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Male bluebird with radio transmitter attached to his back. Photo by Liliana Menacho.

In most cases, the bluebirds responded quickly to the invading lure bird, vocalizing loudly with displeasure, diving at the intruder, and even landing on the cage to scuffle — beak to beak — with the obnoxious intruder. The pair was then captured as they flew back and forth across the net in response to the lure bird on one side and the bluebird song coming from the speaker on the opposite side.

Once captured, the bluebirds were driven to Everglades National Park in a small cage, placed in an aviary, and given a gourmet diet of mealworms — typically a routine affair.

Can you imagine our surprise when we found the female from Foxfire had laid an egg in the transport cage? Because it was so early in the breeding season, we didn't realize that she might be that close to egg-laying or we would not have attempted to capture her. Fortunately, she appeared to be physically unaffected by what must have been a traumatic expe-

rience for her.

After spending three weeks in the aviary to become better adjusted to their new surroundings, the bluebird pairs were ready to be released. Before release, however, we attached a small, pinto-bean-sized radio transmitter to the back of the male. The transmitter emits a steady beep for about six weeks that we can detect with a radio receiver and antennae up to two miles away. This device greatly improves our ability to locate and track released birds, which often move six to eight miles daily, for the first few days after release.

We had hoped the birds would set up a territory and begin nesting before the radios fail.

That was not to be the case.

The Foxfire pair split up; I'm afraid the egg-laying experience may have persuaded the female to ditch her mate. The other two pairs stayed together, and, like the Foxfire male, moved widely throughout the pine forest in Everglades

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This bluebird nestling, shown here after banding, is the offspring of a Foxfire male and a Royal Poinciana female relocated to the Everglades National Park. Photo by Elizabeth Crisfeld.

National Park. When the radios failed, no evidence of breeding had been found and we lost track of all the birds.

In mid-April, about the time the

radios failed, we moved bluebirds from two more golf courses. This time, though, we moved bluebird pairs and their nestlings. From the Glades Golf Club we

removed a pair of bluebirds with two nestlings and from Eagle Creek CC we removed a pair and three nestlings.

As before, we transported each family to Everglades National Park and placed them in an aviary. The nestlings were put into a new nest box, where they were fed by the adults until they fledged.

One tragedy occurred when a rat snake got into the Glades aviary and swallowed the two fledglings — the lumps were obvious. Unfortunately, this seems to occur once a year regardless of our effort to exclude predators. Small-mesh wire is placed around the aviaries to deter snakes and other predators from entering, but because the ground is limestone rock it's impossible to completely secure the aviary.

Adults are able to get away from a predator inside the aviary, but the slow, uncoordinated flight by juveniles makes them vulnerable. More frustrating, was that these birds were to be released in just a couple days.



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After three weeks, the males from both courses were radio-tagged and the families were released. Immediately, the pairs split up. The Glades adults were seen on a couple occasions near the park's entrance, but neither has been seen since. The Eagle Creek male abandoned its mate and young and set up a territory near a nesting bluebird pair about four miles from its release site.

By early May, ten bluebird adults and three juveniles from golf courses had been released to Everglades National Park. But we knew the whereabouts of only one bird — not a great success story. To make matters worse, we had found only two of the eight bluebirds translocated from Big Cypress National Preserve, and only a few nests had been found.

Overall, the scene was discouraging and I must admit that a few of those unwholesome words escaped from my mouth.

Fortunately, our luck was about to change, and in this case it happened swiftly. One morning in early May, we found the female from Eagle Creek with one surviving juvenile near one of the Park's research buildings. An hour later, we found a nest across the street! The Foxfire male and the Royal Poinciana female had mated and were nesting in the back of a small shed.

We had been looking for golf-course birds in the forest; these birds were hanging out near buildings, people, and well-maintained lawns. I guess old habits die hard.

A few days later, we found the Grey Oaks pair nesting in a natural cavity, and a few weeks later, we located the male

from Royal Poinciana nesting with a female translocated from Big Cypress National Preserve.

The pair nesting in the small shed won the most fledglings contest for all of the territories in Everglades National Park. Their first nest yielded three juveniles, which we banded with color bands to mark them uniquely. To our pleasant surprise, they nested again and raised five more juveniles — a rare event — to bring their total to eight. The Royal Poinciana male and its mate produced three juveniles. However, the Grey Oaks pair failed. In summary, we found seven of the 10 golf course adults released in the park. This is a great success rate and higher than previous years where we had seen 40%–60% of translocated birds remain in the Park.

Also, the three adults that disappeared may still be in the park; it's an enormous area and impossible to survey completely. Golf course bluebirds produced 11 of the 38 (29%) juveniles that fledged in Everglades National Park this year. I could never have anticipated such great success. I expect all the birds to remain in the park and be ready to breed again next year.

Back at the golf courses, bluebirds were successful too. George monitored the nest boxes at four golf courses, while Dr. Harold Dowell of the Foxfire Nature Group monitored the nest boxes at Foxfire Golf and CC. At only one course, Royal Poinciana, did new bluebirds occupy the nest box where we removed bluebirds. However, all courses had significant numbers of bluebird nests (see table), and the juveniles produced this year will find an available nest box ready for them next year.

The bluebird population in Everglades National Park increased in size substantially this year with the help of translocated bluebirds from golf courses. Last year we found only four breeding territories. This year the number jumped to 16 breeding territories (I think we missed some last year).

With 38 fledglings produced this year, the population at the end of the breeding season is around 70 individuals. With such a large population established, we have decided to stop translocating birds and just monitor the population for a couple of years to evaluate its status.

That means an end to the golf course donor program, but not to the golf course bluebirds. Next year, golf course bluebirds and their offspring will continue to be monitored by me in Everglades National Park, by George on courses in southwestern Florida, by the Foxfire Nature Group on its home course, and by other bluebird enthusiasts on golf courses throughout Florida.

Finally, I want to thank the participating golf courses again for taking part in this reintroduction effort. Your cooperation was great and I think our partnership makes for a great conservation story that the entire golf industry can be proud of. For me, it was also a learning experience about golf courses and the role they can play in conservation. I certainly hope to have the opportunity to work with golf courses again.

Gary L. Slater is a research biologist with ARC Institute, Inc. If you have any questions or comments, he can be reached at 305-213-8829, or by e-mail: gslater@yahoo.com.

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STEWARDSHIP NOTES

by Shelly Foy

Ah fall... What a relief to know that you are just around the corner. I look forward to opening my house up and having pleasant nighttime temperatures, college football games to watch (GO DOGS), and those delightful breezes. It's no wonder half the world wants to live in Florida during the fall and winter.

I read an interesting article recently on environmental education and its importance in the development of children. Ken Voorhis, director of the Great Smoky Mountains Institute, reports that several studies have recently been published on the benefits of teaching environmental education in schools.

Those benefits:

- Better performance on standardized measures of academic achievement in reading, writing, math, science and social studies.
- Reduced discipline and classroom management problems.
- Increased engagement and enthusiasm for learning.
- Greater pride and ownership in accomplishments.

Voorhis says, "It seems obvious to many of us that environmental education is not only effective but also critically essential. People can only make informed decisions about the world in which they live if they are environmentally literate.

People also need to feel connected to nature, not separate from it."

Although this article was about environmental education in schools, I think adults can benefit as well. Let's look

at the above listed benefits for children and put them into context for our golfers:

- Better performance on tests could equate to golfers being more knowledgeable and tolerant of golf course maintenance practices and programs.
- Reduced discipline problems could mean less golfer grumbling.
- Increased enthusiasm for learning could mean more golfers getting involved in projects and programs.
- Greater pride and ownership — stands on its own.

The fall and winter is an excellent time of year to work on outreach and education projects with your members and golfers. So, I encourage everyone to take a little time this season to work on environmental education. The most successful golf course superintendents I have ever met are those who make communication with their golfers and members their top priority. The least successful are those who turn and go the other way to avoid running into a member when they might have to actually speak to them.

The Benefits of Reaching Out

Communicating with golfers and the public about your environmental efforts can help you:

- Gain recognition and support for your management efforts.
- Increase golfer understanding of wildlife and environmental quality on the golf course.

Let the public know that environmentally managed golf courses can be valuable community resources — whether

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or not the public ever gets to step on the course.

Audubon International recommends that the first step is to form that all-important Resource Advisory Committee made up of fellow employees, golfers, and even people outside the golf course who can provide technical expertise. Your Resource Advisory Committee's primary role is to aid you in communicating a commitment to environmental stewardship and implementing conservation activities.

There are many ways to let people know about your commitment to conservation. Education projects can inform people about your efforts or teach people how they can support environmental practices.

Try some of the following ideas this year. For more specific information on how to implement these ideas, call Audubon International at (518) 767-9051.

- Create a display to promote the positive efforts you have undertaken to maintain environmental quality at your course. (Artwork, pictures, newsletters, wildlife inventories, etc.. are all things that can be used in your display).
- Write articles for your club newsletter.
- Mount signs (like "Natural Area," "Environmentally Sensitive Area - Please Keep Out," "Shoreline Naturalization," "Critical Nesting Habitat," etc.).
- Write a press release announcing your environmental plans or projects (Audubon International has detailed information on writing press

releases).

- Work proactively with neighbors (adjoining properties, homeowners associations, etc.) by sharing information on your environmental projects, offering to help them with projects, or inviting them to participate in projects on your golf course.
- Request help with building and monitoring a nestbox program.
- Create a garden for wildlife.
- Let members/golfers help you inventory wildlife.
- Create a nature guide.
- Host nature walks.
- Lead a golf course tour.
- Use tournaments to showcase environmental aspects of the course.
- Teach good stewardship to golfers (jr. golf clinics, etc.).
- Offer a workshop like tree and shrub care, IPM, etc..
- Encourage neighborly stewardship.
- Host kids projects.
- Sponsor a school in the ACSF for Schools.

TCGCSA Sponsors Indian River Lagoon Envirothon

My pals with the Treasure Coast GCSA had a good time sponsoring the Indian River Lagoon Envirothon in March. They donated \$5,000 to this annual event established as a competitive, problem-solving, natural resource event for high school students to challenge them about the environment.

High school students in Martin, Okeechobee, St. Lucie and Indian River

counties used critical thinking skills and worked as a team to develop and design a proposal to implement the best environmental management practices for a specific demonstration site of their choice in their county.

Students were trained and tested in five natural resource areas: soil, aquatics, forestry, wildlife, and non-point source pollution.

The Envirothon began in Pennsylvania in 1979 and today, at least 46 states, Canada and Australia have initiated the program. In competing in the Envirothon, not only do students learn about their state's natural resources, problems and solutions, but they also learn about team building, communication, and conservation partnerships. They also indirectly experience natural resource and conservation careers, and most importantly will become more environmentally aware citizens in the future.

Greg Phenegar, John's Island Club, was a judge for this year's event. Greg was very impressed with the Envirothon and said, "it was a great learning experience for the students and I was impressed with their comments and the questions they asked."



Shelly Foy is coordinator of the USGA's Audubon Cooperative Sanctuary Program for the Florida Region. She can be reached at 561-546-2620; fax 561-546-4653; sfoy@usga.org.

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Long-Term Mole Cricket Control on Horizon

By Angela Brammer

- A nematode product patented for use by the University of Florida to provide long-term biological control of turf-damaging mole crickets will be available next year from Becker Underwood. This product, known as Nematac S, will be cost-effective and highly beneficial for a wide range of consumers, from golf course managers to ranchers.

The parasitic nematode *Steinernema scapterisci* attacks only foreign mole crickets — those that are most damaging to turfgrasses in the Southeast. The nematodes live in the soil and enter the mole cricket through openings in the body, such as the mouth or spiracles. Once inside, they release bacteria that feed on the mole cricket, usually killing it within 48 hours. The nematodes feed on the bacteria and reproduce inside the mole cricket, and the next generation emerges to search for another host once it dies.

Steinernema scapterisci spreads slowly on its own, mostly relying on its host for dispersal. After infection, a mole cricket may fly up to a mile, taking the nematodes along for the ride. The nematodes then emerge into the new location once the host mole cricket dies. Because of this, it may be possible to effectively cover a relatively large area of mole cricket infestation by applying the nematodes to the hot spots, those places with the highest concentrations of mole crickets. The mole crickets themselves do the work of spreading the later generations of nematodes throughout the site.

Of the three species of *Scapteriscus* spp. mole crickets that immigrated to the U.S. from their native South America about 100 years ago, the tawny

and southern mole crickets cause the most damage in Florida. With no native natural enemies in the U.S., they multiplied and thrived. Now the two species cause millions of dollars of damage each year to bahia, bermuda, centipede and St. Augustine grasses. Additional millions are spent each year on insecticides to prevent such damage.

In the 1980s, University of Florida scientists imported the mole cricket nematode from South America. The species was formally described in 1990 by UF nematologists Dr. Grover Smart and Dr. K.B. Nguyen. Experiments showed that the nematode killed 100 percent of tawny and southern mole crickets and at least 75 percent of short-winged mole crickets without adversely affecting other insects. It is an effective, permanent method of controlling all three *Scapteriscus* spp. mole crickets.

COST AND AVAILABILITY

The University of Florida has issued an exclusive license to produce the nematodes to the U.K. company MicroBio, owned by Becker Underwood of Ames, Iowa. MicroBio will sell the product under the name Nematac S. It will be available in units of 500 million, and it is expected that the cost will be comparable to that of chemical treatment. The total cost per acre will vary with the type of land and the speed of results needed. A higher initial concentration of nematodes will eliminate mole crickets more quickly and may be the best solution in a situation where speed is key.

Golf courses may require higher concentrations per acre, but in pastures,

fields or areas with large numbers of mole crickets, applying the nematodes in strips can reduce the cost per acre. UF research has shown that a swath of nematodes as small as 1/8 acre, given time, can control an acre's worth of mole crickets. In an experiment on 24 acres of ranchland in Polk County, nematodes applied in proportions varying from none to half of the treated area appeared to spread throughout the 24-acre site in less than a year.

A general recommendation is to use 800 million to 1 billion nematodes per acre. Partial-acre treatments should use a proportional amount of nematodes: 400 million to 500 million for a 1/2-acre strip, 200 million to 250 million for a 1/4 acre strip, etc. This brings the cost for those who treat their pastures in 1/8-acre strips down to an affordable level, especially when a single treatment has the potential for control that will last many years.

BENEFITS OF BIOLOGICAL CONTROL

Chemical control of insect pests is costly. Insecticides are immediately effective but must be reapplied often — at considerable cost — to maintain control of a mole cricket population over time. Mole cricket nematodes, on the other hand, have a residual effect on mole cricket populations that lasts long after the initial application.

The nematodes reproduce inside the mole crickets. Each infested mole cricket can harbor as many as 50,000 new nematodes. Those 50,000 will emerge once the mole cricket dies to seek new host mole crickets. This reduces the need for further application. Because of this, controlling mole crickets with these nematodes costs less than using pesticides.

Nematodes should be used as a preferred tactic in the integrated pest management of *Scapteriscus* spp. mole crickets. Chemical insecticides can be effective in controlling outbreaks and reducing heavy infestations of mole crickets; however, most situations call for prevention or suppression through turf management, biological control and other more sustainable tactics.

Steinernema scapterisci parasitizes only the three South American species in the genus *Scapteriscus*. Native mole crickets are not at risk. With chemi-



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cal pesticide use, not only are other, potentially beneficial, insects at risk, but so are humans, pets and wildlife. This is not the case with nematodes. With nematode applications, golf courses do not have to keep the public away for a time as they do with pesticides.

Nematodes are environmentally friendly as well. There is no danger of contamination of nearby water sources or other negative environmental impacts, which means there won't be any cleanup bills. In addition, the public looks kindly upon biological controls. The use of pesticides is a growing public concern, and minimizing their use when alternatives are available can contribute to a positive public image.

EASE OF USE

Application of the nematodes is simple. Mixed with water, they can be sprayed on the surface or injected into the sod under low pressure. Applying them just beneath the surface provides some protection from desiccation and ultraviolet light. Surface distribution should be followed by irrigation to help the nematodes into the soil. It may be possible to apply nematodes through existing irrigation systems as well.

The nematodes naturally have greater effect on large nymphs and adult mole crickets, as it is easier for them to find their way into the mouths and spiracles of the larger insects. Thus, it makes sense that they would be most effective in the early fall or late spring just before adult mole cricket populations reach their peak. Demonstration and Research Sites

The Florida Legislature awarded \$300,000 in state funds to the mole cricket nematode program this year. The money will enable the Mole Cricket Task Force to establish research and demonstration sites around the state to test the effectiveness of the nematode product on various types of land with different amounts and methods of application. The Mole Cricket Task Force includes University of Florida and Florida Department of Agriculture and Consumer Services, Division of Plant Industry researchers; county extension agents; product development specialists from MicroBio; and members of the affected industries.

The nematodes will be applied

during September and October at various sites around the state including golf courses, pastures, ranchland, sod farms, and city parks and playgrounds. Different methods of application (slit injection, liquid injection and spraying) will be tested and demonstrated. The results of this work will be presented at field days or workshops in areas of the state that are heavily infested with mole crickets.

Angela Brammer is a UF graduate student in entomology. For more information about the mole cricket state program, contact Dr. Norm Leppla, UF, co-chair of the Mole Cricket Task Force, at 352-391-1901 ext. 120, ncl@gmv.ifas.ufl.edu. An extensive article on the specific research and demonstration program appears in the September/October issue of Florida Turf Digest.

Turf Team Gains Entomologist

Dr. Eileen A. Buss is a new UF assistant professor and extension entomologist for turf and landscape. She received her Ph.D. in 1999 from the University of Kentucky in entomology (horticulture specialty). For her dissertation research, she determined the horned oak gall wasp's

biology, within-tree distribution, potential for host-plant resistance, and management on pin oak trees. Her work earned her several prestigious awards and scholarships.

She graduated from Michigan State University with an M.S. in entomology (forestry specialty) in 1996, after evaluating the susceptibility of four Scots pine Christmas tree varieties to the Zimmerman pine moth, European pine sawfly, and pine needle scale. She earned her B.S. in 1993 from MSU with a double major in zoology and German.

Dr. Buss served almost one year as the director of the Industrial Affiliates Program in Purdue University's Urban Center before coming to UF.

As an extension specialist at UF, she will be developing and delivering educational material for the green industry on integrated insect pest management, conducting product tests against turfgrass and ornamental insect pests, and studying the biology and management of these different pests.

She stopped by the FGCSA booth at the FTGA Conference and Show in Gainesville in August to introduce herself and to ask the FGCSA for support in the state's mole cricket control program. She can be reached at 352-392-1901, Ext. 116 or eabuss@ufl.edu.

Joel Jackson



Eileen A. Buss, Ph.D.