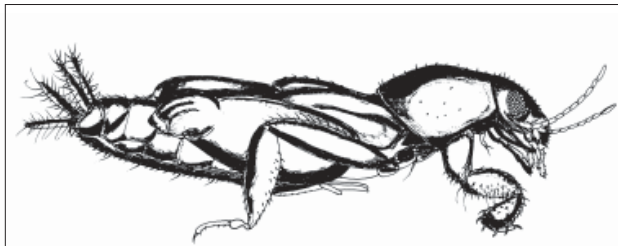
In drier regions of the world, soil microorganisms form what are known as biological soil crusts. Because of their hidden nature, these crusts have been termed cryptogamic, cryptobiotic and microbiotic. Crusts are created when soil organisms cause the uppermost layer of soil to solidify into a single, cohesive layer. The "glue" that holds the soil together is made up of the living organisms themselves together with the sticky substances they excrete and leave behind as they move through the dry soil. Biological soil crusts are a well-known feature of deserts in the southwestern United States and have only recently been recognized in the southeast. Crusts in Florida scrub are unique because they occur in a wet climate where dry conditions are caused by rapid drainage of water through sandy soils.

## WHAT ORGANISMS CREATE SOIL CRUSTS AND WHERE DO THEY OCCUR?

Florida scrub soil crusts are found primarily in openings or gaps in the vegetation. The scrub crusts are unusual in that they are indistinguishable from uncrusted sands until you feel the aggregation and look closely. To feel soil crusts, poke your finger into an undisturbed area and you will find resistance compared to loose sand. To see the soil crusts, gently scrape away the surface sand grains on a wet morning and you will discover a green

layer a few millimeters deep. This green color comes from the algae and cyanobacteria that dominate the scrub crusts. Algae and cyanobacteria are photosynthetic, using sunlight as a source of energy; they move up and down in the sand in response to changing levels of light and water. There are also fungi, bacteria, lichens and occasional mosses living in and on the soil crusts. Fungi and bacteria are heterotrophic, feeding on other organisms and dead material in the soil. Lichens are created by a symbiotic association of fungi and algae (or cyanobacteria) and can become dominant on top of rosemary scrub soils 15 to 30 years after a fire.

Crusts are not uniform across the landscape. They are extremely vulnerable to disturbances, including fire and trampling, resulting in differences across sites based



Pygmy mole crickets live within the stable sand of soil crusts (Drawing courtesy of Archbold Biological Station)

on fire history and within sites based on local disturbances such as animal and hiking trails. For example, after a fire, it takes algae and cyanobacteria 10 to 15 years to reach their peak in abundance. Total recovery may take from one to 100 years depending on crust species composition, size of the disturbance and distance to intact crust.

## SOIL CRUSTS AND ENDANGERED SCRUB HERBS

Seed germination of several endangered scrub herbs is improved by the presence of soil crusts. Seeds of the Highlands scrub St. John's wort, *Hypericum cumulicola*, germinated far more in intact soil crusts particularly at long unburned sites when compared to crusts that had been disturbed or removed. Two other scrub herbs, wedge-leaf button snakeroot, *Eryngium cuneifolium* and papery whitlow-wort, *Paronychia chartacea*, also had increased germination when seeds were in intact crusts in the greenhouse.

Crusts can affect the fate of seeds in several ways. Small seeds that get wedged between crusted grains of sand may be hidden from insects that would like to eat them. Additionally, some of the microorganisms in crusts produce fungal and bacterial inhibitors that may reduce microbial attacks on seeds. And perhaps most important of all, crusts typically have higher levels of soil moisture because the sticky gel-like substances excreted by algae and cyanobacteria can rapidly absorb and retain water from rain, fog or dew.

## SOIL CRUSTS AND SCRUB INSECTS

Mark Deyrup of Archbold Biological Station and Thomas Eisner of Cornell University discovered a species of cricket called the pygmy mole cricket that is only a quarter inch in length. This species is limited to scrub habitats where the crickets burrow in the stable sand of soil crusts. From their burrows, pygmy mole crickets dine on the algae and cyanobacteria that live in the crusts, leaving behind elevated burrow trails that reveal their passing. Little is known about the interactions of these crickets and the soil crusts, but we can imagine that their selective grazing may affect the species composition of crusts and thus, modify the role of crusts in the scrub community.

## SOIL CRUSTS AND THE NITROGEN CYCLE

Nitrogen is generally the nutrient most limiting to plant growth in terrestrial ecosystems around the world. Nitrogen can enter systems in one of two ways: biological fixation and atmospheric deposition. In Florida scrub, soil crusts are important in both of these processes.

Cyanobacteria and some bacteria in soil crusts fix nitrogen. That is, they take gaseous nitrogen from the atmosphere and transform it to ammonium, which can be used by soil microbes and plants for growth. In nitrogen-poor systems like Florida scrub, nitrogen fixed by crusts can be the major source of nitrogen for plants. Crusts in Florida fix substantial amounts of nitrogen as long as they have not been disturbed — after a fire or in trampled areas, their ability to fix nitrogen is reduced by a factor of 50. Though fire is natural in the scrub landscape, understanding its impacts

## Grant Opportunities

*Dawn Zattau, U.S. Fish and Wildlife Service, Jacksonville, FL*

helps land managers use the appropriate frequency, intensity and extent of disturbance.

Nitrogen is also entering Florida scrub through atmospheric deposition. In this case, the nitrogen returns to land with rain or dust. Because of the sandy soils in scrub, most of the nitrogen in rainfall is lost because of rapid drainage. Crusts act as a sieve through which nitrogen entering the system must pass, and crusts immediately sequester a portion of the deposited nitrogen thus making it unavailable to plants. Within 15 days, however, the nitrogen in crusts becomes available to plants, probably as a result of microbial death.

### AN ECOSYSTEM PERSPECTIVE

The greatest danger to the Florida scrub is habitat loss, as the last intact areas are converted to agriculture, housing and commercial building. For the scrub that remains, management of this fire-dependent habitat will be necessary to avoid rapid extinction of the many endangered plants and animals that exist only here. The recognition that even the seemingly invisible soil crusts are important for nutrient cycling and the survival of plant and insect communities makes it clear that scrub conservation will require an ecosystem perspective.

*Christine Hawkes studied biological soil crusts at Archbold Biological Station as part of her graduate work at the University of Pennsylvania. Christine now holds a David H. Smith Postdoctoral Fellowship at the University of California, Berkeley.*

The **FLORIDA COMMUNITIES TRUST** (FL Department of Community Affairs) is accepting applications from local governments for land acquisition projects under the Florida Forever program. The current grant cycle will be open until May 5, 2004. Further information is available at [www.dca.state.fl.us.ffct](http://www.dca.state.fl.us.ffct) or by calling 850-922-2207.

**BIRDNET** has a web site devoted to posting Grants, Awards, and Prizes in Ornithology. Take some time to browse through their extensive list of links, and you may just find a source of money for some work you would like to do. See [www.nmnh.si.edu/BIRDNET/Grants/index.html](http://www.nmnh.si.edu/BIRDNET/Grants/index.html).

**THE FOUNDATION CENTER's** web site has quite a bit of information available not only for non-profits seeking funding, but also information for individuals who may be seeking funding to continue his/her educational ventures. See [www.fdncenter.org](http://www.fdncenter.org) for more.

The **NATIONAL FISH AND WILDLIFE FOUNDATION** funds projects to conserve and restore fish, wildlife, and native plants through matching grant programs. The Foundation awards matching grants to projects that

address priority actions promoting fish and wildlife conservation and the habitats on which they depend, work proactively to involve other conservation and community interests, leverage Foundation-provided funding, and evaluate project outcomes. Federal, state, and local governments, educational institutions, and nonprofit organizations are welcomed to apply for a general matching grant throughout the year, using the General Matching Grant Guidelines. More information is available at [www.nfwf.org/programs/programs.htm](http://www.nfwf.org/programs/programs.htm).

You can look for funding for your environmental projects at Cyber-Sierra's **CONSERVATION GRANTS CENTER**. You'll find a huge amount of information at your finger-tips. See [www.conservationgrants.com](http://www.conservationgrants.com).

**THE ENVIRONMENTAL PROTECTION AGENCY** administers a large number of environmental grants. See if your project may fit into one of their programs at [www.epa.gov/epahome/grants.htm](http://www.epa.gov/epahome/grants.htm).

Information about various educational grant programs can be found at **FUNDSNET**. See [www.fundsnet.com/educ01.htm](http://www.fundsnet.com/educ01.htm).



## Good-Bye to Dr. Grace Iverson

Dr. Grace Iverson, scrub activist and researcher in Palm Beach County, died Friday, April 16, at her home in Hobe Sound. She was 76 years of age.

Grace was an adjunct professor of biology at Florida Atlantic University, and she was one of the most outspoken scrub advocates we had. Her passion for the scrub ecosystem was tireless, and she never relented in her efforts to see as much as possible preserved for future generations. It was largely an uphill battle.

Grace was instrumental in a ballot initiative that has resulted in the purchase of about 30,000 acres of native Florida habitat in Palm Beach County for preservation. She banded Florida scrub-jays for years and added much to the body of knowledge of how scrub-jays behave in fragmented habitats.

She will be missed by all of us here in the scrub community.





# Experimental Introduction of Florida Ziziphus at Lake Wales Ridge National Wildlife Refuge

Carl Weekley, Archbold Biological Station ([cweekley@archbold-station.org](mailto:cweekley@archbold-station.org))



Florida ziziphus flower showing nectar ring and anthers with pollen

One of the rarest plants on the Lake Wales Ridge recently got a little less rare. In June 2002, researchers from Archbold Biological Station and Historic Bok Sanctuary carried out an experimental introduction of Florida ziziphus at a recently-burned sandhill site on the Lake Wales Ridge National Wildlife Refuge.

Florida ziziphus (*Ziziphus celata*) is restricted to yellow sand xeric habitats on the Lake Wales Ridge in Polk and Highlands Counties. The species encompasses seven small, isolated, genetically depauperate and mostly self-sterile populations. All but the two smallest populations are on private lands. Four populations are in cattle pastures. The largest publicly protected population has continued to decline over the last several years despite aggressive management intervention (including prescribed burning and the reintroduction of root cuttings taken from the site).



Irrigation system

The specific-epithet of Florida ziziphus, “*celata*”, means “hidden” and refers to the plant’s obscure taxonomic history. Specimens collected in Highlands County in 1947 languished in a University of Florida herbarium drawer for almost forty years before Walter Judd and David Hall described the species for science in 1984. At the time the plant was thought to be extinct, but it was rediscovered in 1989 by Kris DeLaney.

Florida ziziphus is a multi-stemmed shrub up to 5 feet in height (the “national champion” was just over 6 feet tall when it died) with spiny zig zag branches and small, shiny green leaves. It drops most of its leaves in the late fall and flowers during the winter dry season from late December to early February. Flowers are less than a quarter inch in diameter with inconspicuous white petals but a bright yellowish-green nectar ring that surrounds the pistil. Mature plants produce tens of thousands of these tiny fragrant flowers which attract hordes of bees, butterflies and other potential pollinators. During peak flowering times, plants besieged by honey-bees can be heard as well as smelled from several feet away. Unfortunately, due to genetic incompatibility (and perhaps other reasons) most pollinator activity does not result in fruit production. To date we have obtained no viable fruits from any “natural” Florida ziziphus population.

Fortunately, there is a fertile population of Florida ziziphus in the Center for Plant Conservation’s National Collection at Historic Bok Sanctuary. This *ex situ* population comprises plants propagated from root cuttings from most of the “natural” populations. It has produced thousands of fruits annually since 1994. While only about a quarter of these fruits contain viable seeds (because of the production of seedless fruits and high levels of seed abortion

probably due to inbreeding depression), over the last few years Bok horticulturists have propagated several hundred seedlings. These seedlings provide a pool of available propagules for the introduction of Florida ziziphus to appropriate sites. In addition, thousands of seeds have been stored for future germination and use in introduction projects.

The Refuge introduction is embedded in a larger project to restore a long-unburned sandhill. Three experimental treatments were applied to the site both to test the efficacy of different management strategies for



ABS interns Betsey Hermanson and Courtney McCusker collecting data on introduced plants

sandhill restoration and to provide different microsites for the Florida ziziphus introduction. Replicated treatment blocks within the study site were assigned to one of three treatments: (1) chain saw felling of subcanopy prior to burning; (2) burning without subcanopy felling; and (3) an untreated control. The site was prescribe-burned in August 2001. We selected 36 of 72 5-meter radius circular community plots (established in a stratified random manner prior to the burn for sampling community structure and species composition) to serve as focal points for the introduction. Selection of focal plots was based on treatment effects from the prescribed burn and on logistical considerations.

The introduction has both practical (conservation) and experimental (research) objectives. The primary goal is to create a viable (sexually-reproducing) population of

(Continued on page 5)

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Florida ziziphus on a protected site within the known historical range of the species. This goal conforms to well-established



Seed array containing 24 seeds, with cage and irrigation stake

guidelines for the conservation of rare species through their translocation to previously unoccupied sites. But we also want to use the introduction to gain insight into the biological and ecological requirements of Florida ziziphus. To accomplish this objective we used both seedlings and seeds for the introduction, and these propagules were transplanted to focal plots with different microhabitat characteristics. In addition, we used seedlings and seeds of known maternal genotype to provide a genetic dimension to the introduction. This is important because

of the desirability of promoting genetic diversity within the species.

In June 2002, we transplanted 144 seedlings and 1728 seeds. Within each 5-meter radius focal plot we planted four seedlings (one within each quadrant); within each plot we also set out two seed arrays, each consisting of 24 seeds. Both seedlings and seed arrays were enclosed in wire mesh cages to prevent herbivory. Seedlings are being monitored monthly for survival and growth; seed arrays are monitored weekly for germination and survival of germinants.

After six months, about 90% of the potted plants are doing well; there have been 59 germinants, of which six are still alive.

Prior to the introduction, the Archbold maintenance staff and Plant Lab personnel installed almost 3 miles of irrigation tubing on site to provide water for the seedlings and seed arrays if summer rains prove inadequate. On-site rainfall is monitored three times a week to determine if back-up irrigation from Archbold is needed.

From a conservation perspective, the criterion for success is the production within



Transplanted seedling inside cage

the experimental population of viable seeds resulting in seedlings and a growing and self-sustaining population. From a research perspective, any new insights into the seed germination or seedling establishment requirements, microhabitat needs or biology and ecology of Florida ziziphus will aid in planning future introductions.

The introduction represents the culmination of several years of collaboration between Archbold Biological Station, Historic Bok Sanctuary, the U.S. Fish and Wildlife Service (which manages the introduction site), the Division of Forestry's Florida Plant Conservation Program (which funded much of the work), The Nature Conservancy, and several individual agency and university scientists. Our common goal is to rescue this highly endangered plant from extinction.

## Meetings, Etc.

**INTER-AGENCY PRESCRIBED FIRE TRAINING** May 2-7, 2004. TNC's Natural Areas Training Academy Workshop, Wekiva Springs State Park. Register online at [cnr.ifas.ufl.edu/programs/nata.htm](http://cnr.ifas.ufl.edu/programs/nata.htm) or contact Peter Colverson, [pcolverson@tnc.org](mailto:pcolverson@tnc.org).

**MANAGING VISITORS AND VOLUNTEERS IN NATURAL AREAS** May 4-6, 2004. TNC's Natural Areas Training Academy Workshop, Disney Wilderness Preserve, Kissimmee, FL. Register online at [cnr.ifas.ufl.edu/programs/nata.htm](http://cnr.ifas.ufl.edu/programs/nata.htm) or contact Peter Colverson, [pcolverson@tnc.org](mailto:pcolverson@tnc.org).

**FLORIDA NATIVE PLANT SOCIETY** May 13-16, 2004, Royal Plaza Hotel, Lake Buena Vista, FL. Visit [www.fnps.org](http://www.fnps.org).

**AMERICAN ASSOCIATION OF MAMMALOGISTS** June 12-16, 2004, Humboldt State University, Arcata, CA. See [www.humboldt.edu/~asm](http://www.humboldt.edu/~asm).

**SOCIETY FOR CONSERVATION BIOLOGY** July 30-August 2, 2004, New York, NY. "Conservation in an Urbanizing World." See [cerc.columbia.edu/scb2004](http://cerc.columbia.edu/scb2004).

**ECOLOGICAL SOCIETY OF AMERICA** August 1-6, 2004, Portland, OR. "Lessons of Lewis & Clark: Ecological Exploration of Inhabited Landscapes." See [www.esa.org/portland](http://www.esa.org/portland).

**AMERICAN ORNITHOLOGISTS' UNION/ SOCIETY OF CANADIAN ORNITHOLOGISTS** August 16-21, 2004, Université Laval, Quebec City, QC, Canada. See [aou-soc-2004.ul.ca/jahia/jsp/index.jsp](http://aou-soc-2004.ul.ca/jahia/jsp/index.jsp).

**SOCIETY FOR ECOLOGICAL RESTORATION** August 24-26, 2004, University of Victoria, Victoria, BC, Canada. See [www.serbc.info/public/ser\\_seminar](http://www.serbc.info/public/ser_seminar).

**2004 NATURAL AREAS CONFERENCE** October 13-16, 2004, Chicago, IL. "Emerging Issues, Possibilities, and Perils." See [www.naturalarea.org](http://www.naturalarea.org).

**LAND TRUST ALLIANCE RALLY 2004** October 28-31, 2004, Providence, RI. See [www.lta.org](http://www.lta.org).

**ASSOCIATION OF SOUTHEASTERN BIOLOGISTS** April 13-15, 2005, Florence, AL. See [www.asb.appstate.edu/Preliminary2005.htm](http://www.asb.appstate.edu/Preliminary2005.htm).

**ECOLOGICAL SOCIETY OF AMERICA** August 1-6, 2004, Portland, OR. "Lessons of Lewis & Clark: Ecological Exploration of Inhabited Landscapes." See [www.esa.org/portland](http://www.esa.org/portland).

**MISC. TRAINING** in a wide variety of topics, including (but not limited to) conservation biology, permitting, and partnership building is available at U.S. Fish and Wildlife Service's National Conservation Training Center, based in Shepardstown, WV. For additional information see their web site at [www.nctc.fws.gov](http://www.nctc.fws.gov).



# Work in Cedar Key Scrub State Reserve

*Jeff DiMaggio, Florida Park Service (wbsp@inetw.net)*

Cedar Key Scrub State Reserve is a 5,000-acre reserve containing a variety of important habitats, including salt marsh, pine flatwoods, and sand pine scrub. It is located near the Gulf coast approximately 3 miles north of Cedar Key, accessed from State Roads 347 and 24.

Most of this area has not had any fire applied since the "Great Fire of 1955," during which over 23,000 acres burned, placing fear in the hearts of many local residents. The exclusion of fire in the scrub was taken very seriously in the years that followed.

Since that time more and more single-family homes have been built along the perimeter of the reserve, in the middle of mature sand pine scrub. The complexity of burning this area kept increasing as time, fuel, and number of residents increased. One of the main focuses in this area is to stabilize and hopefully increase the scrub-jay population within the reserve. The scrub habitat in this area both within and outside of the reserve is very limited. As the development of this area continues, less and less habitat will be available for this jay population.

As the bird's numbers dwindled and the drought continued, we looked at other ways to achieve restoration without the use of fire. The restoration of the scrub habitat is progressing in Cedar Key Scrub State Reserve. Over the past two years, strides have been made in the restoration efforts on this unique area.

Most of the efforts to restore the role of fire in the reserve previously were limited to the western half of the property where four burns have been recorded from 1985 to 1996 (including one escape). These burns totaled 469 acres with varied results. In 1998 a lightning fire burned 60 acres, and then in 1999, two prescribed burns were conducted totaling 125 acres. One burn was attempted on the eastern half of the preserve in 1999 but was aborted after 54 acres were burned when things did not go as planned.

There were no prescribed fires in the scrub during 2000 due to the drought conditions. During March and April 2000, however, 87 acres of mature sand pine scrub were timbered on the eastern half of the Preserve to reduce the fuel load, allowing us to move ahead with the burning program on this side of State Road 347.

In 2001 (thanks to the assistance of other parks, volunteers, divisions, and agencies), our efforts were focused on the eastern half where timbering and burning have taken place. The sand pine overstory was removed from 87 acres, and three burns were conducted in March and April totaling 147 acres, giving a total of 227 acres of area improved in 2001.

In 2002, small burns were conducted to secure the boundary for additional sand pine scrub burns. In addition, 34 acres of overgrown scrub and scubby flatwoods were cut and crushed in preparation for future burns. A large prescribed burn was conducted in January 2003; 500 acres of scrub were successfully burned east of County Road 347.

The monitoring of the scrub-jays is continuing on a limited basis. Due to budgetary constraints we have been unable to band fledglings for awhile. We do hope our continued efforts will provide for the persistence of this and other species in Cedar Key Scrub State Reserve.

The Staff at Waccasassa Bay Preserve State Park (two people) operates Cedar Key Scrub State Reserve. There is no staff assigned to the reserve.



# Your article goes here!

## **Newsletter Needs:**

- Articles from folks who are on the ground performing restoration and management tasks vital to the ecosystem. These articles should be about management and restoration techniques AND how you have dealt with the public when performing these tasks. Without your successes and/or failures being reported, others may waste valuable time learning what you already know.
- Articles on dispersal of scrub wildlife and how to manage to encourage dispersal among sites
- Articles on the biology of all scrub endemics
- Information about seminars, meetings, workshops, and field trips relating to scrub or scrub management
- Notes about unusual observations in the scrub
- Information about funding opportunities
- Submissions regarding conservation techniques other than land purchase, such as inheritance tax changes, conservation easements, etc.
- Information on pending state legislation
- Articles on successful partnerships
- Plant identification tips
- Citations for new journal articles or grey literature about scrub
- Information on anything else about scrub that you think the readers would find interesting

The editor is seeking unique scrub pictures to place in each newsletter at this location. Your photo (or drawing) could be anything scrub-related (e.g. general habitat shots, shots of flora or fauna, management activity, etc.). Please submit any photos and captions via email to [dawn\\_zattau@fws.gov](mailto:dawn_zattau@fws.gov) or mail a print, negative, or slide to Dawn Zattau, U.S. Fish and Wildlife Service, 6620 Southpoint Dr. S., Ste. 310, Jacksonville, FL 32216. I promise to return the original to you as soon as I have scanned the image!

Photo by Parks Small, FDEP



A scrub-jay who tells it like it is

