

**Wildlife Habitat Planning Strategies, Design Features and
Best Management Practices for Florida Communities and Landowners**

Wildlife

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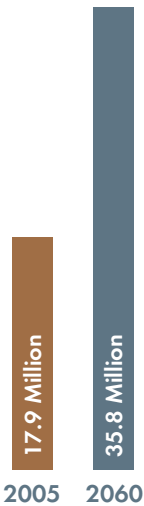
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POPULATION
FORECAST

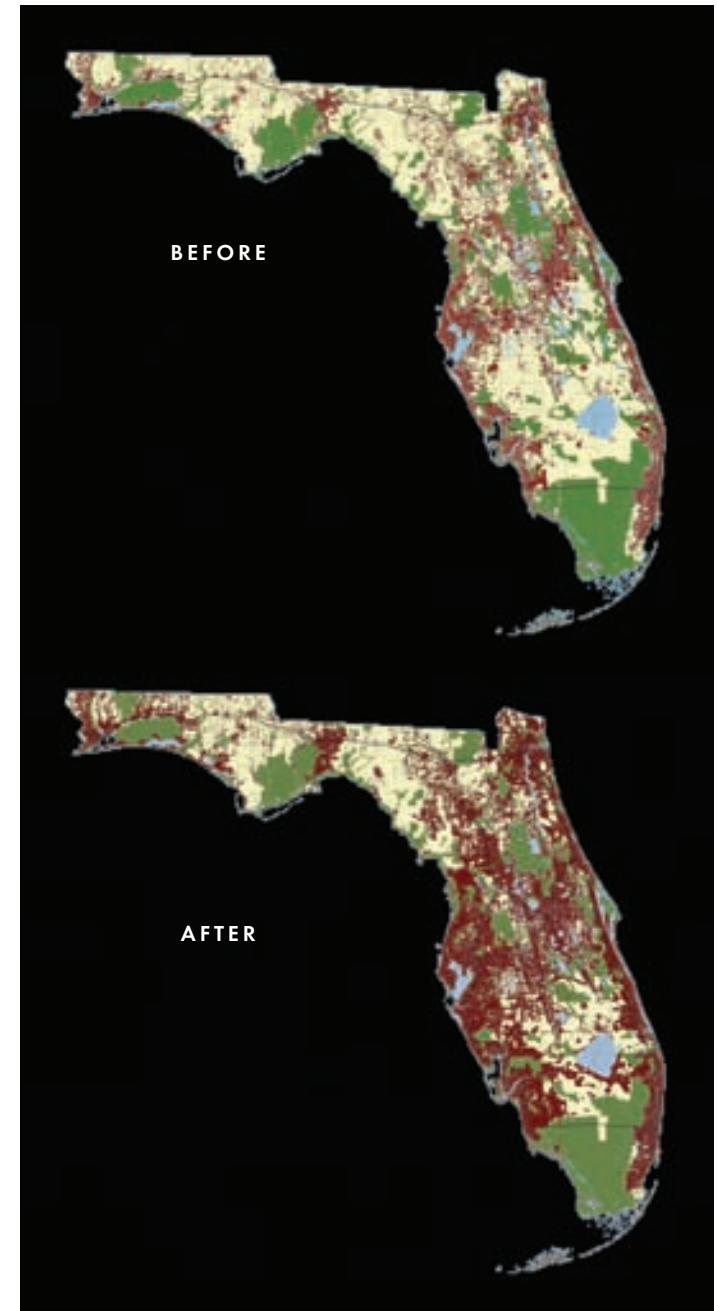
Florida 2060:
A Research Project of
1000 Friends of Florida

Both geologically and biologically, Florida is a very distinct region of the United States. Southern Florida has a subtropical climate which transitions through the central part of the state to a more temperate climate in North Florida. Due to its peninsular geography and this range of climates, Florida supports in excess of 700 terrestrial animals, 200 freshwater fish, and 1,000 marine fish, as well as numerous other aquatic and marine vertebrates, and many thousands of terrestrial insects and other invertebrates. While many of these species can be found elsewhere in North America, there are also a number that are unique to Florida.

As with so many other places in the world, Florida is facing rapid growth, which is resulting in major changes in land use and related impacts on the state's natural resources. Florida's population grew from approximately 3 million people in 1950 to more than 18 million in 2005. Moderate projections indicate that Florida's population could increase to 36 million by the year 2060. If the historic patterns of development continue over the next 50 years, Florida could stand to convert 7 million acres of additional land from rural to urban uses, including 2.7 million acres of native habitat.

Adding millions of new residents to this state will only serve to heighten the competition between wildlife and humans for land, water, food and air resources. Given the ability of humans to reshape entire landscapes to meet their needs, there is no doubt that wildlife will not fare well. In the face of this unrelenting growth and development, it is imperative that Floridians recognize the need to serve as wise stewards of the land, water, and the intertwined ecosystems.

While protecting large tracts of undisturbed landscapes is best from a wildlife perspective, unfortunately that is increasingly impossible in Florida. Future efforts, then, must include strategies to maximize habitat within and adjacent to developed, managed, or otherwise human-influenced landscapes. The goal of this manual is to share Florida-specific wildlife conservation tools that can be used by community planners, landscape architects,



Florida 2060: A Research Project of 1000 Friends of Florida

landowners, developers, and active citizens to minimize impacts of development on the state's rich natural resources through development of a green infrastructure for Florida.

THE VALUE OF GREEN INFRASTRUCTURE

In its May 1999 report, *Towards a Sustainable America – Advancing Prosperity, Opportunity and a Healthy America*, the President's Council on Sustainable Development helped institutionalize the phrase, "green infrastructure." It defined green infrastructure as "... an interconnected network of protected land and water that supports native species, maintains natural ecological processes, sustains air and water resources and contributes to the health and quality of life for America's communities and people."

Green infrastructure can include greenways, parks, wetlands, forests, and other natural areas that help manage stormwater,

reduce the risk of flooding, improve water quality, and provide other ecological and recreational services. Other names for green infrastructure identification include greenprinting, biodiversity by design, sustainable development, ecological principles for managing land uses, and a variety of other terms.

There is an increasing awareness of the inherent value of – and need for – green infrastructure to support human and wildlife needs. This is contrasted by human activities – ranging from farming and suburban development to the introduction of non-native species – that act as stressors to wildlife. These stressors may affect the ability of native organisms or communities to sustain themselves over time and can lower their ability to resist invasion by fungi, microorganisms, or non-native species. Common stressors include:

- Suburban and urban development that fragment habitats and isolate plant and wildlife populations.
- Hydrological modification of streams, and drainage of land via ditching, berming redirecting or causing the drawdown of water.
- Dredging, filling and draining and drying out of wetlands.
- Fire suppression in fire-evolved habitats.
- Introduction of non-native species that reduce or eliminate native species.
- Pollution by toxic or metabolic-altering substances.
- The addition of excess nutrients and sediment.
- Increase in domestic and feral animals such as cats and dogs that prey on sensitive species and alter ecosystem structure.
- Removal of native vegetation and alteration of micro-climates supportive of local species.
- Addition of nighttime lighting and noise which disrupts normal behavior, disorients animal functions and reduces ranging areas.
- Global climate change, causing changes in natural processes faster than many species can respond.

"When we examine anything in the universe we find that it is hitched to everything else." – John Muir



Many smaller creatures – from newts to eagles – can find sufficient habitat to survive in our suburban and urban environments if we recognize their basic needs and work to integrate them into the developed landscape.

IMPORTANT ECOSYSTEM “SERVICES” OF GREEN INFRASTRUCTURE

- Sustain biodiversity.
- Protect areas from impacts of flooding, storm damage or drought.
- Protect stream and river channels and coastal shores from erosion.
- Provide a carbon sink. As an example, 100 acres of woodland can absorb emissions equivalent to 100 family cars.
- Offer pollution control. Vegetation has a significant capacity to attenuate noise and filter air pollution from motor vehicles. Wetland ecosystems are also effective in filtering polluted run-off and sewage.
- Provide natural “air conditioning.” A single large tree can be equivalent to five room air conditioners and will supply enough oxygen for ten people.
- Provide microclimate control by providing shade, hold in humidity and blocking winds and air currents.
- Protect people from the sun’s harmful ultraviolet rays.
- Cycle and move nutrients and detoxify and decompose wastes.
- Control agricultural pests and regulate disease carrying organisms.
- Generate and preserve soils and renew their fertility.
- Disperse seeds and pollinate crops and natural vegetation.
- Contribute to the health and wellbeing of our citizens. Accessible green space and natural habitats create opportunities for recreation and exercise, and studies have shown that this increases our creative play, social skills and concentration span.
- Contribute to a community’s social cohesion. The active use of greenspaces, including streets and communal spaces, can encourage greater social interaction and contribute to a lively public realm. Participation in the design and stewardship of green space can help strengthen communities.
- Enhance economic value. Natural greenspaces can increase property values, reduce management overheads, and reduce healthcare costs.

Adapted from: Ecosystem Services, Ecological Society of America, 2000, at www.esa.org; and, Biodiversity by Design: A Guide for Sustainable Communities, Town and Country Planning Association (TCPA), England, 2004.

Thoughtful planning at the community level can lessen the impacts from these stressors. Many smaller creatures – from newts to eagles – can find sufficient habitat to survive in our suburban and urban environments if we recognize their basic needs and work to integrate them into the developed landscape. To promote sustained biodiversity, a community first must identify local wildlife and habitats, and then ensure that basic necessities for survival are sustained, including food, cover, water, living and reproductive space, and limits on disturbances.

At the same time, ecosystems provide many “services” with little or no capital costs involved. These can range from protecting areas from flooding, to providing natural “air conditioning,” to offering pollution control. The ecological services of green infrastructure can be conserved and enhanced through careful planning. Extending the green infrastructure network to adjacent communities and regional, state or national managed environmental lands is often very possible and can further enhance the value and utility of the services.

In addition to the ecosystem service values, a community can gain monetary value from carefully integrating habitat into its jurisdiction. The 2006 total retail sales from wildlife viewing in Florida were estimated at \$3.1 billion (\$2.4 billion by residents and \$653.3 million by nonresidents). Since 2001, expenditures in Florida for wildlife viewing have almost doubled (\$1.6 billion in 2001). These 2006 expenditures support a total economic effect to the Florida economy of \$5.248 billion. The 2006 economic impact of wildlife viewing in Florida is summarized below. (Information from, *The 2006 Economic Benefits of Wildlife Viewing in Florida*, Southwick Associates, Inc, 2008)

2006 ECONOMIC IMPACTS OF WILDLIFE VIEWING IN FLORIDA			
	Resident	Nonresident	Total
Retail sales	\$2.428 billion	\$653.3 million	\$3.081 billion
Salaries & wages	\$1.204 billion	\$391.8 million	\$1.595 billion
Full & part-time jobs	38,069	13,298	51,367
Tax revenues			
State sales tax	\$243.1 million	\$69.7 million	\$312.8 million
Federal income tax	\$292.5 million	\$92.8 million	\$385.3 million
Total economic effect	\$4.078 billion	\$1.170 billion	\$5.248 billion

A TIERED APPROACH TO CONSERVATION

Over the past few decades, a three-tiered approach to land conservation has evolved in Florida. The top tier includes large statewide and regional land acquisition and protection efforts intended to establish “islands” of protected and relatively intact habitats which are linked, where possible, by ecological greenways. These efforts have laid the foundation for a statewide green infrastructure in Florida.

The bottom tier includes programs directed at protecting habitats within neighborhoods and in backyards. Often grassroots in nature, these include the University of Florida’s Florida Yards and Neighborhoods program and the National Wildlife Federation’s Backyard Wildlife Habitat Program, both of which are targeted

at individual citizens, families, and/or neighborhoods.

The middle tier focuses on creating regional and community-wide green infrastructure to promote conservation within large landholdings, large developments, and neighborhoods. This tier is perhaps the least evolved of the three, but includes better land use planning, development design, and best management practices by both the public and private sectors. It is the middle tier at which most development approvals are issued. This tier offers the greatest potential for better integration of human and wildlife habitat.

THE TOP TIER: TOWARD A STATEWIDE GREEN INFRASTRUCTURE IN FLORIDA

Before the phrase “green infrastructure” had even been coined, Florida launched an ambitious series of land acquisition and conservation planning projects which laid the foundation for creating Florida’s existing green infrastructure. Building on earlier state land acquisition programs, in 1990 Florida established the Preservation 2000 program. This 10-year program raised \$3 billion, and protected 1,781,489 acres of environmentally sensitive land. In 1999, the Florida Legislature created Florida Forever, also designed to dedicate \$3 billion to land acquisition over the following decade. As of December 2006, another 535,643 acres of environmentally sensitive land had been protected through this effort.

As these major land acquisition programs evolved, there was a growing awareness of the need to be more strategic in land acquisition, and a series of efforts were launched in the 1990s. In 1994, researchers from the Florida Fish and Wildlife Conservation Commission (FWC) completed a very important report, *Closing the Gaps in Florida's Wildlife Habitat Conservation*. This cornerstone report used a geographic information system approach to identify key habitat areas to conserve in order

Over the past few decades, a tiered approach to land conservation has evolved in Florida. The top tier includes large statewide and regional land acquisition and protection efforts intended to establish “islands” of protected and relatively intact habitats which are linked, where possible, by ecological greenways.

As part of this effort, the University of Florida undertook the Florida Ecological Network Project, and completed the first phase in 1998. It used GIS data to identify large connected ecologically significant areas of statewide significance. The goal was to create a system of interconnected lands protected for their ecological value to native wildlife and plants, or for their provision of ecological services such as water quality protection and flood prevention.

THE FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

The Florida Constitution vests the Florida Fish and Wildlife Conservation Commission with regulatory and executive powers of the state with respect to wild animal life. In the area of regulating hunting and specific wild animal management actions, the principle of state wildlife primacy over local regulation is well established. Courts will invalidate local ordinances in clear conflict with state authority on hunting and wildlife. On the other hand, when such regulations are not in clear conflict, the courts will often seek to interpret local regulations and state law harmoniously.

By contrast, actions affecting habitat and biodiversity are not yet an organizing concept for federal or state regulatory programs. Local governments have considerable discretion to define their planning, management and regulatory niche. So, for example, a local action prescribing gopher tortoise protection or mitigation in a manner that conflicts with state regulations, would likely be invalidated on preemption grounds, whereas a local regulation directed more generally to gopher tortoise habitat might survive such a challenge. A local regulation directed even more broadly to protection of entire natural vegetative community types or ecosystems would certainly not be preempted on these grounds.



Graphic Courtesy of Noss & Cooperrielder, 1994

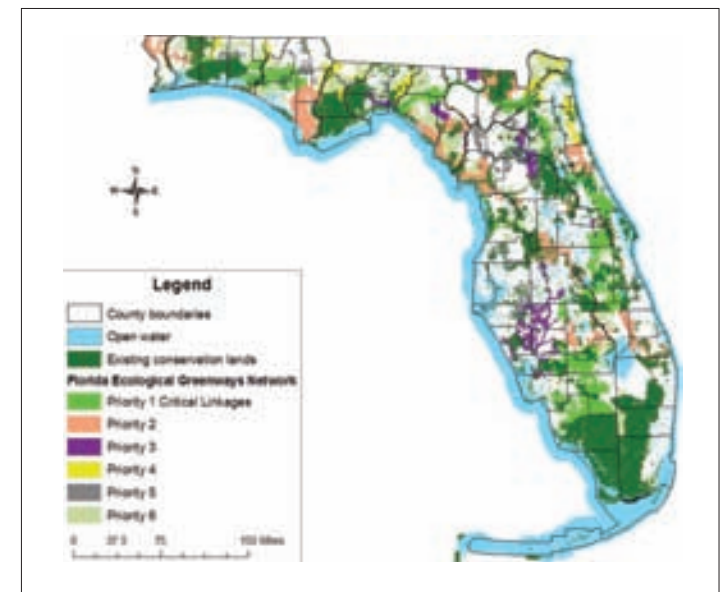


Photo Courtesy of GeoPlan Center

The Florida Ecological Greenway Network

to maintain key components of the state's biological diversity. These areas, known as Strategic Habitat Conservation Areas (SHCA), continue to serve as a foundation for conservation planning in Florida.

Around the same time, the seed was being planted for Florida's greenways network. In the early 1990s, 1000 Friends of Florida and The Conservation Fund launched a coordinated effort to identify and protect a linked network of natural areas to accomplish both ecological and recreation needs. This evolved into the Florida Statewide Greenways Planning Project, established under the Florida Department of Environmental Protection in 1990s.

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The result of this process was an updated Florida Ecological Greenways Network. This network provides a linked statewide reserve system containing most of each major ecological community and most known occurrences of rare species. It represents significant progress toward a more integrated approach to biodiversity conservation in Florida.

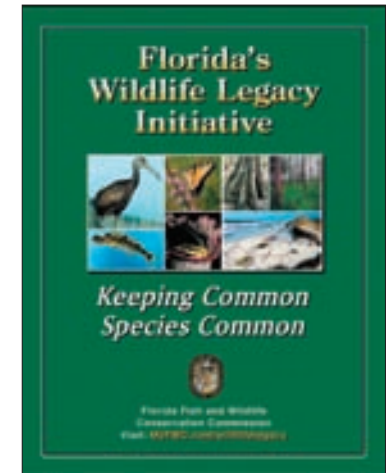
In 2000, the Florida Natural Areas Inventory released its *Florida Conservation Needs Assessment*. Prepared on behalf of the Florida Forever Advisory Council, this report focused on the

geographic distribution of natural resources, or resources-based land uses (such as sustainable forestry) to guide conservation decision making related to Florida's second major state land acquisition program, Florida Forever.

TWENTY-FIRST CENTURY INITIATIVES — LINKAGE BETWEEN TIERS

A new round of conservation planning has now begun, building on these earlier efforts. Begun in 2004 as part of a nation-wide effort, the Florida Fish and Wildlife Conservation Commission's *Wildlife Legacy Initiative* is an action plan to address the long-term conservation of all native wildlife and the places they live. The stated goal is to "prevent wildlife from becoming endangered before they become more rare and costly to protect." The initiative focuses on creating partnerships to better protect Florida's wildlife and their habitats. As part of the initiative, the Commission has created Florida's Wildlife Conservation Strategy. This updates existing conservation plans from the last 30 years into a single state wildlife action plan, providing a platform for proactive conservation. Florida's State Wildlife Grants Program provides funds to assist with implementing the Strategy.

One outgrowth of the Wildlife Conservation Strategy is the Cooperative Conservation Blueprint. The Florida Fish and Wildlife Conservation Commission, The Century Commission for a Sustainable Florida and Defenders of Wildlife are providing leadership on this project, the goal of which is to build agreement between government and private interests on using common priorities as the basis for state-wide land use decisions. When completed, it will include a fully unified set of Geographic Information System (GIS) data layers of conservation and development lands that will be available to all Floridians, and a package of recommended landowner incentives to apply the strategies statewide.

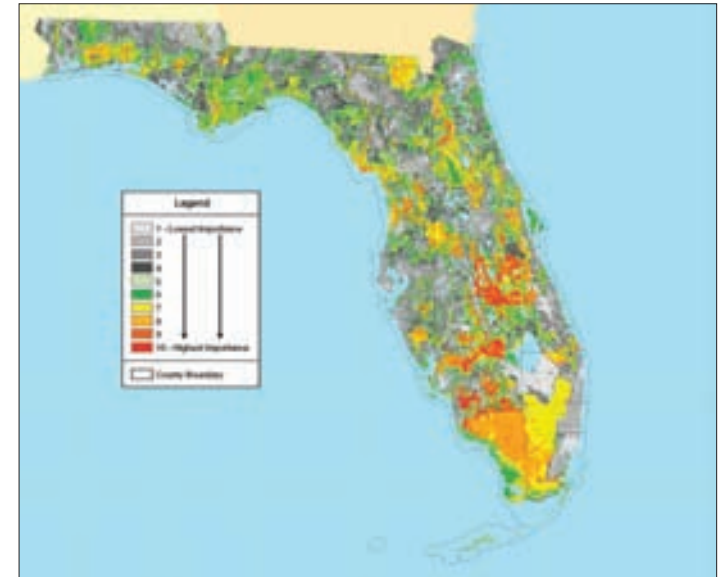


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The challenge for Florida communities is to craft situations to healthily maintain the maximum number of wildlife species. This is becoming increasingly difficult as sprawling development has pushed much wildlife to the wilderness edge. Additionally, human-to-wildlife contact is escalating, including negative interactions.

The Florida Fish and Wildlife Conservation Commission updated Closing the Gaps in the 2006 report, *Wildlife Habitat Conservation Needs in Florida: Updated Recommendations for Strategic Habitat Conservation Areas*. The report details an assessment to determine the protection afforded to focal species, including many rare and imperiled species, on existing conservation lands in Florida and to identify important habitat areas in Florida that have no conservation protection. These areas, known as Strategic Habitat Conservation Areas, serve as a foundation for conservation planning in Florida and depict the need for species protection through habitat conservation. This was further enhanced with development of The Integrated Wildlife Habitat Ranking System. The Integrated Wildlife Habitat Ranking System (IWHRS) ranks the Florida landscape based upon the habitat needs of wildlife as a way to identify ecologically significant lands in the state, and to assess the potential impacts of land development projects. The IWHRS is provided as part of the Commission's continuing technical assistance to various local, regional, state, and federal agencies, and entities interested in wildlife needs and conservation in order to: (1) determine ways to avoid or minimize project impacts by evaluating alternative placements, alignments, and transportation corridors during early planning stages, (2) assess direct, secondary, and cumulative impacts to habitat and wildlife resources, and (3) identify appropriate parcels for public land acquisition for wetland and upland habitat mitigation purposes.

These resources and land acquisition funding sources have gone a long way toward creating a statewide green infrastructure network, and can serve as valuable tools which can complement and/or leverage activities at the regional and local levels. Building on these efforts is the Critical Lands/Waters Identification Project (CLIP) sponsored by the Century Commission for a Sustainable Florida. The Century Commission was formed by the Florida Legislature in 2005 and is tasked with: envisioning Florida's future by looking out 25 and 50 years; making recom-



The Integrated Wildlife Habitat Ranking System, 2007.

Florida Fish and Wildlife Conservation Commission

mendations to the Governor and Legislature regarding how they should address the impacts of population growth; and establishing a place where the "best community-building ideas" can be studied and shared for the benefit of all Floridians. CLIP is a process to identify Florida's "must save" environmental treasures and critical green infrastructure (see Chapter 4 for more information on CLIP).

PROMOTING GREEN INFRASTRUCTURE AT THE MIDDLE TIER

While much has been accomplished at the top and bottom tiers, a great deal still remains to be done at the regional and community levels in Florida to conserve Florida's wildlife and habitats. Very little will happen at the middle tier to conserve, integrate or enhance wildlife habitat unless people plan, design and manage for this purpose. Fortunately, more and more com-



munities, landowners and developers are beginning to integrate wildlife features into their local landscapes.

The challenge for Florida communities is to craft situations to healthily maintain the maximum number of wildlife species. This is becoming increasingly difficult as sprawling development has pushed much wildlife aside. Additionally, human-to-wildlife contact is escalating, including negative interactions. The public safety threat of large predators has been unintentionally marginalized (alligators, panthers and bears do kill people). While there is, perhaps, a great appreciation of wildlife today, there is also a growing “Not In My Back Yard” – or NIMBY–reaction that wants wildlife to be put back “where it belongs.” Better planning, design, and use of best management practices at the local community level need to be used to help address these issues.

A new wildlife and habitat paradigm needs to be encouraged. It need not be a revolution, but instead, it can evolve from where we have been, using many of the same strategies, albeit in a new context. Keys to success will include using science to frame the issues, involving the public in making the decisions, and garnering sufficient support to fund the needed actions.



Photo Courtesy David Woychak Photography

Signage can help educate the public regarding wildlife conservation efforts.

Photo Courtesy of Dan Pennington and Joanne Davis, 1000 Friends of Florida



Numerous models, frameworks and principles have helped to shape approaches to wildlife conservation in the United States. From the original North American Model of Wildlife Conservation to modern ecosystem management, wildlife conservation has evolved to include the seminal works of E.O. Wilson, Michael E. Soule, Richard Forman, Larry Harris, Reed Noss and others. To meet the future challenge of sustaining wildlife, habitat and ecological systems, a wildlife and habitat conservation framework must be incorporated into land use planning and land-management decisions.

THE NORTH AMERICAN MODEL OF WILDLIFE CONSERVATION

Underpinning the approach to wildlife management in the United States and Canada is the *North American Model of Wildlife Conservation*. This model has evolved over the last 175 years and is based on two basic principles – that our fish and wildlife belong to all citizens of North America, and that they should be managed in such a way that their populations will be sustained forever.

It is rooted in the Public Trust Doctrine, derived from the 1842 U.S. Supreme Court case, *Martin v. Wadell*, where wildlife was held in common ownership by the state for the benefit of all. Thanks to this foundation, modern wildlife management has been hugely successful in restoring populations of game animals and their habitats. Species once generally regarded as nuisances, such as alligators, eagles and bears, are now revered by the public and have become icons for wild lands.

ECOLOGICAL PRINCIPLES FOR MANAGING LAND USE

The Ecological Society of America, a scientific non-profit established in 1915, released a report in 2000 entitled *Ecological Principles for Managing Land Use*. This includes a series of five ecological principles for managing land use to ensure that the “fundamental processes of Earth’s ecosystems are sustained.” According to the society, the responses of the land to changes in use and management by people depend on expressions of these fundamental principles:

1. **Time Principle** – In order to effectively analyze the effects of land use, it must be recognized that ecological processes occur within a temporal setting, and change over time. In other words, the full ecological effects of human activities often are not seen for many years, and the imprint of a land use may persist for a long time, constraining future land use for decades or centuries even after it ceases. Also under the time principle, given time, disturbed ecosystem components can often recover. This should guide a community to take a long view when striving to create and maintain habitat linkage corridors.
2. **Species Principle** – Individual species and networks of interacting species have strong and far-reaching effects on ecological processes. These focal species affect ecological systems in diverse ways:
 - **Indicator species** tell us about the status of other species and key habitats or the impacts of a stressor. Many amphibians and bird species are often considered indicator species. For example the Green Treefrog (*Hyla cinerea*) and Squirrel Treefrog (*Hyla squirella*) in Florida have served this function. Native indicator species are often used to assess system-wide ecological responses to land use changes, analogous to the canary in the coal mine.

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WHAT IS THE NORTH AMERICAN MODEL OF WILDLIFE CONSERVATION?

Derived from our rich national hunting heritage, the North American Model of Wildlife Conservation includes a set of guidelines known as the “Seven Sisters for Conservation.” These serve as a basis for the conservation of both game and non-game wildlife. They are:

1. **Wildlife is a public resource.** It is held in common ownership by the state for the benefit of all people.
2. **Markets for trade in wildlife have been eliminated or publicly managed.** Generally, it’s illegal to buy and sell meat and parts of game and non-game species.
3. **Allocation of wildlife by law.** States allocate wildlife use and taking by law, not by market pressures, land ownership or special privilege. The process fosters public involvement in managing wildlife.
4. **Wildlife can only be killed for a legitimate purpose.** The law prohibits killing wildlife for frivolous reasons.
5. **Wildlife species are considered an international resource.** Some species, such as migratory birds, transcend boundaries and one country’s management can easily affect a species in another country.
6. **Science is the proper tool for discharge of wildlife policy.** The concept of science-based, professional wildlife management is central.
7. **The democracy of hunting.** In the European model, wildlife was allocated by land ownership and privilege. In North America, anyone in good standing can participate.

The enduring strategies of the North American Model include collaboration, partnerships, coalition building, professional development, science, political savvy, persistence, and open-minded approaches.

Source: “The Zoo without Bars, Wildlife Management for the New Millennium”, Tim Breault, FFWCC, 2007.

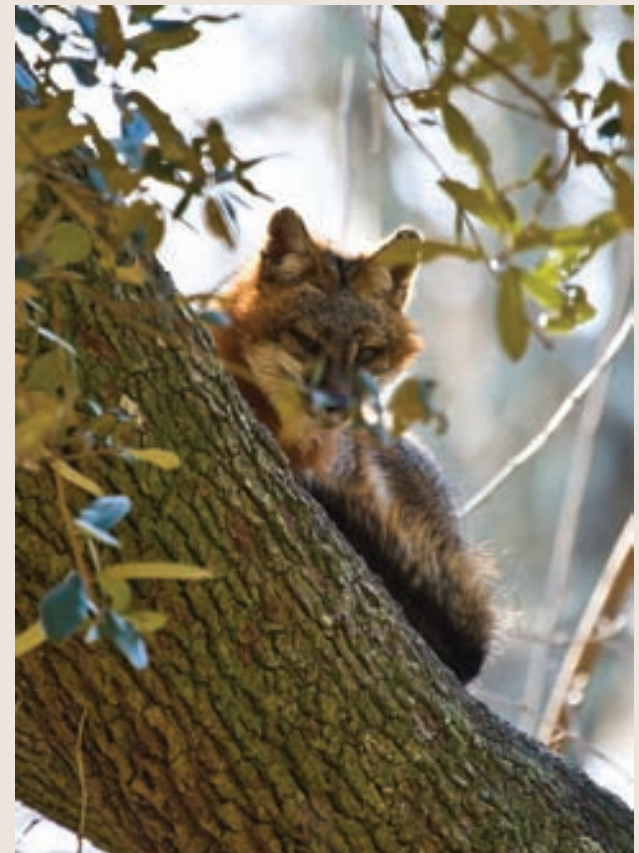


Photo Courtesy of David Moynahan Photography



- **Keystone species** have greater effects on ecological processes than would be predicted from their abundance or biomass alone. In Florida, the gopher tortoise can be considered a keystone species.
 - **Ecological engineers** alter the habitat and, in doing so, modify the fates and opportunities of other species. Florida examples include the gopher tortoise and beaver.
 - **Umbrella species** either have large area requirements or use multiple habitats and thus overlap the habitat requirements of many other species. These can include the panther and black bear.
 - **Link species** are those that perform an important ecological function or provide critical links for energy transfer within or across complex food webs. Their removal from the system would affect one or multiple other species (e.g., alligators and their role in the creation and maintenance of ponds and wet areas during times of drought).
3. **Place Principle** – Each site or region has a unique set of organisms and abiotic conditions influencing and constraining ecological processes.
 4. **Disturbance Principle** – Disturbances are important and ubiquitous events whose effects may strongly influence popula-

tion, community, and ecosystem dynamics. Disturbances can include natural events such as fires, drought and inundation, as well as man-made disturbances including building roads, drawing down water tables, adding night lighting, or clearing land for development. Land use changes that alter natural disturbance regimes or initiate new disturbances are likely to cause changes in species abundance and distribution, community composition, and ecosystem function.

5. **Landscape Principle** – The size, shape, and spatial relationships of habitat patches on the landscape affect the structure and function of ecosystems. Settlement patterns and land use decisions fragment the landscape and alter natural land cover patterns. Habitat fragmentation decreases in the size or wholeness of habitat patches and can increase in the distance between habitat patches of the same type. This can greatly reduce or eliminate populations of organisms, as well as alter local ecosystem processes.

Two other commonly accepted principles can perhaps be added to this list of ecological principles (Dr. T. Hctor, University of Florida, Geoplan):

1. **Ecological Complexity Principle** – Ecosystems are not only more complex than we think, but they may be more complex than we can think.

Link species are those that perform an important ecological function or provide critical links for energy transfer within or across complex food webs. Their removal from the system would affect one or multiple other species (e.g., alligators and their role in the creation and maintenance of ponds and wet areas during times of drought).

Photo Courtesy of: Panther in Tree: Mark Lotz, FWC; Manatee in Canal: Eric Weber; Cow-Nosed Rays: Jeffrey Pennington; Snake: Matt Aresco

In Florida, some commonplace applications include avoiding sprawling development and minimizing the need for new roads and other infrastructure. Additionally, when planning new or retrofitting old development, it is important to maintain or restore linkages between sizable patches of critical areas, and minimize or compensate for the effects of development on ecological processes.

2. **Precautionary Principle** – When there is uncertainty in land planning and wildlife and habitat conservation needs (which is most always), err toward protecting too much instead of too little. It is difficult and, at times, impossible to restore what has been lost.

The *Ecological Principles for Managing Land Use* report also includes a series of guidelines to incorporate ecological principles into land use decision making. The society recommends that land managers should:

1. Examine the impacts of local decisions in a regional context.
2. Plan for long-term change and unexpected events.
3. Preserve rare landscape elements and associated species.
4. Avoid land uses that deplete natural resources.
5. Retain large contiguous or connected areas that contain critical habitats.
6. Minimize the introduction and spread of nonnative species.
7. Avoid or compensate for the effects of development on ecological processes.
8. Implement land-use and management practices that are compatible with the natural potential of the area.

In Florida, some commonplace applications include avoiding sprawling development and minimizing the need for new roads and other infrastructure. Additionally, when planning new or retrofitting old development, it is important to maintain or restore linkages between sizable patches of critical areas, and minimize or compensate for the effects of development on ecological processes.

DESIGNING FUNCTIONAL GREEN INFRASTRUCTURE FOR WILDLIFE

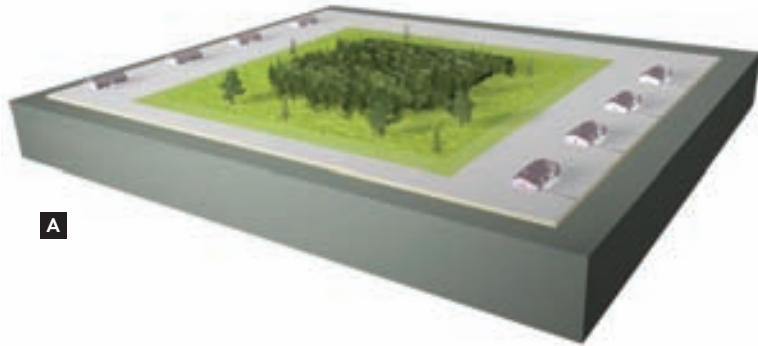
Our understanding of how to design wildlife-sustainable green infrastructure has its roots in a field known as island biogeography. Scientists observed that islands and peninsulas around the

world generally hold fewer species than expected when compared to larger land masses. In their 1967 book, *The Theory of Island Biogeography*, Edward O. Wilson and R.H. MacArthur propounded that the number of species found on an island is determined by the distance from the mainland and the size of the island, both of which would affect the rate of extinction on and immigration to the island. Thus, a larger island closer to the mainland would likely have a greater diversity of species than a smaller island farther from the mainland. Later studies have expanded this to include that habitat diversity may be as, or more important than, the island's size.

An "island" can include any area of habitat that is surrounded by areas unsuitable for species on the island – including forest fragments, reserves and national parks surrounded by human-altered landscapes. This theory has proven remarkably accurate and has become an important foundation of modern landscape ecology. It also has led to development of the habitat corridor as a conservation tool to increase the connections between habitat islands. These corridors can increase the movement of species between protected lands, helping to increase the number of species that can be supported.

As landowners and local governments work together to create wildlife-friendly communities, it is important to understand more about the key concepts of patches, corridors, and edge effects which have evolved out of the study of biogeography. In his 1995 book, *Land Mosaics: The Ecology of Landscapes and Regions*, noted Harvard Professor of Landscape Architecture Richard T.T. Forman described these important concepts in great detail.

Patches – Forman defined a patch as a relatively homogenous area that differs from its surrounding. From a wildlife perspective, patches are discrete landscape areas which offer better survival prospects for wildlife, and regularly meet living prerequisites, including food, cover, water, living space, and limits on disturbances. Human impacts tend to lead to smaller and smaller



A



B

A) A small patch of habitat, cut-off from similar habitat areas, is depleted overtime of wildlife and the opportunities for wildlife replenishment.; B) Habitat patch shape, size and connectivity can be important to wildlife survival. A large patch with a coherent interior environment is best for many species. Several smaller habitat patches with reasonable cross-connections may sustain desired wildlife. Several patches in relative close proximity are often better than stretched-out or smaller chopped-up patches that lose unique interior habitats and micro climates.

patches – or islands—of living space. Patches are further fragmented by development impacts including roads and subdivisions. Agricultural practices leading to increased fragmentation include tilling for crops, burning, over and under watering, dosing with fertilizers and pesticides, and livestock ranging.

Habitat fragmentation can lead to changes in physical factors, shifts in habitat use, altered population dynamics, and changes in species composition. Patch (or island) size has been identified as a major feature influencing the health and sustainability of plant and animal communities (Monica Bond, Center for Biological Diversity, *Principles of Wildlife Corridor Design*, 2003). There are a few exceptions. For example, raccoons and mockingbirds have adapted to human-dominated landscapes and discontinuous habitats.

The composition and diversity of patches, as well as their spatial relationship with one another, will determine the relative sustainability of a community's green infrastructure. Patches may or may not be self evident, so it is important to have experienced input into the design of the community plan.

Corridors – A corridor can be defined as a strip of land that aids in the movement of species between disconnected patches of their natural habitat. This habitat typically includes areas that provide food, breeding ground, shelter, and other functions necessary to thrive. Not only can human impact affect the size of patches, as described earlier, but it can also cause animals to lose the ability to move between the patches. Because they allow for long-term genetic interchange, corridors can also reduce inbreeding, facilitate patch re-colonization, and increase the stabilities of populations and communities.

Planners, landscape architects, land managers and conservation biologists are faced with the task of reconnecting existing fragmented landscapes. Strategic conservation decisions need to be made within a larger community context. Clear financial

A corridor can be defined as a strip of land that aids in the movement of species between disconnected patches of their natural habitat. This habitat typically includes areas that provide food, breeding ground, shelter, and other functions necessary to thrive.

Wildlife corridors appear to benefit not only wildlife but also plants. A six-year study at the world's largest experimental landscape devoted to the corridors has found that more plant species – and specifically more native plant species – persist in areas connected by the corridors than in isolated areas of the same size. The results suggest that corridors are an important tool not only for preserving wildlife but also for supporting and encouraging plant biodiversity.

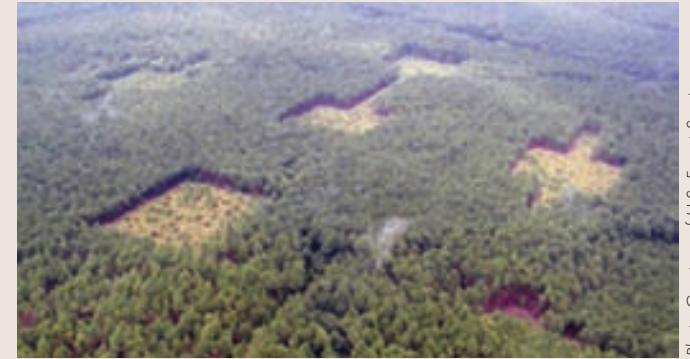
CASE STUDY

Wildlife Corridors Benefit Plant Biodiversity

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Researchers created a massive outdoor experiment at the Savannah River Site National Environmental Research Park on the South Carolina – Georgia line. In two earlier studies, the researchers concluded that corridors encourage the movement of plants and animals across the fragmented landscapes. They also found that bluebirds transfer more berry seeds in their droppings between connected than unconnected habitat patches, suggesting that the corridors could help plants spread.

The latest research tackled a much broader question: Do corridors increase plant biodiversity overall? The difference between the habitats studied was similar to the difference between urban and natural areas, where corridors are most often used. The experimental sites were created in 1999, and there was little difference between connected and unconnected patches of habitat one year later. But a different pattern became clear in ensuing years. Not only were there more plant species in connected than unconnected patches, there were also more native species. The difference arose because unconnected patches gradually lost about 10 native



An aerial photograph of one experimental landscape showing habitat patch configurations.

Photo Courtesy of U.S. Forest Service

species over the 5 years, whereas the natives persisted in connected patches.

Meanwhile, the corridors seemed to have no impact on the number of exotic or invasive species in the connected and unconnected patches. It seems that either exotic species already were widespread, and did not rely on corridors for their spreading, or they remained in one place. The scientists think that invasive species, which by definition are good at spreading, are little affected by corridors. Native species, by contrast, are less invasive in nature and appear to be assisted more by the corridors and the linkages they provide. The researchers suggest it may be that corridors play to the strengths of native species.

Source: University of Florida News, 2006; Writer, Aaron Hoover, reporting on work by Douglas J. Levey, et al, Science, 2005 "Effects of Landscape Corridors on Seed Dispersal by Birds."

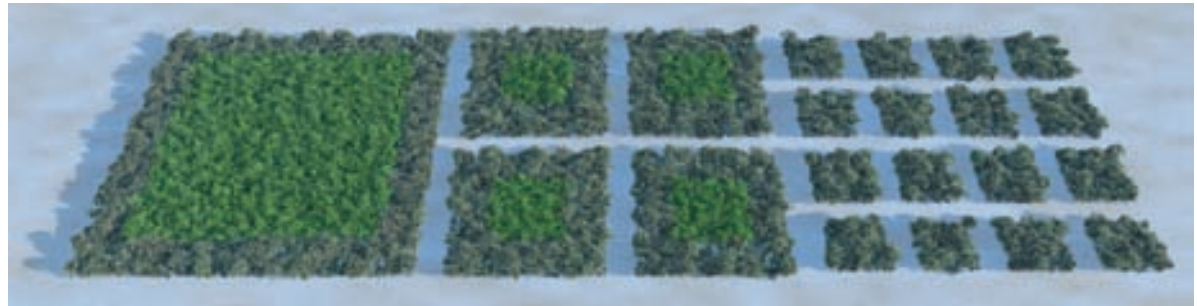
limitations related to land purchases, restoration options, easements and other tools will shape the final outcome.

Facilitating connections between Florida's already protected lands and outlying patches can be a valuable tool. Through careful planning and design, wildlife corridors can lessen the negative effects of habitat fragmentation by linking patches of remaining habitat. Corridors can be incorporated into the design of a development project either by conserving an existing landscape linkage, or by restoring habitat to function as a connection between protected areas onsite, off-site and through-site.

There is still considerable debate over the effectiveness of corridors and how they should be configured and sized. The answer depends on the species under conservation consideration. The level of connectivity needed to maintain a population of a particular species will vary, and depends on such issues as the size of the population, survival and birth rates, the level of inbreeding, and other demographics which can serve as baseline data to determine whether a corridor is likely to be functional.

In 1992, forestry experts Paul Beier and Steve Loe drafted, *In My Experience: A Checklist for Evaluating Impacts to Wildlife Movement Corridors*. They identified six steps for evaluating corridor practicality, including to:

1. Identify and select several target species for the design of the corridor (e.g., select "umbrella species" and the associated benefiting species).
2. Identify the habitat patch areas the corridor is designed to connect.
3. Evaluate the relevant needs of each target and associated species such as movement and dispersal patterns, including seasonal migrations or environmental variations (e.g., some species depend on there being season wetlands available).
4. For each potential corridor, evaluate how the area will accommodate movement by each target species.



Protected interior environment (brighter green), progressing to those that essentially become all edge environment and no interior.

Graphic by Benjamin Pennington, remade from illustrations in Micheal E. Soule, *Journal of the American Planning Association*, "Land Use Planning and Wildlife Maintenance, Guidelines for Conserving Wildlife in an Urban Landscape," 1991

5. Draw the corridor on a map and work with community to establish a pragmatic plan to sustain or restore the connections.
6. Design a monitoring program to gauge corridor viability, human community interface impacts and modification needs.

When evaluating a potential corridor, it is important to consider how likely the animal(s) will encounter the corridor's entrance, actually enter the corridor, and follow it. Factors to evaluate include whether the corridor contains sufficient cover, food, and water, or whether these features need to be created and maintained. It is also important to determine if the new development contains or creates impediments to wildlife movement. These may include topography, the introduction of new roads, and the types of road crossing, fences, outdoor lighting, domestic pets, and noise from traffic or nearby buildings, exotic plant migration, and other human or disturbance impacts.

Edges – The "perimeter zone" of a patch can have a somewhat different environment from the interior of the patch, due to its proximity to adjacent patches, changes in light penetration, noise, microclimate, and other factors. This "edge effect" can have implications when planning for conservation areas. For example, a long, thin, habitat patch could essentially be all edge, while a circle has the minimum perimeter for a given area, and

There is still considerable debate over the effectiveness of corridors and how they should be configured and sized. The answer depends on the species under conservation consideration.

Edge effects have implications when planning the major components of a community's green infrastructure such as deciding whether to work toward a single large or several smaller interconnected reserves. In more developed areas, a carefully considered network of varying sized habitat patches with appropriately designed linkage corridors may be appropriate.

CONSIDERATIONS OF CORRIDOR DESIGN

- The corridor should be as wide as possible. The corridor width may vary with habitat type or target species but a rule of thumb is wider and larger areal extent is better.
- The longer the corridor the wider it may have to be.
- Maximize land uses adjacent to the corridor that reduce human impacts to the corridor. Essentially, corridors surrounded by intensive land uses should be wider than those surrounded by low intensity uses.
- To lessen the impact of roads, maintain as much natural open space as possible next to any culverts and bridge under/overpasses to encourage their use.
- Do not allow housing or other impacts to project into the corridor or form impediments to movement and increase harmful edge effects.
- If buildings or housing are to be permitted next to the corridor, establish a buffer and place a conservation easement over this area.
- Where the hydrology supports it, place the development's stormwater retention/detention facilities between the managed land and conservation land as an added buffer.
- Develop strict lighting restrictions for the houses adjacent to the corridor to prevent light pollution into the corridor. Lights must be directed downward and inward toward the home. (This may involve adopting local "Dark Skies" lighting ordinances).

Source: Adapted from Monica Bond, Center for Biological Diversity, *Principles of Wildlife Corridor Design*, 2003.

thus the least edge. Some species, such as white-tailed deer, eastern cottontail, bobwhite, are edge-adapted and are not harmed by the edge effect. Many other common species have not adapted to the edge zone.

Edge effects have implications when planning the major components of a community's green infrastructure such as deciding whether to work toward a single large or several smaller interconnected reserves. In more developed areas, a carefully considered network of varying sized habitat patches with appropriately designed linkage corridors may be appropriate.

MERGING BIOLOGY WITH PLANNING

In 2003, Karen Williamson of the Heritage Conservancy produced *Growing with Green Infrastructure*, which pulls together biology and planning studies. She describes a network of lands that can make up green infrastructure. These lands can range in size and shape, and require differing levels of conservation and protection from human impact, according to the type of resources being protected.

These include hubs, generally larger tracts of land which act as an 'anchor' for a variety of natural processes and provide an origin or destination for wildlife. These can include wildlife reserves, managed native lands, working lands including farms, forests, and ranches, parks and open spaces, and recycled lands including mines, brownfields, and landfills that have been reclaimed. Links "interconnect the hubs, facilitating the flow of ecological processes." These may include linear conservation corridors such as river and stream corridors and greenways, and buffer lands such as greenbelts. Landscape linkages are "open spaces that connect wildlife reserves, parks, managed and working lands, and provide sufficient space for native plants and animals to flourish." These may also include cultural resources, recreational areas and trails, scenic viewsheds, and even street-scapes.



One of the best ways to ensure a future for wildlife is to work toward developing an integrated mix of connected parcels or patches within and near to our communities that are planned, designed and managed for their habitat values.



A green infrastructure and wildlife friendly vision can provide many benefits to a community and its residents. One of the best ways to ensure a future for wildlife is to work toward developing an integrated mix of connected parcels or patches within and near to our communities that are planned, designed and managed for their habitat values. Impacts to wildlife habitat in a local community occur, for the most part, as a result of development approvals given incrementally over time. To sustain wildlife and biodiversity within, or in close proximity to, “developed” land, sustained efforts must involve limiting and managing disturbance to habitats and enhancing connectivity. Very little will happen at the level of the community to conserve, integrate or enhance wildlife habitats unless people understand, plan, design and manage for this purpose.

GOALS FOR PLANNING WILDLIFE-FRIENDLY COMMUNITIES

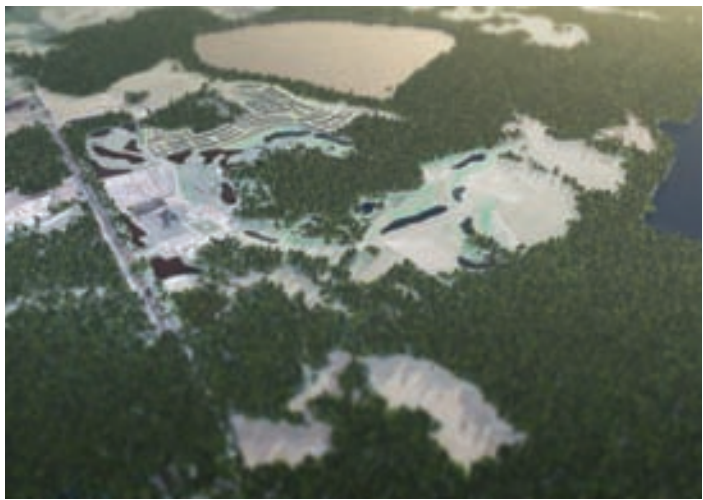
From the perspective of planning a wildlife-friendly community, there are a number of goals around which an effective local effort can be formulated, keeping in mind that each species

requires a particular mix of food, cover, water, living and reproductive space and limits on disturbances.

Goal 1 – Plan and maintain an overall habitat framework with identified ecological corridors, linked to larger patches of habitat managed around systematic efforts to minimize habitat loss and its fragmentation. Supportive actions may include:

- Linking (where possible) community and regional parks, mitigation areas, greenways and forests against the backbone of local watershed features (streams, bayous, wetlands, rivers, sink holes, etc.).
- Integrating transportation and stormwater infrastructure development to capture wildlife supporting and enhancement opportunities.
- Incorporating private green areas into the larger green infrastructure network (e.g., golf courses, botanical gardens, large parcel easements and set-asides).
- Planning a hierarchy of open spaces. For example, one layer might include parks, another larger stormwater infrastructure components that function as buffers to create planned separation of human and wildlife communities (this may be of particular importance in the planning of large new developments that come up against large managed environmental areas, especially those that support larger species such as Florida black bear, panther, alligators, crocodiles, beaver. Such separation conversely discourages intrusion of domestic cats and dogs into the managed protected areas).

Goal 2 – Preserve and enhance waterbody and riverine native green edges (create combined upland buffer and in-water littoral edges that further link to larger habitat patches). Where possible, do not subdivide properties down to the water’s edge; instead, maintain a common community shoreline corridor with an upland component that links to larger habitat patches. Following a tiered landscape conservation approach, a community can enhance or maximize buffer variety and size



Graphic Courtesy of Benjamin Pennington

Significant forested riparian edge has been left alongside this lake in Harmony in Osceola County. Even within the community, sizable tracts of forest wrap through the developed areas and golf course. Water quality and wildlife benefit, as do the community residents that share the common natural land and lake resources.

by leveraging connectedness to existing conservation areas. Importantly, wildlife linkage benefit is available across jurisdictions when upland and riparian habitats are conserved through corridors and buffers.

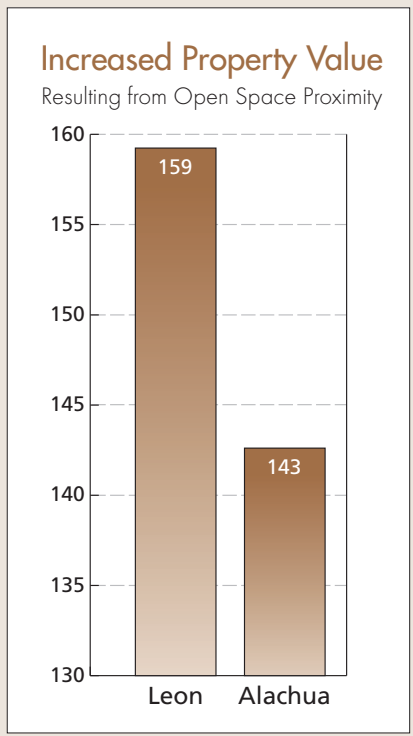
Goal 3 – Carefully weigh the impacts of the pattern of development when planning for larger areas or multiple smaller parcels (cities, counties, large landowners). Sprawl results in proportionately more fish and wildlife habitat loss and habitat fragmentation than compact patterns of development. Compact development patterns allow a linking of undeveloped parcels through developed landscapes. In addition, sprawl’s dispersed development pattern leads to a greater reduction of water quality and quantity by increasing runoff volume and stormwater treatment and facility maintenance costs, altering regular stream and/or wetland flow, lessening water height and duration, and affecting watershed hydrology by reducing groundwater recharge and groundwater levels.

MANAGED ENVIRONMENTAL LANDS ADD TO THE QUALITY OF LIFE AND REAL MARKET VALUE

In most instances the value of land adjacent to parks, greenways and other environmental managed lands increases due to the permanence and desirability of having assured natural lands as a neighbor. According to a study conducted for the Trust for Public Land in 2004, proximity to open space has a significant effect on land values in Leon County and Alachua County. In densely settled portions of Leon and Alachua Counties, the report found buyers could expect to pay \$14,400 and \$8,200 more respectively for single-family homes if they were within 100 feet of open space. The study also found that proximity to open space raised the value of vacant land. In Leon County, vacant parcels within 100 feet of open space commanded a premium of \$31,800. Leon had about 5,900 parcels close enough to open space to have their values enhanced; Alachua had 8,100. The study estimated that the aggregate impact on land values in Leon County was \$159 million, and in Alachua County, \$143 million. At 2004 tax rates, the additional land values brought in an additional \$3.5 million in property taxes for each county.

In recognition of this value, local governments should consider working hand-in-hand with the land managers of managed environmental areas to establish buffered overlay areas (sometimes called Greenline areas or overlay zones) wherein new development or redevelopment receives an “up front” review to addresses and resolve compatibility issues.

Source: E. Moscovitch, (2004). Open Space Proximity and Land Values, Trust for Public Land study by Cape Ann Economics



Habitat is impacted by a progression of spatial deterioration advanced by poor land development choices overtime. Broadly these include: dissection, fragmentation, perforation, shrinkage and eventual attrition.

THE PATTERN OF LAND DEVELOPMENT RELATIVE TO HABITAT SPATIAL PROBLEM

Land development patterns affect existing habitat areas. As an area is being planned for development or redevelopment, actions can be taken to reduce or minimize the habitat-damaging effects. First and foremost is to limit (or at least direct and manage) sprawling, low density patterns of development. Look for opportunities to concentrate development in more compact formats while permanently setting aside linked habitat within common open space areas. This can be promoted using planning tools such as conservation subdivision, rural land stewardship areas,

traditional neighborhood design patterns, sector plans and Developments of Regional Impact.

Habitat is impacted by a progression of spatial deterioration advanced by poor land development choices overtime. Broadly these include: dissection, fragmentation, perforation, shrinkage and eventual attrition.

Sources: 1) Soule, Michael. *Land Use Planning and Wildlife Maintenance _ Guidelines for Conserving Wildlife in an Urban Landscape*, 1991; 2) Forman, R. T. T. *Land Mosaics: The Ecology of Landscapes and Regions*, 1995; and, 3) *Ecological Design Manual for Lake County*, 2001.



Habitat dissection (a road through it), fragmentation (multiple roads), dissection with perforations (roads and development sites), habitat dissection with shrinkage and finally attrition (overall loss or reduction of habitat).

Goal 4 – Where present, strive to maintain the rural character and rural economic base. Sustain agriculture areas, infrastructure and working rural landscapes.

Goal 5 – Recognize and plan for natural ecological maintenance events such as floods and fires. These events are a part of natural ecosystem dynamics and are important to native habitat health and continued existence. Plan communities to incorporate and sustain the flood prone areas as undeveloped common areas. Also, plan land uses around the ecological realities of smokesheds incorporating “firewise” community designs (see Chapter 7, “Management and Design Factors”).

Goal 6 – Preserve a background matrix of predominate native vegetation and habitat types. These features are adapted to local climate and soil conditions, support wildlife and likely

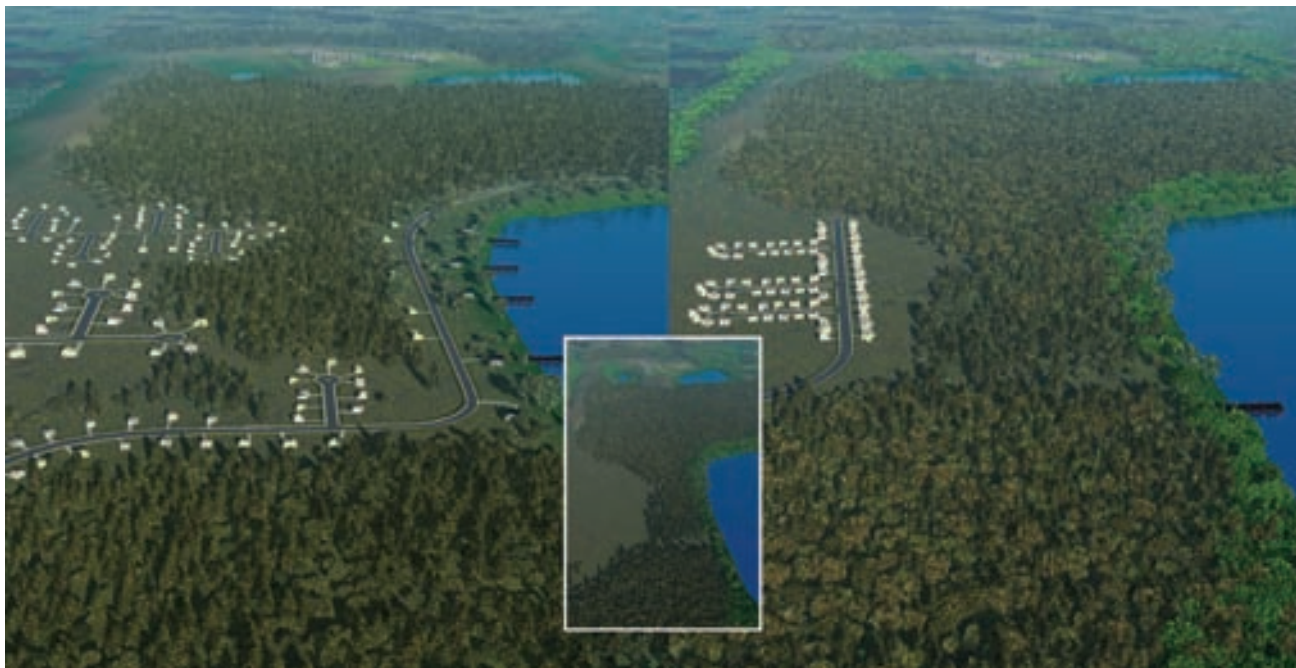
require less maintenance and water.

Goal 7 – Preserve forested areas and the understory and native soil associations. Minimize disturbance of such areas and remember that larger forested patches have a better chance of preserving localized micro-climate features supportive of unique plant and animal species (e.g., consider light and humidity).

Goal 8 – Identify and avoid activities that dehydrate or alter the seasonal water flows or duration of inundation to wetlands, hammocks or waterbodies (e.g., diversions, drawdown, or damming effects from roads and berms, etc.).

Goal 9 – Preserve and use natural systems (or even linked fragments of natural systems) within a community to enhance, add value and distinction.

Recognize and plan for natural ecological maintenance events such as floods and fires. These events are a part of natural ecosystem dynamics and are important to native habitat health and continued existence.



Graphic Courtesy of Benjamin Pennington

Comparative scenario between two forested, lakeside development plans. Left shows a common Florida development pattern that removes or reduces the lakeside forest, places multiple piers into the lake and, segments the lake frontage into multiple individual lots. Right side shows a more wildlife friendly approach that clusters homes and roads away from the lake to preserve the forested edge, places one common community pier in the lake (accessible by a community trail) and, keeps the lake frontage unsegmented allowing linkage between aquatic and upland environments.

Graphic by Benjamin Pennington using a FDEP, Land Boundary Information System (LABINS), photo



Oscar Scherer State Park (outlined), like many managed environmental areas, is feeling the impact from neighboring developments

CASE STUDY

The Good Neighbor Approach: Oscar Scherer State Park in Sarasota County

As with many other managed environmental areas, Oscar Scherer State Park in Sarasota County has faced development pressures from surrounding properties that affect the sustainability of the park itself. A comprehensive plan amendment for an increased density development on a parcel adjacent to the park served as a catalyst for a partnership between the local government, the developer and area citizens. The resulting local Blackburn Point Sector Plan was adopted by Sarasota County through an ordinance.

The plan provides guidance on how new development can be designed to be habitat and wildlife friendly. One of the most critical elements is the "Notice of Proximity," which is recorded in the deeds and rental agreements on all properties within the Sector Plan boundaries. It puts all property owners on notice that the park is within close proximity and that there are certain practices such as prescribed fire, pesticide usage, heavy machinery usage, and removal of exotic plants and animals that take place in the park. The notice states that these property owners or renters shall be deemed to have knowledge of and to have consented to these resource management practices. The State's Division of Forestry routinely requires such notice for properties bordering its lands.

Further, the plan emphasizes that:

- Adjacent developments use materials and colors that help to camouflage the appearance of buildings, fences and other structures to reduce their visual impact on park visitors.
- Stormwater ponds be designed along the park boundary to minimize the impact of feral and domestic cats and, conversely, discourage intrusion of wildlife into the backyards of residents.
- Native vegetation buffer zones be used, and be maintained to be free of exotic vegetation.
- Consideration be given to wildlife friendly lighting, known as “Dark Skies Lighting.”

Such a cooperative approach could also be used to promote:

- Clustering homes and development away and reducing the number of individual lot lines that directly abut the park boundary, providing greater buffer between wildlife and people.
- Expanded perimeter buffers of native vegetation to help address noise, light and other wildlife disturbance issues.
- Interconnections between the park and adjoining development greenways and open spaces.
- Development-wide use of native vegetation and landscaping that blends with the native habitat but includes consideration of fire and smokesheds and firewise development.

- Water conservation, use of reclaimed water, energy conservation and environmentally benign building materials.
- Elimination or reduction of the use of pesticides and fertilizers.
- Homeowner involvement in park management and educational programs.

Adjacent developments use materials and colors that help to camouflage the appearance of buildings, fences and other structures to reduce their visual impact on park visitors.



Stormwater management facilities for developments backing-up to managed environment areas can be strategically placed to create a barrier to developmental impacts such as lights, domestic cats, and children.

ADDRESS ALL PHASES OF A DEVELOPMENT

Once a site has been chosen, developers must consider three phases of development when creating a neighborhood: design, construction, and post-construction. The design phase is typically where, lot size, roads, open spaces and wildlife patches and corridors are laid out on paper and distributed throughout the site. During construction, contractors and sub-contractors implement the design on the ground, constructing streets and homes and providing landscaped and conserved natural areas. Post-construction is where buyers purchase the homes, move into the community, and manage their own homes, yards, neighborhoods, and common areas.

The construction and post-construction phases have a huge impact on how functional wildlife habitat is over the long term (Hostetler and Drake 2008). During the construction phase, without trained or knowledgeable contractors and landscapers, many things can happen that could impact the viability of future wildlife populations. For example, even if the most important large trees and natural areas are preserved across the subdivision and built areas are designed around them, the placement of fill dirt, upkeep of silt fences, and management of heavy construction vehicles routes during construction is critical to the survival of these sensitive areas. Further, once homes are built and people move into a neighborhood, additional problems can arise if residents are not knowledgeable about the habitat and wildlife friendly design. Imagine homeowners moving in and planting invasive exotics in their yards and allowing their cats and dogs to run about the various conserved natural areas. It is typical for many “green” developments to leave out or de-emphasize the construction and post-construction phases, and these two phases (along with design) are critical when creating communities that are meant to conserve wildlife populations.

For additional information see: University of Florida, Program for Resource Efficient

Communities at: www.buildgreen.ufl.edu and Living Green at: www.livinggreen.ifas.ufl.edu.



Local wildlife and habitat issues need to be a part of design, construction and post construction issues and actions.



Goal 10 – Plan for and recognize the importance of addressing wildlife issues during the design, construction and post-construction phases of development.

THE FIRST STEPS

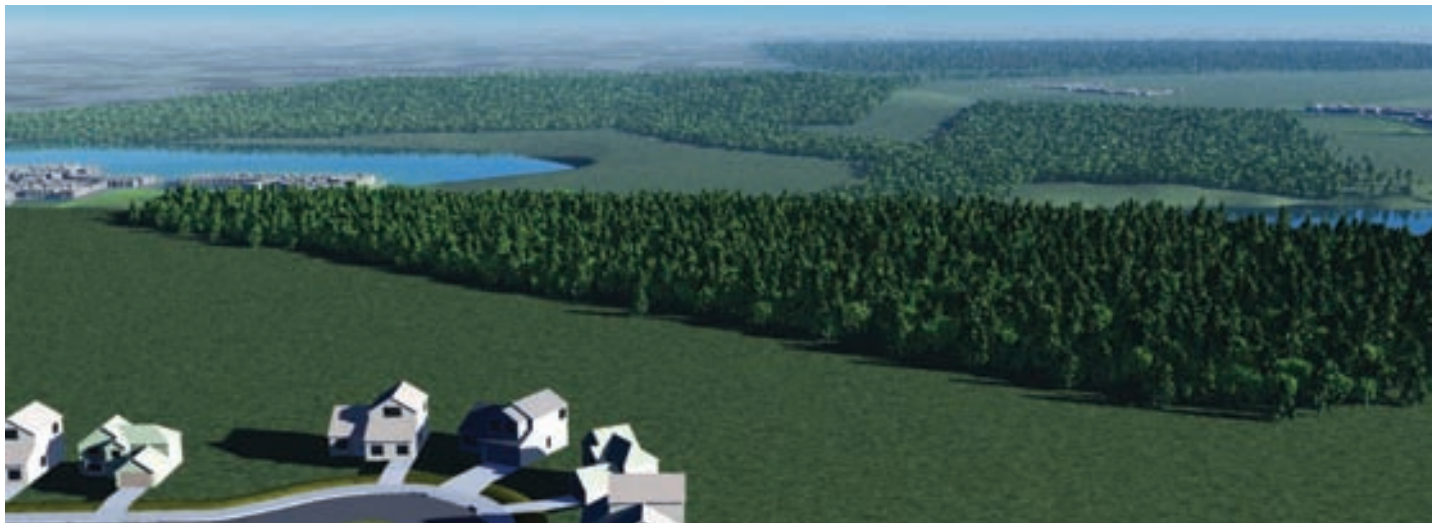
Green infrastructure and associated wildlife habitat already exist in our communities but often go unrecognized and undervalued. Some portions of this infrastructure are publicly owned, other portions may be established as easements, exist through management agreements, or by thoughtful land stewardship on private properties. Establishing a formal green infrastructure framework assigns value and a hierarchy of natural green spaces within a community and identifies the varieties of ecological services and benefits they provide.

There is no right way toward development of a formal green infrastructure and wildlife habitat network at the local community level. Nevertheless, a variety of steps are suggested below that may help guide an effort.

1. **Begin with existing local government departmental organizational structure.** What local government departments do, or do not do, links back to local elected officials, administrators, staff and the directives of the adopted comprehensive plan and land development code. To develop a wildlife-friendly community, the jurisdiction's officials and departments need to be a part of the plan. It is very important to ensure that sufficient cross-departmental project review occurs and to have both staff and decision-makers understand the "Big Picture" as well as site specific linkage considerations.

It is important for commissioners, planners, landowners and other local decision makers to understand the importance of "scale" in wildlife planning. It is most helpful to think in terms of at least two different scales and the particular linkages between scales: (1) the landscape scale, such as a city, county or a region; and, (2) the site scale such as an individual subdivision or development project. Different approaches to planning and different tools or combination of tools may be necessary depending on the scale of the project being considered.

It is important for commissioners, planners, landowners and other local decision makers to understand the importance of "scale" in wildlife planning. It is most helpful to think in terms of at least two different scales and the particular linkages between scales: (1) the landscape scale, such as a city, county or a region; and, (2) the site scale such as an individual subdivision or development project.



Local wildlife and habitat conservation planning should strive to provide linkage. Pictured a forested habitat patch in the foreground that retains corridor linkage to distance habitat patches.

CASE STUDY**Capital Cascades Greenway, Tallahassee: Integrating “Hard” and “Green” Infrastructures**

Tallahassee, like many cities in Florida, has experienced significant growth in recent years. Natural wildlife habitats and waterways have been developed and converted to impervious surfaces at an alarming rate. Over time, economic and environmental interests began to clash, making it difficult for new development or community improvement projects to take place. To help solve this dilemma community leaders and environmental groups came together and formed the Economic and Environmental Consensus Committee (EECC). Members of the EECC cooperatively developed Blueprint 2000— a series of recommendations for balancing healthy economic growth and conservation of natural resources, habitat, and green space. In order to fund the critically needed BP 2000 initiatives identified by the committee, voters approved a one-cent sales tax extension (for 2004 through 2019).

One of the most important projects to come out of Blueprint 2000 is the Capital Cascades Park Greenway—an urban redevelopment project linking a major thoroughfare with a downtown revitalization area. This multi-use greenway will enhance transportation options, business redevelopment and recreational opportunities by:

- Creating a more park-like atmosphere and forming a continuous walking park around downtown Tallahassee.
- Providing needed flood control using a combination

of engineered and restored natural features.

- Making strategic intersection improvements to facilitate traffic flow and alleviate safety concerns.
- Enhancing values of adjoining properties, thus promoting redevelopment options and revitalizing what has been an economically depressed area of the City.
- Providing a continuous green-space corridor for native wildlife habitat.
- Replacing existing drainage ditches with park-like urban wetlands for stormwater treatment and water storage for flood control.
- Creating a series of smaller, cascading urban wetlands for stormwater treatment and connecting them with attractive flow-ways, moving water through Cascades Park during dry weather and smaller, more frequent rain events via the naturally restored “green” infrastructure. More highly engineered conveyances will improve flood relief for larger, less frequent events, and protect the natural system from erosion when the channel capacity is exceeded.

The Capital Cascades Greenways Project promotes the restoration of dwindling urban wildlife habitat and revitalization priorities while at the same time addressing two of Tallahassee’s most serious stormwater pollution problem areas. The two watersheds that are the focus of the Capital Cascades Greenway project drain an area of 4477 acres. The overall project involves the creation of a greenway corridor with bike/pedestrian trails and includes development of a park and restoration of water features in the Cascades area adjacent

to the downtown business district of Tallahassee, the construction of 5 new park-like areas and a total of 73 acres of open space along the riparian corridor. Other work will involve stabilization of the entire 4.1 miles of highly eroded stormwater channels that traverse the Old St Augustine Branch and the Central Drainage Ditch watersheds.

These improvements, funded gradually by sales taxes, are underway. Several of the new stormwater ponds and wetland areas that have been built are regularly included in the local Audubon chapter’s “hot spots” for bird-watching activities. Once complete, the project will be an example of an urban greenway and park system that also provides stormwater treatment, wildlife habitat, flood control, and urban recreation opportunities. The project will also enhance economic development and property value in the area, and promote exercise and community gatherings.

Tallahassee, like many cities in Florida, has experienced significant growth in recent years. Natural wildlife habitats and waterways have been developed and converted to impervious surfaces at an alarming rate. Over time, economic and environmental interests began to clash, making it difficult for new development or community improvement projects to take place.



Graphics courtesy of City of Tallahassee

The Cascades Park portion of the Blueprint 2000 riparian corridor

2. Cross-train administrators and staff regarding linkage and integration of green infrastructure to other infrastructures. On a project-by-project basis, land development and infrastructure provision are made through the guidance of the local comprehensive plan, capital budgeting processes and implementing land development regulations. Only through purposeful cross-departmental integration can money, time and efficiencies be advanced and wasteful or duplicative actions minimized.

A good example of cross-connection benefits to be gained by having an official underlying green infrastructure framework is the linkages between planning transportation, stormwater and recreation facilities. Money savings, safety and public facilities efficiencies are advanced when development and budgeting review processes are integrated to capture or enhance existing green infrastructure benefits and multi-use facility development. Each local government should examine its existing development review processes (the local planning agency, planning department, city county administrator reviews, etc.) for opportunities to incorporate and build upon the green infrastructure network.

3. Perform a wildlife and habitat assessment and context study. Know what resources you have, where they are located, their extent and their existing or potential linkage to other resources. This involves identifying and mapping landscape and habitat characteristics relative to existing or potential species occurrence and extent (also see Chapter 4 - Data and Analyses Development).
 - Identify and map the existing green infrastructure, noting the historic and current use and condition. Features to include may encompass parks, major water/drainage ways, pedestrian paths, canopy or parkway roads and highways, street trees, existing greenways, mitigation areas and lands under conservation or stormwater easements, cultural resources, etc.

Consider All Species

A basic tenet is always to inventory the habitats present on your land and surrounding lands, so that you know what you have to work with and what species you might expect to be present. Endangered, threatened and other listed species represent wildlife of particular planning interest, nevertheless, focusing just on those species is inadequate. The goal must be planning and managing to prevent wildlife from becoming endangered, threatened or listed and to keep existing common species common.

Use citizen committees to help develop possible green infrastructure components. Just about every community has a variety of un-tapped citizen resources that can contribute if called upon. Neighborhood workshops can be used to establish a vision of creating a wildlife friendly community and develop implementation tools and programs. They can also help build public support and consensus for adoption of wildlife-friendly efforts.

- Identify and map distinctive and environmentally sensitive features, such as ravines, sinkholes, lakes, springs, rookeries, fish nesting areas and wetlands.
 - Identify and map the various wildlife community landscapes types, and both common and protected species habitats types.
 - Identify existing regional and/or neighboring wildlife areas, parks, conservation lands, potential corridors, linkage needs, fire management needs and efforts of adjacent local governments and state and regional entities.
 - Identify and map possible wildlife and habitat integration/enhancement opportunities into transportation and storm-water infrastructure projects and networks. These facilities are often very large budget items which can incorporate multi-use habitat and wildlife enhancements or design features.
4. **Consider preparing a formal resolution or statement of intent.** The local governing body can consider and possibly adopt a resolution supporting the value of a green infrastructure approach. Adoption of such a resolution or statement of intent by local elected officials acknowledges the values of these resources to the community health, safety ecological, recreational and aesthetics services provided. The resolution helps frame a community's intent to understand what green infrastructure ecological resources exist within the jurisdiction and nearby, and what values or ecological services they provide.
 5. **Use citizen committees to help develop possible green infrastructure components.** Just about every community has a variety of un-tapped citizen resources that can contribute if called upon. Neighborhood workshops can be used to establish a vision of creating a wildlife friendly community and develop implementation tools and programs. They can also help build public support and consensus for adoption of wildlife-friendly efforts.
 6. **Develop specific and integrated conservation and management goals, objectives and policies to integrate into the local government comprehensive plan.** Each city and county in Florida adopts a legally-binding comprehensive plan to direct future growth and development. This is the logical place to begin incorporating wildlife-friendly provisions into a community's design. Please remember, however, that any final action to adopt, or not adopt, is always in the hands of elected public representatives.
 7. **Identify and incorporate other appropriate planning tools to develop an integrated habitat network.** These may include large-scale greenway, habitat and wildlife corridor plans, wildlife-friendly community design standards, and community-wide "Dark Skies" ordinances for wildlife-friendly lighting.
- Further, Florida-specific planning tools such as the rural lands stewardship areas, sector plans, or developments of regional impact (DRI) can be applied in a wildlife and habitat attentive fashion. Other important options include the use of buffers to protect sensitive features, conservation subdivisions, clustering and conservation easements. Additionally, incentives for landowners and developers, and development of a local environmental lands acquisition program to fund and leverage funding for significant lands, can be explored. Finally, measures should be incorporated into basic local government permitting and development approval review processes to keep development out of inappropriate areas, such as those prone to recurrent floods, and allow for special needs such as fire to maintain native fire dependent ecological communities.



Photo Courtesy of Joanne Davis, 1000 Friends of Florida

In order to sustain wildlife biodiversity, it is important to develop background data on what wildlife and habitats exist locally (currently as well as historically), and then strive to ensure that the basic wildlife necessities for survival are protected or restored—food, cover, water, reasonably connected living and reproductive space, and limits on disturbances. Successful planning of a wildlife-friendly community relies heavily upon having and utilizing the best available data. This chapter provides information on data needs and analysis tools that can be utilized in planning wildlife-friendly communities.

CONDUCTING A BIRDS-EYE-VIEW ANALYSIS

As discussed throughout this manual, it is vitally important that habitat and wildlife planning decisions be made with a greater than one parcel context in mind, and that viable corridors of passage and patches for living be provided. To identify these relationships, an aerial perspective is important. Several very usable tools are available online that provide aerial views of a community from differing altitudes (scales) and perspectives (see below).

TAKING ADVANTAGE OF GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Data for wildlife and habitat conservation purposes has relevance when it has geographic linkages and relationships. From the outset, anyone pursuing habitat and wildlife conservation should make an investment in GIS. GIS is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. There are a variety of base GIS platforms on the market available for a relatively minimal investment. An industry standard, around which many other supporting products have been developed and marketed, is the Environmental Systems Research Institute, Inc., (ESRI) ArcGIS suite of products.

A GIS is most often associated with maps. A map, however, is only one way to work with geographic data in a GIS, and only one type of product generated by a GIS. A GIS can provide a great deal more problem-solving capabilities than using a simple mapping program or adding data to an online mapping tool. A GIS can be viewed in three ways (adapted from ESRI information): *The Database View*: A GIS is a unique geographic database (geographic database), also known as an "Information System for Geography." Fundamentally, a GIS is based on a structured database that describes an area in geographic terms and allows each point to have multiple attributes. For example, a pine tree (Attribute 1) that has an eagle nest (Attribute 2), that is active (Attribute 3), that has successively produced young (Attribute 4), that is one of several in the area (Attribute 5) can be mapped.

1. *The Map View* – A GIS is a set of intelligent maps and other views that show features and feature relationships on the earth's surface. Maps of the underlying geographic information can be constructed and used as "windows into the database" to support queries, analysis, and editing of the information. This is called geovisualization. Thus, multiple maps of point, polygon (area shapes) or photographic imagery can be layered over one another, and then query and/or

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Reprinted by permission of the artist Bruce Beattie

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SCALE AND BIRDS-EYE-VIEW TOOLS

Google Earth (www.earth.google.com) – Google Earth is a platform for creating, exploring, and visualizing location-specific information. It includes detailed 3D images that can be rotated (to give side-angle perspectives), zoomed, and manipulated to suit visualization needs. *Google 3D Warehouse* provides 3D images of buildings and other 3D content created and shared by Google Sketchup users. Additionally, users can view points of interest and other useful information about localities. Advanced functionality is available for an extra cost.



“mix and match” attribute data can be used to visualize important features.

2. **The Model View** – A GIS is a set of information transformation tools that derive new geographic datasets from existing datasets. These geoprocessing functions take information from existing datasets, apply analytic functions, and write results into new derived datasets. The newly derived data sets can be displayed using the GIS map and data views to improve understanding and planning functionality. In other words, by combining data and applying some analytic rules, the user can create

Microsoft’s Virtual Earth (www.microsoft.com/virtualearth/default.msp) – The Virtual Earth platform is an integrated set of services that combines unique bird's eye, aerial, and 3D imagery with mapping, location and search functionality. Advanced functionality is designed for government and development users and is available for an extra cost.



a model that helps answer the question that has been posed.

Together, these three parts of an intelligent GIS are used at varying levels in all GIS applications. For a community or land manager involved in habitat and wildlife planning, a GIS is critical. Once in place, the next logical step is to acquire various data layers and proceed with a general landscape analysis and then an ecological inventory to measure ecological status of remaining or restorable habitats and wildlife. Basic data layers such as land cover and land use, some species data, topographic and hydrogeologic data, and aerial imagery are generally available.

WILDLIFE AND HABITAT INFORMATION AND ANALYSES SERVICE PROVIDERS

Many available sources of data are at hand for Florida communities.

The Florida Natural Areas Inventory (FNAI) (www.fnai.org)

– FNAI is associated with Florida State University, and provides services related to ecological inventories, biodiversity analyses, Geographic Information Systems analyses, and other data related services. It provides these services to governments, developers, and other entities wishing to obtain the sorts of useful spatial and biological information that will allow for better wild-life planning. For more information, visit the website or call (850) 224-8207.

- **Biodiversity Matrix (www.fnai.org/biointro.cfm)** – The Biodiversity Matrix Map Server is an online screening tool from FNAI that provides immediate, free access to rare species occurrence information statewide. This tool allows the user to zoom to a site of interest and create a report listing documented, likely, and potential occurrences of rare species and natural communities. The FNAI Biodiversity Matrix offers built-in interpretation of the likelihood of species occurrence for each one-square-mile Matrix Unit across the state. The report includes a site map and list of species and natural communities by occurrence status: Documented, Documented-Historic, Likely, and Potential.
- **Standard Data Report** – FNAI provides detailed natural resource information for individual sites. This is a site-specific report that includes an 8.5" by 11" color map of the site and surrounding area, and lists of detailed natural resource information. The report includes rare plant and animal species, high-quality natural communities, conservation lands, land acquisition projects, potential habitat for rare species, and Potential Natural Areas. The report is available as

a paper hardcopy or an electronic PDF file. Requests are generally processed within 5 working days.

- **GIS Data** – FNAI maintains a variety of natural resource GIS data, including rare species occurrences, conservation lands, land acquisition projects, natural communities and other statewide natural resource data used to inform state conservation planning efforts such as the Florida Forever program and the FWC Cooperative Conservation Blueprint. Much of these data are available on the FNAI website; more information may be available by contacting FNAI.
- **Ecological Surveys** – FNAI performs ecological surveys to target specific inventory needs of local governments. Inventory scientists meet with local governments to discuss their greatest inventory needs, and select sites of highest priority based on those needs. Expert botanists, zoologists, and ecologists on staff perform field surveys for a wide range species in Florida. Surveys range from individual managed areas to comprehensive county inventories, and may include a variety of maps and data in paper and electronic format.

Geo-Facilities Planning and Information Research Center (GeoPlan) (www.geoplan.ufl.edu/project.html)

– Similar to FNAI, GeoPlan was established in 1984 in the Department of Urban and Regional Planning at the University of Florida's College of Design, Construction and Planning. The Center was developed as a GIS research and development lab that has completed contracts involving the marriage of GIS and environmental data and research of varied sorts. In addition to contracting with national and state agencies, GeoPlan also contracts with local and regional governments on specialized projects.

GeoPlan's Florida Geographic Data Library (FGDL)

and map server (www.fgdli.org) provides a mechanism for collecting and distributing spatial Geographic Information Systems (GIS) data statewide. The database is warehoused and maintained at the University of Florida's GeoPlan Center and is organized by county and state. There are many GIS data layers in the FGDL, including data on land use, hydrology, soils, transportation, political boundaries, environmental quality, conservation, census data, and more. Data is available for download free of charge from the FGDL Metadata Explorer or FTP site. FGDL Metadata Explorer is continuously growing and new data layers are added as they become available. Data is also available for purchase on CD-ROM and DVD.

The Florida Fish and Wildlife Conservation Commission, Cooperative Conservation Blueprint (CCB)

– The CCB represents an effort to combine existing conservation priority data from a range of sources into a single, agreed upon, and unified blueprint. It will unify existing terrestrial conservation modeling efforts into a single GIS application, which will be available to the public via an online searchable application. The goal of this effort is to identify important conservation areas in Florida. The database will incorporate data from FNAI, GeoPlan, FWRI and others to identify important conservation areas, working landscapes, water resources, and development areas. In addition to creating a single, unified and updated GIS database, this project seeks to more effectively incorporate social and economic factors in planning for conservation in Florida. The CCB is an ongoing process, regularly updated by local and state government, stakeholder, public, and conservation organizations as conditions change or other conservation activities are successfully completed. By continually updating the CCB, it is intended that wildlife and habitat conservation efforts be more concentrated on high

WILDLIFE AND HABITAT INFORMATION AND ANALYSES SERVICE PROVIDERS (continued)

priority areas and be flexible in adapting to Florida's changing landscape and land use.

Florida Fish and Wildlife Conservation Commission (FWC), Fish and Wildlife Research Institute (FWRI) (www.research.myfwc.com/) – The Fish and Wildlife Research Institute's work includes assessment and restoration of ecosystems and studies of freshwater and marine fisheries, aquatic and terrestrial wildlife, and imperiled species. Additionally, it deals with spatial analysis, biostatistics and modeling, wildlife forensics, and socioeconomic research. Below are descriptions of some of the relevant datasets available from the FWRI, all of which are either available in raster or shapefile format. All data described can be obtained from the FWRI website or by sending a written request. The FWC will also respond to requests from the public to produce digital maps of the vegetation type, wildlife occurrence, SHCA, and IWHRS values. All data described can be obtained from the FWRI website (<http://research.myfwc.com/>) or by sending your request to gisrequests@myfwc.com.

- **Strategic Habitat Conservation Areas (SHCA)** (Endries et al 2008) – SHCA are lands identified by the FWC that need some form of conservation protection to maintain viable populations of wildlife to preserve biodiversity. SHCA are areas of high ecological significance and a priority for conservation protection.
- **The Integrated Wildlife Habitat Ranking System (IWHRS)** (Endries et al. 2008) – The IWHRS is an assessment tool that collects a large diversity of available wildlife and landcover datasets and presents the information in an easy to interpret format. The IWHRS uses a wide variety of landcover and wildlife data (including SHCA, listed species locations and richness,



Land cover and vegetation in the Lake Apopka and Wekiva areas of Central Florida. The orange in the upper left is the sand hill pine and scrub of the Ocala National Forest; the red and brown in the lower left are cypress and hardwood wetlands of the Green Swamp; the brown in the central area of the figure the rich forested wetlands of the Wekiva system; and, the grey and white are more developed areas.

roadless patch size, habitat connectivity, and more) to rank the landscape of Florida based upon the habitat needs of wildlife. By simply overlaying a property boundary on the IWHRS map, one can visually identify any lands of significance. For those with full GIS capabilities, one can obtain an average property value, query the individual layers to identify how the individual components of the IWHRS rank in and around a site, and recalculate the IWHRS by adding or removing layers the user feels should or should not be included in the assessment.

Photo Courtesy of Florida Fish and Wildlife Conservation Commission

- **The FWC 2003 Landcover Map** (Stys et al. 2004) – The FWC 2003 landcover map can be used to identify and estimate vegetative cover by category. The landcover map contains 43 vegetation and land cover types, including 26 natural and semi-natural vegetation types, 16 types of disturbed lands (such as agriculture, urban, and mining), and one water class.
- **Wildlife Potential Habitat Maps** – If individual wildlife species are of concern, the FWC maintains individual species potential habitat maps that could be used to identify if any potential habitat is associated with an area of interest.
- **Biodiversity Hotspots** – A measure of biodiversity created by overlaying all potential habitat maps over one another to create an additive calculation, also newly created and released in 2007.
- **Species Location Records** – Includes panther and bear telemetry and road kill data, nuisance bear data, bald eagle nests, and others
- **Rare Fish Species Locations** – Locations of rare and imperiled freshwater fish species populations are provided.
- **Priority Wetlands** – Provides identification of priority wetlands based on the number of wetland dependent and associated species.
- **Quick Maps** – Quick Maps are Google Earth files that contain FWRI data layers. They represent data layers that are the most requested from the public.
- **Florida's Imperiled Species (www.myfwc.com/imperiled-species/)** – Florida Fish and Wildlife Conservation Commission's Imperiled Species page includes management plans, lists of imperiled species,

permitting information, etc. This source offers information for only a certain limited number of species that have been identified as imperiled in the State of Florida.

Florida Department of Environmental Protection (DEP) (www.dep.state.fl.us/gis/) – The DEP has online collections of spatial data that can be useful in the planning process. Two of the more pertinent available databases include the GeoData Directory and the Geospatial Resource Index.

- **GeoData (GIS) Directory (www.dep.state.fl.us/gis/datadir.htm)** – The GeoData Directory is an online database of GIS layers available from DEP. This includes land use/ land cover layers as well as myriad other resources including data on habitat, water bodies, mines, geology, elevation, and brownfields. More generalized GIS information is available at: www.dep.state.fl.us/gis/
- **Geospatial Resource Index (www.ca.dep.state.fl.us/GRIsearch/index.jsp)** – The Geospatial Resource Index is the Department’s central database for searchable maps and spatial data. The site offers a wide selection of maps ranging from interactive scientific watershed data to identifying recreational canoe trails throughout the state. Searching by title, program area or keyword, the Index provides easy, hands-on access to detailed Department-related maps.
- **Land Boundary Information System (LABINS) (www.data.labins.org/2003/)** – The Land Boundary Information System (LABINS) began in 1984 as a means for distributing survey-related data that is maintained by federal and state agencies to the general surveying community. Today LABINS is a store-house for survey data and provides access to County level GIS data, National Wetland Inventory maps, and Digital Orthographic Quarter-Quads

(DOQQ), and allows the user to search for data by location. LABINS is sponsored by the Florida Department of Environmental Protection, Division of State Lands, Bureau of Survey and Mapping.

Florida Department of Transportation (DOT) (www.dot.state.fl.us/planning/statistics/gis/default.htm) – Florida’s system of roads and highways has a significant impact on where and how we plan for wildlife. New roads may encourage development and perhaps sprawl in areas that were once natural. Therefore it is important not only to know what roads exist in an area, but also what roads are scheduled for maintenance, widening, and/or creation. The web site includes significant amounts of transportation related data.

Water Management Districts – Florida’s five Water Management Districts each have data of varying degrees of usefulness to planners and citizens interested in wildlife-friendly communities. Below is a breakdown of some of the more pertinent data sources available online. Additional information can be obtained by contacting the Districts.

- **Southwest Florida Water Management District (SWFWMD)**
 - ♦ GIS Catalog, District maps, etc. (www.swfwmd.state.fl.us/data/) – Check out the “Physical Dense” option which includes land use/ land cover layers, wetlands, soils, and topography layers.
- **St. Johns River Water Management District (SJRWMD) (www.sjrwmd.com/programs/plan_monitor/gis/gis.html)** – Index of downloadable GIS data.
- **South Florida Water Management District (SFWMD)** – GIS and Maps catalog www.spatial1.sfwmd.gov/sfwmdxwebdc/dataview.asp
- **Northwest Florida Water Management District**



Photo Courtesy of David Moynahan Photography

(NFWWMD) (www.nfwmd.state.fl.us/pubsdata.html) – For more information, contact the NFWWMD at (850) 539-5999.

- **Suwannee River Water Management District (SRWMD) (www.srwmd.state.fl.us/)** – For specific information regarding available data, contact the SRWMD at (386) 362-1001.

Natural Resources Conservation Service – Soil data is available from the below sites.

- **US General Soil Map (STATSGO) – www.ncgc.nrcs.usda.gov/products/datasets/statsgo/**
- **Soil Survey Geographic (SSURGO) Database – www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/**

National Wetlands Inventory (www.fws.gov/nwi/) – Provides geospatially referenced information on the status, extent, characteristics and functions of wetland, riparian, deepwater and related aquatic habitats in priority areas to promote the understanding and conservation of these resources.

The mission of The Florida Natural Areas Inventory (FNAI) is to collect, interpret, and disseminate ecological information critical to the conservation of Florida's biological diversity. FNAI continually builds and maintains a comprehensive database of the biological resources of Florida, which includes more than 28,000 Element Occurrences of rare plants and animals, and high-quality natural communities.

PERFORMING AN ECOLOGICAL INVENTORY

One of the most important steps in planning for a wildlife-friendly community is to conduct an inventory and to create a baseline data set of existing and potentially restorable habitats and wildlife. Such a wildlife and habitat study should seek to identify and map landscapes and habitat characteristics, species occurrence and extent as well as basic topographic, drainage and general hydrogeologic characteristics. The following general steps may be used as a guide for conducting an ecological inventory.

Query the databases of the Florida Natural Area Inventory – The mission of The Florida Natural Areas Inventory (FNAI) is to collect, interpret, and disseminate ecological information critical to the conservation of Florida's biological diversity. FNAI continually builds and maintains a comprehensive database of the biological resources of Florida, which includes more than 28,000 Element Occurrences of rare plants and animals, and high-quality natural communities. For each occurrence, FNAI documents information on location, observation date, habitat description, details about the condition of the occurrence, and source information.

FNAI can develop lists, maps and assessments of species that occur or are likely to occur in a community. FNAI will generate a list of potential rare species occurring in a jurisdiction or on a parcel of land, and will recognize exemplary natural areas or rare species locations. FNAI can develop predictive range maps for various species that incorporate assumptions about possible restorative scenarios or different land development options. The Florida Natural Areas Inventory is a non-profit organization administered by Florida State University; it is part of The Florida Resources and Environmental Analysis Center (go to FREAC at: www.freac.fsu.edu/).

Identify significant natural areas – Significant natural areas in a community can be identified and digitized using 2004 Digital Ortho Quarter Quads (DOQQs) or other imagery, FNAI's

Potential Natural Area data layer, and the Water Management District Florida Land Use Cover Class System (FLUCCS).

The definition of a significant natural area may vary from community to community. Expertise from qualified biologist/ecologists is recommended to help define, identify and interpret significant natural areas. The following is an example of how such areas might be identified within a county. Using ArcGIS, delineate and digitize any site greater than 40 acres that appears natural on the aerial photographs. Additionally, designate smaller sites if they contain an Element Occurrence (EO) from the FNAI Database, and if the site appears to provide habitat for the element. Include Managed Areas (MA), according to the FNAI Conservation Lands Database, as significant natural areas.

Prepare a natural community map – A natural community is defined as a distinct and reoccurring assemblage of populations of plants, animals, fungi and microorganisms naturally associated with each other and their physical environment. For practical purposes these may be thought of as habitat types. A guide to the natural communities of Florida may be found on the FNAI website at (www.fnai.org/PDF/Natural_Communities_Guide.pdf).

A basic natural community map can be generated in GIS with minimal effort using Florida Land Use, Cover, and Forms Classification System (FLUCCS) polygons or the FWC vegetation layer. For a more detailed and accurate assessment of natural communities, additional steps requiring ecological expertise are recommended:

1. Digitize preliminary natural community polygon boundaries using Florida Land Use, Cover, and Forms Classification System (FLUCCS) polygons overlaying 1995, 1999, and/or 2004 infra-red Digital Ortho Quarter Quads (DOQQs), high resolution aerial photography, USGS 7.5 minute topographic quadrangles, and Soil Conservation Service soil maps.

2. Ground-truth the polygons drawn in the preliminary natural community maps and collect data within representative areas of the polygons describing community structure, species composition, threats, management concerns, and landscape context. Correct the preliminary natural community polygons based on field observations.

Conduct additional field surveys for rare species and invasive exotic species – An essential component of protecting Florida's unique biodiversity is knowing where those species and habitats are located. A systematic survey for rare plants and animals will help fill in gaps, update old records, and put natural areas in context relative to each other. Examples of data recorded at rare species occurrences are size of population, phenology, threats, condition, landscape context, and associated species. It is also important to map and control invasive non-native plants that displace native plants and animals, change the structure of natural communities, or affect adversely the ecological functions of our ecosystems.

A comprehensive inventory is critically important for prioritizing natural areas and managing lands appropriately. These surveys should be performed by professional biologists with survey experience. The results of any species surveys should be submitted to the FNAI for entry into the statewide database.

DEVELOPING ECOLOGICAL SCORING CRITERIA AND A SCORING SYSTEM

For most purposes, (e.g., a community working to develop its green infrastructure or a landowner of a large parcel looking to develop portions of his or her property) an ecological-based approach to prioritizing significant natural areas is an important analysis to be performed. Examples of criteria could be but are not limited to, size of property, condition of natural communities present, presence of rare species, presence of exotic invasive

species, and landscape context. Each criterion may be prioritized based on importance. A scoring system (for example, very high, high, medium, low or a numerical system) can be developed and vetted prior to initiation. A variety of methodologies and related software packages are available but professional expertise should be sought to help craft these ecological scoring criteria and scoring systems.

CHOOSING FROM A GROWING LIST OF ANALYSIS AND MAPPING TOOLS

There are a number of software programs available to help communities or land owners evaluate wildlife habitat and develop a local decision support system (DSS) that integrates conservation information with land use patterns and policies to provide planners and resource managers with tools to help manage their natural resources. These tools can help to summarize the conservation value of multiple elements across the planning area, allowing identification of locations that should be conserved as well as locations that are less important for conservation. These tools can help generate a set of proposed conservation areas to help meet conservation goals.

Programs are now available that allow local users to insert, query, update, and delete geographical features and the data associated with them from standard Web browsers. As a community moves forward to identify, map and develop its green infrastructure and pursue wildlife-friendly planning and design strategies, getting professional expertise is recommended. In Florida there are numerous consulting biological/engineering firms and governmental, quasi-governmental or not-for-profit organizations that are familiar with the available data and analyses tools that can assist (e.g., the FFWCC, FNAI, TNC, local biological and land planning firms). It includes some of the planning and analysis tools that have been developed.

A comprehensive inventory is critically important for prioritizing natural areas and managing lands appropriately. These surveys should be performed by professional biologists with survey experience. The results of any species surveys should be submitted to the FNAI for entry into the statewide database.

MAPPING AND ANALYSIS TOOLS

Ecosystem-Based Management (EBM)

(www.ebmtools.org/) – The EBM Tools Network is an alliance of EBM tool developers, practitioners, and training providers to develop EBM tools and support their use. EBM tools are software or other highly documented methods that can help communities implement an ecosystem services and green infrastructure planning approach by:

- Providing models of ecosystems or key ecosystem processes.
- Generating scenarios illustrating the consequences of different management decisions on natural resources and the economy.
- Facilitating stakeholder involvement in planning processes.

EBM tools include data collection and management tools; data processing tools; conceptual modeling tools; modeling and analysis tools (such as watershed models, marine ecosystem models, dispersal models, habitat models, socioeconomic models, and model development tools); scenario visualization tools; decision support tools (such as coastal zone management tools, fisheries management tools, conservation and restoration site selection tools, land use planning tools, and hazard assessment and resilience planning tools); project management tools; stakeholder communication and engagement tools; and monitoring and assessment tools.

Nature Serve Vista – This is a grouping of software products that integrates conservation planning with socioeconomic factors such as current and proposed land use, management practices, and threats, allowing

an evaluation of the compatibility of various land use plans or management practices with the elements that needing conservation. It also facilitates evaluating whether or not adequate policies are in place to ensure that compatible land uses or management practices remain compatible over time. The program will help access site-level information and generate development planning and mitigation plans that result in alternative land use and management plans that better meet a community's conservation goals.

For example, NatureServe Vista could assist with evaluating the compatibility of various land use scenarios or management regimes for species, ecological systems, and places needing conservation. The programs help manage projects and planned development for an area through including initial analysis, planning, implementation, and monitoring. FNAI is a member of NatureServe and is the primary contact for NatureServe Vista users in Florida.

Marxan – This program provides decision support to conservation planners and local experts identifying efficient portfolios of planning areas that combine to satisfy a number of ecological, social and economic goals. It is readily available via the Internet at no cost. It is a stand-alone program that requires no other software to run, although a GIS is required to prepare the data, make the input files, and view the results. It is designed to help automate the planning process so that a team of planners can offer many different conservation plan scenarios. It can be used to offer planning scenarios that are alternatives to pre-conceived patterns of reserve or conservation area networks. It can also be used to offer alternatives and solutions where the

input of local stakeholders is highly valued and a compromise with prospects for achievable results is sought. A pattern of priority sites that satisfy explicit quantitative biodiversity goals can be identified that are of low political or social pressure, or where resources necessary to implement conservation strategies or threat abatement are forecast to be lower.

Conservation Land-Use Zoning software

(CLUZ) – CLUZ is an ArcView GIS interface that allows users to design protected area networks and conservation landscapes. It can be used for on-screen planning and also acts as a link for the Marxan conservation planning software. It was developed at Durrell Institute of Conservation and Ecology (DICE) and is funded by the British Government. CLUZ allows ArcView to import, analyze and display Marxan data. It also allows the user to explore the spatial data and interactively modify the conservation landscape plan. The three main ways that CLUZ can be used to develop these conservation land use plans are:

- Using Marxan to identify near-optimal combinations of planning units that meet specified conservation targets and attributes.
- Using Marxan to record the number of times that each unit is selected in each of the different runs. This number acts as an “irreplaceability” score, so that units that are selected in every run could be considered irreplaceable or of particularly high wildlife value. CLUZ can display these scores and the resultant maps are valuable for conservation planning because they give a value for each unit, rather than showing a unit as either being part or not part of the most efficient solution.

- Using CLUZ to interactively create and modify existing conservation plans by interactively adding and removing units. These interactive functions automatically update information on how the selected units meet the conservation targets. CLUZ can also be used to display the distribution of each biodiversity element and to identify suitable units for swapping with selected units that are in unsuitable locations.

Protected Areas Network Design Application for ArcGIS (PANDA) – PANDA is a stand-alone application developed to provide a user-friendly framework for systematic protected areas network design for ArcGIS users. Through the use of PANDA, different hypothetical configurations of a system of protected areas in the planning landscape can be explored. Conservation goals and associated costs of each scenario are based on the available data and knowledge. The designer can edit the scenario by interactively modifying the status of the planning units among four managed area categories (Included, Protected, Available and, Excluded). A target table is provided to see the resulting changes in conservation goals of a particular scenario and the associated costs. PANDA allows interacting with the software Marxan. The user can use PANDA main interface to refine Marxan solutions. Conservation features distribution, the cost, and the Marxan irreplaceability score can be easily mapped. Auxiliary tools involved in systematic conservation network design, including a tool to generate a grid of management units of the desired shape and size and an easy interface to add new conservation features and targets, can be employed.

The Habitat Priority Planner (HPP) – A new tool from the National Oceanic and Atmospheric Administration, Coastal Services Center was designed with the local planner, coastal conservation group, and coastal manager in mind. HPP is

a spatial decision support tool designed to assist users in prioritizing important areas in the landscape or seascape for conservation or restoration action. The Habitat Priority Planner (HPP) is a toolbar for the Environmental Systems Research Institute's ArcGIS. What makes this tool unique is the ease with which the scenarios can be displayed and changed, making this a helpful companion when working with a group. In addition to the scenarios, the tool also generates pertinent reports, maps, and data tables.

HPP is composed of three modules: Habitat Classification, Habitat Analysis, and Data Exploration. The tool calculates basic ecological statistics that are used to examine how habitats function within a landscape. The tool pre-packages several useful ecological metrics into a user friendly interface to serve intermediate GIS users. In addition, HPP allows the user to interactively build queries using a graphical interface to demonstrate criteria selections quickly in a visual manner that is useful in stakeholder interactions. Possible applications include:

- Screening-level assessments of habitat for habitat restoration, land conservation, and general resource planning.
- Assessing and inventorying site-specific issues and conditions.
- Utilizing interactive mapping and prioritization.
- Providing spatial support to natural resource strategic planning efforts.
- Identifying and ranking potential restoration and conservation sites.
- Analyzing “what if” scenarios for proposed changes in land use or land cover.
- Creating maps, reports, and data tables.

PANDA is a stand-alone application developed to provide a user-friendly framework for systematic protected areas network design for ArcGIS users.

CLIP is sponsored by the Century Commission for a Sustainable Florida. CLIP is a cooperative effort of the Florida Natural Areas Inventory, Florida State University; GeoPlan Center, University of Florida; and, the Florida Fish and Wildlife Conservation Commission to develop a scientifically-sound and transparent process to identify Florida's "must save" environmental treasures and critical green infrastructure. The goal of CLIP is to develop, with a broad technical advisory group and through phases, the best available planning tool to inform the state's decision-making in envisioning – and ensuring – a sustainable future.



Photo Courtesy of David Moynahan Photography

CONSULTING ADDITIONAL STATE AND REGIONAL WILDLIFE AND HABITAT DATA SOURCES

In addition to obtaining data related to habitat and wildlife in an area, there are always other sorts of information that are needed in the planning process. In the X box are some examples of important ancillary data sets that should be consulted to obtain a complete picture of the area being planned.

ADDITIONAL STATE AND REGIONAL WILDLIFE AND HABITAT DATA SOURCES

Archbold Biological Station (www.archbold-station.org/abs/index.htm) – This independent, non-profit research facility in Lake Placid, Florida, is devoted to long-term ecological research and conservation. The station fosters long-term ecological research on native plants and animals of central Florida, especially along the Lake Wales Ridge.

Critical Lands/Waters Identification Project (CLIP) – CLIP is sponsored by the Century Commission for a Sustainable Florida. CLIP is a cooperative effort of the Florida Natural Areas Inventory, Florida State University; GeoPlan Center, University of Florida; and, the Florida Fish and Wildlife Conservation Commission to develop a scientifically-sound and transparent process to identify Florida's "must save" environmental treasures and critical green infrastructure. The goal of CLIP is to develop, with a broad technical advisory group and through phases, the best available planning tool to inform the state's decision-making in envisioning – and ensuring – a sustainable future. CLIP follows a combined approach of layering and assessing differing resource data in a rules-based geographic overlay environment. CLIP offers a decision support tool linked to a spatial database that can help to identify important areas for conservation, biodiversity, landscapes, water, and valuable ecosystem services.

East Gulf of Mexico Coastal Conservation Corridor Project (www.egmccc.org) – The East Gulf of Mexico Coastal Conservation Corridor Project is a partnership of local, regional, state, and federal government agencies as well as non-profit groups working together to establish a comprehensive natural resource and planning GIS data-

base. This database will be used to help identify, create, and manage a conservation corridor system of various habitats in peninsular Florida to maximize the effectiveness of conservation lands in the region. The U.S. Fish and Wildlife Service provided funding for the project and The Nature Conservancy was contracted to coordinate the project.

EPA Southeastern Ecological Framework Project (www.geoplan.ufl.edu/epa/index.html) –

The Southeastern Ecological Framework Project is a GIS-based analysis project to identify ecologically significant areas and connectivity in the southeast region of the U.S. The states included in the project are Florida, Georgia, Alabama, Mississippi, South Carolina, North Carolina, Tennessee and Kentucky. The resulting product of the study can be utilized by state, local and private entities in addressing regional ecological connectivity and other environmental resource allocation issues.

Florida Biotic Information Consortium (www.palmm.fcla.edu/lfnh/related/fbic/FBICdatabases.html) –

This is an integrated statewide environmental database on Florida animals, plants, habitats and ecosystems that accesses bibliographic information from the state university libraries, bibliographic information from a customized bibliography created from comprehensive reference sources, full text database comprising 200 publications, and specimen information from the Florida Museum of Natural History records.

Florida Coastal Everglades (FCE) Program

(www.fce.lternet.edu/) – The FCE is part of the Long Term Ecological Research (LTER) Network established by the National Science Foundation in 1980. The FCE LTER program was established in May of 2000 in south

Florida, where a rapidly growing population of over 6 million people live in close proximity to—and in dependence upon – the Florida Everglades.

Florida Geological Survey (FGS)

(www.dep.state.fl.us/geology/) – Established in 1907, the FGS provides information and interpretive data dissemination for geology and earth science related information to governmental agencies, land-use planners, environmental and engineering consultants, mineral owners and exploration companies, industry, and the public. Program outreach related to earth science education and the prehistoric development of our state is also provided to the public and educators.

Florida Museum of Natural History Collections/Databases (www.flmnh.ufl.edu/sitemap.htm) –

Located at the University of Florida in Gainesville, the Florida Museum of Natural History is Florida's state museum of natural history, dedicated to understanding, preserving and interpreting biological diversity and cultural heritage. A variety of biological data bases and species specimen collections are available.

Forest Inventory and Analysis National

Program (www.fia.fs.fed.us/) – The Forest Inventory and Analysis (FIA) Program of the U.S. Department of Agriculture (USDA) Forest Service provides the information needed to assess America's forests. The Forest Inventory Data Online (FIDO) and the FIA Program collects, analyzes, and reports information on the status and trends of America's forests: how much forest exists, where it exists, who owns it, and how it is changing, as well as how the trees and other forest vegetation are growing and how much has died or has been removed in recent years.

GeoCommunicator

(www.geocommunicator.gov/GeoComm/index.shtml)

– GeoCommunicator is sponsored by the Bureau of Land Management and the US Forest Service. As an integral part of the National Integrated Land System (NILS), GeoCommunicator is designed to provide geospatial data and products from NILS to the public. GeoCommunicator facilitates the sharing of geographic data among federal, state, local, and private individuals and organizations interested in providing the public with national data sets including: Land and Mineral Use Records, Federal Land Stewardship and Land Survey Information System.

Habitat Management Plans for Existing

Conservation Lands – Habitat Management Plans are prepared by federal, state, regional, or local agencies that own or manage natural areas such as forests, parks, and conservation easements. State land management plans are guided by Section 253.034, F.S. The purpose of these documents is to prescribe a plan for the management and stewardship of the natural resources associated with that property. Habitat Management Plans may list what land uses are allowed (i.e. logging, agriculture, etc.); identify management mechanisms for the land (i.e. prescribed burning, etc.); and/or prescribe restoration measures that are needed on the land amongst other considerations.

Habitat Management Plans may be useful in the decision-making process and typically include information on habitats, species, approved and prohibited uses, and other various information depending on the purpose for which the plan was developed. As an example, planners and affected citizens could determine if a protected area

ADDITIONAL STATE AND REGIONAL WILDLIFE AND HABITAT DATA SOURCES (continued)

in the vicinity is managed with prescribed fire, which could have a bearing on where certain sorts of infrastructure, such as airports or hospitals, are built. Below is information on how to locate some of these plans.

- **DEP-Division of State Lands** – The Division of State Lands is a repository for management plans developed for state lands that are managed by a wide range of agencies and entities. They are particularly responsible for Management Plans for lands managed or owned by the Board of Trustees of the Internal Improvement Trust Fund. It should be noted that all lands under State lease have to do a management plan, but they may not all have a conservation purpose in mind. Currently these plans are not available online, but copies can be requested from the Division of State Lands at (850) 245-2784.
- **Florida Fish and Wildlife Conservation Commission** (www.myfwc.com/wma-planning/) – FWC refers to their Plans as Conceptual Management Plans which are created for FWC's Wildlife Management Areas.
- **Department of Agriculture and Consumer Services, Division of Forestry** – The Division of Forestry produces ten-year Resource Management Plans for their lands. Currently these plans are not available online. To obtain a copy one must submit a Request for Duplication of Records to DOACS. For questions call the Forest Management Bureau at (850) 488-6611.
- **Water Management Districts** – The Districts produce Land Management Plans for their properties. They often have good biological background information. Management plans may be obtained by contacting the respective Districts.

National Biological Information Infrastructure (www.nbio.gov) – The NBII links diverse, high-quality biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry.

Non-indigenous Aquatic Species Data Set (www.nas.er.usgs.gov/) – This site has been established as a central repository for accurate and spatially referenced biogeographic accounts of non-indigenous aquatic species.

Ordway-Swisher Biological Station (www.flmnh.ufl.edu/herbarium/) – The station is a year-round biological field station established for the long-term study and conservation of unique ecosystems through management, research, and education. It is managed for the University of Florida by the UF/IFAS Department of Wildlife Ecology & Conservation.

Statewide Endangered and Threatened Plant Conservation Program (www.fl-dof.com/forest_management/plant_conservation_index.html) – The Florida Plant Conservation Program works to restore and maintain existing populations of listed plants on public and private lands managed for conservation.

Tall Timbers Research Station and Land Conservancy (www.talltimbers.org/mandph.htm) – The mission of Tall Timbers is to foster exemplary land stewardship through research, conservation and education. Its primary research focus is the ecology of fire and natural resource management.

UF/IFAS Center for Aquatic and Invasive Plants (www.aquat1.ifas.ufl.edu/) – This multidisciplinary research, teaching and extension unit focuses on management of aquatic and natural area weed species and coordinating aquatic plant research activities within the State of Florida.

University of Florida Herbarium (FLAS) (www.flmnh.ufl.edu/herbarium/) – The University of Florida Herbarium is a unit of the Department of Natural History of the Florida Museum of Natural History. The UF Herbarium's collection databases and image galleries provide interactive, virtual access to fragile collections. The specimen based images are associated with label information in the collection catalog with data on habitat, flowering and fruiting period, frequency, and distribution. A common name search tool provides a walkway to the scientific names used in the catalogs.

U.S. Geological Survey operates the Biological Resources Discipline (BRD) and works with others to provide the scientific understanding and technologies needed to support the sound management and conservation of our Nation's biological resources. The Survey also offers the Florida Integrated Science Center (FISC at: <http://fisc.er.usgs.gov/>) which has a special mission to provide USGS science to Florida, the Southeastern States, the U.S. Caribbean, and elsewhere in the world. Some of the resources include:

- Earth Resources Observation and Science (EROS) <http://edc.usgs.gov/>
- Earth Resources Observation and Science (EROS), Seamless Data Distribution System <http://seamless.usgs.gov/>



Photo Courtesy of Joanne Davis, 1000 Friends of Florida

The comprehensive plan is the community's legal instrument which provides the foundation for developing programs, actions and specific land development regulations needed to protect sensitive resources. The comprehensive plan contains interrelated "elements" that deal with issues such as intergovernmental coordination, future land use, conservation, recreation and open space, sanitary sewer, potable water, stormwater management, natural ground water aquifer recharge, and capital improvements.

Many Florida-specific planning tools are available to assist with developing green infrastructure which support wildlife-friendly communities. First and foremost, each municipality and county government in Florida is required to develop a local comprehensive plan to guide the way the community grows and develops. There are numerous opportunities to integrate wildlife-friendly concepts into this fundamental planning tool. Additionally, there are other opportunities afforded by such Florida planning initiatives as developments of regional impact, rural land stewardship areas, sector plans, and other programs. This chapter provides an overview of these major planning approaches unique to Florida.

THE LOCAL COMPREHENSIVE PLAN

Local governments in Florida have abundant authority to protect and sustain wildlife habitats by virtue of home rule powers and planning authorities under Chapter 163 Part II, Florida Statutes – the Growth Policy; County and Municipal Planning; Land Development Regulation Act. The local comprehensive plan is intended to:

...provide means to preserve, promote, protect, and improve the public health, safety, comfort, good order, appearance, convenience, ... prevent the overcrowding of land and avoid undue concentration of population; facilitate the adequate and efficient provision of transportation, water, sewer, schools, parks and recreational facilities, housing, and other requirements and services; and conserve, develop, utilize, and protect natural resources within their jurisdictions. (Chapter 163, Part II F.S.)

The comprehensive plan is the community's legal instrument which provides the foundation for developing programs, actions and specific land development regulations needed to protect sensitive resources. The comprehensive plan contains interrelated "elements" that deal with issues such as intergovernmental coordination, future land use, conservation, recreation and open

space, sanitary sewer, potable water, stormwater management, natural ground water aquifer recharge, and capital improvements. These elements include specific goals, objectives and policies that outline how the local government will pursue its goals. Each local government must also adopt a future land use map that shows the "proposed distribution, location and extent of the various categories of land" included in its local comprehensive plan.

Under the law, local government land use decisions must be consistent with the adopted comprehensive plan and future land use map. The comprehensive plan provides the basis for developing and adopting specific land development regulations, programs, best management practices and land stewardship arrangements.

Rule 9J-5 of the Florida Administrative Code provides more detailed interpretation of the planning requirements found in Chapter 163, Florida Statutes. Both Chapter 163 and Rule 9J-5 emphasize the importance of planning for natural living assets and environmentally sensitive features. Required plan elements such as the Future Land Use, Conservation, Coastal and Recreation and Open Space underscore the importance of planning toward sustaining habitat, wildlife and environmentally sensitive features. Further, Florida's land planning agency, the Department of Community Affairs, is directed to take into consideration the existence of natural resource features of the local area when assisting local governments and applying Rule 9J-5 in specific situations.

Following are two ways to use the local comprehensive plan to better protect wildlife habitat.

Minimum 9J-5 Requirements with a Wildlife Focus – Rule 9J-5 requirements related to wildlife are dispersed through multiple plan elements. Those elements that emphasize wildlife to the greatest degree are the Future Land Use and Conservation Elements, and also the Coastal Management Element in coastal counties.



Cow-Nosed Rays Photo Courtesy of Jeffrey Pennington



Manatees Photo Courtesy of Carrie Wenger and the Florida Wildlife Federation

As an example, the Conservation Element promotes conservation, use and protection of natural resources, requiring that the following natural resources be identified and analyzed:

- Rivers, lakes, wetlands including estuarine marshes, and ground water and air including the quality of the resource.
- Floodplains.
- Areas known to have experienced soil erosion problems.
- Areas that are the location of recreationally or commercially important fish or shellfish, wildlife, marine habitats and vegetative communities including forests; indicating dominant species present and species listed as endangered, threatened or of special concern.

For each of these resources “the potential for conservation, use or protection shall also be identified.” Rule 9J-5 also requires that every plan include and adopt specific Goals, Objectives and Policies (GOPs) to establish the long-term conservation programs and activities addressing the conservation, appropriate use and protection of native vegetative communities including forests, fisheries, wildlife, wildlife habitat and marine habitat, describing actions to protect these resources.

(Appendix I provides sample goals, objectives and policies that can help frame various community’s habitat and wildlife actions.)

Following the prescribed 9J-5 mapping and GOPs requirements, the community planning focus is multifold:

- Identify and map existing wildlife habitats and vegetative communities indicating species present (or likely to present) including common as well as species listed as endangered, threatened or of special concern (look within and beyond jurisdictional bounds).

Rule 9J-5 requirements related to wildlife are dispersed through multiple plan elements. Those elements that can emphasize wildlife to the greatest degree are the Future Land Use and Conservation Elements, and also the Coastal Management Element in coastal counties.

Top: Cow-Nosed Rays in St. Joseph Bay.; Bottom: Manatees in the Homosassa Springs area.

Educate the various city/county departments regarding conservation and enhancement of local green infrastructure (including habitat and wildlife) and provide cross-departmental training, process linkages and discussion opportunities.

- Develop and link a plan of conservation and enhancement (essentially a jurisdictional green infrastructure plan) to the mapped and identified wildlife and habitat resources.
- Educate the various city/county departments regarding conservation and enhancement of local green infrastructure (including habitat and wildlife) and provide cross-departmental training, process linkages and discussion opportunities (e.g., ensure that the stormwater, roads, parks and recreation departments understand and are “on board” with the conservation and enhancement objectives for the community’s green infrastructure network, and ensure that development land planning and development review processes factor in habitat issues).
- Involve citizens and landowners in the community and adjacent communities, and tap the resources and expertise of wildlife and resource agencies, local schools and universities.

A “Green Infrastructure” Element or Sub-Element –

Rather than following a minimum 9J-5 approach, a community can follow a more innovative approach to being wildlife friendly. A community can choose to prepare and adopt a “Green Infrastructure” element, either as a stand-alone element or as a sub-element of an existing element such as Conservation or Infrastructure. Rule 9J-5.001 recognizes and supports the development of such optional elements within, or in addition to, the required elements. This approach specifies the means to ensure these natural system services and benefits are considered in planning and development review processes and “memorialize,” a community’s green infrastructure components.

Critical startup efforts involve gathering data on local habitats, the mix of species they are likely to support (see Chapter 4, Data and Analyses Development) and the variety of ecosystem service benefits received. Further startup work might include: establishing a citizens committee to help identify opportunities and develop background materials; holding local workshops and seminars on habitats and the mix of species supported (or which could be supported); and, drafting preliminary sketches

regarding what comprises or could comprise a habitat network.

With a little initial funding, guidance and technical support from local planning staff and the volunteer efforts of a few local citizens, a beginning framework for a community’s green infrastructure can be drafted for public consideration. The larger and more obvious components emerge from these efforts such as anchoring local habitat areas [e.g., existing regional, local and neighborhood parks, streams, rivers, bays, sloughs, bayous, wetlands]. With these beginning actions a community can initiate a green infrastructure planning effort and then seek support for a more serious and sustained approach.

DEVELOPMENTS OF REGIONAL IMPACT

In order to protect natural resources while facilitating orderly and well planned development, the State of Florida created the Development of Regional Impact (DRI) process. The DRI program establishes criteria and procedures to ensure that local development decisions address the regional impacts of proposed large-scale developments.

A DRI is defined as a development which because of its character, magnitude, or location, results in a substantial effect on the health, safety, or welfare of citizens of more than one county (Section 380.06, F.S.). The DRI is to:

- Identify issues early in the planning process.
- Provide extra-jurisdictional approach.
- Allow for state and regional agency expertise and technical assistance.
- Assess and mitigates project impacts to state and regional resources and facilities.
- Result in a specific development order (DO) that runs with the land and is considered more difficult to alter than a basic comprehensive land amendment.



Photo Courtesy of Greg Gologowski, Director of the Harmony Institute.

Pictured here are the master site plan and an aerial picture of the Harmony DRI in Central Florida. The developers of this site worked with the natural features of the land from the start. Two large lakes with substantial surrounding vegetated buffers and the large wetlands strands that pass through the site were kept intact. Development was clustered and a variety of common public areas were put in place to allow residents to enjoy nature without major dissecting and fragmenting the natural areas.

A DRI review is processed in accordance with the procedures contained in Chapter 380, F.S., and implementing regulations in Chapter 9J-2, F.A.C.

The DRI process provides a useful tool for inclusion wildlife and habitat conservation objectives as the development of an area proceeds. In addition to addressing particular listed species concerns, careful use of the DRI process can foster important wildlife conservation objectives such as maintaining or enhancing habitat connectedness, variety, shape and size.

Like many large parcel planning tools, the DRI process anticipates careful natural resource planning and the consideration of habitat and wildlife protection needs. Agreed upon habitat conservation areas, buffers, set-asides, management needs, mitigation areas and costs can be addressed through the process and the adopted DO and appended wildlife and habitat conservation management plans. Once adopted, the DO governs use of the land irrespective of new or number of owners. Substantial modifications to DO specified management directives occurs through amendments to the DO involving local as well as regional and state agency review.

When using the DRI process for wildlife and habitat planning, important aspects need to be followed:

- Maintain or enhance the variety, connectedness and size of vegetation and water related features (wildlife habitats) where the greater the variety, size and connectedness of habitat areas, the more useful and sustained they will be to wildlife.
- Manage for specific wildlife by knowing the habitat requirements of the species and its needs for cover, food, water, space and acceptable level of disturbance and the arrangement of these factors.
- Plan in the “big picture,” maintaining or enhancing natural landscape linkages by working with adjacent property owners.
- Plan internally to incorporate and appropriately buffer existing

The DRI process provides a useful tool for inclusion wildlife and habitat conservation objectives as the development of an area proceeds. In addition to addressing particular listed species concerns, careful use of the DRI process can foster important wildlife conservation objectives such as maintaining or enhancing habitat connectedness, variety, shape and size.

Important to any DRI development order implementation is the need to provide a long-term habitat and wildlife management plan with realistic actions, expectations and management responsibilities. So often, developments are approved with specific habitat features included, but with little-to-no direction on long-term management actions and responsibilities.

wildlife habitat by shifting unit density and intensity within the footprint of development, keeping sensitive habitat and topographic features undeveloped.

- Look for opportunities to restore and enhance degraded areas and maintain or improve natural hydrological connections.
- Include long-term management actions and responsibilities and avoid “cookie cutter” habitat/landscape management responsibilities to multiple future property owners.

Planning for wildlife and habitat conservation needs to occur early in the process, during the pre-application meetings and certainly during the first sufficiency reviews of the Application for Development Approval (ADA). At the ADA stage, plans of development have not been legally established and there are opportunities to shift proposed developmental footprints, densities and intensities, roads and other infrastructure locations to benefit wildlife.

The affected local government(s) should sit with the applicant, resource agency experts and others to identify important landscape and habitat features on and near the project. The planning objective at this early stage is to look for opportunities to keep or restore natural landscape linkages and habitats within the development area, and to sustain, restore and enhance habitat linkages to adjacent parcels. Off-site corridor linkages along rivers, lakes, wetlands, streams or uplands can be identified, buffered and crafted into the overall plan of development.

Establish Long-term Management Responsibilities –

Important to any DRI development order implementation is the need to provide a long-term habitat and wildlife management plan with realistic actions, expectations and management responsibilities. So often, developments are approved with specific habitat features included, but with little-to-no direction on long-term management actions and responsibilities. Future land managers within the DRIs (e.g., golf course operators,



Graphic by Benjamin Pennington

Through DRI and other large parcel land development tools, restoration of disturbed habitat areas, such as the mosquito ditched wetlands on the right side of this graphic, can be negotiated. Designated conservation areas can be sized and structured to retain both core and edge habitats benefiting multiple species.

landscapers, the homeowners and their associations) are often unaware of specific agreements and actions in their approved development orders. The DO should address these long-term conservation management expectations. Further, through the DO, third party agreements can be set into motion with local land trusts or conservation organization to help monitor implementation of development order agreements conditions relative to wildlife, habitat management plans and other natural resource concerns within a DRI.

The Listed Plant and Wildlife Resources Uniform Standard Rule, 9J-2.041 –

In addition to promoting logical landscape level planning, the DRI process through Rule 9J-2 establishes a means to address specific impacts of development on listed plant and wildlife species. Through the DRI develop-

ment review process, a development order is drafted that must contain the applicable preservation and mitigation actions for the protection of listed plant and wildlife species and wildlife species habitats.

As in most all natural resource planning, avoidance of impacts is emphasized as the most desirable option. However, at times, impacts affecting listed plant and wildlife resources will be unavoidable and will need to be addressed through appropriate mitigation. Often (though not always), onsite mitigation and management is preferable to off site mitigation. Latitude is available so that the onsite, off-site or a combination approach can be used that will best assure long-term species and habitat protection. For plants and habitat areas, avoidance or mitigation of significant impact to an onsite population consists of the preservation of species population habitat coupled with the development of a management plan that avoids the adverse impacts of development. The DO should specifically identify the location and size of the onsite land to be preserved, restrictions of uses or impacts applicable the preserved habitat, acceptable onsite management practices and the fiscal resources necessary to preserve the habitat area.

Offsite mitigation for specific species impacts must be biologically viable, manageable and appropriate for the listed plant and wildlife species requiring mitigation. Offsite mitigation must minimally be type-for-type and acre-for-acre habitat acquisition or preservation or other acquisition or preservation of habitat of comparable biological value for the listed species requiring mitigation.

Linkage to the Comprehensive Plan – For the local community, it is valuable that all onsite preservation land arising from the development order be shown on the local government’s Future Land Use Map series as conservation/preservation land use. The conservation land use designation and associated site specific protection goals, objectives and policies should be

adopted as part of the local comprehensive plan within one year of the issuance of the DO, and prior to the commencement of any development onsite that would significantly impact listed species or their habitat, (except when a subsection 380.032(3) or 380.06(8), Florida Statutes, development agreement is used).

Further, within the overall context of a community’s green infrastructure, the landowner and the local government should use the DRI planning opportunity to link (on and off site) upland habitat to sustain future wildlife populations that use and rely on these areas. To maximize habitat and wildlife benefits, local governments should recognize that DRIs represent large blocks of the community wherein the coordinated use of a mix of land planning tools such as upland protection ordinances, conservation easements and acquisition can be used to lay the foundation for an integrated green infrastructure.

SECTOR PLANS

In 1998, the Florida Legislature authorized optional sector planning. As a “demonstration project,” up to five local governments were authorized to adopt sector plans. Initially, through an agreement with the Department of Community Affairs, four local governments were selected: Orange County Horizons West, Clay County Brannon Field, Palm Beach County, and Bay County West Bay Area. The applicable Regional Planning Council was involved in this initial phase of selection and conducted scoping meetings to initiate the development of the sector plan. Clay County’s effort was rescinded and Palm Beach County withdrew its sector plan. Since then, Escambia County and the City of Bartow have initiated sector planning.

The sector plan process was established as an alternative to the Development of Regional Impact (DRI) process, pursuant to Section 163.3245, F.S. Sector plans are approved through comprehensive plan amendments and initiated by the local government in agreement with the DCA. A sector plan has two

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The conceptual long-term build-out overlay includes a conceptual framework map and identifies public facilities, natural resources and includes principles and guidelines that address urban form and interrelationships of anticipated future land uses including procedures for intergovernmental coordination. The detailed specific area plans represents sub-units of the long-term build-out overlay.

levels, a conceptual long-term build-out overlay and detailed specific area plans (DSAPs). Additionally, sector plans strive to combine the purposes of chapters 380 and 163, Florida Statutes and require public participation throughout the process, emphasizing urban form and the protection of regional resources.

A sector plan consists of:

- The Agreement authorizing preparation of the optional sector plan.
- Delineated geographic area.
- Planning issues that will be emphasized (e.g., wildlife corridors, significant habitat area, unique issues).
- Requirements for intergovernmental coordination to address extra-jurisdictional impacts.
- Supporting data and analyses.
- Procedures for public participation.

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Once the agreement is executed, the local government and the landowner negotiate a conceptual long-term build out overlay for the area. The overlay map identifies anticipated areas of land use and includes more specific direction for development within the area regarding the protection of natural resources and

the provision of infrastructure. The specific area plans identify objectives and policies in the comprehensive plan to address infrastructure needs, natural resource protection and mitigation, and extra-jurisdictional impacts of development. Once the specific area plan is adopted, the requirements for DRI review are waived.

From the outset of the sector planning process, wildlife and habitat conservation, biodiversity linkages, enhancement, restoration and other natural resource protection issues are legitimate areas of focus. Each sector plan begins with a scoping meeting conducted by the regional planning council to identify relevant planning issues and to establish an agreement with the DCA to authorize development of an optional sector plan. State, regional and local agencies with jurisdiction over planning and permitting within the boundaries of the optional sector plan attend the scoping meeting. Prior to execution of an agreement, the regional planning council makes a recommendation as to whether a sector plan is appropriate.

At a minimum, regionally significant wildlife and habitat resources must be addressed as they would under the DRI Rule 9J-2 of the Florida Administrative Code. Resources to be reviewed for significant impacts under the rule include: endangered, threatened, and special concern plant and animal species; populations and habitats, unique or rare natural communities, significant archaeological and historical resources; floodplains, wetlands, estuaries, beaches, dunes, aquifer and recharge areas; and air and water resources. At the applicant's option, the long-range portion of the sector plan may address restoring key ecosystems, achieving a cleaner, healthier environment, limiting urban sprawl, protecting wildlife and natural areas, advancing the efficient use of land and other resources. Local governments, affected parties and citizens must negotiate and leverage specific wildlife and natural resource requirements.

THE WEST BAY SECTOR PLAN

West Bay is a natural bay and sub-basin of the greater St. Andrews ecosystem near Panama City in Bay County. Due to its long-term single ownership by The St. Joe Company, the land has remained relatively undeveloped and in good biological shape, with the land primarily in silviculture. When an international airport and major development were proposed for the area, the Bay County Board of County Commissioners, the local airport authority, and The St. Joe Company agreed to use the sector planning process for this land.

As a result, about 41,000 acres of the West Bay Sector Plan area's 75,000 acres will be designated for preservation purposes. This includes 33 miles of bay frontage and 44 miles of creek and tributary frontage, or an area twice the size of Manhattan. From an upland habitat perspective, the sector planning process helped avoid piecemeal habitat fragmentation and cumulative development impacts on the area. It has the potential to accomplish a level of ecosystem conservation and connectivity that cannot be easily accomplished through other planning techniques.

On another parcel just west of the sector plan parcel, The St. Joe Company cooperated with the U.S. Army Corps of Engineers in developing a Regional General Permit, and worked with the Florida Department of Environmental Protection to develop an Ecosystem Management Permit for the area extending from Highway 79 westward into Walton County. These regulatory permits emphasize the ecosystem approach and place under conservation easement an additional 7,200 acres of connected land in southwestern Bay County.

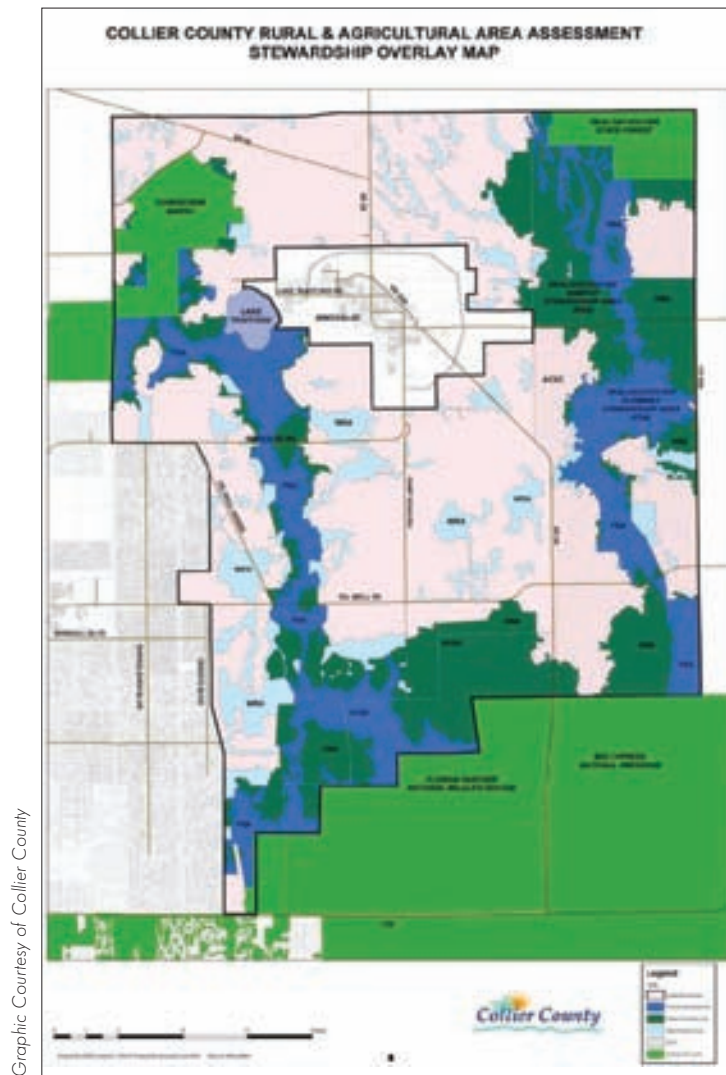


West Bay Sector Plan map showing conservation areas in green and the Regional General Permit also shown in green.

Graphics courtesy of the St. Joe Company

West Bay is a natural bay and sub-basin of the greater St. Andrews by ecosystem near Panama City in Bay County. Due to its long-term single ownership by The St. Joe Company, the land has remained relatively undeveloped and in good biological shape, with the land primarily in silviculture. When an international airport and major development were proposed for the area, the Bay County Board of County Commissioners, the local airport authority, and The St. Joe Company agreed to use the sector planning process for this land.

The intent of the Florida Legislature was that rural land stewardship areas be used to further the following broad principles of rural sustainability: restoration and maintenance of the economic value of rural land; control of urban sprawl; identification and protection of ecosystems, habitats, and natural resources; promotion of rural economic activity; maintenance of the viability of Florida's agricultural economy; and protection of the character of rural areas of Florida.



Graphic Courtesy of Collier County

The Collier County RLSA.

RURAL LAND STEWARDSHIP AREAS

Section 163.3177(11)(d), F.S. establishes the Rural Land Stewardship Areas program, or RLSA. This is an incentive-based large parcel(s) development process that encourages the voluntary preservation and private stewardship of natural resources and retention of rural uses and agriculture that strives to accommodate economic growth and diversification while at the same time sustainable rural character. Participation in this program is entirely voluntary to landowners within a delineated overlay zone. Rural land stewardship areas may be multi-county, must consist of an area of at least 10,000 acres, and must "be located outside of municipalities and established urban growth boundaries." They are designated by plan amendment.

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Through incentives, the program provides landowners with a means of obtaining this value from market place transactions in return for protecting natural or community resources. This is accomplished by transferring certain rights to another parcel of property where development can suitably take place. These actions are accomplished by assigning transferable land use credits whereby private landowners are provided commensurate equity for their natural, agricultural or community resources. Some of the public value features that could be protected as a result include wetlands, wildlife habitats, recharge areas for underground aquifers, open space and active agricultural lands.

Private landowners and affected communities work cooperatively to develop an agreed upon plan, complete with necessary infrastructure and services, and developed within an overall

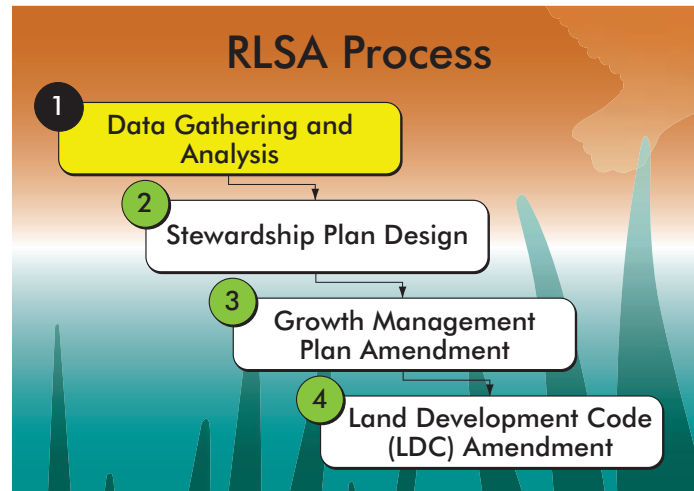
setting of private agricultural and conserved natural resources areas. For wildlife and habitats, the RLSA approach can promote development and conservation planning together across large landscapes. This can allow for the wildlife corridors and decreased fragmentation of habitats.

The RLSA program is a relatively new tool. Local governments need to carefully address a host of related land planning issues such as minimum developmental density, intensity and required mix of land uses, size and percentage of public open space, affordable housing, street layout, school location and transportation. For a truly rural pattern to be maintained, the use of this tool may need to carefully control the spacing and distance between development areas. The goal should be to achieve rural and agriculture land protection, conserve habitat, and new community development with appropriate transportation and other infrastructures without inducing sprawling or leap-frogging patterns.

The Mechanics of RLSAs – The tool is different from “Transfer of Development Rights” (TDR) or conservation easement programs, which only give value for one land use layer – the residential layer. RLSAs set up a limited trading program within the designated stewardship area that provides landowners within Stewardship Sending Areas (SSAs). These valuable credits are for defined resources in exchange for giving up specific uses of the land and placing a perpetual conservation or agricultural easement on the land. In order to build under the RLSA, landowners must petition to have a given area designated as a Stewardship Receiving Area (SRA) and purchase a specific number of credits per unit from SSA landowners. This allows multiple owners of natural amenities to participate in the economic development of the land. In fact, the more valuable the natural system resource is, the more the owner of that land can participate in the economic benefits of development within the buildable SSAs.

Assigning Values and Designating Stewardship

Sending and Receiving Areas – A stakeholder consensus-based process is used to assign and apportion natural, agricul-



Steps of the Rural Land Stewardship Area Process.

Graphic Courtesy of Wilson Miller, Inc.

tural or identified community resource values within a RLSA. Land within the designated RLSP overlay zone is carefully analyzed through remotely-sensed imagery, field work and research. The resultant data are then assimilated into a Geographic Information System-based matrix and index system. Through a series of analyses, all land within the RLSA is scored (often on a per acre basis) with a value that is based on natural, agricultural or community resources indices representing the magnitude of resources present. Then modeling is used to determine which areas score higher or lower in overall resource values. Based on this analysis, those areas with higher resource scores are likely more suitable areas for sending areas and those areas with lower natural resource scores are likely more suitable for receiving areas.

By design, the program relies on development market rewards as incentives to protect sensitive lands. This is at very little or no cost to taxpayers and does not tap into public land acquisition and management funds. In theory, property lines are erased in the analysis phase, so that developments can be situated in the least environmentally damaging locations, and assets from multiple landowners can be pooled.

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PART I – NATURAL RESOURCE INDEX (NRI) FACTORS		
Step 1: The parcel of land within a potential Sending Area is scored on each of the following four NRI factors.		
Step 2: Sum the scores and enter the cumulative total.		
Land Use / Land Cover	Value	Score
Scrub	1.0	
Hydric and Native	0.8	
Non-Hydric and Native	0.6	
Plantations/Ranching	0.4	
Cropland/Groves	0.3	
Exotics / Others	0.0	
Soils / Surface Water	Value	Score
Xeric (knoll) soils	1.0	
Everglades peat	0.9	
Muck depressions	0.8	
Sand depressions	0.7	
Flats soils	0.5	
Flatwoods soils	0.4	
Water, urban, made lands, or not coded	0.0	
Listed Species	Value	Score
Panther and Federal and State Listed Species	1.0	
Panther and Federal Listed Species	0.9	
Panther and State Listed Species	0.8	
Panther	0.6	
Federal Listed Species and State Listed Species	0.5	
Federal Listed Species	0.4	
State Listed Species	0.3	
None of the above	0.0	
Overlay Designation	Value	Score
Flow way stewardship area (FSA)	1.0	
Habitat stewardship area (HSA)	0.9	
Water retention area (WRA)	0.6	
Not otherwise designated	0.0	
SUBTOTAL =		X.X
PART II – ACREAGE		
Step 1: Enter the total acreage of the subject parcel of land to be designated as SSA:		
SUBTOTAL =		X.X
PART III – INCENTIVE CREDITS		
Step 1: Enter any additional "Incentive Credits" in accordance with County GOP policies:		
SUBTOTAL =		X.X
PART IV – STEWARDSHIP CREDIT FORMULA		
Step 1: Stewardship Credits are calculated using the following formula:		
Stewardship Credits for the subject parcel = subtotal of Part I x subtotal of Part II + subtotal of Part III.		
GRAND TOTAL		X.X

This is a sample acreage credit scoring sheet. There are no set standards or values. Wilson Miller, Inc.

Environment and Wildlife – The RLSA program has the potential to accommodate significant community development while protecting large un-fragmented natural and rural resources. This is achieved by directing development into discreet, clustered settlement patterns away from environmentally sensitive lands, farms and open space. The program has the potential to extend protection over entire regions, rather than protecting land on a piecemeal, parcel-by-parcel basis, and could be useful in large animal protection strategies for both the Florida panther and black bear. Under a RLSA program, environmental and regulatory liabilities (from a land developer’s perspective), such as the presence of wetlands or an endangered species, are turned into assets that actually multiply the market value of a property. Further, RLSAs have the potential to foster maintenance, or even restoration, of local or regional wildlife habitat patches and corridors and to sustain

rural working landscapes without drawing significantly on funds from public land acquisition or management programs.

Nevertheless, if applied inappropriately the RLSA program could also induce sprawling, leap-frogging and strip development patterns harmful to affected habitats and wildlife species. Essentially, through indiscriminate use of this tool, islands of unbalanced development could be approved beyond existing urban service areas, producing satellite urban/suburban areas without sufficient internal economies and services. Such unbalanced development would result in residents driving back and forth to larger, more established urban areas for work and leisure. This could stimulate strip and suburban development in the intervening areas. Careful planning and growth management at the regional and inter-jurisdictional levels should be a part of RLSA use, in order to limit potential negative impacts.

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WILDLIFE CONSIDERATE BRIDGING

Prefabricated bridges that can easily be used to accommodate wildlife passage are manufactured by a number of companies. They are generally inexpensive and can be set in place with minimal difficulty and used in many differing circumstances. Wildlife considerate bridging over waterways, wetlands, ravines and sloughs can be accomplished by developers of DRIs, sector plans, RLSA projects or used by local governments. They require minimal bridge design efforts and construction budgets. Versions exist for golf carts and trail bridges.



Graphic Courtesy of URS Southern

Babcock Ranch is home to the Florida panther, Florida black bear and other threatened and endangered wildlife such as the crested caracara. The ranch includes large, well managed areas of pine and scrubby flatwoods along with a highly functional freshwater swamp system known as Telegraph Swamp. Acquisition of the Babcock Ranch completed a massive natural land corridor from Lake Okeechobee to the Gulf of Mexico.

SPECIAL LARGE PROPERTY OPPORTUNITIES

Occasionally unique opportunities occur to protect large parcels of wildlife habitat that do not necessarily follow existing tools or patterns. These parcels are important in their own right but often also form pieces of larger conservation plans and opportunities. Below are a few examples to consider.

Babcock Ranch – Straddling the border between Charlotte and Lee counties, the 91,000- acre Babcock Ranch was one of the largest remaining undeveloped tracts of privately-owned land in Florida. As part of its continuing commitment to preserve habitats, Florida bought 74,000 acres (staged over several years) of land in Babcock Ranch for 3 hundred million dollars under an agreement that was linked to approval of new town development on the remaining 17,000 acres. Babcock Ranch is home to the Florida panther, Florida black bear and other threatened and endangered wildlife such as the crested caracara. The ranch includes large, well managed areas of pine and scrubby flatwoods along with a highly functional freshwater swamp system known as Telegraph Swamp. Acquisition of the Babcock Ranch completed a massive natural land corridor from Lake Okeechobee to the Gulf of Mexico.

On the top is the proposed master plan for the Babcock Ranch community (17,000 acres) and on the bottom is the adjoining conservation lands bought by the State (74,000 acres). Note that even within the proposed developed area, large open space corridors are being left between development pods. These can be designed to support wildlife.



Nokuse Plantation pronounced “nō-gō-see”, this 48,000-acre, private conservation initiative is in the Florida Panhandle. It is designed to be both a model and a catalyst for future landscape level conservation projects. The effort actively engages the private sector in the implementation of large scale conservation, preservation and restoration projects using both private funds and federal and state grants. Nokuse is focusing on securing a vital corridor between existing federal and state lands in the Florida Panhandle that will serve as the first link in a biodiversity chain. Part of the effort has included establishment of the E.O. Wilson Biophilia Center. Wilson used the term “biophilia” to describe the hu-man propensity to affiliate with other forms of life. The Center’s goal is to inspire a new generation of stewards by providing students an opportunity to learn and fall in love with life.

Nokuse Plantation lands (red) are strategic links to the larger Eglin Air Force Base lands, the Choctawhatchee River Conservation lands of the Northwest Florida Water Management District, and The Nature Conservancy’s Delta Preserve. Neighboring conservation areas of Point Washington and Pine Log State Forests offer potential for possible future corridor connections.



Graphic Courtesy of Matt Aresco, Nokuse Plantation

Corkscrew Swamp Sanctuary –

Located northeast of Naples, Corkscrew Swamp Sanctuary is owned and operated by the National Audubon Society and was established in 1952. The Sanctuary’s 11,000 acres are within the Big Cypress Swamp and the Corkscrew Regional Ecosystem Watershed (CREW) planning area. A two-mile long boardwalk passes through the sanctuary and through distinct environmental areas including pinelands, freshwater marshes and wet prairie, cypress swamps and hardwood hammocks. The Sanctuary is one of the largest remaining breeding ground for the endangered wood stork. Low, winter water levels in the Sanctuary provides water holes laden with fish and signals the storks to begin nesting. Unfortunately, if water management practices delay the winter drying season, the storks begin nesting later and when the spring rains disperse the fish from the water holes, the storks prematurely abandon their nests and young.

Corkscrew Swamp Sanctuary (Orange) is located in the center of this map, forming a linkage between the east and west conservation planning area known as Corkscrew Regional Ecosystem Watershed.



Courtesy of Matthew Paulson and the Florida Wildlife Federation

Archbold Biological Station – This independent, non-profit research facility is devoted to long-term ecological research and conservation. The Station owns and manages a 5,200-acre, globally significant natural preserve. The Station also manages the MacArthur Agro-ecology Research Center (10,300 acres) at Buck Island Ranch. Archbold Expeditions also manages the Reserve (3,648 acres) adjacent to the Station. The Station has been instrumental in developing a major plan for a network of biological preserves to protect the endangered habitats of the Lake Wales Ridge ecosystem. This plan includes the first National Wildlife Refuge in the United States to be designed around protection of endangered plants.



Graphic Courtesy of Archbold Biological Station

Archbold Biological Station is a 5,200 acre protected site at the south end of Lake Wales Ridge which is a hotspot for many species endemic to Florida. The Lake Wales Ridge has been heavily impacted over the years from citrus groves and suburban development each of which also favor the well-drained sandy soils.

Eglin Air Force Base and The Gulf Coastal Plain Ecosystem Partnership (GCPEP) – The Gulf Coastal Plain Ecosystem Partnership (GCPEP) is a unique collaboration among Eglin AFB, The Nature Conservancy (TNC), Champion International Corporation, Blackwater River State Forest, Northwest Florida Water Management District and National Forests in Alabama and Florida (Cooperation under the auspices of a 1996 multi-party Memorandum of Understanding). The partners manage more than 840,000 acres in one of the most important conservation landscapes in the Southeast. Eglin Air Force Base alone spans 463,742 acres across three counties in Northwest Florida, and over 130,000 square miles of military operating airspace in the eastern Gulf of Mexico. The base was created out of the Choctawhatchee National Forest in the World War II era. Eglin's mission acknowledges responsible stewardship of the area's natural resources using integrated natural resources management employing principles of ecosystem

management. This allows compatible, multiple use of ranges and ensures ecosystem viability while protecting and conserving biological diversity. Ecosystem management, biodiversity conservation and adaptive management are the foundations of Eglin's conservation programs. Ecosystem principles and guidelines are implemented through an adaptive management approach.

The Eglin landscape contains almost half of the 83 natural community types recognized in Florida. These natural communities vary in size from hundreds to thousands of acres. Thirty-four are the premiere remaining examples of high-quality natural communities in the world. They provide critical habitat for rare and endangered plants and animals. Eglin's noteworthy community types include: the largest remaining contiguous acreage of old-growth longleaf pine forests; twenty miles of pristine barrier islands; and the best remaining global examples of steephead creeks.



Graphic Courtesy of The Nature Conservancy

Eglin AFB and the proposed Northwest Florida Greenway would serve the dual purposes of protecting military mission capabilities of air training and testing routes from the Gulf of Mexico and provide habitat and wildlife conservation areas linking the Apalachicola National Forest, Eglin and Blackwater State Forest. Coordinated land planning across multiple jurisdictions and properties is required.



An easement is a legal instrument or agreement between a landowner and a qualified governmental entity or conservation organization which contains restrictions on the property. To enter into an easement: the landowner can voluntarily agree to place an easement over all or some portion of their property; the landowner can be required to place some property under easement through various permitting regulatory processes; or the easement can result from an infrastructure project such as a roadway, stormwater management, or other utility passage.

Building on the Florida-specific planning strategies outlined in Chapter 5, there are also many other tools that can be used to develop a wildlife – and habitat – friendly green infrastructure. Easements, conservation subdivisions, upland habitat protection ordinances, habitat conservation plans, mitigation and restoration plans and mitigation parks and banks can all assist with protecting habitat and wildlife on natural lands. No one tool will serve as a panacea. Communities that achieve successful wildlife and native habitat friendly outcomes will likely use a mix of these tools.

EASEMENTS

An easement is a legal instrument or agreement between a landowner and a qualified governmental entity or conservation organization which contains restrictions on the property. There are three primary ways to enter into an easement: the landowner can voluntarily agree to place an easement over all or some portion of their property; the landowner can be required to place some property under easement through various permitting regulatory processes; or the easement can result from an infrastructure project such as a roadway, stormwater management other utility passage. Easements are generally negotiated on a case-by-case basis and can include provisions that allow active management such as timbering, grazing or other functional or marketable actions.

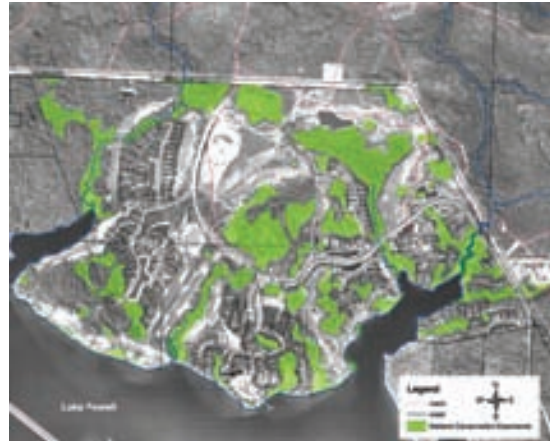
In planning for its green infrastructure and habitat conservation, a community would be smart to develop a general conservation easement plan and guidance document that identifies area or project types appropriate for potential large scale voluntary easements, off-site conservation easements for mitigative actions, substantial infrastructure easement linkages, and other easement development and placement tips.

Voluntary Easements – These are legal agreements that permanently restrict the use of land to protect resources such as productive farmland or wildlife habitat. Voluntary easements are essentially custom-made to meet landowner and often regional

management objectives and do not require public access (though this option can be included). Most of these easements are perpetual, although some are time-limited. Landowners may receive a number of benefits such as:

- **Substantial federal income tax reduction.** Donation of the easement (e.g., to a local land trust) qualifies as a charitable income tax deduction. A landowner can stage the donation over several years to overcome annual charitable deduction limitations.
- **Possible reduction of property taxes and possible prevention of forced land sales.** After establishment of the easement, reassessment by the local tax appraiser office including the reduced future development potential may lower taxable value and thus yearly property tax.
- **The elimination or reduction of estate taxes.** Easements may be gifted and transferred to a government or IRS approved nonprofit organizations (exempt from federal gift taxes). The gifted easement value amount based on the fair market value of the easement property reduces the estate value and taxes to be paid.
- **Estate Tax Exclusion for Qualified Conservation Easements (QCE) under federal tax provisions.** With a QCE, up to 40 percent of the land's value may be excluded from the federal estate tax. The exclusion applies after the value of the easement is subtracted from the fair market value of the land.
- **Permanent generational protection of valued resources of the land.**
- **Reduction in the potential for disagreements or misunderstanding about the long-term conservation areas and objectives for the land.**
- **Landowner flexibility to meet monetary and use of the land objectives for their private lands.**

Photo Courtesy of Neil J. Lamb Ph.D and Edwin J. Keppner, Ph.D.



Example of regulatory easements for wetlands around subdivisions in Bay County.

To maximize the benefits of a landowner's voluntary easement, a qualified tax advisor counsel should be sought. (Source: Martin B. Main, Annisa Karim and Mark E. Hostetter, University of Florida. *Conservation Options for Private Landowners in Florida*, 2003 and 2006)

Regulatory Easements – Easements are often required by various regulatory processes in Florida such as wetland and surface water management permitting actions of the US Army Corp of Engineers, Florida Department of Environmental Protection, or the appropriate water management district. These easements can be located, within the limitations of the permitting process, to increase their value to the local ecosystem. For example, they can be used to expand existing areas of protected habitat, interconnect existing patches of habitat, and maintain the diversity of natural biotic communities in the ecosystem.

Because intergovernmental coordination requirements relating to the establishment of regulatory easements are weak (i.e., agencies do not always inform or work with local governments regarding placement of these easements), it is important to establish intergovernmental agreements with the agencies to ensure that the

appropriate local government departments receive notice of the easements.

Pragmatically, from a green infrastructure development standpoint, a local government in coordination with the affected regulatory agencies should develop a plan for guiding the strategic placement and linkage of regulatory easements for permit mitigation actions (onsite or off-site). Compensatory mitigation actions may include, but are not limited to, onsite mitigation, off-site mitigation, offsite regional mitigation, and the

purchase of mitigation credits from permitted mitigation banks. The plan should guide the maximization of the ecological value of the easements, and provide for better management, and easier monitoring and enforcement of the easement conditions and restrictions. Further, guidelines should strive where feasible to expand existing protected areas of habitat, interconnect existing patches of habitat, and to maintain the diversity of natural biotic communities in the ecosystem.

Infrastructure Project Easements – Easements related to larger infrastructure placement can be designed and managed for increased habitat and wildlife value. Examples include regional, sub-regional and neighborhood stormwater treatment and conveyance facilities, road side edges or road bridging or culverts. These easement areas can often serve as reasonable linkages to other protected habitat patches within and between other conservation areas.

Conservation Easement Requirements and Planning

Tips – The following activities are often prohibited on property subject to a conservation easement.

- Construction or placing of buildings, roads, signs, billboards, or other advertising, utilities, or other structure on or above ground.

“Woe unto them that join house to house, that lay field to field, till there be no place that they may be placed alone in the midst of the earth.”

- Bible, Isaiah 5:8

Each local government should inventory and map the easements in the community. First priority should be given to larger voluntary conservation easements, as well as those regulatory easements held by the water management district, Department of Environmental Protection, and U.S. Army Corps of Engineers, as these are often directed at preserving lands for their natural characteristics.

- Dumping or placing of soil or other substances or material as land fill, or dumping or placing of trash, waste, or unsightly or offensive materials.
- Removal or destruction of trees, shrubs, or other vegetation, with exception of nuisance and/or exotic plant species, as may be required by regulatory agencies.
- Excavation, dredging, or removal of loam, peat, gravel, soil, rock, or other material substances in such a manner as to affect the surface.
- Surface use except for purposes that permit the land or water area to remain predominantly in its natural condition.
- Activities detrimental to drainage, flood control, water conservation, erosion control, soil conservation, or fish and wildlife habitat preservation.
- Acts or uses detrimental to such aforementioned retention and maintenance of land or water areas.
- Acts or uses detrimental to the preservation of any features or aspects of the property having historical, archaeological or cultural significance.

Each local government should inventory and map the easements in the community. First priority should be given to larger voluntary conservation easements, as well as those regulatory easements held by the water management district, Department of Environmental Protection, and U.S. Army Corps of Engineers, as these are often directed at preserving lands for their natural characteristics. Infrastructure projects easements should also be mapped as they can add opportunities for wildlife habitat linkages and strengthen the overall community green network. Substantial conservation easements may also be incorporated as conservation or preservation lands on the jurisdiction's comprehensive plan's future land use map and more detailed zoning maps.

When working on larger development projects (for example Planned Unit Developments, DRIs and Sector Plans) added effort should be made to interconnect on-site conservation easements and to link the easements to off-site natural areas. Isolated patches of conservation easements within development proposals should be avoided particularly the inclusion of conservation easements as part of multiple individual residential lots. The "hodge-podge" of differing lot layouts, vegetation and ground maintenance schemes, fences, lighting and other activities make reasonable easement management for habitat and wildlife difficult to impossible. Smaller easement fragments are difficult to manage and to monitor and less ecologically sustainable.

Long-term Management and Monitoring – Long-term management of dedicated easements and dedicated open space will be necessary. The development review process should require that conservation area management plans be submitted and approved prior to final subdivision approval. The management plan should spell out the special characteristics of the conservation area, the specific goals of the plan (i.e. reha-



FFWCC biologist Robin Boughton prepares a young red-cockaded woodpecker for relocation to another property. Using a net, biologists capture the birds from their cavities in live pines and move them to other areas to increase the likelihood of the species' survival.

bilitation of the red-cockaded woodpecker habitat or natural undisturbed edges along creeks and wetlands) and list the best management practices that may be suitable. The management plan should be included as an appendix to the conservation easement, and also be included within the homeowner's or property management association materials.

The management entity is largely dependent upon who holds title or easement to the property. In many cases, the landowner or homeowner's association may be in charge of management. If the area is of particular ecological concern, the local government or a local land trust may be willing to get involved in the management, especially if there is a corresponding dedicated maintenance funding source and if the easement links to other protected areas off-site. Once a management plan has been accepted by all parties and the land is placed under easement, it is possible to revisit and alter the management plan if needed, but usually only if circumstances have changed enough to warrant such changes.

Other Costs – There are two particular costs that may apply to a conservation subdivision that may not be encountered with a traditional subdivision. These include initial regulatory review costs, and costs associated with managing and monitoring the easement. For communities that have antiquated ordinances, the greatest cost associated with conservation subdivisions compared to traditional subdivisions may be for obtaining rezoning, variances and permits to allow for the necessary clustering. Old fashioned, inflexible zoning and restrictive design standards are typically the principal barriers. Proactive local governments remove these impediments and speed up the approval process as effective incentives. Increasingly, more local governments adopt land development regulations that provide for conservation subdivisions without having to obtain special variances and permits. Some municipalities are creating specific land use categories and

implementing policy while others are creating overlay zones or other mechanisms that guide use of conservation subdivisions.

There are also costs associated with managing and monitoring the easement over time.

Although conservation easements typically are granted at no cost to the conservation entity, there will be administrative and, perhaps, management costs in holding and monitoring the easement property. Some local governments and land trusts require a stewardship fee commitment from the developer and eventually the homeowners association, others just have one time fee – percent of value of easement or per acre one time assessment to fund the long-term management, monitoring and enforcing costs for the easements (including periodic site visits).

Sometimes an endowment can be established at the time the easement is granted, in an amount sufficient to generate income for the annual land managing and monitoring expenses. If such an endowment cannot be established by the landowner at the time of easement creation, potential donor(s) may be identified to assist meeting these needs or the local government (or land trust) may agree to assume the costs if the costs are marginal or can be captured by linking them to other public or privately held conservation lands or conservation easements. As noted above, such actions increase the size of the preserved areas, provide for more efficient monitoring and management, help to defragment the ecosystem, and provide larger areas for wildlife habitat and passive human use. (Source: Southern Appalachian Highlands Conservancy. Conservation Easements, Frequently Asked Questions, www.appalachian.org/about/faq.htm)

If the land is dedicated to a land trust or local government they assume the legal responsibility for that land. They may strike a deal with the landowner or homeowners association or another party for all or some of the long-term management actions.

Sometimes an endowment can be established at the time the easement is granted, in an amount sufficient to generate income for the annual land managing and monitoring expenses. If such an endowment cannot be established by the landowner at the time of easement creation, potential donor(s) may be identified to assist meeting these needs or the local government (or land trust) may agree to assume the costs if the costs are marginal or can be captured by linking them to other public or privately held conservation lands or conservation easements.

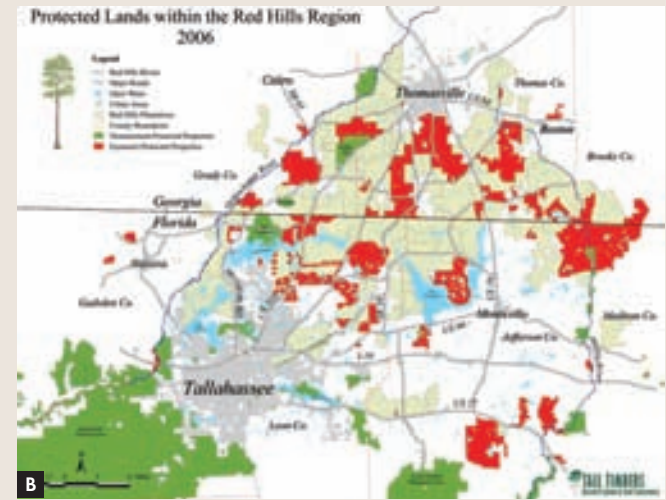
Conservation subdivisions can be ecologically and economically beneficial alternatives to traditional subdivisions. Generally speaking, a conservation subdivision features clustered homes and other development with a large portion of the property's environmentally sensitive areas legally protected through an easement as habitat and open space.

CASE STUDY Tall Timbers Land Conservancy

Photo Courtesy of Tall Timbers Research Station and Land Conservancy



A) Healthy longleaf pine forests in the Red Hills region. This habitat type must be regularly burned. Developments in the region should be cognizant of this need.; B) The Red Hill region spreads across the Florida-Georgia border. Areas in red are under conservation easement, areas in green are public conservation lands, and grey areas are the urban-suburban areas of Tallahassee and Thomasville.



Over the last two decades, the Tall Timbers Land Conservancy in the Red Hills region of North Florida and Southwest Georgia has had an impressive track record with regard to voluntary conservation easements. Since 1990, Tall Timbers has conserved over 108,000 acres of working forests, farms

SUBDIVISIONS AND CONSERVATION SUBDIVISIONS

Conservation subdivisions can be ecologically and economically beneficial alternatives to traditional subdivisions. Generally speaking, a conservation subdivision features clustered homes and other development with a large portion of the property's environmentally sensitive areas legally protected through an easement as habitat and open space. It is a variant of a Planned Unit Development (PUD), a common tool used by communities to craft

for a parcel of land a specific development plan that meets various community objectives. Common steps in the conservation subdivision process include (adaptation from various works of Randall Arendt):

- Identifying primary conservation areas on the property (high value habitat areas, hammocks, wetlands, streams, sinkholes, floodplains, etc.) followed by secondary conservation areas that should be protected to the maximum extent possible (forested areas, and scenic, sensitive, or historically significant features). Always look for opportunities to work with adjacent

and recreational lands, and are working toward protecting another 100,000 acres by 2020.

Tall Timbers' primary focus is protecting lands from Tallahassee, Florida to Thomasville, Georgia and from the Aucilla River to the Ochlockonee River. Recently, Tall Timbers began working to conserve high quality habitat in an area centered-around Albany in South Georgia. These ecologically rich areas contain some of the last remnants of the nation's great longleaf pine forests and more than 60 listed species of plants and animals. The region also contains some of the highest recharge areas for the Floridan Aquifer, the primary source of drinking water for portions of Florida, Georgia and Alabama. Easements placed on these lands protect the region's water quality, air quality, wildlife and distinctive scenic roads.

Healthy longleaf pine forests in the Red Hills region. This habitat type must be regularly burned. Developments in the region should be cognizant of this need. Tall Timbers Research Station and Land Conservancy

The majority of the land in the Red Hills region has been privately owned as large quail hunting plantations for generations, and has to date been largely spared from sprawling development.

Landowners donate conservation easements because of a strong desire to protect their land for their families and future generations. Conserving land using a conservation easement allows the landowner to retain ownership and prescribed use of the property, while providing substantial tax benefits through the reduction of federal income and estate taxes, and possible property tax relief. Landowners retain all property rights except those specifically relinquished or restricted by the easement and, in many cases, are free to use their property as they have in the past.

Changes to the federal tax code in 2006 raised the deduction donors can take for donating an easement. Congress is considering making these changes permanent or alternatively, extending them some time period. The new rules provide a significant benefit to landowners who previously could not deduct the full value of their gift. By taking advantage of incentives provided by federal tax law, understanding the needs of its landowner base, and protecting the natural, scenic, and cultural traditions of this working rural landscape, Tall Timbers has developed a model of conservation well suited to the Red Hills region. Perhaps this is a model that can be reproduced elsewhere?

Conserving land using a conservation easement allows the landowner to retain ownership and prescribed use of the property, while providing substantial tax benefits through the reduction of federal income and estate taxes, and possible property tax relief. Landowners retain all property rights except those specifically relinquished or restricted by the easement and, in many cases, are free to use their property as they have in the past.

properties to link topographic and habitat features.

- Locating clustered development and home sites in a manner that avoids the identified sensitive areas. Use the set-aside areas to the best advantage to add value to the clustered home sites.
- Aligning streets, utility easements, sidewalks and trails to best serve home sites while minimizing impacts on the landscape (e.g., use the streets and stormwater facility easements to provide separation between conserved habitat areas and home cluster locations).

- Drawing in the lot lines and identified easement areas.
- Drafting and recording easements and easement area management guidelines and any directives to be part of the homeowner's covenants.

The open space in a conservation subdivision can be protected with a conservation easement or other legal apparatus to ensure that the area is left undeveloped and is appropriately managed. Such easements can allow discrete but sizeable environmentally sensitive areas on a property to be linked via dedicated open space. This provides the opportunity to increase the functionality

When developing a conservation subdivision there are some general ecological guidelines that should be followed with regard to habitat protection and conservation. The first rule of thumb is to know the lay of the land and the potential wildlife and habitat types both on and adjacent to the site. It is important to design a site that does not disrupt, fragment or otherwise isolate habitats.

Photo Courtesy of Southeastern Wisconsin Regional Planning Commission



A) The same piece of land can be subdivided to better conserve the natural system, habitat and wildlife resources (bottom) or subdivided in what is commonly called conventional subdivision design (top).; B) Subdividing property judiciously to preserve the natural features and wildlife opportunities. The top illustration shows the traditional subdivision of land, while the bottom illustration has the same number of lots, but preserves the natural features and wildlife opportunities.

of on-site wildlife habitat.

The usefulness of a given conservation subdivision to wildlife will largely depend on local plans and objectives, care of the landowner, an understanding of the life needs and habitat requirements of the species affected, and the topography of the land being developed. This tool is useful in suburban and suburbanizing rural-fringe areas, but should be approached

cautiously in rural areas as it can promote premature “leap-frog” development and sprawl.

Local governments should strive to differentiate between areas with established urban service areas-urban fringe designations and designated rural lands beyond the urban fringe where the adopted plan is attempting to conserve rural land. In counties relatively high unit per acre density in throughout the rural area

(e.g., 1 unit per acre) the use of conservation subdivisions may be preferable to conventional practices because of the ability to cluster the units.

General Ecological Guidelines for Site Protection –

When developing a conservation subdivision there are some general ecological guidelines that should be followed with regard to habitat protection and conservation. The first rule of thumb is to know the lay of the land and the potential wildlife and habitat types both on and adjacent to the site. It is important to design a site that does not disrupt, fragment or otherwise isolate habitats. Additionally, every effort should be made to retain or enhance contiguous blocks (or swaths) of habitat and to minimize habitat breaks or long thin corridors that limit or impede wildlife movement and exacerbate edge effects (e.g., loss of important microclimate or physical features such as the humidity provided by a hardwood hammock or dry sandy soils of regularly burned xeric scrub areas). Sizing and shaping conserved areas to limit edge effects via wider corridors and preserved understory environments maintains biodiversity in the area.

When waterbodies, wetlands and karst features are involved, the easement area and management plan should limit adjacent impacts harmful to the natural values. Including natural buffers adjacent to water and wetland features ensures that wildlife will have continued access to water and associated food, cover and nesting benefits.

Legal Tools to Protect Common Space within Conservation Subdivisions – There are several legal tools to protect the habitat and open space of a conservation subdivision: conservation easements; dedication of common space to a local government or land trust; or covenant conditions and restrictions. There are many variables that should be considered when deciding which tool will work best:

- **Conservation Easements –** Easements are advantageous because they run with the land, can last in perpetuity, are well accepted by courts, and are not easily changed. Easements

spell out in detail the allowable uses and intentions as well as those activities that are prohibited. This approach may have an economically beneficial aspect to developer landowners from tax breaks. Additionally, the property sale value of homes adjacent to protected open space generally shows an increase more than parcels that do not abut protected land.

- **Dedication of the Common Space –** Dedication of the conservation open space involves transferring the title of the property to a second party (usually either a land trust or local government) through a charitable donation or bargain sale. Either method can be advantageous to the landowner, who may be eligible for federal tax deductions or may transfer the ongoing maintenance costs and management duties to another party. By taking title of the land, the second party also assumes the costs associated with management of land as well as liability of owning the land. An important factor to note in dedication of land to a local government is that it typically results in public access to the land. This may be undesirable to many home owners associations.
- **Covenants, Conditions and Restrictions (CCRs) –** A final option for preserving the set-aside lands involves relying on the Covenants, Conditions and Restrictions within the declarations that are a part of the conservation subdivision's community association. While it is important to have such restrictions, they are not generally enough on their own. First, CCRs are typically dynamic in nature and can be changed by a vote of the community association's members. Second, the term of the covenants is subject to each state's common law. Finally, enforcement of the CCRs can be problematic.

UPLAND HABITAT PROTECTION ORDINANCES

A local government can adopt an upland habitat protection ordinance to protect upland natural plant communities and wildlife habitat. This type of ordinance can promote air and water quality maintenance, erosion control, stormwater runoff reduction, water

A local government can adopt an upland habitat protection ordinance to protect upland natural plant communities and wildlife habitat. This type of ordinance can promote air and water quality maintenance, erosion control, stormwater runoff reduction, water resources conservation, aquifer recharge area preservation, biological diversity, and native upland habitat preservation.

When habitat islands which would normally be too small to support diverse populations are in close proximity to or connected by habitat corridors with larger areas, they have been found to be capable of maintaining such populations. Virtually any suitable physical link between habitat areas may serve as a corridor for some species.

Photo Courtesy of Dan Pennington, 1000 Friends of Florida



A preserved upland buffer pine forest area in Tampa sits adjacent to a development stormwater treatment pond. The protected pine forest upland links to wetlands and a stream to provide a variety of linked habitats.

resources conservation, aquifer recharge area preservation, biological diversity, and native upland habitat preservation. These ordinances should be linked to specific goals, objectives and policies in the comprehensive plan to require local implementation actions to conserve significant wildlife habitat and environmentally sensitive areas (see Appendix 1 for some examples). These specific actions generally occur during local land development planning processes and reviews to protect both important upland habitats and contiguous environmentally sensitive areas needed to sustain various terrestrial wildlife species.

For example, in areas such as Tampa and Hillsborough and Pasco counties, many undeveloped landscapes are being subdivided and developed under multiple large Planned Unit Developments (PUDs) and DRIs. These areas naturally contain a matrix of upland habitats, creeks, wetlands and river systems of sufficient size and connectedness to sustain wildlife populations if an integrated development-to-development approach is taken.

A viable matrix of uplands and related wetlands can be maintained and integrated through protecting areas that include:

- Jurisdictional wetlands, streams and linked cypress domes to form a corridor of undeveloped lands.
- Significant upland wildlife habitat layered along these corridor areas.
- Stormwater facilities, trails and bike paths for adjacent developments located alongside the protected wildlife areas.

Then, where the opportunity presents itself, these areas are linked to other existing environmentally sensitive areas to enlarge the wildlife sustaining effects.

Determination of the minimum width(s) necessary for an area to function as an upland wildlife corridor is based on a number of factors which can only be determined by evaluating site-specific characteristics. These factors may include: 1) the species which would be expected to use the corridor; 2) whether the corridor would be used by a single species, several species, or an entire assemblage of species; 3) the individual needs of the species expected to use the corridor; 4) the corridor length, or the distance between larger tracts of habitat connected by the corridor; 5) the habitat quality; 6) the habitat composition (e.g., the amount of wetland and upland habitat); and 7) the adjacent land uses and disturbances.

When habitat islands which would normally be too small to support diverse populations are in close proximity to or connected by habitat corridors with larger areas, they have been found to be capable of maintaining such populations. Virtually any suitable physical link between habitat areas may serve as a corridor for some species. Hedge rows and abandoned railroad grades are examples of very narrow corridors which have been shown to provide travel routes for wildlife. Nevertheless, the wider and more solid block of upland habitat that can be preserved, the more species and individuals it will harbor and sustain.

CASE STUDY**Upland Ordinances in Tampa and Martin County**

Martin County's comprehensive plan includes policies that a minimum of 25 percent of the existing native upland habitat shall be preserved per development. This may be increased to more than 25 percent for planned unit developments or DRIs which take advantage of variances in lot sizes, density and clustering. Martin County also requires the retention, in an undisturbed state, of all existing native trees and native vegetation not located in buildable areas. Increased conservation of native habitats which are determined to be endangered, unique, or rare in Martin County, or regionally rare may also be required. On sites where endangered, unique, or rare native upland habitat exists, up to 25 percent of the total upland area shall be preserved, using cluster development where possible, in a manner that is consistent with a reasonable use of the property.

In Tampa and Hillsborough County, policy guidance to protect the significant wildlife habitats is included in the comprehensive plan along with an upland habitat

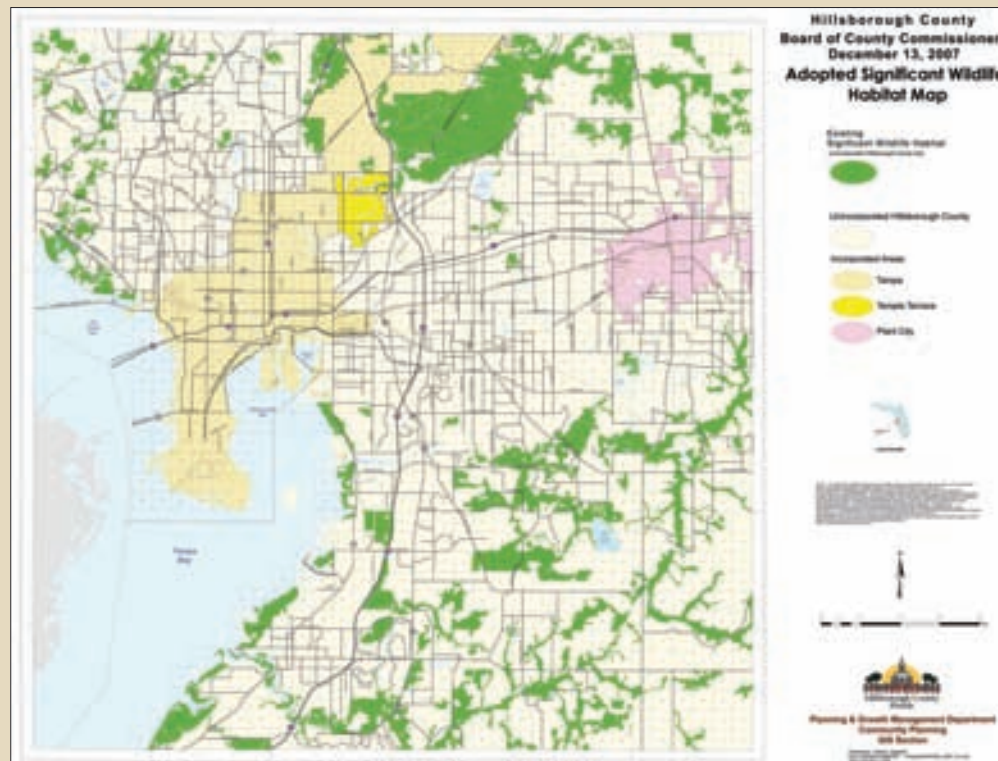
protection ordinance in the City's land development code. In the City, most of the original upland wildlife habitat has been replaced with urban or suburban development. The remaining upland habitat is comprised of xeric and mesic natural plant communities that are either uncommon, scarce, occur in very restricted geographic areas, or have few high quality sites remaining. Protection of those xeric and mesic habitats which constitute significant wildlife habitat is necessary to retain remaining habitat diversity and

wildlife corridors and to maintain healthy and diverse populations of wildlife.

The ordinance directs the protection of significant and essential wildlife habitats throughout the city with regulations to protect designated areas from the negative impacts of development. Implementation is assisted provision of significant wildlife habitat minimum width and size criteria, habitat management guidelines and general guidelines for listed species.

This ordinance further references a "Significant Wildlife Habitat Map" identifying possible locations of habitat to consider. The implementation of the ordinance for a particular project is subject to specific field verification of the presence of significant wildlife habitat as depicted on the map.

The approach recognizes that the City has a mix of unique urban, suburban and natural environments. Comprehensive protection of significant wildlife habitats and specific site implementation of the ordinance must be able to take into account differences between areas such as size of habitat patches, location and linkage within the developed and natural landscape and, applicability of protection strategies.



The Federal Endangered Species Act (ESA) mandates protection of threatened and endangered species and their habitat on federal and private land by prohibiting "take" of listed species through direct harm to individuals or habitat destruction.

HABITAT CONSERVATION PLANS

The Federal Endangered Species Act (ESA) mandates protection of threatened and endangered species and their habitat on federal and private land by prohibiting "take" of listed species through direct harm to individuals or habitat destruction. Section 10 authorizes states, local governments, and private landowners to apply for an Incidental Take Permit for otherwise lawful activities that may harm listed species or their habitats. To obtain a permit, an applicant must submit a Habitat Conservation Plan (HCP) outlining what is to be done to "minimize and mitigate" the impact of the permitted take on the listed species. Under this amendment, private landowners affecting land known to be home to listed species are required to design and implement a plan that will minimize and mitigate harm to the impacted species during the proposed project.

Approved HCPs vary greatly in size, duration, and species covered. According to the U.S. Fish and Wildlife Service, the trend among HCPs is towards larger, regional plans, "evolving from a process adopted primarily to address single developments to instead, a broad-based landscape level planning tool utilized to achieve long term biological and regulatory goals."

As a wildlife protection tool, an HCP should meet the requirements of federal law and federal Fish and Wildlife Service policy. The adequacy of the HCP should be assessed by asking certain critical questions such as:

- What species are covered by the plan? What habitat types?
- What area is covered by the plan? What area should be covered?
- What are the scientific assumptions of the plan? How were they evaluated? Are the objectives clearly stated?
- Does the plan rely on adjoining land uses? Is its reliance valid?
- What alternatives are considered? What impacts are analyzed?
- What will the plan do for listed species over time?
- What will the plan do for unlisted species?
- What provision is made for funding the plan?
- What activities are covered by the plan?

CASE STUDY

Sarasota County HCP for Scrub-Jays



A) The Florida Scrub-Jay is a very friendly and rather gregarious bird.

Photo Courtesy of Jack Rogers and the Florida Wildlife Federation

- How long will the plan last?
- How is it assured that the plan is being implemented and if it's working?

(Source: *A Citizen's Guide to Habitat Conservation Plans*, National Audubon Society, Inc. at: www.audubon.org/campaign/esa/hcp-guide.html)

The federally threatened Florida Scrub-Jay population has been declining across its entire range, and Sarasota County is no exception. Scrub-jays live only in sandy scrubs, which are dominated by squat scrub oaks and an occasional pine tree. The same habitat suits several other threatened and endangered species, including gopher tortoises and indigo snakes.

Between 2000 and 2005, the county's Florida Scrub-Jay population declined by 23 percent. More than two thirds (71 percent) of the occupied scrub patches within the county experienced population declines during this period, and several are nearly extirpated. Statewide, the greatest threats to Florida Scrub-Jay persistence are outright habitat loss, habitat degradation owing to absence of fire management, habitat fragmentation, and

poor reproductive success as a consequence of proximity to human habitation. The same patterns hold true for Sarasota County: jays in unprotected habitat patches are experiencing precipitous declines, and even the most "optimally" managed scrub preserve appears to function as a "catching basin" for displaced and dispersing jays.

In an effort to create a comprehensive approach to scrub-jay conservation and provide an improved regulatory framework for property owners, Sarasota County pursued a county-wide habitat conservation plan for scrub-jays. The county worked to draft a habitat conservation plan for the remaining scrub-jays to attempt to provide a means to sustain this threatened species. The work underscores the importance not only of protecting suitable habitat for scrub-jays within Sarasota County, but also of aggressively managing large areas of potentially suitable habitat to create optimal conditions for re-colonization, survival, and successful reproduction.

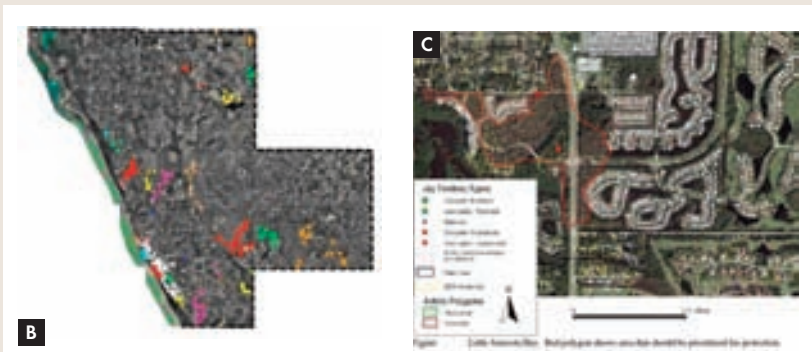
Many of the birds live in suburban areas that are under enormous development pressure. As the county strives to develop a habitat conservation plan it should address where habitat may be lost, will establish a preserve area network, and will

create a mitigation framework. For example, where long-term survivability is low in the Venice suburbs sub-population, a scientific model suggests restoring habitat at Lemon Bay Preserve and on County property. This approach is designed to create viability and establish a county-wide network preserve. In a promising trend, a few scrub-jays appear to have moved into patches that are being aggressively managed or restored by the County. Ideally, the plan and subsequent implementation will result in permanent scrub-jay populations throughout the county on adaptively managed habitat areas. Displaced birds may potentially relocate to managed land within preserve areas.

The plan must be approved by federal officials, but once approved a property owner within identified scrub-jay habitat will be able to get the necessary development authorization directly from the county rather than going through the federal process. Mitigation will be local under the county's plan. The change saves property owners time, keeps local fees for local preserves, and sets a clear strategy for giving the animals a place to live and breed into the future.

Source: Fitzpatrick, John W. Ph.D., et al. *Draft Habitat Conservation Plan and Adaptive Management Recommendations for Threatened Florida Scrub-Jay (Aphelocoma coerulescens) in Sarasota County.*

Photo Courtesy of Sarasota County



B) Map showing 24 patches or clusters of Florida scrub-jay territories, including potential territories on currently unoccupied habitat in Sarasota County.; C) Little Sarasota Bay area, the red polygon showing the area that should be prioritized for protection.

Growing communities necessitate the construction of new and expanded roadways, utilities, stormwater management facilities and other public works projects. While all public works projects are designed to avoid negative impacts to wildlife and habitat, there are times when impacts cannot be avoided. Such impacts, even when minimized, must be mitigated for, and such mitigation cannot always effectively occur on the site of the project.

Photo Courtesy of: David Maynathan Photography



The Pros and Cons of Habitat Conservation Plans – If not properly created; HCPs can result in plans that allow for development that may further threaten the species in question. HCPs can result in a net loss of habitat. Additionally, the “No Surprises Rule” which gives land owners assurance that they will not have to change their plan if additional resources are found can constrain the ability to improve HCPs and avoid species decline. HCPs may be based on inadequate scientific assessment of the situation, and complaints arise that the public does not have adequate opportunity to provide input.

Nevertheless HCPs often serve to benefit wildlife and habitat

conservation in an area because they can: 1) Shift the conservation focus from single-species management to multi-species and habitat management; 2) Engage private landowners and local governments in conservation planning; 3) Protect unlisted species, thereby reducing the likelihood that listing will be needed; and, 4) Promote long-term conservation of species and habitats through protection and management.

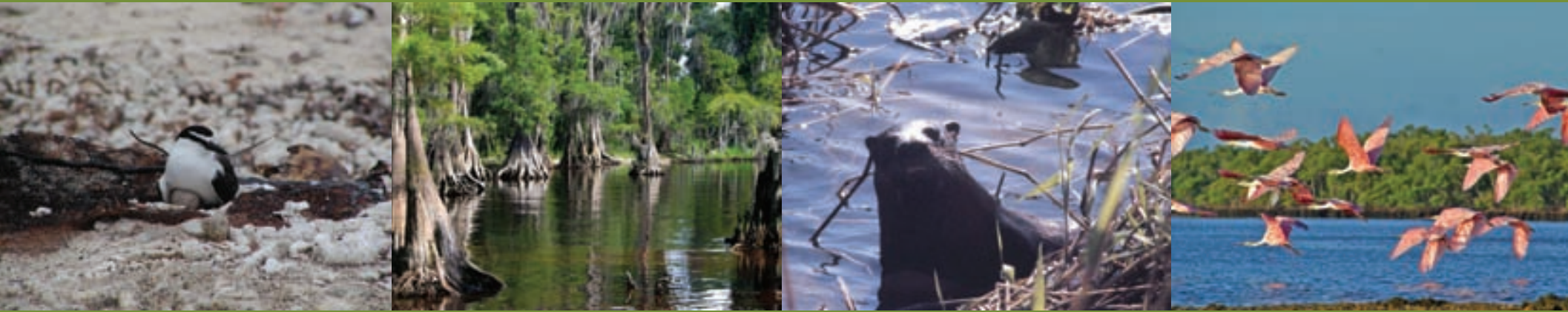
MITIGATION AND RESTORATION PLANS

Growing communities necessitate the construction of new and expanded roadways, utilities, stormwater management facilities and other public works projects. While all public works projects are designed to avoid negative impacts to wildlife and habitat, there are times when impacts cannot be avoided. Such impacts, even when minimized, must be mitigated for, and such mitigation cannot always effectively occur on the site of the project. A local government mitigation and restoration plan is a tool designed to compensate for the environmental impacts of infrastructure projects in a logical, environmentally and economically sound manner. The mitigation and restoration plan has three main purposes:

1. To provide a master strategy by which critical environmental features within the community continue to be preserved.
2. To provide “safe harbor” approaches for mitigation projects that are required for the infrastructure needed to accommodate growth, which in turn will enable the budgeting process to be reliable.
3. To restore degraded natural resources important for the health, safety, and welfare of the public.

Importantly, linking of non-green infrastructure impact mitigation to green infrastructure restoration, management and acquisition serves to align long-term habitat mitigative and restoration efforts to local budgetary, comprehensive planning and regulatory processes.

A coordinated local mitigation and restoration plan must use the jurisdiction’s reoccurring planning and budgeting process for its



identified projects. Mitigation plan requirements are addressed synergistically through local government planning, budgeting and operational efforts, capitalizing on larger landscape level restoration and preservation opportunities for water pollution abatement and wildlife and natural habitats conservation.

Further, a mitigation plan can provide a vehicle whereby a local government can seek to ameliorate consistency and cumulative accountability problem inherent in incremental habitat impacts of a continuing public works program. Once in place, a mitigation plan will allow a jurisdiction to more effectively accommodate the growth that is occurring, while ensuring the restoration and long-term protection of the important natural resources that provide identified community benefits.

A mitigation plan envisions use and modifications to the Capital Improvements Program (CIP). As capital infrastructure development projects are identified in the five-year CIP, the Mitigation Plan calls for:

- Including a gross quantification of impacts that will result from each capital project.
- Listing of mitigation projects that may provide the remedy for these impacts. These mitigation projects may stand alone, or be part of larger restoration, remediation, or preservation efforts that

are also underway.

- Funding estimates and identification of sources for mitigation.

A Capital Improvement Mitigation Plan captures this information and serves as an addendum to the overall CIP.

Implementation of the Mitigation Plan may be incrementally facilitated through the local government's annual work plan and identifies and funds through the CIP. Mitigation Plan implementation depends on several key elements such as:

- Its adoption as a supporting document to the Comprehensive Plan.
- The partnership of regulatory and related regional agencies.
- A process that ensures ongoing review and updating so that it reflects changes that occur in the restoration and protection priorities.

Mitigation Plans can be designed to be reviewed and updated on an annual basis as a part of the capital budgeting process. They can be expected to continually evolve and be influenced by the development of new or improved management techniques; increased coordination with other regional programs and conservation organizations; and changes in federal, state and local regulations.

A mitigation plan can provide a vehicle whereby a local government can seek to ameliorate consistency and cumulative accountability problems inherent in incremental habitat impacts of a continuing public works program.

Photo Courtesy of: Bird on Beach – David Moynahan Photography; Undisturbed Shoreline, Lake Louisa State Park – Myrna Erlen Bradshaw and the Florida Wildlife Federation; River Otter – David Moynahan Photography; Flock of spoonbills, Everglades National Park – Constance Mier and the Florida Wildlife Federation

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CASE STUDY

Lee County Capital Improvements Plan



Source: Lee County Master Mitigation Plan (Environmental Quality Investment and Growth Mitigation Strategic Plan), May 16, 2007.

Here is an example from the Lee County experience. Project "X" is in the Five Year CIP. The project is initially assessed through a preliminary planning phase to have impacts on specific resources – wetlands, water storage, listed species, and associated water quality. Through overall plan review with the appropriate regulatory agencies, the degree to which impacts can be satisfied "off site" is ascertained. Then, using the sample calculations for mitigation, the Five Year CIP can include an estimate of some permitting costs affiliated with each capital project. These costs can then be aggregated and compared to projects (or a series of projects) on a master mitigation list that are deemed suitable. That project is then added to the CIP as the Capital Improvement Mitigation Plan (CIMP) addendum. The CIMP will have several components. In addition to straight-up mitigation and restoration, there are sections on land acquisition, water quality/remediation and legitimate corollary expenditures by the local parks and recreation department. Below is a sample of the listed projects. Note the involvement of multiple departments and divisions within the Lee County government.

LEE COUNTY GOVERNMENT DEPARTMENTS AND DIVISIONS

CIP Number	Department/Division	Project Name
204083	Transportation	Gladiolus Road Widening
204007	Transportation	Environmental Mitigation
203091	Natural Resources	Blind Pass Ecozone
208545	Natural Resources	Briarcliff Ditch Filter Marsh
208546	Natural Resources	Island Park Filter Marsh
208547	Natural Resources	Three Oaks Parkway Filter Marsh
201999	Parks/Recreation	Estero Community Park
201873	Parks/Recreation	South Fort Myers Community Park
207097	Utilities	Corkscrew Wellfield - Alico Road
207240	Utilities	Pine Island WWTP Reuse System
208800	County Lands	Conservation 2020 Land Acquisition Program

CASE STUDY**Island Park Regional Mitigation Site at Estero Marsh Preserve**

In 2006, the Lee County reached a significant milestone when the first project in a cooperatively developed Natural Resources Preservation and Master Mitigation Plan was completed. This first project, The Island Park Regional Mitigation Site at Estero Marsh Preserve, linked restoration and enhancement mitigation actions for unavoidable impacts associated with the expansion of the Three Oaks Parkway Extension South to other publicly-owned lands. The regional mitigation site is land acquired under Lee County's Conservation 20/20 program. Conservation 20/20 lands are acquired using property taxes approved by county residents in 1997 to preserve biodiversity while conserving and enhancing water resources.

The Natural Resources Preservation/Master Mitigation Plan is the product of the Lee County Commission, Lee County Conservation Land Acquisition and Stewardship Advisory Committee, US Army Corps of Engineers, Charlotte Harbor National Estuary Program, Florida Department of Environmental Protection, South Florida Water Management District and the Southwest Florida Regional Planning Council, including the Estero Bay Agency on Bay Management. From the beginning of the process, the Southwest Florida Regional Planning Council, serving as the facilitator, brought all the key agencies and organizations to the table to discuss and plan this major environmental project. These agencies worked cooperatively to establish a plan to efficiently restore wetlands on county-owned and environmentally

sensitive Conservation 20/20 lands. They addressed potential cumulative impacts to the county's natural resources, including water supply, water quality and wildlife habitat, due to existing and future private development and public works. Through this proactive and comprehensive approach, meaningful environmental mitigation projects and results can be obtained in exchange for impacts to lower quality wetlands and wildlife habitat from public infrastructure projects.

The County Commission endorsed the developed plan in May 2005, allowing mitigation of public sector projects by improving habitat, water quality and hydrology on Conservation 20/20 parcels. This first project is an 80-acre project on the 243-acre Estero Marsh Preserve in Lee County. Exotic vegetation was removed and replaced by native species and overtime additional native plants will be planted. The remainder of the preserve will be restored and enhanced in the next phase. Further cooperative actions included Florida Power & Light granting a right-of-way consent agreement to allow culverts to be installed under the power line easement. This is allowed meaningful water quality

improvement because reestablishing historic water flows and the creation of the filter marsh provide additional water quality treatment prior to discharge into Hendry Creek and Estero Bay, both Outstanding Florida Waters. Overall, through the use of regional mitigation sites and careful coordinated planning between local, regional and other agencies, area restorative and enhancement action can improve habitat and wildlife objectives.

Sources: *Charlotte Harbor National Estuary Program (CHNEP)*, www.CHNEP.org, *Partnership Between Agencies and the Public Produces Better Results, "Harbor Happening", Volume II, Issue 1: 2007* and personal communications with Cathy Olson and Betsie Hiatt from Lee County and Lisa Beever, Director, CHNEP.



Pictured is a rather raw Island Park Mitigation site where wetlands are being restored. Note the line of Melaleuca tree infestation in the background. In the foreground, mitigation efforts have removed all such exotics and work is progressing to re-establish water flows and native wetland habitat species.

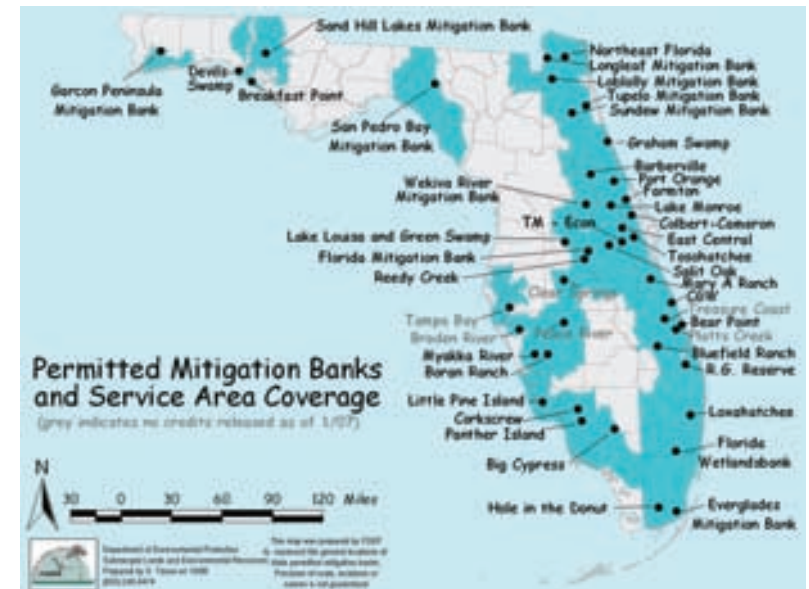
Mitigation banking is a practice in which an environmental enhancement, restoration, and preservation project is conducted by a public agency or private entity (“banker”) to generate and sell mitigation credits to offset permitted wetland impacts within a defined region.

FEDERAL, STATE AND WMD MITIGATION BANKS AND PARKS IN FLORIDA

Mitigation banking is a practice in which an environmental enhancement, restoration, and preservation project is conducted by a public agency or private entity (“banker”) to generate and sell mitigation credits to offset permitted wetland impacts within a defined region. The “mitigation service area” is generally based on the watershed in which the bank lies. The Department of Environmental Protection or water management districts issue the permits for mitigation banks. The permits define the mitigation and long-term management plans, assess the total number of potential credits, provide performance criteria for incremental credit release and success criteria for final release, and determine the mitigation service area. The bank is the site itself, and the currency sold by the banker to a permittee who wants to impact wetlands is a credit. A credit represents an increase in wetland ecological value equivalent of one acre of successful creation/restoration, i.e., restoring one acre with no wetland function to optimal wetland function. On average it takes a little over three acres of wetlands in a mitigation bank to create one credit.

Currently, there are 48 permitted mitigation banks in Florida with a total of about 120,000 acres. The median size of a bank is 1,300 acres. A total of about 40,000 potential credits are permitted, of which about 16,000 have been released by the agencies for use. About 11,000 credits have been used. Although it is difficult to assess with the current data systems, it is estimated that about half of wetland impact acreage is being mitigated at mitigation banks.

Mitigation banks are authorized by granting a Mitigation Bank Permit, which includes the Environmental Resource Permit (ERP), by the FDEP or water management districts. Additionally, a mitigation bank requires federal authorization in the form of a Mitigation Bank



Florida Department of Environmental Protection

Instrument (MBI) signed by several agencies, with the Corps of Engineers as lead.

As stipulated by the mitigation bank permit, credits are released for sale and use by the permitting agency based on activities (i.e. recording conservation easement, removing exotic vegetation, etc.) and success criteria (i.e. having a certain coverage of appropriate native plant species, etc.). No credits may be released until the mitigation bank property is placed in a conservation easement and financial assurance is obtained for the full implementation of the permit and for the long-term management of the bank property. The agency that permitted the bank maintains a ledger of the total number and type of potential credits released to the bank; an up-to-date accounting of the credits that are available for sale or use; and an accounting of the number and type of credits used for each impact permit. The banker determines the cost of the credit. The FDEP and WMDs do not regulate the amount a banker can charge or are they in any way associated with money collection. The permitting agencies are only involved in maintaining the ledger as noted above.

Mitigation banks are established throughout the state; however, not all portions of the state are serviced by a mitigation bank. The map shows mitigation bank locations along with service area coverage. Mitigation service areas for different banks may overlap; thus some areas in the state may be serviced by more than one mitigation bank. More information is available at:

www.dep.state.fl.us/water/wetlands/mitigation/

FWC Mitigation Park Program – Attempts to protect listed wildlife through land use regulations in Florida have frequently involved the "on-site" preservation of habitat within the boundaries of a development. Such efforts are often opposed by the landowner or developers whose particular project might benefit if mitigation could occur off-site. In response to some of the problems associated with "on-site" mitigation, the FWC has authorized the development and implementation of the Mitigation Park Program as an alternative wildlife mitigation strategy. The goal of this program is to provide an off-site alternative for resolving certain wildlife resource conflicts.

Thus the FWC "parks" are managed, conservation lands set up to receive individuals of an imperiled species displaced by development and manage for them (e.g., gopher tortoise and red-cockaded woodpecker).

In practice, this program consolidates mitigation throughout a geographical region and directs these efforts toward the acquisition of large and manageable Mitigation Parks. Each park is publicly owned and ranges in size between 350 and 2,000 acres. Management activities are tailored to emphasize the protection and enhancement of habitat important to upland listed wildlife.

In general, the program increases the biological effectiveness of mitigation and it: (1) provides an opportunity to direct wildlife habitat protection and acquisition efforts to the most biologically important sites in a region; (2) can consolidate many otherwise small and isolated protection efforts into larger units which maximizes resource protection efforts; (3) allows public access and

use of mitigation lands that are managed by the state for the long-term protection of wildlife resources; and (4) from an economic perspective provides a cheaper form of mitigation than preserving acreage within a development, and developers retain greater use of a project site for development.

Most mitigation park facilities are developed in cooperation with other local, state and federal agencies, usually following the signing and execution of a Memorandum of Understanding (MOU). Developers who direct monies to the mitigation park program make their deposits to the FWC's Land Acquisition Trust Fund in care of the appropriate regional mitigation park account. Lands that are eventually approved for acquisition are vested with either the Board of Trustees, or another appropriate government entity.

The responsibility for the management of lands acquired through the mitigation park program rests with the FWC. These parks are managed primarily to enhance listed species populations, particularly those animals for which state and federal approvals are required prior to their being impacted by new land development. All mitigation parks are designated by the FWC as Wildlife and Environmental Areas, and are open to the public for low-intensity forms of recreation such as wildlife viewing, hiking and nature study.

Funding for land management within the mitigation park program is generated through an endowment-based format which allows the program to be virtually self-funding. Management fees that are collected from the sale of mitigation credits are deposited into separate management endowment accounts, and invested with the State Board of Administration. Only the interest that accrues on behalf of the management endowment is used to fund management expenses, thus preserving the earning power of the endowment and the availability of management funds for future years.

As of 2008, land purchases in excess of 9,700 acres have been completed. For additional information concerning this program, please call the FWC Mitigation Park Coordinator at (407) 846-5300.

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Photo Courtesy of David Moynahan Photography



In addition to the planning tools described earlier, there are a number of management and design factors that can be incorporated into communities and developments to make them more wildlife friendly. For example, following “Firewise” practices such as establishing buffer zones and removing exotic vegetation benefit humans and wildlife alike. Dark Skies ordinances protect wildlife from the harmful effects of ecological light pollution. Additionally, steps can be taken to plan stormwater management, buffer waterbodies and managing the long-term behavior of residents for wildlife value.

MANAGING FOR FIRE

It is counter-intuitive to many, but Smokey the Bear was quite wrong—at least when it comes to fire-adapted ecosystems. Fire is a desirable and essential event for many of Florida’s natural systems, as well as for the safety of developed areas. Fire is part of the natural regime in many Florida ecosystems including pine flatwoods, dry prairies, scrubby flatwoods, sandhills, sand pine scrub and xeric oak scrub. Even many of Florida’s wetland areas benefit from fires that sweep across their expanses during extended droughts.

Many habitat types depend on cyclic regularity of fire, plant growth, fuel accumulation and fire again. Fire brings benefits to ecosystems, including reducing fuel, opening the landscape, killing back certain plant species, releasing nutrients, and stimulating new growth, as some species only go to seed after a fire. The changes that fire causes in plant community structure are essential for many species of wildlife. Without periodic fire, the type and distribution of plant communities change. The habitats become increasingly unsuitable for native wildlife adapted to these environments. Additionally without periodic fire, fuel loads accumulate. This results in extremely disastrous fires that destroy or damage both human and wildlife habitats during drought years.

Fire is part of the natural regime in many Florida ecosystems including pine flatwoods, dry prairies, scrubby flatwoods, sandhills, sand pine scrub and xeric oak scrub. Even many of Florida’s wetland areas benefit from fires that sweep across their expanses during extended droughts.



Controlled burns of underlying vegetation are a must for many Florida habitats and needs to be factored into local planning and development decision.

The idea behind prescribed fire for fire-adapted ecosystems is that regular landscape fires are not destructive to the prevailing habitat types and, in fact, burning acts to sustain the native composition and density of vegetation. This can serve to reduce competing invasive plants, and control pest problems and opens space for tree regeneration, wildlife feeding and travel.

Reprinted with permission of the artist Douglas MacGregor



In many areas, the natural fire cycle has been disturbed. This is due to a developing consensus that the best way to eliminate damaging fires was to suppress fires. In Florida and around the nation, this has led to dangerous fuel load accumulation. As a result, there is greater potential for fires to burn out of control. This impacts rural and suburban communities. In addition to obvious property damage or destruction, these fires can result in a temporary reduction of air quality and impacts on human health, due to smoke, as well as reduced visibility and more accidents due to smoke encroachment on roadways. Where prescribed burns are regularly and properly conducted, a smaller fuel load remains than under periodic wildfire conditions, causing less damage to wildlife and human settlement areas.

Ecosystem Benefits of Prescribed Burning – For wildlife and habitats there are many benefits from fire. Many species of plants and animals require periodic fire to maintain habitat conditions needed for their survival. For example, the Florida

scrub jay and red-cockaded woodpecker, both listed endangered species, are each dependent upon fire to maintain suitable habitat conditions. In the absence of fire, habitat conditions change and the diversity and abundance of wildlife eventually declines.

The idea behind prescribed fire for fire-adapted ecosystems is that regular landscape fires are not destructive to the prevailing habitat types and, in fact, burning acts to sustain the native composition and density of vegetation. This can serve to reduce competing invasive plants, and control pest problems and opens space for tree regeneration, wildlife feeding and travel. Surprisingly, wildlife begins to use burned areas immediately following a fire, often literally before the smoke clears. Observations reveal a wide variety of species, including white tailed deer, tortoises, snakes, and all manner of bird life in areas immediately following a fire.

The post-fire recovery process is influenced by fire intensity, type of habitat, and patterns of rainfall. Recently burned areas actually attract many species of wildlife and seem to have little effect on use by others. Tender shoots from re-sprouting shrubs and herbaceous vegetation that emerge following a fire are highly nutritious and attract wildlife such as white-tailed deer and other herbivores. Fruit production is also stimulated by fire, resulting in increased availability of seeds and berries that provide food for many species of wildlife. Predators too, are attracted to these areas, presumably in response to the abundance of prey. Recently burned areas also are important feeding areas for chicks of ground foraging species, such as turkey and bobwhite quail. The rapid recovery of vegetation, the apparent ability for most species of wildlife to use recently burned areas, and the high-quality habitat provided during post-fire recovery indicate that fire enhances wildlife habitat in Florida's fire-adapted habitats. Fire in Florida often represents renewal of wildlife habitats.

In this regard, to most closely mimic the natural regime, controlled burns are generally conducted during the lightning season (May-June). Nevertheless, season timing of a burn is site specific and specific to particular management goals. Further, the return frequency of controlled burns for an area should strive to mimic the natural fire adapted ecology regime. The Division of Forestry's *Basics Prescribed Fire Training Manual* for maintaining natural communities and wildlife habitat provides recommended burning frequencies for different habitat types. It is available at www.fl-dof.com/wildfire/rx_training.html.

“Firewise” Design and Management – Due to the impacts of repeated wildfires on ecosystems and developed areas, Florida has adopted a design and management approach known as “Firewise.” This approach seeks to strike a balance between known ecological benefits of regular fires across many of Florida’s landscapes, and the pragmatic realities that human development must be designed to be safe and sustained within fire the dependent ecosystems. Firewise development design is well covered in the Florida Departments of Community Affairs and Agriculture and Consumer Services 2004 publication, *Wildfire Mitigation in Florida: Land Use Planning Strategies and Best Development Practices*, which is available at www.firewise.org.

Firewise community planning and development design actions can incorporate the following:

- Preservation of Critical Smoke Dispersal Areas (CSDAs) or important smoke sheds that are essential for the safe and effective dispersal of smoke resulting from prescribed fire. These areas are identified through GIS mapping and delineate portions of the landscape needed for smoke dispersal dependent upon the spatial context of the fire use area and the ambient wind direction patterns used for prescribed fire. Proper growth design should avoid placement of critical smoke targets such as airports, schools, hospitals and roadways within these historic dispersal areas. Uses such as agriculture, silviculture, low density residential

development, and appropriately designed and configured roadways may be appropriate within these areas.

- Creation of an overlay for developed areas adjacent or proximate to managed lands receiving ecological burns, which note the realities of regular burns and a “Notice of Proximity” issued. This notice is recorded in the deed or rental agreement on all properties within the overlay zoned area boundary. It makes all property owners aware that the managed area is within close proximity and that there are certain practices regularly take place such as prescribed fire (and thus smoke and increased fire risk), pesticide usage, heavy machinery usage, removal of exotic plants and animals.
- For developments within fire dependent ecosystems, not only should habitat be saved, but a minimum 30 foot buffer for a fire line should be saved adjacent to habitat. This, due the periodic construction of fire lines separating developed areas and preserved habitat.
- Incorporation of Firewise Practices in any subdivision built within fire dependent ecosystems. Without these practices it will be harder to do prescribe burns or protect homes and lives from wildfires.
- Placement of stormwater ponds, trails, or other open space along outer edge of developed areas adjacent to managed lands to act a fire break.
- Use of conservation subdivision designs wherein the common area set-aside is strategically placed as a fire break between the managed fire-adapted area and the developed area.
- Regular elimination and control of exotic plants that may contribute to the fuel load can be programmed.
- Hydrology restoration for altered, over-drained land and habitats proximate to developed or developing areas can be instituted. This is often possible as old agricultural areas are urbanizing or suburbanizing.

Conducting Prescribed Burns – From a wildlife and habitat perspective, before development dominated the Florida land-

Due to the impacts of repeated wildfires on ecosystems and developed areas, Florida has adopted a design and management approach known as “Firewise.” This approach seeks to strike a balance between known ecological benefits of regular fires across many of Florida’s landscapes, and the pragmatic realities that human development must be designed to be safe and sustained within fire the dependent ecosystems.

Today, the principal management tool to supplement wildfire's role in perpetuating such communities is the "prescribed ecological burn". (i.e., a controlled burn which promotes ecological benefits), mechanical treatments, herbicides, and biomass removal.

scape, fires were generally ignited by lightning strikes. The intensity of the fire varied by plant community, and frequency ranged from 1 to 40 years. Today, the principal management tool to supplement wildfire's role in perpetuating such communities is the "prescribed ecological burn" (i.e., a controlled burn which promotes ecological benefits), mechanical treatments, herbicides, and biomass removal.

In many instances, prescribed burning is by far the most cost effective treatment to reduce fuel loads. In Florida, prescribed burning is authorized by Chapter 590, Florida Statutes and Chapter 51-2 of the Florida Administrative Code, commonly known as the Florida Prescribed Burning Act. The statute includes two sets of provisions regulating prescribed burning, one for non-certified burners, and another for certified prescribed burn managers. A "certified prescribed burn manager" is a person who has completed the Division of Forestry (DOF) prescribed burning certification program. Such an individual can be authorized to conduct burns under the sensitive, open, and forest and range categories. A certified prescribed burn manager can burn under less restrictive air dispersion criteria, and enjoys increased liability protection. Under the Florida Prescribed Burning Act, prescribed burning must:

- Be performed only when at least one certified prescribed burn manager is present on site.
- Have a written prescription (a plan for starting and controlling a prescribed burn) prepared prior to receiving authorization from DOF to burn.
- Be in the public interest and not cause a public or private nuisance when conducted pursuant to state/local air pollution statutes and rules applicable to prescribed burning.
- Be considered a property right of the property owner if naturally occurring (vegetative) fuels are used and when conducted pursuant to the Act's provisions.

As long as these provisions are fulfilled, no one can be held

liable for injury or damage caused by a fire unless negligence can be proven.

The Florida Division of Forestry has a Smoke Screening Tool available at www.fl-dof.com/wildfire/tools_and_downloads.html. Anyone can use the tool, but it is primarily designed to allow individuals who are planning on conducting acreage or pile burning to view a predicted smoke plume for the planned burn. As long as all burn parameters are the same, you will see the same plume with the Smoke Screening Tool that the Division of Forestry Duty Officer sees when they issue or deny an official authorization. However, the Smoke Screening Tool does not authorize a burn, and an individual must still contact the appropriate Division of Forestry District Office to obtain a burn authorization.



Disney Wilderness Preserve with Critical Smoke Dispersal Areas.

Photo Courtesy of The Nature Conservancy

FIRE IN THE SUBURBS: ECOLOGICAL IMPACTS OF PRESCRIBED FIRE IN SMALL REMNANTS OF LONGLEAF PINE SANDHILL

Logging, fire suppression, and urbanization have all contributed to the serious decline and fragmentation of the longleaf pine ecosystems in Florida and the southeastern United States. Management practices (or lack thereof) have led to replacement of many longleaf pine savannas by closed-canopy forests dominated by oaks and other hardwoods. Effective management of the remaining patches of these fire adapted communities must incorporate periodic low-intensity fires, even where they are located on private lands in populated urban and suburban areas. Research has demonstrated that prescribed fire can be used for restoration and management of small remnants of longleaf pine sandhill in suburban neighborhoods. It is also clear that although a single prescribed burn can be effective, it will take more than one burn to attain desired restoration goals in degraded longleaf remnants.

Approximately 75 percent of the remaining longleaf pine lands occur in stands less than 100 acres; about one-third are less than or equal to 20 acres. Most remaining longleaf pine habitats are on private lands. Many of these areas are in ecological decline and are being lost in suburban settings, partially because people are uninformed about how longleaf pine ecosystems can be maintained. One conservation option is to work to preserve or restore the multitude of small fragments that remain. Although it is comparatively easier to maintain the ecological integrity of larger tracts of forest, these small habitat "islands" can provide effective demonstrations the benefits of restoration and management of natural ecosystems. Small habitat remnants, even in highly fragmented areas, can play critical roles in the preservation of biological diversity though management plans are needed for these longleaf pine remnants

Photo Courtesy of Ginger L. Corbin, U.S. Fish & Wildlife Service



located within suburban areas.

These areas are small and are likely to require labor-intensive management to maintain or enhance sandhill species' population sizes and diversity, reduce hardwood densities, and prevent further invasion of native hardwoods and exotic species. Prescribed fire is a cost-effective and ecologically beneficial tool that can be used to achieve these objectives. Where longleaf pine ecosystem restoration is the goal, herbicide and mechanical treatments in addition to prescribed burns are the standard treatments used to reduce dense hardwood midstories that occur as a result of fire suppression. Although herbicides and mechanical treatments are effective in eliminating unwanted plants, each can be significantly more costly than prescribed burning. Furthermore, herbicides can be toxic to wildlife, and wiregrass, a keystone component of longleaf pine ecosys-

tems, is adversely affected by mechanical treatments.

Research shows that prescribed fire can be a viable and effective land management tool in small habitat remnants. However, it is also evident that after many years of fire prevention it will take more than one prescribed burn before a degraded remnant of a fire adapted ecosystem can be "restored." Multiple prescribed burns may be necessary to achieve this goal. The impacts of additional fires can be enhanced by selective removal or thinning of dense areas of hardwoods; many degraded sandhills will likely require the use of multiple management tools.

Source: Fire in the Suburbs: Ecological Impacts of Prescribed Fire in Small Remnants of Longleaf Pine (Pinus palustris) Sandhill. By, Kimberly A. Heuberger and Francis E. Putz, University of Florida, Gainesville, Florida, 2003.

Light pollution has several forms. “Astronomical light pollution” obscures the view of the stars, planets, and other features of the night sky, while “ecological light pollution” alters natural light regimes in terrestrial and aquatic ecosystems, affecting the behavior of plants and animals.

Ecological light pollution is a pervasive problem for wildlife. The introduction of artificial light into wildlife habitat represents a rapidly expanding form of human encroachment.

Wildlife-Friendly Lighting – Light pollution has several forms. “Astronomical light pollution” obscures the view of the stars, planets, and other features of the night sky, while “ecological light pollution” alters natural light regimes in terrestrial and aquatic ecosystems, affecting the behavior of plants and animals. Ecological light pollution is a pervasive problem for wildlife. The introduction of artificial light into wildlife habitat represents a rapidly expanding form of human encroachment. Many animals are nocturnal and thus most active for feeding and mating during the low light or nighttime portions of the day. Ecological light pollution has demonstrable effects on the behavioral and population ecology of organisms in natural settings. As a whole, these effects on the biological community derive from changes in orientation, disorientation, or mis-orientation, and attraction or repulsion from the altered light environment. These responses in turn may change habitat quality, disrupt biological rhythms related to foraging, reproduction, migration, and communication, and disrupt inter species specific interactions evolved under natural patterns of light and dark. Light-induced changes may have serious implications for wildlife sustainability.

Impacts on Wildlife – Here in Florida, sea turtle populations have received attention as they are affected by extensive shoreline lighting that disorients and disrupts egg-laying adults and hatchling sea turtles on their natal beaches. Disorientation due to artificial lighting causes thousands of turtle hatchling deaths each year. Thanks to ongoing marine turtle conservation efforts, most coastal counties have responded by adopting some form of dark sky ordinance along the beaches.

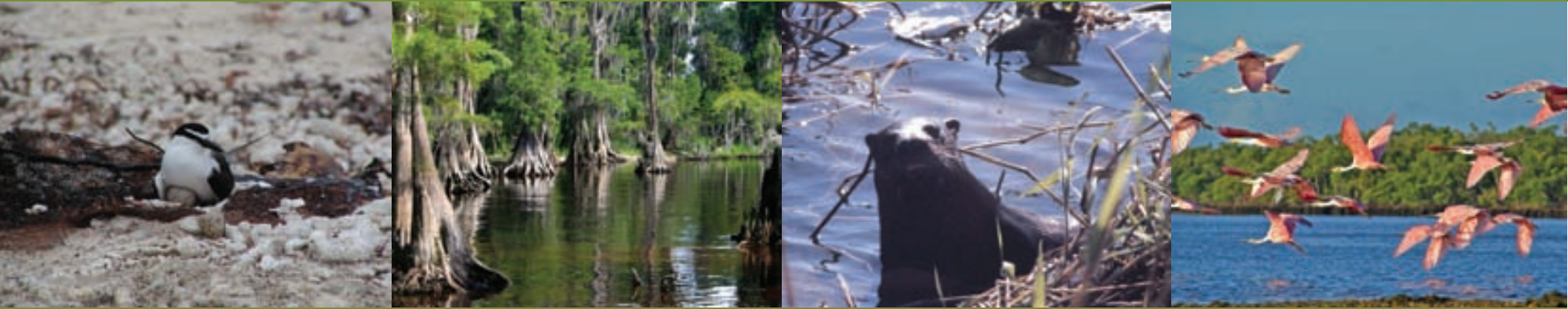
In addition to sea turtles, many other animals are also affected by stray light intruding into their night world. The detrimental effect of light pollution from our communities is pervasive with light spillage affecting many habitats and exacerbated by increases in the use of security and garden lighting. The problems penetrate deep into the heart of rural landscapes and are not just limited to



Photo Courtesy of Josh Best

urban or highly suburban areas. Some of the consequences of light for certain taxonomic groups are well known, such as the deaths of migratory birds around tall lighted structures. Birds are known to circle lights until they drop from exhaustion. Others, disoriented, fly directly into the buildings at full speed, either at night or at daybreak, mistaking clear glass for an endless blue sky. Scores of birds lured by the bright lights of developed areas could be saved from a skull-crushing death if lights were simply turned off at night or toned down.

The more subtle influences of artificial night lighting on the behavior and community ecology of species are less well recognized, and constitute a new focus for research in ecology and a pressing conservation challenge. For instance, investigators exploring the effects of lights on the foraging behavior of Santa Rosa beach mice found the mice exploited fewer food patches near artificially lighted areas than in areas with little light, and harvested fewer seeds within patches near bug lights. Other researcher found that roads illuminated by white streetlamps attracted three times more foraging bats than did roads lit by



orange streetlamps or unlit roads, and that more insects flew around white lamps than around orange lamps. Further, the number of bats recorded in any section of road was positively correlated to number of white street lamps along the section.

In other experiments on the effects of light pollution on salamanders, it was found that white holiday lights strung along transects in Virginia result in salamanders staying hidden for an additional hour, affecting the amount of feeding time. These researchers also discovered that some tree frogs stop calling in brightly-lit areas, which may affect mating occurrence. Further, lab studies show that the amount of light exposure may affect DNA synthesis and the production of hormones—hormones that regulate everything from how much fat the frogs store for the winter to when they produce eggs. Other studied wildlife and light effects show:

- Panthers traveling at night avoid brightly-lit areas causing them to miss crucial landscape linkages.
- Moths may lose essential defensive behaviors when near artificial light, making them vulnerable to predators.
- Dark-adapted frogs exposed to rapid increases in illumination may be temporarily 'blinded', unable to see prey or predators until their eyes adapt to the new illumination.
- Salamanders are strongly attracted to light which could divert salamanders away from breeding sites, and make them more vulnerable to predation or road mortality during migrations.

A growing body of evidence shows that artificial light affects the behavior of wildlife and that light pollution deserves greater consideration in planning wildlife-friendly communities.

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Photo Courtesy of: Bird on Beach – David Moynahan Photography; Undisturbed Shoreline, Lake Louisa State Park – Myrna Erlen Bradshaw and the Florida Wildlife Federation; River Otter – David Moynahan Photography; Flock of Spoonbills, Everglades National Park – Constance Mier and the Florida Wildlife Federation

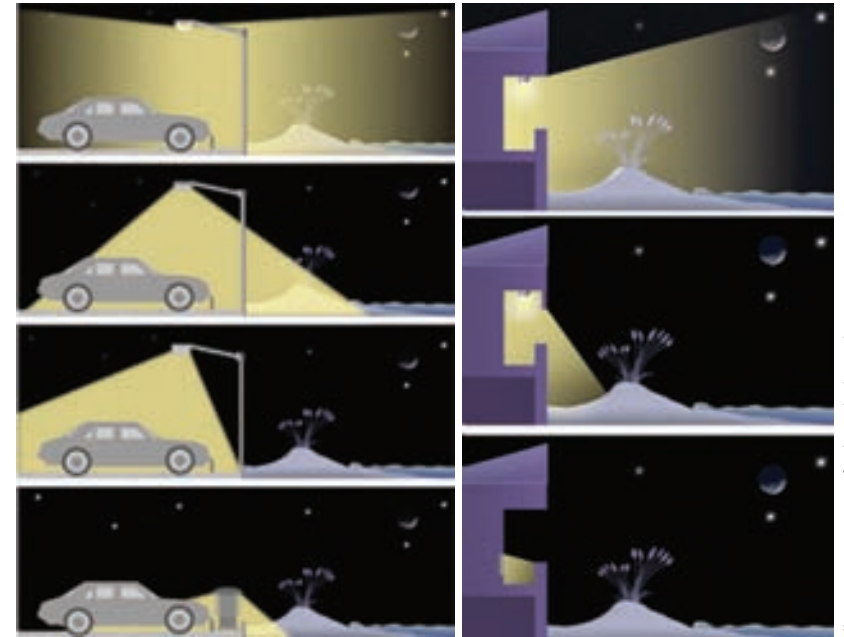
A local government can work to manage negative lighting impacts on local wildlife by adopting what is termed a “Dark Sky” ordinance that provides for wildlife-friendly lighting.

Management Recommendations for a Dark Skies Community – A local government can work to manage negative lighting impacts to local wildlife by adopting what is termed a “Dark Sky” ordinance that provides for wildlife-friendly lighting:

- Keep them low (close to the ground).
- Keep them shielded, and minimize light trespass into the night



Photo Courtesy of Dan Pennington, 1000 Friends of Florida



Progressively better lighting situations.

Illustration Courtesy of Edmond Alexander

sky or adjacent areas. Exterior and road lighting should use low spillage lights that reflect light directly downward onto the area to be illuminated. A variety of products to accomplish this goal are now on the market.

- Use long-wavelength lighting, as studies indicate longer wavelengths are less likely to impact sea turtles and other wildlife.
- Avoid using fluorescent and mercury vapor lighting.

LIGHTING FOR CONSERVATION OF PROTECTED COASTAL SPECIES

To prevent adverse impacts to nesting and hatchling sea turtles, the nocturnal movements of beach mice, and resting shorebirds, the minimal amount of exterior lighting for human safety and security should be installed following the guidelines below.

1. Lights should not be placed within the developed footprint such that the light is visible outside the developed area.
2. Lights on dune walkovers or boardwalks should not be located seaward of the landward toe of the dune (or its equivalent).
3. The light source or any reflective surface of a light fixture should not be visible from any point beyond the developed footprint. There should be no illumination of any area outside the developed footprint, either through direct illumination, reflective illumination, or cumulative illumination.
4. Exterior wall light fixtures should be either low pressure sodium lamps or low wattage (i.e., 480 lumens or less) "bug" type florescent bulbs. The light fixtures should be completely shielded without interior reflective surfaces and directed downward. Lights may also be louvered and/or recessed, with black baffles or without interior reflective surfaces as appropriate.
5. Light fixtures should be mounted as low as feasible to provide light where it is needed (i.e. patios, balconies, pedestrian paths). This can be accomplished through the use of low bollards, ground level fixtures, or low wall mounts.
6. Lights for purely decorative or accent purposes should not be visible outside of the developed footprint and shall be limited in number and intensity. Up-lights shall not be used.
7. Roadway lighting should use shielded low pressure sodium (LPS) lamps. The height and number of fixtures should be kept to a minimum and should be positioned and mounted in a manner such that the point source of light or any reflective surface of the fixture is not visible on the development outside of the developed footprint.
8. Lighting in parking areas should use shielded low pressure sodium (LPS) lamps, have a height of 20 feet or less, and should not be visible from any point outside the developed footprint.
9. The lighting should be positioned and shielded such that the point source of light or any reflective



Outdoor lighting can be designed to lessen light pillage into the surrounding night sky.



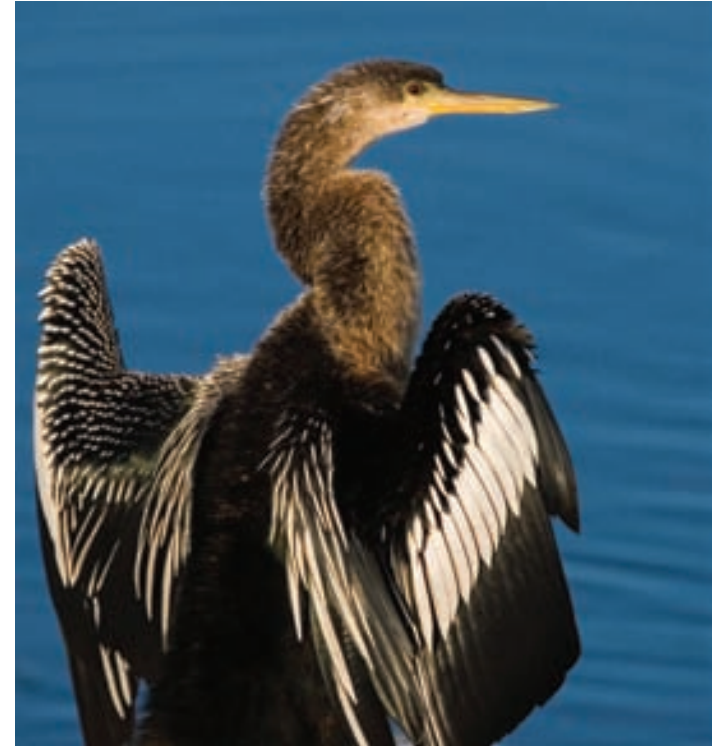
The more subtle influences of artificial night lighting on the behavior and community ecology of species are less well recognized, and constitute a new focus for research in ecology and a pressing conservation challenge. For instance, investigators exploring the effects of lights on the foraging behavior of Santa Rosa beach mice found the mice exploited fewer food patches near artificially lighted areas than in areas with little light, and harvested fewer seeds within patches near bug lights.

LIGHTING FOR CONSERVATION OF PROTECTED COASTAL SPECIES (continued)

- surface of the light fixture is not visible outside of the developed area. The light emanating from such fixtures may not directly or indirectly illuminate the area outside of the developed footprint.
10. Car and other vehicle parking areas should be designed or positioned such that vehicular headlights do not cast light outside the developed footprint. Native dune vegetation, and/or other ground-level barriers may be used to meet this objective.
 11. Minimal temporary lighting during construction should only be used for security and safety. The lights should be completely shielded and low-mounted. Low pressure sodium lights or low wattage yellow "bug" type bulbs (480 lumens or less) should be used. The lights should not directly or indirectly illuminate any area outside the construction site.
 12. Light fixtures using natural gas as the light source should not be used for fixtures unless they are fully shielded and the lighting is not visible outside the developed footprint.
 13. Tinted glass or window film that meets a transmittance value of 45 percent or less (inside to outside transmittance) should be used on all windows and glass doors.
 14. All ceiling-mounted light fixtures in the interior of the condominium units that could be visible from the outside should minimize the amount of exposed light bulbs.



Source: U.S. Fish and Wildlife Service,
Panama City, Florida,
www.fws.gov/panamacity



PLANNING STORMWATER MANAGEMENT AND WATERBODY BUFFERS FOR WILDLIFE VALUE

Local watershed features – including streams, wetlands, rivers, sinkholes, and natural or man-altered drainage features – form the backbone of a community’s landscape and are quite important to wildlife. Local governments, landowners and developers should examine stormwater, transportation and recreational infrastructure networks and proposed projects for wildlife integration and enhancement opportunities. These infrastructure facilities are often large budget items, which can incorporate multi-use wildlife enhancements or design features. A community should work to identify and develop cross-connections and multi-use opportunities when planning transportation, stormwater management and community recreation facilities. Public money can be saved and safety and efficiencies gained when these public facilities are integrated with community design that capture and conserve or enhance green infrastructure benefits.

The role of the local government is to plan for and encourage conservation-oriented low impact development design:

- Use natural hydrologic functions as the integrating planning framework.
- Direct clustering of development to the more developable areas and set aside wildlife habitats and environmentally sensitive portions.
- Link density bonuses to tightly clustered development when environmentally logical.
- Provide for logical environmental links to adjacent parcels to extend the habitat, wildlife and natural functionality benefits (think connectivity).
- Integrate stormwater management early in site planning activities.
- Preserve waterbody and riverine green edges (a combined natural upland buffer and in-water littoral edge).
- Work with landowners and developers to not subdivide lots and properties to the water’s edge, but instead maintain a common community shoreline corridor with wildlife habitat features.
- Emphasize simple, nonstructural, low-tech, and low cost methods that incorporate natural landscape features and functions.
- Create a multifunctional multi-use landscape.
- Provide for permanent set-aside of undeveloped areas via conservation easements or other legal instruments.
- Develop and implement reoccurring events to cross-train the jurisdiction’s professional planning, engineering and related development review staff and administrators regarding linkage and integration of green infrastructure with other necessary infrastructures.

Local watershed features – including streams, wetlands, rivers, sinkholes, and natural or man-altered drainage features – form the backbone of a community’s landscape and are quite important to wildlife. Local governments, landowners and developers should examine stormwater, transportation and recreational infrastructure networks and proposed projects for wildlife integration and enhancement opportunities.



Graphics by Benjamin Pennington

Too often shoreline habitats (upland-to-water edge and in-water near shore environments) are subdivided into multiple lots with multiple home sites, management schemes and individual piers. Leaving a common vegetated shoreline, linked to interior upland habitat and constructing one (or possible several) community piers would benefit wildlife and water quality.

Ephemeral wetlands and ponds are small landscape features that provide important wildlife rearing, feeding and life cycle opportunities for amphibians and other wildlife species. These areas contribute significantly to local biodiversity by supporting an abundance of plants, invertebrates, and vertebrates that would otherwise not occur in the landscape.

EPHEMERAL WETLANDS AND POND LANDSCAPES

Ephemeral wetlands and ponds are small landscape features that provide important wildlife rearing, feeding and life cycle opportunities for amphibians and other wildlife species. These areas contribute significantly to local biodiversity by supporting an abundance of plants, invertebrates, and vertebrates that would otherwise not occur in the landscape. These often fish-free ponds provide optimal breeding habitat for specialized groups of amphibians that have evolved to use these wetlands to avoid fish predation. In fact, 20 percent of Florida's amphibians breed only in these ephemeral ponds and many others do so opportunistically. Most ephemeral wetland amphibians return to breed in the ponds where they originated and show little tendency to relocate if their breeding habitat is disturbed. Protecting ephemeral wetlands and ponds is a critical first step in conserving amphibians and the variety of other wildlife food chain linked species.

In addition to reproduction needs of amphibians, many other interesting species rely on these ponds for food, reproduction,



Photo Courtesy of Rebecca Meegan, Coastal Plains Institute and Land Conservancy

An example of an ephemeral wetland area that is so important to the life cycle of numerous wildlife species.

and other habitat needs, including carnivorous plants such as sundew and butterworts, birds such as the great blue heron, white ibis, and wood duck, reptiles like the striped mud turtle and scarlet kingsnake, and medium-to-large-sized mammals such as fox, deer, bobcat, and bear. After emerging from the relative safety of the ephemeral wetlands, frogs and salamanders provide a valuable food source for a wide variety of these forest animals. For example, researchers have found that the weight of all pond-breeding amphibians exceeded the weight of all breeding birds and small mammals in the 50-acre upland forest surrounding their study pond. The results emphasized that ephemeral wetland amphibians exert a powerful influence on the ecology of surrounding lands, up to 0.25 miles from the edge of the pond, and that the loss of individual ephemeral wetlands weakens the health of entire wildlife communities.

The destruction of small wetlands in the landscape increases the distances between remaining wetlands, which can fragment populations and ultimately lead to local extinctions. A unique feature of ephemeral ponds is that bigger is not necessarily better. Research in Florida repeatedly has shown that ponds smaller than 1 acre can support more than 15 amphibian species, including rarer species such as the flatwoods salamander, striped newt, and gopher frog. Additionally, wetlands that hold water for only a few months out of the year can be just as important in terms of bio-productivity as ponds that remain hydrated throughout most of a year.

Uplands and ephemeral wetlands are uniquely tied. As important as small wetlands are, preserving the uplands surrounding these landscape features is also essential for maintaining ecosystem health. Pond-breeding amphibians spend more of their life in uplands than in the wetlands; conversely, turtles that inhabit these ponds require the uplands for nesting. By creating a buffer around these ponds, developments can support an increasingly rare ecosystem in Florida while providing a unique aesthetic value to their community.

DESIRED PLANNING, DESIGN AND MANAGEMENT FOR EPHEMERAL WETLANDS AND PONDS

Community plans and individual development plans need to exhibit cognizance and care to protect ephemeral wetlands and ponds in their land development design and management features. For example, clustering development away from ephemeral wetlands and ponds and establishing permanent conservation easements over the area is an important planning tool that can be used that not only conserves open space, but also reduces impervious surfaces and accessory infrastructures. The ephemeral nature of water in these ponds means that any pond surveys should be conducted during the rainy season, when ponds are more likely to hold water and are easier to identify. Specific planning, design and BMP considerations:

- Preserve the wetland/pond, including both canopy and understory (e.g., shrubs and herbaceous vegetation). The integrity of the habitat immediately surrounding the ephemeral wetland or pond depression is critical for maintaining water quality, providing shade (or open sun in some instances), and wildlife habitat. For example, juvenile salamanders are especially vulnerable to drying during the first months after emergence and such desiccation is much more likely where habitat elements described above are lacking.
 - Avoid barriers to amphibian dispersal such as walls, high curbs and fences.
 - Protect and maintain ephemeral wetland/pond hydrology, hydroperiod and water quality.
 - Maintain a pesticide-free environment.
 - Provide permanent easements over the land to protect these areas and their contiguous critical terrestrial critical habitat for alteration. On subdivision projects where open space with ephemeral wetlands is reserved, a developer can convey a conservation easement to a local land trust, local government, or a conservation not-for-profit organization.
- Communities may also consider overlay zones specifically designed to protect ephemeral wetlands and ponds. These zones should be surveyed and graphically depicted and adopted into the comprehensive plan, neighborhood subplans or included as a part of a separate ordinance within the local land development regulations. While leaving zoning in place, additional standards, requirements, and incentives are applied in the overlay zone. The zone could provide a mix of regulations and incentives to conserve ephemeral wetlands and pools and preserve economic equity including (but not limited to):
- Minimal lot-clearing restrictions within the zone.
 - Denser clustering of development, including density bonuses for tightly clustered, conservation-oriented subdivisions.
 - Reduced road width standards including cul-de-sac radii, prohibiting hard 90 degree vertical curbing.



The Ornate Chorus Frog is one amphibian linked to ephemeral wetland areas.

- Establishing a transfer of development rights program where a landowner gets credits in a developable portion of the community in exchange for giving up development credits in the overlay zone.

Sources: Rebecca Meegan, Coastal Plains Institute and Land Conservancy; and M.A. Bailey, et al, *Habitat Management Guidelines For Amphibians And Reptiles Of The Southeastern United States, 2002*; and, Calhoun, Aram J. K. Ph.D. et al, *Best Development Practices Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States, 2002*.

Community and homeowner understanding and buy-in are essential to the creation and sustaining a wildlife-friendly community. Although it may be a developer who originally implemented the green design, it is up to the community residents to manage and maintain many of the sustainable features.

PLANNING FOR SUPPORTIVE LONG-TERM BEHAVIOR IN A WILDLIFE-FRIENDLY COMMUNITY

Community and homeowner understanding and buy-in are essential to the creation and sustaining a wildlife-friendly community. Although it may be a developer who originally implemented the green design, it is up to the community residents to manage and maintain many of the sustainable features. Why is this important? Studies have indicated that homeowners living in conservation designed development often do not understand the concept of open space and are not aware of appropriate management practices to minimize impacts on wildlife (Youngentob and Hostetler, 2005; Nosieux and Hostetler, 2007).

For example, decisions made by homeowners in maintaining their own homes and yards can have drastic consequences for nearby conserved wildlife habitat. Consider the effect when a homeowner unknowingly chooses invasive exotics for their garden. That choice can have an impact on natural areas that a developer set aside during site development. The invasive plants often spread into those natural areas and have negative impacts on the habitat. Property owners need to know which plants are considered invasive exotics and avoid planting them in their yards. They also need to know how to remove any invasive that might currently be part of their gardens.

Other impacts include pets (particularly cats) that are off leash and roaming in communities. They can be significant predators on a wide variety of mammal, amphibian, reptiles and bird species. Further, even where protected patches of habitat have been designed within a community, local residents need to understand the importance of staying on designated trails and not walking through or using ATVs to traverse conserved areas. The presence of humans walking near or through

conserved areas can negatively affect wildlife. The frequent presence of humans within an area has been shown to diminish the number of breeding bird territories and nests (e.g., Miller and Hobbs 2006).

Initial community planning and design for wildlife is necessary, but management over time is key! Neighborhoods evolve: houses are sold, experienced owners leave and new owners arrive who are unfamiliar with the communities "wildlife-friendly culture." Success relies on residents being on board in terms of understanding the goals of the community and actions that help conserve specific wildlife populations and biodiversity.

Actions may include having the developer set up an educational package that consists of a brochure, a website, and kiosks (Hostetler 2006) and to include critical wildlife friendly goals, objectives and policies in the homeowner association's bylaws and covenants. Three specific elements help inform residents:



Interpretive signage can help residents know wildlife and habitat features.



- **Interpretive Kiosks:** Highly visible interpretive kiosks and signs are placed in public areas where people traffic is high or on a trail system. Each of the signs contains informative displays that discuss a particular topic, such as water, energy, or wildlife. Kiosks should be dynamic, with different informative panels being inserted throughout the year. These kiosks are not only informative and provide a place for neighbors to interact, but can they also serve as a catalyst for people to obtain more information by directing them to the website.
- **Website:** Because the kiosks and signs can give only limited information, an associated website is constructed that gives detailed environmental information and management strategies pertinent to a community.
- **Brochures:** A brochure is given to each new homeowner. This brochure highlights local natural resource issues and invites homeowners to explore the kiosks in their neighborhood and visit the website.

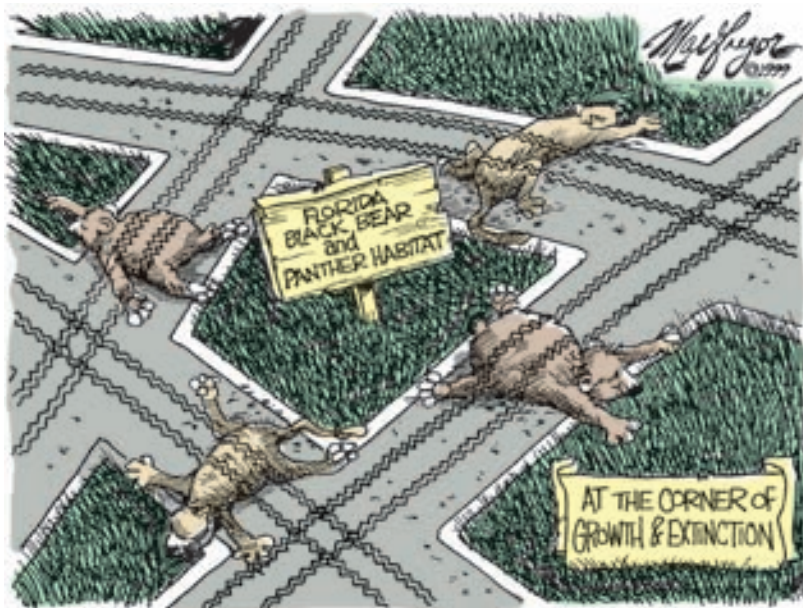
Wildlife information should be specific to the community and not just a general list of "good" practices—for example, the web site should not simply say it's good to plant native vegetation for wildlife, but should list which plants affect which species and where to obtain the native plants nearby. For large master-planned communities, it is also useful to have a full-time conservation manager that works for the neighborhood and to ensure that all landscaping and maintenance staff is educated on the wildlife and habitat needs. A dedicated conservation manager can serve as a local source for information and help implement newsletters, local conservation committees, and environmental activities such as bird walks and clean-ups. For an example of a community that has both an environmental education package and a conservation manager, visit www.wec.ufl.edu/extension/gc/harmony/.

Wildlife information should be specific to the community and not just a general list of "good" practices – for example, the web site should not simply say it's good to plant native vegetation for wildlife, but should list which plants affect which species and where to obtain the native plants nearby.

Photos Courtesy of David Moynahan



This chapter presents information and guidelines to assist in accommodating wildlife and habitat permeability and sustainability along Florida's roadways. The decision of how, when, and where to incorporate structures for wildlife linkages and maintaining habitat permeability must be based on scientific evidence. They benefit by being done with the cooperation and coordination from resource agencies, conservation experts, the Florida Department of Transportation (FDOT), local transportation authorities, and other interested entities.



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GUIDELINES FOR ACCOMMODATING WILDLIFE

Roads as obstacles to animal movement can be a major determinant of functional connectivity across landscapes. With this realization, roadway projects at many scales (national, state, regional or local) are beginning to incorporate designs for the maintenance of wildlife movement and habitat permeability. Roads, highways and their related facilities (e.g., stormwater management areas, or entrance and exit features) are prominent

parts of the modern landscape and subdivide and fragment Florida habitats. Further, each road's environmental footprint can extend far beyond the edge of pavement—the “road-effect zone” is estimated to be 15 to 20 times as large as the actual paved right of way. In these regards, roads impact wildlife habitats and rural areas beyond just direct impacts.

While few people dispute the need to avoid or minimize roadway-wildlife interactions, it has not always been easy obtaining consensus on how to achieve this goal. Decisions regarding wildlife accommodations in planning transportation infrastructure must be based on careful consideration of relevant ecological, safety, engineering, financial, and regulatory concerns associated with an area and project. Each stakeholder in the process has a viewpoint that must be understood, although not necessarily agreed to, by all other stakeholders. It is important that questions of sustaining or restoring wildlife habitat connections are raised early in the transportation facility planning process.

As Florida's resident and visitor populations continue to expand, an increasing network of roadways is being planned and constructed to accommodate this growth. The majority of these roadway improvements include adding additional lanes on existing roadway to increase vehicle capacity; however, new roads are being planned and constructed in areas where locally-approved development is projected or occurring. As development and transportation projects occur in Florida, it is important to implement measures that will both serve public safety and sustain Florida's wildlife. To maintain Florida's rich diversity of wildlife, attention must be directed to local, regional, and state road building projects to reduce wildlife damaging impacts, including roadkill, displacement, and habitat fragmentation. Solutions to address these wildlife sustainability and traffic safety concerns may range from reducing speed limits and adding cautionary signage,

Roads as obstacles to animal movement can be a major determinant of functional connectivity across landscapes. With this realization, roadway projects at many scales (national, state, regional or local) are beginning to incorporate designs for the maintenance of wildlife movement and habitat permeability.

The need for establishing a wildlife linkage along an existing or proposed roadway may seem straightforward, but can be clouded by conflicting viewpoints and goals among interested parties and project stakeholders. The need for a wildlife linkage should always be based on relevant scientific data and facts.



Photo Courtesy of Don Pennington, 1000 Friends of Florida

State Road 29 in Collier County impacts the Fakahatchee Strand. In addition to signage and warning lights, several wildlife underpasses have been constructed and directional fencing provided.

to designing and building more habitat and wildlife linkage features for new facilities, to working to retrofit older facilities to incorporate wildlife friendly designs. The term “wildlife linkage” is used to describe the crossing structure, including associated components such as directional fencing or barrier walls, and the immediately adjacent habitat corridor on both sides of the roadway.

IDENTIFYING THE NEED AND GOALS FOR WILDLIFE LINKAGES

The need for establishing a wildlife linkage along an existing or proposed roadway may seem straightforward, but can be clouded by conflicting viewpoints and goals among interested parties and project stakeholders. The need for a wildlife linkage should always be based on relevant scientific data and facts. If construction of a crossing is warranted following an analysis of the data, the goal of the linkage is then defined. The goal establishes the benchmark by which the success of the linkage can be measured. But first, let’s look at how the need for a wildlife linkage should be determined.



Photo Courtesy of Florida Department of Transportation

Exclusionary fencing keeps animals from wandering onto roads.

What Data are Available to Support the Need? –

It is necessary to document the need for the wildlife linkage with scientifically valid data or evidence. The purpose of documenting the need is to ensure the linkage is designed and located in a manner that will maximize its success in meeting the established goal of the structure. Installing a structure because, “it seemed like a good idea,” is a poor excuse and a waste of economic resources if target species don’t occur in the area, or fail to use the crossing because of its location. The types of information that should be reviewed in assessing the need for a crossing may include:

- Identified chronic road-kill sites and carcass data.
- FDOT or local wildlife-vehicle crash data and law enforcement reports.
- Known wildlife migration/movement routes.
- Predictive modeling results and identified hot spots of focal species.

- Presence of listed, rare, endemic or species population of interest.
- Identified strategic habitat conservation areas.
- Riparian corridors.
- Designated greenways or presence of core conservation areas adjacent or nearby the project.
- Presence of separated required ecological resources for a species or set of species (e.g., a forest patch and ephemeral wetland breeding area for amphibians that are separated by a highway).
- Public ownership (or in public land acquisition programs or some permanent form of conservation or rural working lands designation) as opposed to private lands susceptible to development.
- Existing and future land-use on both sides of the roadway.
- Potential to be included in proposed road improvement project.

The data should be used to answer the following key questions in determining the need for a wildlife linkage:

- What are the ecological conditions that lead to the potential need for a wildlife linkage?
- What species would be affected by the presence or absence of a linkage?
- How would existing and future populations of these species be affected by the presence or absence of a linkage?
- How would the presence or absence of a linkage affect the safe passage of motorists on the highway?
- Instead of a linkage, would other wildlife accommodations be better suited to the situation (e.g., exclusionary fencing to prevent wildlife from crossing the road)?

The answers to each of these questions should be clearly documented in a technical memorandum or summary report with appendices containing the reviewed data and analysis process. This document then serves as the basis of decision for determining whether or not to proceed with planning, design, and construction of a wildlife crossing or other structure (e.g., exclusionary fencing, barrier wall, etc.).

What is the Goal of the Wildlife Linkage? – Once the need for a wildlife linkage has been determined, the central question that must be answered is: What are the goals of the structure(s)? It is not possible to consider the size, shape, and location of structures without first defining the purpose they are expected serve and what the desired outcomes are following construction. The goals should be well-defined and measurable where possible.

Goals of almost all wildlife linkages designed and constructed across transportation facilities originate from at least two important points of view; a human road use viewpoint and wildlife use and sustainability viewpoint. Each viewpoint needs to be considered. The human road use goals are often to reduce roadkill and thereby reduce the risk of wildlife-vehicle crashes with their resulting injuries, death and financial loss. The human viewpoint also includes a desire to conserve wildlife for our enjoyment and pleasure. From a wildlife use and sustainability perspective the goals are often to prevent individual road kill incidents, maintain or restore habitat permeability, decrease habitat and population fragmentation, and reduce direct habitat loss.

DESIGN CONSIDERATIONS FOR WILDLIFE LINKAGES

Much of the information used to justify the need for a wildlife linkage can also be used to assess the optimum design and location of the structure. As with the need for the crossing, scientifically valid data should be used to support the crossing's design

and location. Some important initial factors to consider include:

- Use by target species.
- Use by secondary or non-target species.
- Wildlife landscape and habitat linkage features.
- Specific location and design environmental factors of wildlife linkages.
- Long-term linkage sustainability (property ownership, conservation easements, etc.).
- Engineering and safety considerations.
- Costs.
- Monitoring and evaluation.
- Maintenance.



Graphic courtesy Benjamin Pennington

Hypothetical example showing a possible connection between two large conservation properties. As the highway is improved, a wildlife retrofit would strive to place an underpass, reforest a portion of pasture and install appropriate directional fencing to funnel wildlife to the underpass. Ownership outright, or easements, of land on both sides of the highway facilitate the connection.

CASE STUDY

Wildlife Crossings in Florida

Although not the first state to install wildlife crossings, Florida is recognized as a national leader in the use of crossings to minimize roadway-wildlife interactions. FDOT initiatives to address roadway-wildlife interactions began in the early 1990s with the upgrading of SR 84 (Alligator Alley) to interstate standards. Following a Section 7 consultation under the Endangered Species Act, the FDOT constructed 23 wildlife crossings and 13 bridge extensions over dry land to allow the Florida panther and Florida black bear to safely cross the new four-lane roadway. No Florida panthers or black bears have been killed on Alligator Alley in the project area since completion of the project. This project was notable for both its use of multiple crossings and for targeting multiple species.

NOTABLE WILDLIFE CROSSINGS IN FLORIDA

Six-laning of I-4 in Volusia County – Based on the results of an Environmental Assessment in 2000, the FDOT designed two large wildlife underpasses and a wildlife overpass along a six-mile corridor of public lands in the area of Tiger Bay State Forest in Volusia County. Major issues addressed by this project included Florida black bear road-kills, habitat connectivity, impacts to public land, and direct and secondary habitat loss.

US 441 Crossing at Paynes Prairie State Preserve – The Payne's Prairie State Preserve is a unique wet prairie managed by the Florida Department of Environmental Protection. Thousands of reptiles and amphibians were being killed annually where US Highway 441 crosses the preserve. In 1999, a 3-foot high wildlife barrier wall and culvert underpass system was constructed to keep reptiles and amphibians off the highway and allow them to move under the road.

Photo Courtesy of Dan Pennington, 1000 Friends of Florida



Photo Courtesy of Dan Pennington, 1000 Friends of Florida



Wildlife crossing on State Road 29 is interesting in that on one side of the road is a canal. To allow access across the canal, and under the wildlife crossing, the designers constructed a small bridge. The bridge has white sand rather than concrete on the walkable area to encourage animals to cross and leave footprint evidence of usage. A sensor initiated camera is located under the underpass. And as evidenced by the April 2008 photo, the underpass functions as intended for panthers.

Shown during very dry conditions, the Paynes Prairie box culvert wildlife crossing has an over-hanging upper lip to discourage crossing over the road.

SR 46 Bear Underpass in Lake County – Florida black bears were routinely being struck and killed by vehicles on SR 46 near County Road 433 as they crossed to habitat within central Florida’s Wekiva River Basin. In 1994, FDOT constructed a dirt-floor box culvert 47 feet long by 24 feet wide by 8 feet high and planted pine trees in the open pasture on one side of the road to guide bears to the culvert. A second crossing was later added. Additionally, the FWC purchased a 40-acre private in-holding within Rock Springs Run State Park (RSRSP) to ensure preservation of the bears’ travel corridor near the culvert. There are now two underpasses and bear movements have been recorded through both. Also, the second

structure provides connectivity under the road for recently acquired additions to Seminole State Forest on the north side of the road. These crossings link Wekiva State Park and RSRSP to Seminole State Forest. This is part of the effort to maintain viable regional connections, between the Wekiva Basin and the Ocala National Forest to the north, for black bears as well as many other species of wildlife.

Concrete culverts designed as wildlife crossings for black bears on SR 46 between the Wekiva River State Park and Seminole State Forest in central Florida have high fencing to either side to funnel wildlife toward the underpass opening.

SR 29 Panther Crossings in Collier County – SR 29 in south-central Florida runs through prime Florida panther habitat. At least 23 panthers were killed

on the highway between 1975 and 2005. Six wildlife crossings have been constructed along the highway in an effort to reduce roadway panther mortality. The two new crossings are 50 feet long and 8 feet high. Together, these six crossings allow panthers and other animals to move between Fakahatchee Strand State Forest and the Florida Panther National Wildlife Refuge on the west side of SR 29 and Big Cypress National Preserve



Photo Courtesy of Steve Homan



Photo Courtesy of FFWCC (panther surveillance photo)

on the east side of SR 29.

US 1 Key Deer Crossings on Big Pine Key – In 2002, the FDOT modified a 2.6 kilometer segment of US 1 to include fencing, experimental deer guards, and underpasses designed to prevent entry of Key deer onto the roadway. Post-construction monitoring showed a 95 percent reduction in Key deer-vehicle collisions by the second post-construction year.

The potential interactions among species should also be considered for placement and design of the crossing structure. Use of the passage system by predators may inhibit use by prey species. Careful study of the likely users of the structure and appropriate design features can minimize these interactions.

Use by Target Species – The target species is often the controlling factor in determining the type and size of the crossing structure. While no single design will accommodate all species at every crossing location, nearly three decades worth of crossing monitoring studies in the U.S. and Europe have revealed the following generalizations:

- Larger is generally better; however certain amphibians, reptiles, and small mammals may benefit from smaller diameter crossings.
- Most species prefer cover at both ends of the crossing. Other species require cover within the crossing.
- Natural lighting via a skylight in long crossings is preferred by most species but may repel certain reptiles or amphibians.
- To the maximum extent possible, crossing bottoms should mimic the substrate of the surrounding landscape.
- Crossings require fencing, barrier walls, or berms directing wildlife to the crossing entrance.
- The existence of conservation lands on both sides of the crossing is crucial to the long-term success of the crossing.

Data on the target species should also be used to support the location of the crossing. A properly designed crossing may not be used by the target species if it is not placed in an appropriate location. Telemetry recordings, least-cost pathways (travel/migration corridors), home range requirements, and life-cycle requirements of target species should all be used in assessing crossing location. For example, habitat use in the Everglades is dictated by the wet and dry seasons, with a more general use of the area during dry seasons. This was a consideration in measures to protect the Florida panther and other wildlife along Alligator Alley (I-75), where crossings were placed in the highway to allow wildlife movement to the drier northern areas during exceptionally wet years when habitat values were diminished in the area south of the interstate.

Use by Secondary Species – Although the target species

should be one of the determining factors in selecting the size, shape, and location of a crossing, ideally, the crossing should also provide habitat connectivity to other species that occur in the area. A large box culvert with an open dirt bottom may be appropriate for the Florida black bear, but certain species of small rodents and amphibians may be reluctant to enter the structure because of the lack of cover and moisture. Providing hollow logs, stumps, stones (often called debris walls) and a shallow channel within the culvert and vegetative plantings near the entrances may greatly increase the use of the crossing by secondary species (this would not be appropriate in an area where no stream channel exists). Structures in dry areas should be constructed so that they do not contain the lowest elevation to the surroundings. Most importantly, characteristics in a structure should most closely mimic the adjacent habitat.

Remember that the “target species” may be amphibians and reptiles or small mammals, so primary design concerns may center on them instead of needs for bears and panthers. Crossing structure systems should be designed as multi-species conveyances and for ecosystem level benefits, not for a single species.

The potential interactions among species should also be considered for placement and design of the crossing structure. Use of the passage system by predators may inhibit use by prey species. Careful study of the likely users of the structure and appropriate design features can minimize these interactions.

Wildlife Landscape and Habitat Linkage Features –

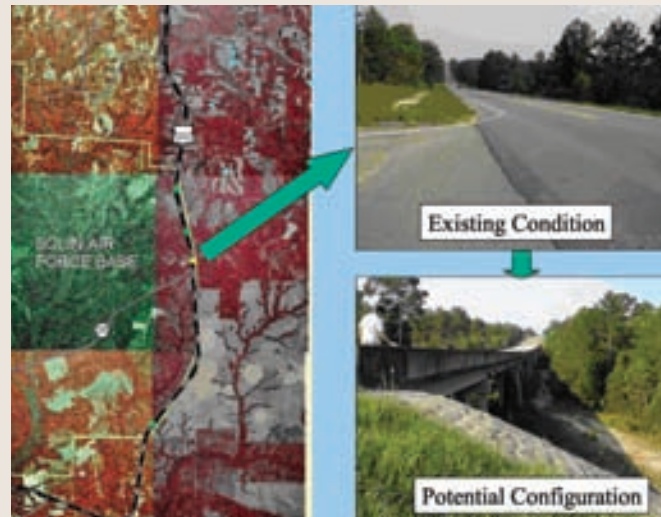
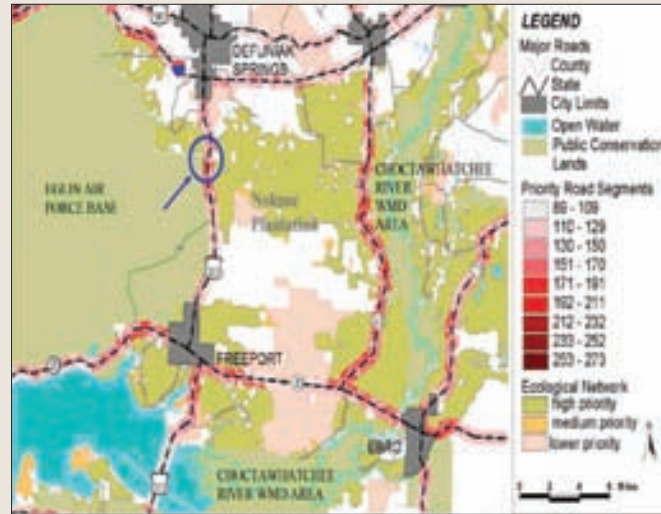
The landscape and habitat features surrounding the roadway may have a profound effect on the success of the wildlife linkage. Landscape features include such variables as topography, hydrology, and vegetative habitats. Specific design criteria for wildlife linkages will always need to be made on a case-by-case basis since they must take into account site-specific landscape and habitat features variables (e.g., topography, hydrology, adjacent habitats and species of interest habitat characteristics, etc.).

Nevertheless, initiating planning studies to determine the need

CASE STUDY**Planning for a Eglin-Nokuse Wildlife Linkage**

US 331 is a major highway that bisects the combined Eglin-Nokuse conservation area. The average annual daily traffic level is about 11,000 vehicles. Rapid growth and development in the coastal areas of Walton County have recently highlighted the need to widen the road to four lanes for hurricane evacuation purposes. The researchers used a comprehensive approach that employed several methods to determine the current and potential impacts of US 331 on wildlife resources in the Nokuse-Eglin habitat corridor. These methods included roadkill and track surveys, mark-recapture and existing culvert wildlife use studies, and GIS analysis of habitat types and configuration. The study used each method to evaluate road impacts on different taxa and used this multi-species approach to determine effects of the road on presence and movement behavior for suites of wildlife (e.g., primarily carnivores, selected herptiles, and small mammals).

Source: Smith, Daniel J. Ph.D., Reed F. Noss, Ph.D., and Thomas S. Hoctor, Ph.D., 2005. *US 331 Wildlife Impact Study, Final Report*.



Highway 331 is just east of Eglin Air Force Base in North Florida. The circled area has the topography to allow altering the existing "at grade" wildlife linkage to a bridged linkage.

Graphic courtesy of Daniel J. Smith, Ph.D.

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In some instances likely or known interactions between particular wildlife species and planned or expanding transportation infrastructure are reasonably well known. This may be the case when wildlife populations of a particular umbrella species such as bear, panther, or gopher tortoises are already documented in an area and rely heavily on identified landscape features.

for wildlife linkages should proceed along at least two lines of rationale: (1) areas of known or likely wildlife transportation infrastructure interactions; and (2) ecological “hotspot” areas.

Areas of known or likely wildlife transportation infrastructure interactions – In some instances likely or known interactions between particular wildlife species and planned or expanding transportation infrastructure are reasonably well known. This may be the case when wildlife populations of a particular umbrella species such as bear, panther, or gopher tortoises are already documented in an area and rely heavily on identified landscape features. For example, existing data, public investment, and other factors made it clear that linkages for the Florida black bear needed to be a part the planned connection of the Orlando Beltway through the Wekiva Basin or, similarly, the planned expansion of SR 40 through the Ocala National Forest. The Florida panther and its identified habitat areas in south Florida may at times also be instances of known or likely wildlife transportation infrastructure interactions.

Other examples may be less clear but may occur where known habitat for rare, threatened or endangered species is being affected. For example, upland scrub area in central Florida is home to the Florida scrub jay, gopher tortoise, bluetail mole skink, sand skink, Florida pine snake, scrub lizard, and short-tailed snake.

Identification of ecological hotspots – Where specific data are lacking about likely wildlife-transportation infrastructure interactions, a two-tiered ecological hotspots analysis can be used. First, if actual species data are unavailable for the site of interest, a habitat model results can be consulted. Second, if the models denote that the area may include important wildlife resources, then site surveys should be initiated to assess the potential impacts and what species are likely affected. Such surveys should not be simple one-time or minimal site visits. With the tremendous seasonal and inter-annual variability of rainfall in Florida, ideally these surveys should span a minimum of 2-3 years.

As an example, a multi-year survey of wildlife-vehicle interactions was performed on SR 200 and County Road 39 at Ross Prairie in Marion County, Florida. During the second year of the survey, significant rainfall occurred and Florida gopher frogs were observed killed on the roadway in large numbers. If monitoring had occurred only during the first year a conclusion that few gopher frogs occur in the area might have been made. Years with relatively little rainfall also affect animal movements; for example, river otters and alligators have been known to be killed on roadways in much higher numbers in dry versus wet years.

Essentially, when a project is considered, it should trigger an evaluation of whether data exists to make an informed decision. If it does not exist and ecological models show that a crossing may be needed, than efforts should be initiated to collect needed data to determine exactly what type of crossing, if any, is needed. This is necessary so that determinations that crossing are or are not needed are based on fact. A lack of information should not be the basis for a final decision to not address wildlife needs.



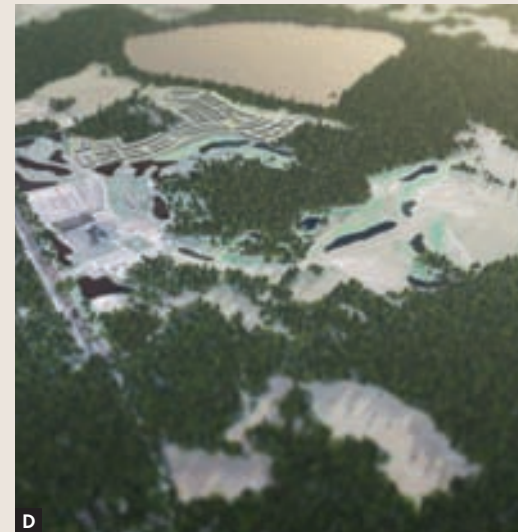
Ross Prairie and SR 200 Wildlife Impact Study showing the combined home range for all carnivores with various ranges overlapping S R 200 from “Ecological Impacts of SR 200 on the Ross Prairie Ecosystem”, 2005.

A) Bobcat resting along the Withlacoochee River;
 B, C & D) Identify existing highway and wildlife cross-over points (left). Highway retrofit or widening projects can include strategic wildlife movement improvements such as the improvements to US 192 just east of the Harmony development where forested wetland stands on both sides of the highway were better linked with larger culverts, one with an internal shelf to allow passage during times of high water.

Photo Courtesy of Matt Fleming



Photo Courtesy of Dan Pennington



B & D) Graphics Courtesy of Benjamin Pennington

INTERSECTING PATHS: LINEAR HABITATS AND ROADWAYS

When a transportation corridor is being planned, special attention should be given to linear habitats and geophysical features such as rivers, streams, wetlands, known karst features and upland ridges. These features should be identified and mapped against the proposed corridor. In addition, existing habitat should be modeled against the corridor's path and likely wildlife interaction hotspots identified.

For example, animals often follow along water courses (rivers, streams, sloughs) as a necessity for their daily and life-cycle needs—a natural wildlife movement corridor (a wildlife highway, so to speak). Thus, where a road or highway crosses one of these features, it should be treated as one transportation facility crossing another.

Water courses are in fact dual purpose corridors serving both upland and aquatic species—upland for many mammals such as otter, bobcats, raccoons, skunks, ferrets, bears and panthers, and aquatic for fish, amphibians, reptiles and some mammals. The reality of upland passage of wildlife is made clear by road-kill studies that show higher animal mortalities where roads meet rivers, streams, and wetlands.

Roadways passing over or through these natural wildlife corridors should be designed to provide adequate wildlife passage, habitat linkage enhancements, and general habitat clearance and disturbance limitations so that wildlife will continue to traverse unimpeded. Above are a series of photos that help to demonstrate good road-to-wildlife corridor linkages.

Placement and spacing of wildlife linkages directly affects travel distance to a passage and can influence use by the target species. Spacing may be especially important for small animals. Mammals are often capable of learning to use underpass and culvert cross-road linkages and may impart this knowledge to their young. However, the learned use of linkage structures is unlikely with reptiles and amphibians. Successful passage of these animals relies on regularity, distance, and designed habitat cues such as vegetation, upland edges, moisture, temperature and lighting.

SPECIFIC DESIGN ENVIRONMENTAL FACTORS OF WILDLIFE LINKAGES

Much of the information used to justify the need for wildlife linkages can also be used to determine the optimum design and location of particular structures. As with the need for the crossing, scientifically valid and applicable evidence (when available) should be used to support the linkage's design, location, and unique environmental attributes. In order to design effective wildlife linkage structures, attention needs to be directed to features that affect their utilization by the intended wildlife. The following factors may need to be considered.

Placement and Spacing – Placement and spacing of structures can be very important for some species, even relatively mobile species. In particular, culverts and bridges serve as connections between landscapes divided by highways and play a critical role in decreasing the barrier effect of roadways for wildlife. Bridges and culverts can be designed from the start for use as a passageway, or when redesigned and retrofitted can function as useable passageways for one or several species.

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Approaches, Context Sensitivity, and Substrates – The physical and vegetative characteristics of the approaches to a wildlife linkage may affect their use by some species.

Forest animals such as black bears may prefer well vegetated approaches, while other species appear to prefer approaches that provide good visibility to avoid predators. The presence of cover on the approaches, in the form of vegetation, rocks, and logs, may enhance use by a variety of small, and mid-sized mammals. For example, rows of stumps in an underpass appear to facilitate use by small mammals (often called debris walls). In addition, the selection and location of vegetation along a road and leading to the planned wildlife linkage should be consistent with the surrounding habitat.

Practical efforts may include maximizing the natural attributes of the area. These include maintaining the native forested landscape, minimizing mowed landscapes, and not planting exotic species for groundcover. Further, substrates should be of similar texture and form with the adjacent area. Constructed passage substrate should not be of concrete, asphalt or rip rap when the natural approach substrate is forest soil, riverine sand, or other natural soil or surface feature. Consideration should be given to using or mimicking the surrounding natural substrate. For example, mimicking stream bed conditions within culverts or bridges that maintain semblance of habitat continuity through the linkage may facilitate use by salamanders, frogs, small mammals and aquatic invertebrates.

Other variables that investigators have found correlated with crossing success include distance from the structure to the nearest habitat, the type of vegetation present near the entrances of the crossing structure, and the height of vegetation adjacent to the structure.

Directional Fencing – Wildlife is often opportunistic in its daily travels and will either wholly avoid roads or will cross over at any point. Directional fencing should be considered to funnel wild-life through passages and away from road surface. Although some species may utilize underpass or overpass systems without fences, some form of fencing does appear to be necessary for most species. Fences guide animals to passage



Photos Courtesy of Dan Pennington, 1000 Friends of Florida

Along the SunCoast Parkway in Pasco and Hernando Counties, bridges were designed with well vegetated underpasses and high fencing to discourage wildlife from venturing up onto the highway.

systems and prevent wildlife from circumventing the system. Fencing is also a means to improve safety and reduce general automobile and wildlife collisions. If the placement and spacing of crossings is sufficient and fencing is provided to funnel wildlife toward properly vegetated approaches, then the number of animal and automobile collisions can be reduced.

Berming – Berming can be used to reduce effects of traffic noise and lights in the area of the planned wildlife crossing. Berming can also be used to guide some species (bats and birds for example) to cross above highways at sufficient height to avoid collisions (see Case Study on page X).

Size – It is difficult to determine critical size thresholds for passage structures because these size thresholds undoubtedly vary from species to species. For some species, openness (the size of underpasses relative to the width of the roadway) may be more important than absolute size. Tunnel layouts that allowed animals to see the opposite end of a wildlife passage may be preferred by some species. In general, bigger is better and if water passes through the connection, the design and construction of a passable upland edge should occur. This allows wildlife use even during rainy high water season months.

Length, Width, and Height – The effects of length, width, and height of a structure, especially culverts, may combine to form a “tunnel effect” that deters many animals from passing through the structure. As length increases, the width and/or height must be increased to reduce tunnel effect. A measure of tunnel effect is the openness index value which is computed as width (W) x height (H) ÷ length (L). This index needs to be used with care because it can be skewed, thus distorting true performance measures. Basically the same index value for two completely different sized structures can be obtained by adjusting each value. For instance, a tall-narrow (2 x 4) structure can have the same index value as a short-wide (4 x 2) structure given equal lengths. However, each would not result in equal use by the same wildlife.

Lighting – Some species are hesitant to enter underpasses that lack sufficient ambient light. Maintenance of natural lighting through the crossing may help some species avoid long, dark passages. Helpful design improvements for increasing light within an underpass include overhead grates, increasing the openness value (height to width and length), and providing open medians for light penetration beneath divided highways.

Wildlife is often opportunistic in its daily travels and will either wholly avoid roads or will cross over at any point. Directional fencing should be considered to funnel wildlife through passages and away from road surface. Although some species may utilize underpass or overpass systems without fences, some form of fencing does appear to be necessary for most species.

Consideration should be given to use of the linkage by predators that may inhibit use by prey species. Entrances and exits to regularly used wildlife linkages may prove to be a good place for predator species to wait for their meal. Careful study of the likely users of the connector and appropriate design mitigative features can minimize these interactions.

Moisture and Hydrologic Variability – Moisture is important for some species. For instance, shrews are often more active on rainy nights and may prefer wet substrates for traveling. Underpasses at stream crossings with sufficient upland edge will probably suffice for species that utilize riverine or riparian habitat, provided there is enough water to maintain moist travel conditions without creating flooded or overflow conditions. In some instances, providing open-top (grated or slotted) underpasses may provide sufficient moisture for crossings that lack flowing water, and also provide for some ambient lighting. Proper drainage is important, because some wildlife species are less likely to use structures when they contain standing water. An elevated terrestrial passage such as upland edge or shelf should be provided at semi-aquatic sites during periods of high water levels, thus providing dry, moist and wet environments. Culvert or bridge wildlife passages that are poorly planned and flooded most of the time waste money and fail to support intended wildlife connectivity functions.

Temperature – Small tight linkages may create temperature disparities (inside versus outside the structure) that deters use by some wildlife. Larger underpasses or open-top grate systems that allow for more air flow may effectively address this concern by keeping adjoining ambient and linkage temperatures similar.

Noise – Traffic and adjoining community noise can be a problem for some mammals, especially those sensitive to human disturbance. Certain underpass designs, such as those with expansion joints or uncovered medians, can be very noisy. Open-top designs would be inappropriate for species that are sensitive to traffic noise. Just as planning for noise reduction for adjacent human communities, a variety of design and best management practice features can mitigate noise impacts. These may include planting hedges, tree and shrub edges, providing strategically placed berms or walls, or providing raised or depressed crossing areas.

Interactions Among Species – Consideration should be given to use of the linkage by predators that may inhibit use by

prey species. Entrances and exits to regularly used wildlife linkages may prove to be a good place for predator species to wait for their meal. Careful study of the likely users of the connector and appropriate design mitigative features can minimize these interactions.

Human Presence/Disturbance – Human disturbance or presence in or near designated wildlife crossings may reduce their usage by some wildlife. In an evaluation of underpasses in Banff National Park, human influence—either as proximity of town or human activity within an underpass—was consistently ranked high as a significant negative factor affecting passage use by ungulates and carnivores.

Long-term Linkage Sustainability – Once constructed wildlife crossings are a permanent fixture within the landscape and cannot be easily moved because of a change in local land use or property ownership. For this reason, natural habitats in the vicinity of a crossing should be conserved to prevent future loss of habitat and a functional loss of the wildlife linkage. Land on both sides of the wildlife linkage can be protected by conservation easement or public ownership. For example, a community or the road building entity can buy the adjacent land that would connect protected areas in proximity of the crossing. Linkages can be made between areas in conjunction with a proposed road project, or be established ahead of a project. Whatever the initial land ownership situation, if the need for a linkage has been sufficiently demonstrated by the needs study, the planning and development of wildlife linkage facilities should be considered in planning transportation infrastructure and not cast aside simply because there may be a current gap in public ownership.

The width and size of adjacent habitat areas are entirely relative and species-specific. Movement or dispersal corridors do not have to serve all “life requirements” of a species. Their purpose is to act as a linkage or conduit from one block of core habitat to another and they likely will be serving multiple species. Thus, a crossing for amphibians may only need to have adjacent wetlands and upland buffers under protection,



whereas a crossing for the Florida black bear or Florida panther should have significant area of protected land available on both sides of the crossing.

Sometimes it may be possible to include public acquisition and preservation of land adjacent to the crossing as part of the roadway project. For example, concurrent with construction of the SR 46 bear underpass in Lake County, the Florida Fish and Wildlife Conservation Commission purchased a 40-acre private in-holding within Rock Springs Run State Park to ensure preservation of the bears' travel corridor near the crossing.

Engineering and Safety Considerations – In addition to the environmental considerations discussed above, engineering and safety aspects must also be considered when determining the configuration and location of a wildlife crossing. Design engineers should consider the following criteria when evaluating potential crossing locations:

- The crossing must accommodate state or Federal safety criteria.
- The crossing must accommodate or support access to adjacent property owners.
- The crossing should not negatively impact existing drainage patterns or flood off-site properties.
- For existing roadways, significant modifications that would

decrease public safety cannot occur as a result of the addition of the crossing (e.g., an excessive increase in roadway grade may decrease sight distance).

In keeping with these criteria, modifications may be made in the design of the crossing in order to minimize impacts to habitats, project design modifications, and costs while still meeting the overall objective of the crossing.

Cost – Finally, it must be realized that financial resources are limited and a cost analysis of each wildlife linkage option should be undertaken. While the design and construction of crossing structures is not inexpensive, consideration should also be given to the economic benefit of the presence of the crossing, such as decreased physical damage and human injury costs. Likewise, it is not always the case that the most expensive crossing alternative is the best alternative. For example, there is no need to design a crossing suitable for bears and panthers when the target species are amphibians.

Monitoring and Evaluation – Although many wildlife linkages have been constructed across the U.S., the vast majority of these have no monitoring program to evaluate the effectiveness of the structure in preserving wildlife, maintaining habitat connectivity, and reducing vehicle crashes. Fortunately, there is a tendency for a greater percentage of new linkages to be monitored for efficacy.

Sometimes it may be possible to include public acquisition and preservation of land adjacent to the crossing as part of the roadway project.

Photos Courtesy of (from left to right): Jeffrey Pennington, Matthew Paulson and the Florida Wildlife Federation; Mark Lotz, FWC; David Moynahan

Since many animals use floodplains and water bodies to move from one wildlife corridor to the next, it's logical and easy to design bridge ends to extend farther beyond the floodplain or water body than is required.

MODELING TOOLS FOR WILDLIFE CROSSINGS

The National Cooperative Highway Research Program has sponsored research to evaluate the use and effectiveness of wildlife crossings and to include analytical tools to help assess under what conditions wildlife crossings may be needed and where they should be located. The research describes guidelines for the selection, configuration, and location of crossing types, as well as suggestions for the monitoring and evaluation of crossing effectiveness, and their maintenance. The guidelines are available as a final report and a web-based electronic decision tool. The decision tool can be found at www.wildlifeandroads.org. The basic outline of the decision tool has been developed with the following seven steps listed in hierarchical order.

1. Consideration – Do we need to consider mitigation measures?
2. Selection – What type of structures for what species and processes?
3. Placement – Where along the highway and on the landscape do we place these measures?
4. Configuration – What are the dimensions, materials, bottom surface, light and noise considerations, and human activities?
5. Monitoring/Evaluation – How do we assess the effectiveness of our efforts?
6. Maintenance – What actions are necessary to maintain structure efficacy?
7. Final Plan – Full suite of mitigation efforts and necessary actions, and how to enact them.

The National Cooperative Highway Research Program's web site is at www.trb.org/default.asp

LONGER BRIDGE SPANS PROVIDE MORE SPACE FOR WILDLIFE PASSAGE

Since many animals use floodplains and water bodies to move from one wildlife corridor to the next, it's logical and easy to design bridge ends to extend farther beyond the floodplain or water body than is required. Longer bridge spans also cost far less than a separate wildlife crossing under an existing roadway. Over the last few decades the Florida Department of Transportation has designed and built extended bridges on I-75 (Alligator Alley) in Collier County and in other locations throughout the state. The efforts are paying off. Florida panthers and other wildlife are using the bridges to safely cross roads and to move back and forth between wildlife corridors.

Source: *Keeping It Simple: Easy Ways to Help Wildlife Along Roads, U.S.* Department of Transportation and FDOT.



Photo showing bridges constructed to allow for good vegetative coverage and wildlife connections.

CASE STUDY**Design, Installation, and Monitoring of Safe Crossing Points for Bats in Wales**

Photo Courtesy of David Moynihan



In order to reduce the likelihood of horseshoe bats being killed on a new road, it was necessary to discourage the bats from foraging along the road edge, while simultaneously providing safe and attractive

crossing points at locations where the bats were already known to cross the route. This involved: (1) maintaining attractive vegetative linear features perpendicular to the route to lure the bats away from the road; (2) placing a relatively wide verge of poor quality habitat directly adjacent to the road to discourage the bats from foraging; (3) including safe crossing points at culverts underneath the road on the alignment of existing flight lines (the effort found that there is value in maintaining existing flight line routes - particularly for horseshoe bats in question); and (4) controlling street lighting at crossing points to ensure that the areas remained in relative darkness. The exact location of the tunnels, the planting leading to them, and the engineering design of the tunnel approaches were developed by an integrated team of ecologists and engineers. The success of the mitigation measures has been monitored, and the tunnels are proving to be extremely effective in allowing bats to cross the road safely.

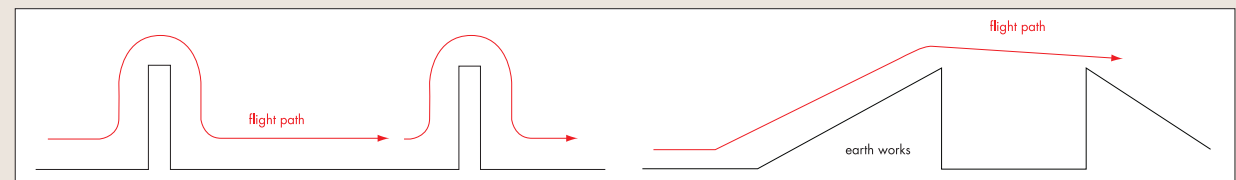
The culverts were positioned on the lines of severed hedgerows so that they followed the bats' desired flight lines as far as possible. Small embayments were made in the embankment earthworks, creating a "funnel" shape to maximize the chance of bats encountering the tunnel. Planting was provided around the vertical sides of the funnels, extending towards the severed hedgerows,

to increase the funnel effect. The intention of the planting was to guide bats from the severed hedgerow to the culvert mouth and, thus, planting was not extended up over the top of the culvert as this might encourage bats to fly over the road.

Further, because bats encountering a fence fly up and over it, and immediately twist to return to their original flight path height, gently-sloping earthworks were employed and appear to greatly reduce this pattern by extending the bats' higher flight path. The effectiveness of this mitigation has depended upon:

- Identifying in a timely manner the potential impacts allowing mitigation measures to be put in place during construction and avoiding costly retro-fit.
- Locating safe crossing points for bats in the positions most likely to be effective based on a comprehensive baseline survey.
- Modifying the earthworks and planting close to crossing structures so that bats are led towards them.
- Monitoring effectiveness post-construction so that any necessary modifications can be made.

This example from Wales illustrates the common problem that jurisdictions face whether in Florida, the United Kingdom or elsewhere, and that care should be taken in relation to the interpretation of each particular situation when applying solutions or corrective measures. Each situation is unique as there are differences in species behavior and general context.



Flight paths of lesser horseshoe bats over obstructions

Source: *Design, Installation, and Monitoring of Safe Crossing Points for Bats on a New Highway Scheme in Wales*, by Dr. Stephanie Wray, Paola Reason and David Wells, Warren Cresswell and Hannah Walker, Cresswell Associates, 2005. All graphics used with permission of Transport Wales and the Welsh Assembly Government.



Fortunately, there is a tendency for a greater percentage of new linkages to be monitored for efficacy. Monitoring and evaluation of wildlife linkages is important in determining whether the best use of resources is being made, and providing critical information useful for future projects. Although it costs money to design and implement a monitoring program, the results may more than pay for these costs on later projects.

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All monitoring plans should be clearly written, and state the original goal of the linkage as a benchmark measure of success. If possible, the plan should include both pre-construction and post-construction monitoring. It is recommended that monitoring should occur for at least five years following construction, and that pre-construction monitoring should be at a minimum one year and optimally two to three years in advance of the project design. In many cases, it takes wildlife at least two years to adapt to the presence of the crossing, especially if it is used for seasonal migration. Finally, results of the monitoring should be made available in a timely manner so that corrective actions can be undertaken, if necessary.

Maintenance – In several instances across the U.S., the failure of a wildlife linkage to produce the desired results has been attributed to lack of proper maintenance of the structure. Examples range from collapse or obstructions within the crossing to human habitation of the crossing. One of the most critical areas is maintenance of fences or barrier walls. Damage to fences and gaps caused by erosion allows animals to cross the barrier and enter the roadway. For example, at the Payne’s Prairie crossings in Alachua County, infrequent mowing of adjacent vegetation allows animals to climb over the wall and enter the roadway.

Roadway maintenance crews should be made aware of the presence of linkage structures and instructed how best to maintain them. Periodic inspections of the structures should be made by qualified biologists and engineers. Ideally, these inspections should be incorporated into the monitoring plan developed for the linkage.

LINKAGES FOR ETDM PROJECTS

Wildlife linkage options are increasingly being considered and developed for FDOT projects, but it is very important to incorporate wildlife mitigation needs early in the programming, planning, and design process. The magnitude of current environmental, safety, capacity, and financial aspects of roadway projects makes early planning a must. Florida has addressed this challenge by developing the Efficient Transportation Decision Making (ETDM) process.

The ETDM process defines the procedures for planning, conducting environmental reviews, and developing and permitting state transportation projects. During the ETDM process, present and future FDOT projects are reviewed by the state and federal natural resource and regulatory agencies. It is during this process that the Florida Fish and Wildlife Conservation Commission, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and other commenting regulatory agencies work with the FDOT to identify and consider potential roadway/wildlife interactions and the need for a wildlife linkage for a particular project.

The ETDM Process and Wildlife Linkages – The transportation planning process begins when Metropolitan Planning Organizations (MPOs) and FDOT identify mobility needs. Project needs are matched to available funding for projects and ultimately a cost-feasible plan is adopted by the MPOs. This is referred to as the Long Range Transportation Plan. Similarly, FDOT develops a cost-feasible plan for the Florida Intrastate Highway System and for the Bridge Program. Priority projects are selected annually from these cost-feasible plans and are presented to the Legislature as the tentative Work Program. The Legislature then approves the Work Program which is a five-year program. New projects may await funding for up to five years before significant work proceeds. The Project Development and Environment (PD&E) process begins after funding for a project is approved, and then design survey work is conducted and the design phase begins.

In the ETDM process, member agencies are provided two opportunities to review projects prior to the start of significant engineering work. These opportunities are referred to as the “Planning Screen” and the “Programming Screen.” The Planning Screen occurs in conjunction with development of cost-feasible plans by MPOs or the FDOT. Project information is reviewed by regulatory and resource agencies which then respond to project planners on the effect that a project may have on resources protected by that agency. The time to highlight the potential need for a wildlife linkage is when the project is reviewed in the Planning Screen.

The Programming Screen occurs before projects are considered for the FDOT Work Program. The intent during the Programming Screen is that member agencies provide specific information to identify technical issues that must be addressed by engineers and planners during the Project Development phase. The Programming Screen is where the resource agencies re-state the potential need for a wildlife linkage, and provide preliminary information on potentially affected species and their habitat in the vicinity of the project. This information is used later in the project development phase to develop the goal of the crossing. Finally, the specific location, type, and size of the structure are determined during the design phase.

Once a project proceeds to the construction phase, it is very costly and possibly prohibitive to address major design features such as wildlife linkages and their associated infrastructure, if they have not been previously identified. The ETDM process was designed to prevent such delays and extra costs from being incurred, while at the same time improving environmental aspects of roadway projects through early coordination with permitting and review agencies. Those with concerns for wildlife linkages for a specific project should work through the ETDM process to ensure their concerns are identified early, and coordinated with the appropriate wildlife resource member agencies (i.e., U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Florida Fish and Wildlife Conservation Commission).

A key component of ETDM is the Environmental Screening Tool (EST), an internet-accessible interactive database and mapping application. The EST integrates resource and project data from multiple sources into one standard format, and provides quick and standardized analyses of the effects of the proposed project on natural and human resources. The EST also supports communication between agencies, planners, engineers, and the public. The databases supporting the EST are constantly being updated as new data become available; however, it is likely that additional site-specific studies and surveys will be required to support the need for a linkage.

The public is able to view planning/project information, agency reviews, summary reports, maps, and all official member agency comments. Additionally, the public is able to provide comments on projects via email and during MPO and FDOT meetings and workshops. Each FDOT District Community Liaison Coordinator is responsible for summarizing public input into the EST, and this information is visible to the public. More information on how to become involved in the ETDM process can be found at <http://etdmpub.floridastate.gov/est/>.

The accompanying FDOT decision tree outlines the steps taken when addressing roadway/wildlife interactions for projects within the ETDM process. Note that this process addresses each of the critical steps discussed above to ensure that a linkage is sited and designed appropriately to meet the stated goal of the linkage. In instances where crossing structures are not feasible, or it is not possible to place adjacent lands in conservation due to zoning or land use changes, the decision tree considers the use of exclusionary fencing, barricades, or other conservation measures to reduce impacts to wildlife. Nevertheless, community/road planners should consider the alternative of purchase or placing under easement adjacent private land that would connect existing conservation lands served by the proposed crossing. Barriers should not be the only alternative where private land is involved; it should be examined in the context of local and regional greenway plans, the Florida Greenways Plan, and how it may serve larger conservation goals.

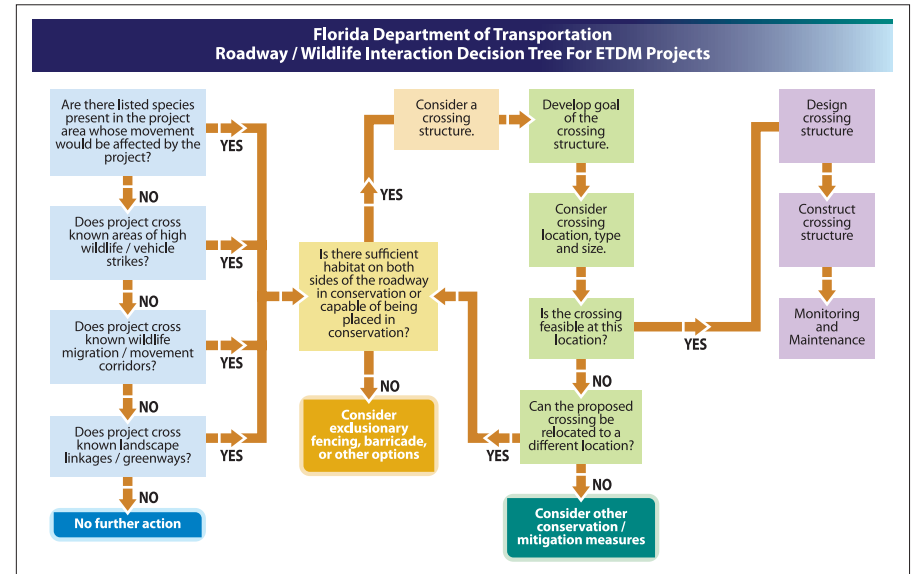
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LINKAGES FOR NON-ETDM PROJECTS

In some instances, it may be necessary to address roadway/wildlife interactions along a segment of roadway that is not part of a project within the ETDM process. Natural resource agencies, local governments, or the public may have identified a potential need for a structure to reduce roadkill or improve public safety. In these cases, interested parties can approach FDOT for support in funding studies to assess the need for linkages and/or to design and construct crossing structures. However, crossings cannot be supported or funded by FDOT without first demonstrating the need for the crossing.

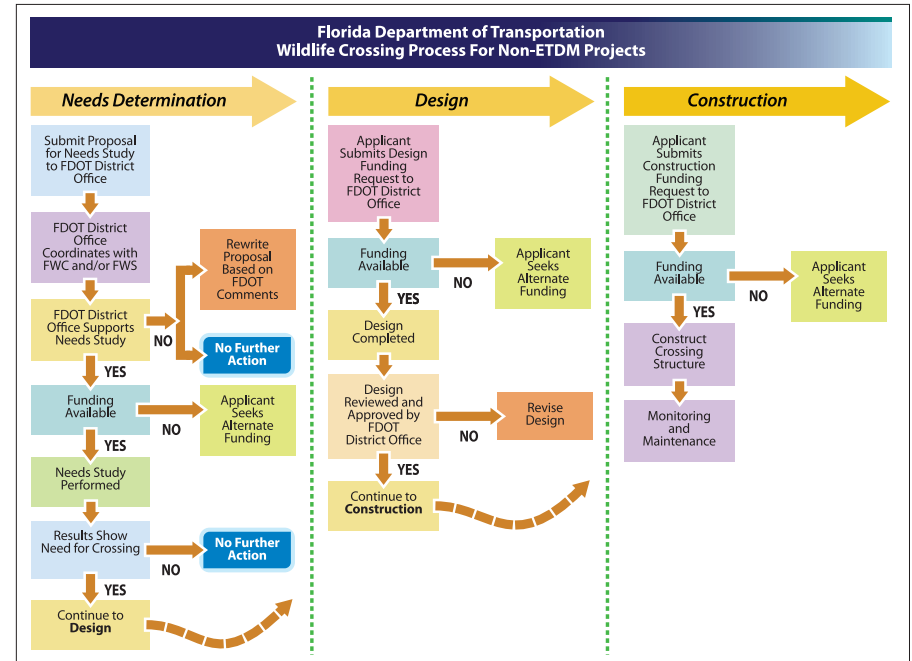
Interested parties may submit a written proposal for a “Needs” study to their local FDOT district office, as depicted in the accompanying flow chart. The proposal should clearly state how the need for a linkage will be determined, and what data will be gathered to support the need. As part of their review of the proposal, the FDOT will coordinate with the FWC and/or FWS. The FDOT district office may then support the proposal by assisting the applicant in obtaining funds for the study. If approved by FDOT, funds may be allocated for the study if and when available. Reasons for not supporting the proposal may include inconclusive or insufficient data, lack of public control of property adjacent to the roadway, and engineering and safety considerations.

If the results of the study demonstrate the need for a wildlife linkage, the applicant may then submit a request for assistance from the FDOT for funding the design of the structure, or the applicant may choose to seek alternative funding from other sources. The completed design is then submitted to the FDOT district office for review and approval to ensure it meets engineering, safety, and cost considerations. Once the design is approved by the FDOT district office, the applicant may submit a request for financial assistance from the FDOT to construct the crossing. If approved by FDOT, construction funds may be allocated, or if funds are not immediately available, the project may be placed on a list for future funding.



Flowchart for ETDM projects.

Photo Courtesy of Florida Department of Transportation



Flowchart for Non-ETDM projects.

Photo Courtesy of Florida Department of Transportation

ROAD AND HIGHWAY RELATED STORMWATER FACILITIES

Stormwater management facilities occupy sizable acreages and are a major part of many road or transportation projects. A certain dilemma exists in that stormwater management facilities are created to capture, sequester, and treat pollutants that, when concentrated, may not present desirable healthy habitat for wildlife. Nevertheless, by design or not, stormwater facilities are regularly used by wildlife. In fact, at times stormwater facilities and the habitat they present act as wildlife attractors. This attractor role is noticeable during drought, when they may still hold water, or when due to their rather rigorous fencing, these facilities keep local feral predators at bay, offering areas of relative safe haven to wildlife. A challenge to community planners and engineers may be to design structures that will manage stormwater, improve water quality, and at times provide intentional wetland and wildlife habitat features.

Opportunities exist to incorporate wildlife-friendly design features for stormwater facilities that can maximize habitat value and assure capture and treatment of runoff from roadways or bridges. In addition, in suburban and urban areas, local and regional greenway development for bike and foot trails can be incorporated into the required road or highway stormwater facilities inclusive of wildlife habitat design features. In Tallahassee, the adopted Blueprint 2000 program took a multi-use approach with the extension of the major cross-town corridor of Blair Stone Road. This project integrated road, stormwater management and greenway facilities that served to provide some habitat aspects.



Park Avenue in Tallahassee is an example of a major road and stormwater management improvement that made it more difficult for wildlife to cross at a traditional wildlife crossing point. Wildlife mortality is now often visible on the road here.

Photo Courtesy of Dan Pennington, 1000 Friends of Florida



Photo Courtesy of Marsha Drew

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Wherever feasible, site plans, PUDs, DRIs, etc. should specify wildlife-supportive buffer zones along existing site drainage features such as upland swales, ditches, intermittent and ephemeral streams, ponds, wetlands, sinkholes, lakes, rivers, etc. Establishing buffer zones along existing drainage features enhances wildlife potential, preserves the drainage system and promotes greater site stability, less erosion, higher aesthetic potential, increased habitat value, and more economical site development.

INTEGRATING TRANSPORTATION AND STORMWATER FACILITY PLANNING WITH WILDLIFE-FRIENDLY COMMUNITY PLANNING

- Educate and train development and site review and planning and zoning staff (as well as citizens) to look for possible greenway and habitat cross parcel connection options prior to development approvals and road or highway development.
- Wherever feasible, site plans, PUDs, DRIs, etc. should specify wildlife-supportive buffer zones along existing site drainage features such as upland swales, ditches, intermittent and ephemeral streams, ponds, wetlands, sinkholes, lakes, rivers, etc. Establishing buffer zones along existing drainage features enhances wildlife potential, preserves the drainage system and promotes greater site stability, less erosion, higher aesthetic potential, increased habitat value, and more economical site development.
- Draft and adopt guiding policy for development reviews to encourage wildlife and greenway interconnections that link throughout and across communities.
- Avoid or minimize the use of highly fenced-off stormwater “stalags” (square/rectangular, steep-sided stormwater retention sites with high, often barbed wire fences). They tend to block and barricade community connectivity as well as wildlife connectivity. This might mean working with FDOT or other city or county transportation planning and design people early on to ensure adequate land is acquired to build larger community multi-use stormwater facilities.
- Factor in existing habitat needs into hydrological flows and fluctuations calculations (seasonal or yearly variations).
- Use native species for vegetated areas, landscaping, and stream or wetland buffer areas wherever possible. Native species can provide year-round attractive scenery, important habitat, pollutant buffering, and structural stability for soils. Native trees and shrubs will not need as much care and maintenance as ornamentals or non-natives.



Fenced-off, stalag-like stormwater facilities, such as these in Tallahassee, create barriers.





“There is a delight in the hardy life of the open. There are no words that can tell the hidden spirit of the wilderness that can reveal its mystery, its melancholy and its charm. The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased and not impaired in value. Conservation means development as much as it does protection.”

– Theodore Roosevelt (26th President of United States)

The elimination of traditional wildlife habitat through urbanization of natural and agricultural areas has increased the importance of urban and suburban green space as habitat for wildlife. In this regard, golf courses are being increasingly recognized for their potential to provide a reasonable level of wildlife habitat. A shift in philosophy has been emerging from the golf course management community, as well as from golfers, supportive of integrating habitat and wildlife features into golf course design. Interestingly, more than 70 percent of many golf courses are rough and non-play areas that feature natural grasses, wetlands, trees, shrubs, and other plants that have habitat potential.

Florida has more golf courses than any other state—more than 1,250. Palm Beach County alone has more golf courses than any other county in the nation. In Florida, golf course community development, as well as public city and county golf courses, present opportunities to conserve and create wildlife habitat adjacent to human habitat. The difference between wildlife-depauperate and wildlife-friendly golf courses is good planning, design, and management and an understanding of plants and animals and their particular needs. A properly designed and maintained golf course can serve as a “buffer” to the “hardscapes” associated with development.

From a pure wild lands perspective, golf courses are contrived and heavily managed lands. The highest intensity of landscape management is practiced on golf course “greens,” with progressively less on tees, fairways, and minimal management in the “rough” area. With development steadily increasing, it is becoming more important that golf courses and the habitat fragments located in and around them play a role in conservation of native species and ecosystems.

PLANNING FOR HABITAT AND WILDLIFE BASICS

When a new golf course community is planned, or when an older course is being redesigned or upgraded, the landowner

and local planning and community development departments should address habitat and wildlife needs at the landscape level of planning. It is important to consider the context in which the entire golf course is sitting. Different layouts and routings of a golf course playing area will shape the available habitat areas, their size, connectedness, and physical makeup. Follow the steps below as planning and designing efforts proceed.

Know the Site and the Surrounding Landscape – As a basis for formulating the layout of a course, conduct an inventory and carefully map the site’s basic natural features, topography, and resident and potential wildlife habitats. It is important to record typical or potential species to the area, noting seasonal variations. Seek local expertise and consult with environmental experts familiar with local plants and animals.

Study the course with an eye to providing the basics for wildlife survival: food, cover, water and diversified space accommodating breeding, nesting and foraging. Cluster buildings, parking lots, clubhouses and guest amenities together so as to leave the greatest amount of undisturbed and connected habitat available for wildlife. Think outside the boundary of the golf course, and ask adjacent land owners if they would coordinate to optimize wildlife habitat linkage potentials.

Think large patches, connectivity, and diversity of cover. Many animal species prefer large patches of habitat with fewer opportunities for predators to intrude and more “interior space” wherein environmental parameters (humidity, light, substrates, etc.) tend to remain constant. Wherever possible, protect and enhance the site’s large habitat patches. This includes expanding existing habitats by adding or allowing natural expansion of native plants and by working to connect smaller habitat patches. If larger patches are unavailable, even small habitat patches—such as individual trees, small wooded areas, ponds, and wetlands—can add value, particularly to birds, small mammals, and reptiles.

SUSTAINING FOX SQUIRRELS, AS IS TRUE OF MANY SPECIES, MAY TAKE A LITTLE PLANNING

In Florida's developing world of fragmented habitats, golf courses can be an attractive location to fox squirrels if planned and managed appropriately. According to wildlife biologist Rebecca Ditgen, "Fox squirrels are a very graceful squirrel. They leap and move around a lot and people find them beautiful to watch."

Fox squirrels are native to pine forests with open understory and spend a lot of time on the ground, so golf courses with open pine and cypress stands are good habitat for them. They often favor mature long-leaf pines with open wiregrass understory forests that burns periodically. The most productive habitats have a variety of tree species with mature mast-producing trees (often over 40 years) with good nesting cavity potential. These squirrels use edges of forests and open lands and will feed in large pastures or fields hundreds of yards from the nearest tree.

Landscape-scale factors are strongly related to sustaining fox squirrel presence on a given golf course. There appears to be a strong "nearest neighbor" effect, in that fox squirrels move between golf courses or adjacent favorable habitat patches. Thus, courses with fox squirrels on their nearest neighbor are several times more likely to have a fox squirrel population, regardless of other course habitat factors. Land cover factors appeared to have relatively less influence on the probability of fox squirrel presence than proximity to other fox squirrel populations.

In planning a golf course to support and sustain fox squirrels efforts should be focused on linkage to other source populations such as regional sub populations and adjacent localized populations.



Fox Squirrel

Photo Courtesy of Judy Hagan and the Florida Wildlife Federation

Golf course managers and other large landowners in the region should be encouraged to cooperate to preserve movement corridors between habitat patches in order to allow continued fox squirrel dispersal. Other factors to note are differences in habitat characteristics such as tree size, presence of snags and nesting cavities, and multiple food sources. To enhance forest stands for squirrels, golf course designers should:

- Leave hardwood corridors along stream sides, between pine stands, and in drainages unsuitable for pines.
- Clear-cuts should be 50 acres or less.
- Protect large mast producing hardwoods and den trees within pine regeneration areas.
- Combine prescribed burning with thinning in pine stands to create and maintain an open understory. The resulting habitat is desirable for fox squirrels.

- During controlled burns, protect adjacent hardwood trees and shrubs (including food producers such as dogwood, blackgum, live oak, hickory, beech and other mast trees).
- Within hardwood stands exclude fire from existing timber.
- When harvesting hardwoods, leave at least one den tree (cavity tree) and five mast trees per acre. These are minimum requirements. Not every mast tree will produce each year, so the more nut producing trees that are left, the better.
- Thin young hardwood stands to favor mast trees and promote faster growth and crown development.

Finally, golf course design should strive to protect understory trees, shrubs, and vines. Many of these understory plants produce important food for squirrels. Planning needs to emphasize that courses plant more native vegetation to provide more year-round food sources for the squirrels. The exotic plants many courses use can be showy but frequently do not provide the best food for the animals. Suitable habitat must contain food sources through all seasons. Food is provided by fruit and nut-producing hardwoods, fungi, conifers, agricultural crops, and the buds, flowers, and inner bark of some trees and shrubs.

Sources: Alexander, B.G., *Fox Squirrel Management in East Texas*, Texas Parks & Wildlife Department, 1994; *The State of Georgia, the Georgia Department of Natural Resources, Wildlife Resources Division, Small Game Management in Georgia-Gray and Fox Squirrels*; and, Cindy Spence, *Threatened Squirrels Can Call Golf Course Home*, University of Florida online news service covering research of wildlife ecologist Rebecca Ditgen, 1997.



A marsh rabbit and a pair of raccoons.

Establish Corridors and Large Habitat Patches –

Corridors connect patches of wildlife habitat, enabling animals to safely travel and forage for food. It is important to establish natural travel corridors at least 30 yards wide for birds and other wildlife. Stream-side and wetland corridors are particularly important because they offer ample cover and food sources (e.g., insects, amphibian and small mammals) for birds and other predators. Attracting birds, foxes, bobcats and other wildlife to golf courses requires designing for and catering to smaller animals on which they depend for food. These smaller animals (many nocturnal), including squirrels, mice, rabbits, toads, lizards and such, are the little big shots of the animal kingdom, meriting consideration in golf course design and management plans.

Maintain as Natural or Naturalize Out-Of-Play Areas –

Look for non-play areas that are naturally vegetated or currently maintained with mowed grasses or disturbed areas that are visually unappealing. Areas between fairways, below elevated tees, in roughs and bordering woodlands and wetlands may be especially suitable for naturalization. Naturalized areas need not be large - they can start small and expand over time. The design of the course should enhance and protect special environmental resource areas and, when present, improve or restore previously degraded areas through the use of plants that are well adapted to the region. Seek opportunities to create and/or preserve habitat areas that enhance the area's ecosystem.

Conserve Native Habitat and Species –

Endangered or Otherwise!-In Florida, the objective is to keep common species common as well as working to improve the situation for threatened and endangered species. Wherever possible, protect existing native habitat. Some of the world's most beautiful and challenging golf courses emphasize their sites' natural characteristics. Left undisturbed or enhanced, native scrub, long leaf pine stands or wetlands alongside a fairway in out-of-play areas can provide valuable wildlife habitat without compromising the game. With easy access to food, water, and cover planned as a part of the course design, these areas can be refuges for many local wildlife species.

Design in Permanent and Seasonal Wetlands –

Golf course wetlands (both permanent and seasonal) provide a haven to local wildlife. Seasonal wetlands are especially important because of the diversity of species they support. Because of the complexity of creating wetlands, the best strategy is to avoid disturbing existing wetlands in the first place by taking advantage of a site's natural topography and features and incorporating them into the master design.

Where impacts to native on-site wetlands cannot be avoided, created wetlands may be incorporated. However, extraordinary care must be taken to ensure that created wetlands provide both the functional and aesthetic qualities of their natural counterparts. Again, leaving the native wetlands on-site and avoiding and minimizing disturbance is the best game plan. Wherever possible, maintain a direct connection between wetlands and wooded upland areas, or establish habitat corridors that link the two. While government regulations rarely stipulate that these connections be preserved, the linkage is essential for a number of species that live in uplands but feed or reproduce at water's edge.



Raptor Bay Golf Club, a WCI Communities course in Lee County, created lakes and ponds on site with significant vegetated littoral zones that support a wide variety of bird life and also act in a stormwater bio-filtration role.

CASE STUDY**Twin Eagles Golf Course and Linkage to the Corkscrew Regional Ecosystem (CREW)**

Bonita Bay Group has been working to establish a regional wildlife corridor running from the CREW lands in Collier County, Florida, along the western boundary of Twin Eagles Golf Course Community, across Immokalee Road and through the Immokalee Road South property. These components were developed and designed in conjunction with the Florida Fish and Wildlife Conservation Commission, Florida Wildlife Federation, Corkscrew Swamp Sanctuary and Collier County Audubon Society. The adjacent Twin Eagles land plan provided an Audubon International Gold Signature Golf Course, lakes with abundant littoral shelves, and single-family residential adjacent to the wildlife corridor. This regional corridor not only provides benefits for wildlife movement in the region but also provides hydrologic benefits in the height of the wet season. The effort:

- Increased the size of the adjoining Corkscrew Regional Ecosystem (CREW) preserve.
- Improved the southward conveyance of water flows originating north of the project.
- Created wading bird foraging marshes and intermittent drawdown pool habitats adjacent to CREW. The marsh habitats created from farm fields were graded to include different elevations to provide a variety of inundated areas and timing of foraging opportunities to the benefit of wood stork and other wading birds.
- Re-forested upland and wet pasture adjacent to on-site corridor which increased corridor width for wildlife.
- Provided environmental educational signage along key points of the preserve for educating the residents and golfers.
- Provided a wildlife underpass connecting the Bonita Bay East Golf Club and Twin Eagles wildlife corridor with the Immokalee Road South greenbelt/wildlife corridor.
- Provided Outstanding Florida Water (OFW) level of water quality treatment from the project's water management system.

Immokalee Road wildlife crossing between the north and south portions of the Twin Eagles Golf Course Community in Collier County (red dot on Map). Corkscrew Regional Ecosystem (CREW) preserve is the shaded green area on the map.



Corridors connect patches of wildlife habitat, enabling animals to safely travel and forage for food. It is important to establish natural travel corridors at least 30 yards wide for birds and other wildlife. Stream-side and wetland corridors are particularly important because they offer ample cover and food sources (e.g., insects, amphibian and small mammals) for birds and other predators.

Photo Courtesy of Joanne Davis, 1000 Friends of Florida



An example from The Old Collier Golf Club in Southwest Florida of a dead tree snag retained to provide wildlife habitat needs. The tree has been cropped to limit liability concern from falling branches or a tree trunk.

QUICK BASIC PLANNING FOR WILDLIFE FEATURES

- Identify the different types of habitat specific to the site and the likely mix of animals supported and identify the habitat requirements (food, water, cover, space) for identified wildlife species.
- Identify common as well as federal and state threatened and endangered species, and state species of special concern inhabiting or near the site, and preserve critical habitat and set-aside areas for on-site species that need protection, conservation or assistance.
- Identify and preserve local wildlife corridors and functional linkages. Linkage within the course and/or off-site to surrounding properties ought to be maintained, enhanced or re-established.
- Retain dead trees and natural debris snags for cover, nesting and feeding sites, cropping them if necessary where they pose danger to people or property.
- Retain or provide substantial "rough" native vegetated riparian buffers along waterways and waterbodies to protect water quality and provide food, nesting sites, and cover for wildlife. Sufficient upland buffer areas ought to be included to assist the life cycle requirements of many water and wetland dependent species that use uplands for reproduction, food or body temperature regulation needs.
- Design and locate cart paths to minimize environmental impacts. If possible, construct the cart paths of permeable materials and bridge wetlands and waterbodies instead of using fill and culverts.

- Avoid or minimize crossings of wildlife corridors. Design unavoidable crossings to accommodate wildlife movement and strive to separate golfers and carts from these wildlife areas.
- Remove nuisance and exotic/invasive plants and replace them with native species that are adapted for the particular site.
- Design perimeter fences or walls to be wildlife porous, especially where water, wetland or sound habitat features cross off-site and should provide sufficient clearance between the ground and the lowest portion of a fence or wall, except in areas where feral animals need to be excluded.
- Construct and place birdhouses, bat houses, and other animal nesting sites in out-of-play areas and plant butterfly gardens around the clubhouse and out-of-play areas.

Need help? Consult with environmental experts familiar with local plants and animals. Local Audubon and Native Plant Society chapters and environmental agencies are good starting points as well as:

- The United States Golf Association (USGA)
- The Audubon Cooperative Sanctuary Program for Golf Courses
- Audubon International
- The Environmental Institute for Golf - Online Information (EDGE)
- Florida Department of Environmental Protection

Source: *Best Management Practices for the Enhancement of Environmental Quality on Florida Golf Courses*, Florida Department of Environmental Protection, 2007; and, *Audubon International, Principles for Sustainable Resource Management, Fact Sheet*.



Photo Courtesy of Dan Pennington, 1000 Friends of Florida

Top: At Harmony in Osceola County careful bridging of onsite wetlands connects various portions of the course minimally impacting wildlife habitat.

Bottom: Bat house on the golf course at Harmony, Florida.

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Ornate Chorus Frog and Gopher Frog - These great croaking voices benefit from use of ephemeral wetlands.

From a conservation standpoint, numerous isolated seasonal wetlands scattered across a habitat mosaic of forested and open areas on a course may create a biodiversity boon for amphibians and some reptiles.

Increase Biodiversity with Seasonal Wetlands – Golf courses should incorporate seasonal wetlands, either in out-of-play areas or as course hazards. From a design standpoint, the incorporation of seasonal wetlands into a course layout has the potential to make a course more varied, aesthetically pleasing and challenging. From a conservation standpoint, numerous isolated seasonal wetlands scattered across a habitat mosaic of forested and open areas on a course may create a biodiversity boon for amphibians and some reptiles. Increased

landscape diversity of wetlands equals higher diversity of amphibians. One study revealed that most golf course water hazards had a lower diversity of amphibians than comparison seasonal wetlands (that is, similar-sized, natural wetlands with variable hydroperiod). Consequently, researchers predict that incorporating more seasonal wetlands into the design of golf courses will increase the biodiversity of amphibians and other semi-aquatic animals.

AUDUBON INTERNATIONAL'S PROGRAMS TO HELP GOLF COURSES AND COMMUNITIES BE WILDLIFE-FRIENDLY

Audubon International is a not-for-profit, 501(c)(3) organization dedicated to educating and assisting golf courses and communities to design and build new developments. As a part of their contracts with member courses and communities, they emphasize the big picture ecosystems approach with: good building and community design practices; water conservation and water quality protection features; efficiently designed transportation systems; and, efficient waste management and energy systems (including renewable energy sources). From a wildlife perspective, Audubon International works with golf courses and communities by following a prescribed planning and design format that:

1. **Performs an Initial Site Specific Assessment** – Before land-use changes take place, it is crucial to understand the characteristics of the site subject to proposed changes.
2. **Strives to Understand Local Habitat Sensitivity** – Sustainable resource management entails careful attention to the wildlife habitat of an area or region. Managing land in a habitat sensitive way includes:
 - Protecting ecologically sensitive areas from all degrading impacts.
 - Not disturbing local wildlife populations by degrading food or water sources, shelter (from predators or weather), or breeding habitat.
 - Not posing threats to species directly or indirectly through increased air or water pollution.
3. **Emphasizes Natural Landscaping** – Sustainable wildlife friendly resource management emphasizes landscaping using a variety of materials and resources native to an area, and maintaining them in a natural condition. Natural landscaping includes:
 - Preserving or enhancing species of vegetation native to the natural region and, to the extent practical, removing species of vegetation not native to that region.
 - Maximizing the size and number of natural or naturalized patches within the area and maximizing the use of natural or naturalized corridors to tie those patches together.
 - Preserving and adding species to establish a wide variety of plants native to the region.
 - Preserving or enhancing a variety of different types of habitat, such as forest, wetland, stream-sides, pond margins, and meadows and grasslands.
 - Preserving or enhancing a variety of vertical layers of plants, such as canopy and understory trees, shrubs, and ground cover.
 - Retaining dead standing trees, fallen trees, logs, and vegetative litter, such as fallen branches, twigs, and leaves.
4. **Designs for Greenspace and Corridors** – Urban parks, forested zones, native grassland areas, and stream corridors reaching into urbanized areas are important elements of sustaining local habitats and wildlife and can include:
 - Identifying and preserving greenspaces and corridors of high wildlife habitat and water quality value within cities and other communities.
 - Maintaining corridors that connect areas and allowing for wildlife movement through and across property boundaries and between adjacent areas.
 - Providing access to appropriate greenspaces for educational and recreational experiences.

Sources: Audubon International, *Principles for Sustainable Resource Management Fact Sheet*; and, *personal communications with Ronald Dodson of Audubon International*.



Aerial photo of St. James Bay an Audubon International Signature golf course in Franklin County.

It is important to determine what bird species are already on the site and make sure to not to destroy habitat features and linkages essential to their survival. It is also important to identify which bird species could potentially be attracted to the course. High quality bird habitat contains a large proportion of native vegetation that provides the basics – a mix of food sources, water and shelter, as well as minimum disturbance from golfers. Positioning high quality patches together is highly preferable to locating them alongside a degraded or busy area.

PLANNING FOR THE BIRDS

It is important to determine what bird species are already on the site and make sure to not destroy habitat features and linkages essential to their survival. It is also important to identify which bird species could potentially be attracted to the course. High quality bird habitat contains a large proportion of native vegetation that provides the basics – a mix of food sources, water and shelter, as well as minimum disturbance from golfers. Positioning high quality patches together is highly preferable to locating them alongside a degraded or busy area.

To support a mix of bird species plan accordingly by investigating the habitat requirements of those species and making appropriate modifications. These include:

- Using a mix of native plants, especially fruit-bearing varieties, as habitat and food sources is vastly superior to using exotic plants.
- Leaving dead trees or large snags standing in out-of-play areas and cropping them where necessary to limit liability concerns.
- Providing bird houses for specific species where natural cavities are lacking.
- Building birdhouses out of wood and positioning them away from human activity.
- Placing bird feeders and baths 8 to 10 feet from trees and cleaning regularly.
- Providing a variety of water depths, perching sites, and vegetation with water features.
- Designing vertical layers of habitat including ground, low, medium, and tall vegetation, and planting clusters rather than isolated plants.

- Establishing buffer zones to protect the nests of large nesting birds, and protecting areas with large numbers of nests and birds. At least a 100-foot buffer is ideal, but carefully placed screening vegetation can reduce the distance required.
- Encouraging the presence of birds and bats to control pests.



Yellow-crowned night heron

UNIVERSITY OF FLORIDA IFAS STUDY SAYS GOLF IS FOR THE BIRDS

Golf course ponds can be used to enhance food sources, shelter, and habitat for resident and migratory water birds, according to a recently completed two-year study conducted by the University of Florida's Institute of Food and Agricultural Sciences. During a study of 183 ponds on 12 golf courses in Southwest Florida over a 2-year period the study evaluated the extent to which created wetlands within golf courses are used as habitat by resident and migratory water birds.

Results indicate that the wide range of habitat variables selected by various bird species indicates that providing a diversity of habitat features among ponds within a golf course would provide the greatest benefits to the largest number of species. To accomplish this goal, ponds can be managed as a wetland complex, whereby different ponds or sections of ponds are enhanced or modified to represent different types of habitat. For example, creating areas along ponds that have dense shrub cover would benefit dense-vegetation waders; trees can provide roosting sites; and the creation of shallow foraging areas will benefit wading birds and numerous other species. Not all pond features were attractive to waterbirds. For example, man-made structures, such as walls and ledges around pond perimeters, were

avoided by some species (dipping and dabbling Foragers), probably because these structures impeded movement into and out of the water.

Habitat management designed to benefit waterbirds may also provide cost savings for the golf course. Maintenance problems associated with wet areas along edges of ponds may be ideal for modifications (e.g., increasing the littoral zone) to benefit waterbirds while simultaneously reducing management costs. Consequently, opportunities likely exist on many golf course ponds to improve habitat for waterbirds, while providing financial savings and generating positive

public relations for practices that provide benefits to wildlife.

In general terms, the study shows golf course ponds may benefit wading birds in several ways:

- Provide permanent sources of water, which is critical during dry spells.
- Reintroduce water and food sources for indigenous water birds in areas that once supported wetland areas, such as land used for agriculture.
- Add water bodies to areas where none existed before.
- Provide substantial food sources and foraging areas for all categories of water birds studied; potentially limit human disturbances of feeding and habitat areas.

According to Martin Main, the study's principal investigator, water birds travel great distances to find food, and the surface area of golf course ponds aids the birds to locate sources.

Source: *Wildlife in Urban Landscapes: Use of Golf Course Ponds by Wetlands Birds*.

C. LeAnn White and Martin B. Main, Institute of Food and Agricultural Sciences (IFAS), University of Florida, 2007.



Golf Course pond at Raptor Bay in Lee County had a double littoral design (shoreline vegetated area and another vegetated rise several feet off-shore) that supports a wide variety of bird life.

Photo Courtesy of Joanne Davis, 1000 Friends of Florida

Prescribed fire is a cost-effective management tool that should be a welcome addition to other integrated pest management techniques. Without periodic fire, the type and distribution of plant communities change in these habitats and they become increasingly unsuitable for wildlife that adapted to these environments.

INTEGRATE FIRE DEPENDENT NATURAL COMMUNITIES AND GOLF COURSES

Golf courses containing remnant fire adapted ecosystems can make effective use of prescribed fire to restore and maintain their rough areas. Prescribed fire is a cost-effective management tool that should be a welcome addition to other integrated pest management techniques. Without periodic fire, the type and distribution of plant communities change in these habitats and they become increasingly unsuitable for wildlife that adapted to these environments. Prescribed burning is by far the most cost effective treatment to reduce fuel loads and sustain native habitats. Burning functions to sustain the native composition and density of the vegetation reduce competing invasive plants, control pest problems, and open space between or below the tree canopy. Below are various planning and design issues requiring forethought within golf course communities and fire adapted ecosystems.

- **Smoke and Liabilities** – Properties adjacent or proximate to managed golf course lands receiving ecological burns should be zoned, or within, a designated overlay area wherein a “Notice of Proximity” is issued (see Chapter 7, Managing for Fire).
- **Strategic Separations** – Stormwater ponds can be planned and located strategically along an outer edge of developed areas and the managed golf course land to act as fire breaks between homes or other buildings.
- **Placement of Development** – Development can be clustered via conservation subdivision design with the common set-aside areas strategically placed as fire break between the prescribed fire-managed areas and residential or other developed sites.
- **Hydrological Restoration** – Golf course landowners can institute surface and groundwater restorative actions for previously altered or over-drained land and habitats. Such hydrological

restoration actions can help define and limit the extent of fire adapted ecosystems.

- **Managing Excessive Understory Growth and Exotic Plants** – These problem spots may contribute to heavy fuel loads. To avoid intense damaging fires, these areas sometimes may require mechanical or chemical treatment for thinning or removal prior to initiation of prescribed burn cycles.

BUFFERS FOR WATERBODIES AND WETLANDS

Buffers around the shore of a waterbody, or other sensitive areas, filter and purify runoff as it passes across the buffer and provides useful areas of habitat. Ideally, plant buffers with native species provide a triple play of water quantity and quality benefits, pleasing golf course aesthetics, and habitat and food sources for wildlife. Buffers generally have several zones inclusive of some upland, a riparian or damp soil area, and an in-water area with emergent vegetation. Depending of the design of the in-play areas, natural buffers adjacent to water and wetlands may need to be strategically reduced or eliminated, providing for managed-grass fairways or greens right to the wet edge. These “sharp” edges of managed grass to water or wetlands should be the exception rather than the rule, and should represent areas of frequent play. Areas outside of frequent play should be designed and managed as soft edges, i.e., natural buffered inclusive of uplands, riparian wet soils, and water emergent plant zones.

A measure of protection can be achieved by instituting special management zones around waterbodies and wetlands. In managed areas around a golf course, the first 25 feet landward should be a No Spray Zone (no pesticides used), and from 25 to 50 feet landward should be a Limited Spray Zone (selected pesticide use, based on a risk assessment protective of aquatic life). The No Spray Zones and buffers occupy the same space. It is important to note, however, that Limited Spray Zones and a policy of “no direct

discharge” provide advantages to all wildlife by maintaining water quality. Efforts are wasted if water quality is not sufficient for wildlife use. Some species, especially aquatic animals that cannot move large distances, are extremely sensitive to even trace amounts of standard fertilizers and pesticides. It is critical to design buffers that incorporate sufficient protective measures to maintain water

quality and wildlife habitat. Effective course BMPs for these buffer and near-to-buffer areas may include site-specific natural/organic fertilization (slow release forms) and limiting pesticide use.

The only downside to native vegetation buffers usually concerns the play of the golf game. Sometimes a waterbody is situated such that a native buffer would take up too much space, obstruct the view, or otherwise interfere with the play of the game. In this case, a grass buffer may be used. A 25-foot buffer of turf mowed at 3 inches and only minimally fertilized with slow-release or organic based products provides an effective buffer from a water quality standpoint, though wildlife benefits are lost.

GOLF COURSE STORMWATER TREATMENT TRAINS AND CAPTURING WILDLIFE HABITAT VALUE

Golf course stormwater management should include “natural systems engineering” or “soft engineering” approaches that maximize the use of natural systems to treat water.

Stormwater treatment is best accomplished by a treatment train approach, in which water is conveyed from one treatment to another by conveyances that themselves contribute to the treatment. For example, stormwater can be directed across a vegetated filter strip through a swale into a wet detention pond, and then out through another swale to a constructed wetland system. Each of these stormwater catchment, transmission, and treatment components can incorporate wildlife habitat features with care taken to manage for removal of trapped pollutants.

Stormwater treatment facilities can accumulate levels of pollutants that are toxic or that may cause chronic problem to wildlife. Proper golf course management recognizes this potential and strives to limit these problems through regular treatment train management actions, use of IPM, and limited strategic fertilization.

Stormwater treatment is best accomplished by a treatment train approach, in which water is conveyed from one treatment to another by conveyances that themselves contribute to the treatment.



Photo Courtesy of Matthew Paulson and the Florida Wildlife Federation

Watching you watching us - a pair of otters alongside a lake or waterway within a golf course setting is enjoyable and memorable experience.

Getting outdoors and reconnecting with nature are among the top reasons why people play golf. Additionally, studies of residents of golf course communities indicate that many do not play golf but seek the “natural” aspects, including the greenspace and open areas the course establishes. It is critical to design courses to educate and engage golfers and residents to be good stewards of the land and living community.

GOLF COURSES AND WILDLIFE FRIENDLY ENVIRONMENTAL PRACTICES

Use Integrated Pest Management (IPM) – The design and implementation of Integrated Pest Management reduces the consumption of pesticides, fertilizer, water and time, thus producing a substantial reduction in operational costs. Essentially this means golf course managers and landscape maintenance personnel are educated to regularly and carefully observe the course and prudently apply pesticides only to the area of infestation and only in quantities sufficient to address the particular problem. The proximity of small mammals to the ground makes them particularly susceptible to harmful chemicals and bioaccumulation of harmful pollutants tends to increase “up the food chain.”

Limit Local Environmental Contamination from Chemical Mixing and Course Equipment Wash-Off Areas. For any golf course, a cornerstone design feature is to site and design the golf course maintenance facility to ensure all chemical mixing areas (insecticides, nematocides, fertilizers, etc.) have spillage catchment design on non-porous concrete surfaces.

RECYCLE AND USE RECYCLED MATERIAL

Use BMPs in recycling water and materials, heating and cooling practices, lighting and energy management and cleaning of equipment. Additionally, golf course bridge surfaces, benches, trash cans, and water coolers can be made of 100 percent post consumer plastics of the highest quality.

Source: The Florida Department of Environmental Protection, Best Management Practices for the Enhancement of Environmental Quality on Florida Golf Courses, 2007.

ENGAGE GOLF COURSE STAFF AND GOLFERS

Getting outdoors and reconnecting with nature are among the top reasons why people play golf. Additionally, studies of residents of golf course communities indicate that many do not play golf but seek the “natural” aspects, including the greenspace and open areas the course establishes. It is critical to design courses to educate and engage golfers and residents to be good stewards of the land and living community.

SUMMARY

There are great opportunities to accommodate wildlife when planning a golf course in a community. In general, the design progression ought to be: identify existing or potential habitats and wildlife connections first; establish or maintain stepwise buffer areas around waterbodies, wetlands, and other environmentally sensitive areas second; and then design the golf course layout with the community’s hardscape areas (homes and developed space). Take cues from the surrounding topography and landscape and incorporate natural features and amenities.

Remember that where habitat is concerned, size and shape matters. One large naturalized area is superior to several small fragments. Nevertheless, enlarging and connecting smaller habitats also creates habitat value. Distance counts too. Animals tend to avoid isolated habitat patches that require them to travel long distances or across open areas where the risk of predation is high. Locating habitat patches in close proximity to one another, or creating natural corridors with less managed or manicured grass areas connecting smaller patches, can increase wildlife value. The more natural vegetation and ground cover within a retained habitat, the more likely it is to attract and sustain a diversity of indigenous animals. Natural food, clean water, native cover, and limits on disturbance are the pre-requisites for local wildlife. Plan and design golf courses to sustain these elements and wildlife will always be present.

CASE STUDY**Encouraging Burrowing Owls at Golf Courses**

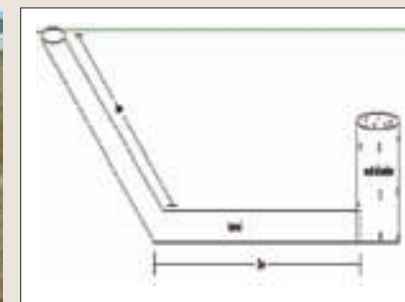
Golf course communities can play a role in helping to restore declining wildlife populations, such as the burrowing owl, by preserving burrowing habitat where it exists, and also by providing artificial nesting burrows on suitable areas. Burrowing owls may be attracted to golf courses because they prefer to nest and forage in open areas with short grass. Burrowing owls may benefit local golf courses by:

- Controlling rodent populations. Owls eat small rodents.
- Preventing outbreaks of insects. Owls feed on invertebrates such as locusts, grasshoppers, beetles, crickets, scorpions, and earwigs.
- Providing wildlife viewing, education, and focus for golfers. The owls are a popular species that people enjoy watching and learning about.
- Providing positive publicity. Golf courses receive positive local publicity by helping conserve a high-profile species of wildlife.

An artificial nesting burrow consists of a 5-gallon plastic bucket buried upside-down (without the lid) approximately 4.25 feet below ground. Ten feet of 4-inch corrugated drainage tubing is used to create a sloped tunnel leading from the ground surface down to the nest chamber. The 4-inch opening of the drainage tubing and a small patch of dirt are all that is visible after an artificial burrow is installed. Tunnel openings should not stick out above grass height so

that mowing and other maintenance can continue without interruption. The 10-inch by 14-inch patch of dirt at the tunnel entrance provides a search image that may help owls locate vacant burrows.

Source: *How To Install Artificial Nesting Burrows For Burrowing Owls: A Guide For Golf Course Superintendents And Grounds Crews*. By: Courtney J. Conway, Matt D. Smith, and Lisa A. Ellis 2002.



Burrows should not be installed near sprinkler heads, and should preferably be greater than 150 feet from the nearest sprinkler. Burrows should be installed in non-maintained areas (areas with minimal watering and mowing) with a minimum of 100 feet between the burrow and the nearest maintained area.



Photo Courtesy of David Moynahan Photography



A number of tools are available to local governments and landowners in Florida that may be tailored for preserving and supporting agricultural interests, native habitats and wildlife.

Among these tools are comprehensive plans, zoning and land use ordinances, and a host of federal and state rural lands and wildlife conservation incentive programs.

Florida's agricultural areas and working landscapes have an important role to play in conserving wildlife habitat. Many agricultural lands, as well as the people who maintain and depend upon these areas, are inextricably linked to an ethic of land stewardship and wildlife conservation. A number of tools are available for rural landowners, planners and land managers to promote both natural habitats for wildlife as well as continued economic farming and forestry viability. This chapter discusses a number of resources available to help achieve habitat preservation and restoration, while protecting long-term productivity of agricultural lands. These include cooperative efforts such as government cost-share programs, agricultural conservation easements, rural land stewardship options, agritourism and land conservation, restoration and management techniques.

STARTING POINTS

Basic Tools for Local Governments – Agricultural wildlife management entails landscape-level consideration of wildlife populations and habitats both on the farm and off, keeping habitat patches, connecting corridors and maintaining linkage to species genetic reservoirs a part of the plan. A number of tools are available to local governments and landowners in Florida that may be tailored for preserving and supporting agricultural interests, native habitats and wildlife. Among these tools are comprehensive plans, zoning and land use ordinances, and a host of federal and state rural lands and wildlife conservation incentive programs. The county comprehensive plan is an excellent place to begin planning for wildlife habitat and agriculture. The plan serves as a legal framework for local land use decisions and zoning ordinances made by a county or municipality. Florida's agricultural landscapes are often heavily influenced by decisions made in comprehensive plans.

Photo Courtesy of (images left to right):
David Moynahan; Matthew Paulson;
David Moynahan; Miguel Aleyva and the
Florida Wildlife Federation

The Agriculture Stewardship Program in Hillsborough County is giving a unique boost to environmental and agricultural protection.

This program establishes a means to pay farming interests for a set time frame to keep their lands in agriculture, maintaining agricultural viability and protecting natural resources.

Hillsborough County's farming economy and culture centers on the production of 88 percent of the state's strawberries, 11 percent of its tomatoes, and locally produced tropical fish.

CASE STUDY

Hillsborough County: Proactive Wildlife Habitat Protection and Agricultural Viability

The Agriculture Stewardship Program in Hillsborough County is giving a unique boost to environmental and agricultural protection. This program establishes a means to pay farming interests for a set time frame to keep their lands in agriculture, maintaining agricultural viability and protecting natural resources. Hillsborough County's farming economy and culture centers on the production of 88 percent of the state's strawberries, 11 percent of its tomatoes, and locally produced tropical fish (Source: Clouser & Gran, 2007).

Facing a rapid population increase and associated conversion of agricultural lands to developed areas, the county sought independent measures to help protect agriculture uses and associated wildlife habitat, corridors, and buffer zones between urban and natural areas. The Agriculture Industry Development Program provides grant payments, funded through general revenue, to agricultural landowners in exchange for leasing a 10-year "agricultural use" easement on their property. Those enrolled in the program can receive an annual grant payment totaling 75 percent of taxes paid on the agricultural value of land. This formula was based on a cost of services study showing that, on average, agricultural interests required only 25 cents worth of services for each dollar spent in taxes (Source: Clouser and Gran, 2007). As the program is based on a first come, first served basis, it does not ensure prioritized enrollment of the most environmentally sensitive or most developable land.



Pelicans and Sebastian Inlet sunset.

Photo Courtesy of Mario Gonzalez and the Florida Wildlife Federation

In its first year, 223 applicants enrolled, covering approximately 9,000 acres of agricultural lands. The program was then capped, and other interested applicants have been placed on a waiting list, pending additional future funding. This program merits further study and may provide a helpful model for other local governments to devise strategies beneficial both to the local rural economy and wildlife habitat communities.

Another excellent starting point for farmers and landowners is the Florida Cooperative Extension Service, administered by The University of Florida's Institute of Food and Agricultural Science (UF/IFAS) and Florida A&M University (FAMU). The Florida Extension Service is a partnership between state, federal and county governments serving to provide scientific knowledge and expert advice to the public. Extension offices operate in each of Florida's sixty-seven counties. Twelve Research and Education Centers (RECs), several Research and Demonstration Sites (RDSs), and several other offices are located throughout the state.

They can provide farmers, landowners, planners, local government officials and other members of the public with valuable information on Florida agriculture and its relationship to wildlife habitat conservation, including agriculture and resource conservation classes, computer networking, consultations, demonstrations, educational materials, field days, meetings and workshops, and numerous resources to assist agricultural interests with beneficial solutions. Florida County Extension Service and offices can be found online at

<http://solutionsforyourlife.ufl.edu/map/index.html>.

Cost-Share Programs – Rural landowners and farmers can make large strides forward in implementing wildlife habitat conservation practices through participation in government programs that provide “cost-share” for practice implementation and specific technical assistance. Cost-share programs are government/sponsored financial assistance packages developed to support agricultural interests. They are intended to ease the financial burden of costs associated with wildlife management, conservation and restoration. These programs are used by many agricultural landowners in Florida to conserve wildlife habitat while simultaneously fostering agricultural productivity, efficiency and overall land health.

FEDERALLY FUNDED FARM BILL PROGRAMS

The Farm Security and Rural Investment Act of 2002 (Farm Bill) offered agricultural landowners a variety of tools to help protect, restore and enhance essential soil, water and wildlife resources, as well as maintain the economic viability of farms. The United States Department of Agriculture (USDA) and its affiliates the Natural Resources Conservation Service (NRCS), the Farm Service Agency (FSA), and the Forest Service (FS) each work in conjunction with the Florida Department of Agriculture and Consumer Services (FDACS) and the FFWCC to provide technical and cost-share assistance to landowners. This assistance may be provided in exchange for implementation of habitat and natural resource management practices, the placement of environmentally sensitive lands under conservation easement, or other types of land protection agreements (Source: www.wildlifeandag.wec.ufl.edu). Several of the programs most commonly employed by Floridian agricultural interests are discussed below.

Wildlife Habitat Incentives Program (WHIP) – WHIP is geared primarily toward farmers and ranchers who seek to improve or provide high quality wildlife habitat on their upland, wetland, riparian or aquatic habitat areas. The program provides technical assistance and cost-share payments to landowners under agreements that are usually 5 to 10 years in duration. The program is administered by USDA and NRCS through federal funding from the Commodity Credit Corporation (CCC).

In addition to private lands, eligibility extends also to tribal lands, federal land (if the primary benefit is incurred by private or tribal lands), and state and local government land on a limited basis. WHIP enrollment emphasizes:

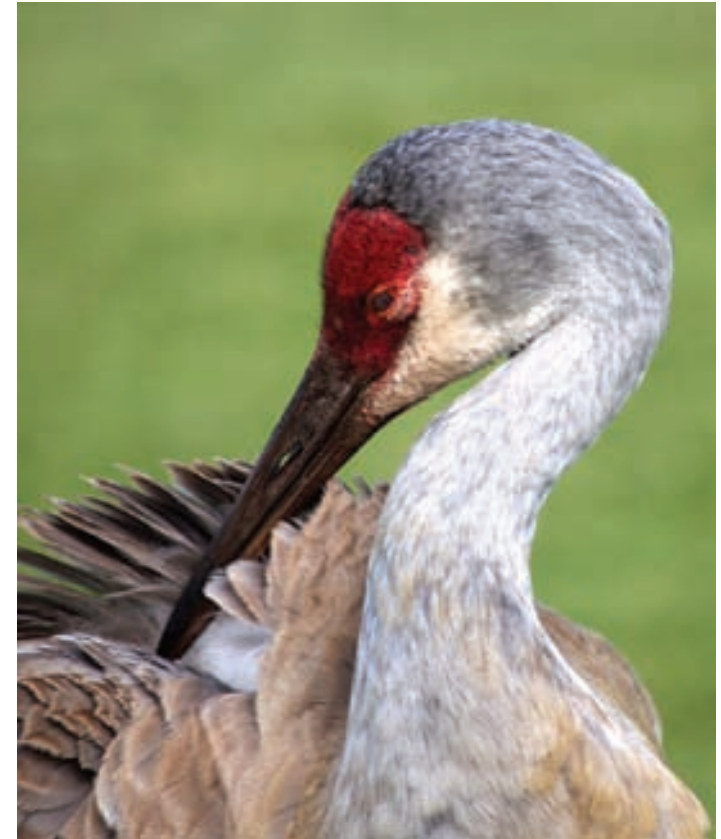
- Land serving as home to wildlife species that are experiencing severe decline or significant reductions.

Rural landowners and farmers can make large strides forward in implementing wildlife habitat conservation practices through participation in government programs that provide “cost-share” for practice implementation and specific technical assistance. Cost-share programs are government-sponsored financial assistance packages developed to support agricultural interests. They are intended to ease the financial burden of costs associated with wildlife management, conservation and restoration.

WHIP can help farmers and landowners by providing technical assistance, up to 75 percent cost-share assistance, and reimbursement payments of as much as \$10,000 per landowner per year for the duration of a contract. Assistance may be provided in exchange for commitments to: monitor habitat practices; review management guidelines to promote habitat development; provide brush management; create wildlife openings and corridors; improve fish streams; and provide basic biological or engineering advice on land management practices for targeted species.

- Beneficial land management practices for wildlife not otherwise subject to funding.
- Special wildlife and fishery habitats identified by state and local partners and/or tribal interests.

WHIP can help farmers and landowners by providing technical assistance, up to 75 percent cost-share assistance, and reimbursement payments of as much as \$10,000 per landowner per year for the duration of a contract. Assistance may be provided in exchange for commitments to: monitor habitat practices; review management guidelines to promote habitat development; provide brush management; create wildlife openings and corridors; improve fish streams; and provide basic biological or engineering advice on land management practices for targeted species. Agreements span from 5 to 10 years, although some shorter terms may be implemented to meet the needs of certain wildlife emergencies. WHIP participants are required to develop a wildlife habitat development plan with qualified technical assistance as a part of a comprehensive conservation plan of operations (Source: www.nrcs.usda.gov, 2004). WHIP has been particularly effective in Florida in promoting improvement and restoration of wildlife habitat, and has been widely accepted as a valuable tool for agricultural landowners and wildlife species alike. The program has had much success in upland wildlife habitat as well as aquatic areas.



Ocala Wildlife Management Area, Preening Sand Crane

CONSERVATION PLANS OF OPERATION AND WILDLIFE HABITAT DEVELOPMENT PLANS

Conservation plans are often developed with the help of technical expertise, including NRCS conservationists and FFWCC biologists.

A conservation plan of operations may incorporate aerial photography and diagrams, and soil and vegetation descriptions and maps to help formulate a list of management decisions, locations and schedules for implementing chosen actions. Information sheets addressing implementation steps are included. Participants are required to certify that they have carried out their plans each year. Benefits to developing a conservation plan of operations include to:

- Clearly define how to effectively maintain the productivity and health of water, soil and other farm resources.
- Protect, enhance and restore wildlife habitat through specifically defined practices and directions for their long-term progression and continuation.
- Comply more readily with environmental regulation requirements.
- Improve eligibility for other government cost-share programs.
- Protect or increase productive value of farmland and its habitat and wildlife values for future generations.

More information on Conservation Plans of operation can be found online at www.fl.nrcs.usda.gov/documents/WhatisaConservationPlan.pdf.

WILDLIFE HABITAT DEVELOPMENT PLANS

Wildlife Habitat Development Plans are often included as an element of conservation plans of operation under USDA programs and requirements. The habitat development plan designs projects which create or enhance wildlife habitat by providing food or cover and are applicable on any landscapes suitable for wildlife habitat or the larger natural community. Plans vary according to the specific location of their application, but usually take into account:

- The landowner's long-term objectives and goals regarding wildlife on their properties.
- The requirements for optimum targeted wildlife habitat.
- The adaptability of plant species identified as habitat beneficial to the climate, soils, and moisture conditions on the site where the habitat is to be established.
- The effects caused by location, installation and management may have on subsurface wildlife resources.
- A supplemental management plan to improve or create wildlife habitats and vegetative areas where invasive plant species pose a threat to the desired plant community (NRCS, 2007).

More information on WHIP and Wildlife Habitat Development Plans can be accessed online through the USDA website or online at www.fl.nrcs.usda.gov/programs/flwhip.html.

A “conservation plan of operations” is a tool used by the USDA to help farmers better manage natural resources on their properties. These plans identify, organize and guide management practices to protect natural resources and wildlife and promote effective farm production.

FSA evaluates candidates for CRP contracts on eligible lands according to an Environmental Benefits Index (EBI). Index data for a specific area is collected by FSA and may cover such factors as: wildlife habitat benefits resulting from maintaining or improving vegetative cover; water quality benefits from implementing various land and/or crop management practices; erosion reduction practices; and air-quality improvements, and other factors.

Wetlands Reserve Program (WRP) – The Wetlands Reserve Program is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. Through the NRCS, the USDA provides technical and financial support to landowners undertaking wetland management and restoration efforts. The program offers landowners opportunities to establish long-term wetland conservation and wildlife protection practices, with a much lesser financial burden than attempting such efforts on their own. The program’s goal is to assure the greatest possible degree of wetland functions and values, along with optimum wildlife habitat on every acre enrolled in the program.

Landowners may participate in the WRP in one of three forms:

1. A 10-year restoration cost-share agreement providing up to 75 percent of the costs for identified beneficial practices, as well as technical assistance to implement approved wildlife and other natural resource protection practices.
2. A permanent agricultural easement including up to 100 percent of costs to restore wetlands.
3. A 30-year agricultural easement, at 75 percent of the payment for a permanent easement.

For both permanent and 30-year easements, the USDA pays all costs associated with recording fees, charges for abstracts, survey and appraisal fees, and title insurance. WRP is widely used in Florida. Its success may be attributed to generous cost-share and easement allowances and focus on wetlands in a state housing many coastal and inland swamp habitat areas.

Conservation Reserve Program (CRP) – The Conservation Reserve Program is administered by the USDA and FSA, and is geared primarily toward non-forestry agricultural interests such as row-cropping farms and livestock ranches, for which contracts



Buffered stream and wildlife corridors.

are created to last anywhere from 10 to 15 years. While the program is administered by FSA, some technical support functions may be provided by the NRCS, Florida forestry agencies, local soil and conservation districts, and private sector providers of technical assistance.

The program serves to encourage wildlife habitat creation or restoration as well as natural resource protection such as planting diverse vegetation habitat between crops to provide essential vegetative cover, prevent erosion, etc. The program has proven successful in Florida as well as in several other states through marked improvements in targeted wildlife populations.

FSA evaluates candidates for CRP contracts on eligible lands according to an Environmental Benefits Index (EBI). Index data for a specific area is collected by FSA and may cover such factors as: wildlife habitat benefits resulting from maintaining or improving vegetative cover; water quality benefits from implementing various land and/or crop management practices; erosion reduction practices; and air-quality improvements, and other factors.

Eligible lands include croplands (including field margins) that are planted or may be considered planted to an agricultural commodity for 4 of 6 previous crop years, and which are physically capable to be planted in a normal manner as an agricultural commodity. CRP also extends its services to marginal pastureland, suitable for use as wildlife-protecting riparian buffer, or for other water quality protection purposes. The cost-share rate for CRP can provide up to 50 percent of state average installation costs, as well as “annual rental” subsidies of as much as \$50,000 per year for the duration of a contract.

Rental payment rates are based on the relative productivity of soils for their intended purpose, as well as the dry land cash rent or cash-rent equivalent. These rates may be adjusted by a participant prior to making an agreement, or offered at a lower rental rate than the maximum allowable, to increase the likelihood that the landowner’s proposal will be accepted or renewed. Enrollment in CRP also requires the development of a management plan for the land subject to cost-share agreement, involving prescriptive practices as a part of a master conservation plan of operations (Source: www.fsa.usda.gov, 2007).

Environmental Quality Incentives Program (EQIP) – The Environmental Quality Incentives Program, administered by the USDA and the Florida branch NRCS office, offers financial and technical assistance to eligible participants to implement wildlife and natural resource friendly management practices on agricultural lands. It provides a broad voluntary conservation program for farmers and ranchers to promote general environmental, wildlife habitat and natural resource quality, and agricultural production as cooperative and compatible goals.

EQIP operates on one-year minimum to ten-year maximum contracts that provide for incentive payments and agreements to share the costs of implementing conservation practices. Once a plan is developed for an EQIP contract, it is reviewed and may be approved by the local NRCS district and then implemented.

In Florida, any land used for agriculture and/or agricultural production may be eligible to participate. Preference is given to land having more sensitive environmental resources, and to lands best suited to implement techniques and land uses. The program can share costs up to 50, 75 or even 90 percent (dependent on approved resource and habitat concerns) of costs associated with intended conservation practices, as well as reimbursements to a maximum of \$10,000 per landowner per year (Source: www.fl.nrcs.usda.gov, 2008).

NON-FARM BILL FEDERAL INITIATIVES

Partners for Fish and Wildlife Program – Sponsored by the US Fish and Wildlife Service, the Partners Program provides financial and technical assistance to private agricultural and non-agricultural landowners who commit to implement practices that meet the needs of Federal Trust Species in Florida. It places emphasis on providing conservation leadership and partnerships, encouraging public understanding and participation, and cooperating with other federal USDA programs to achieve the best possible benefits for participating landowners.

The program is open to all habitat types to conserve or restore wildlife habitat in the form of vegetation, hydrology and soils associated with imperiled species and ecosystems. It may encompass longleaf pine, tropical forests, bottomland hardwood, native prairies, rivers and streams, marshes or otherwise requisite habitat for rare, declining or protected species. The Partners Program employs locally-based field biologists, (often FFWCC biologists), who work in conjunction with private landowners and others to plan, implement, and monitor their projects. Partners Program field staff help landowners find other sources of funding and help them through the permitting process, as necessary. This personal attention and follow-through is a significant strength of the Program that has led to national recognition and wide support.

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Florida is home to a wealth of plant and animal species, some of which are identified as threatened or endangered based on significant reductions in their populations. These species often become imperiled as a result of habitat degradation or loss caused by human activities.

FLORIDA'S FEDERAL TRUST SPECIES

Florida is home to a wealth of plant and animal species, some of which are identified as threatened or endangered based on significant reductions in their populations. These species often become imperiled as a result of habitat degradation or loss caused by human activities. The USFWS may place a species on a Federal Trust list, based on a species receiving status as threatened or endangered and the severity of its situation. The list is prioritized by the level of danger faced by each species.

Listed species are targeted in many government habitat protection initiatives, such as cost-share programs. Private lands which contain habitat necessary to support and encourage population growth of targeted species are often given precedence in the allotment of federal aid opportunities. A few of the species highlighted in Florida's efforts to protect species in danger of severe population loss or extinction are: West Indian manatee, Florida scrub jay, Eastern indigo snake, Gulf sturgeon, fat three-ridge mussel, Florida salt marsh vole, key deer, Florida panther, flatwoods salamander, red cockaded woodpecker and many others.

A complete listing of Florida's Endangered and Threatened Federally Listed Species can be found online at www.fnai.org/ranks.cfm.



Furthermore, the Partners Program has priority ranking factors to guide project selection. These give preference to projects that:

- Improve habitat for Federal Trust Species, including migratory birds, threatened and endangered species, inter-jurisdictional fish, marine mammals, and other declining species.
- Complement activities on National Wildlife Refuge System lands, or contribute to the resolution of problems on refuges that are caused by off-refuge practices.
- Address species and habitat priorities that have been identified through US Fish and Wildlife Service planning teams (with our partners), or in collaboration with state fish and wildlife agencies.
- Reduce habitat fragmentation or serve as buffers for other important federal or state conservation lands.
- Result in self-sustaining systems that are not dependent on artificial structures.

Priority is often directed toward projects that link private lands to important federal lands (such as refuges), have cooperative agreements spanning longer time periods, and incorporate multiple partners, cost sharing, and the greatest cost effectiveness (Source: Environmental Conservation Online System at http://ecos.fws.gov/ecos_public/index.do, 2007).

STATE FUNDED WILDLIFE HABITAT COST-SHARE PROGRAMS

Several state funded cost-share programs are also available to Florida rural land interests.

Landowner Assistance Program (LAP) – The Florida Fish and Wildlife Conservation Commission’s LAP is a voluntary, incentive-based approach to create public-private conservation partnerships. The FWC’s LAP staff work with public and private

landowners across the state to conserve habitat for native wildlife species by providing technical assistance to landowners and through a variety of incentive-based programs.

Pursuant to Florida’s Wildlife Action Plan, partnerships with private landowners are promoted to implement conservation actions that are compatible with the landowner’s land use objectives that strive to reduce treats to important wildlife habitat. FWC’s LAP staff will prepare habitat management plans or prescriptions for landowners, oftentimes working in cooperation with other state and federal natural resource conservation agencies. In addition to technical assistance, staff work with landowners to complete the documentation necessary for financial assistance offered through FWC programs such as the Landowner Incentive Program and Common Species Common Program, as well as federal programs such as Partners for Fish and Wildlife and FARM Bill Conservation Programs are provided.

Another important element of FWC’s LAP is recognition of landowner’s who are demonstrating good wildlife conservation on their properties. Often, this recognition is provided during LAP workshops and field days.

Please visit www.myfwc.com/LAP for more information on how the FWC’s Landowner Assistance Program can assist you.

Forest Land Enhancement Program (FLEP) – The Forest Land Enhancement Program is funded by the USDA and administered by the Forestry Division of the Florida Department of Agriculture and Consumer Services (FDACS). It offers cost-share assistance for private non-industrial forest landowners in Florida to help forest owners manage for wildlife habitat, timber production, recreation, aesthetics, listed species and water quality. The program offers as much as 75 percent cost share for applicants, and includes but is not limited to such practices as site preparation, tree planting, and prescribed burning activities (Source: www.fl-dof.com/forest).

The Florida Fish and Wildlife Conservation Commission (FWCC) sponsors the LIP to conserve habitat for native species by maintaining or enhancing associated habitat resources on private lands. The program focuses on identification and implementation of prescribed fire land management, mechanical and chemical vegetation treatments, native vegetation restoration, and creation of forest openings, hydrology enhancement projects, and installation of nest structures.

The Forest Stewardship Program is overseen by the FDACS Division of Forestry. It is geared toward private forest landowners of at least 20 acres (or a group of landowners pooling resources to meet the acreage limit) who agree, on a long-term basis, to adhere to management objectives that address wildlife habitat and other natural resource bases, economic viability, conservation of resources, and social, environmental and ecological responsibility.

Photo Courtesy of Ginger L. Corbin, U.S. Fish & Wildlife Service



A prescribed burn.

Forest Stewardship Program – The Forest Stewardship Program is overseen by the FDACS Division of Forestry. It is geared toward private forest landowners of at least 20 acres (or a group of landowners pooling resources to meet the acreage limit) who agree, on a long-term basis, to adhere to management objectives that address wildlife habitat and other natural resource bases, economic viability, conservation of resources, and social, environmental and ecological responsibility. It is designed to encourage the state's private non-industrial forest landowners to practice stewardship through:

- Encouraging private non-industrial forest landowners to manage their properties according to multiple-use concepts.
- Increasing public awareness of important amenities provided by Florida's forestlands, especially non-industrial private forestlands, to all citizens of the state.
- Improving coordination among public and private natural resource agencies and groups to better serve landowners in

the state and achieve common goals.

Landowners who hire a private natural resource consultant may be eligible to receive assistance with plan preparation expenses, depending on available funding. In many cases, the landowner may have no out of pocket expense for the Stewardship Plan. Furthermore, participants are eligible to receive Forest Steward Certification, determined by the local county forester and a Forest Stewardship Certification Team (Source: www.fl-dof.com/forest).

To find more information on programs discussed in the manual as well as others available in Florida, consult USDA and FDACS websites and local service centers. More information on the Federal Farm Bill programs is at www.usda.gov. More information of Florida programs can be found through the Florida Department of Agriculture and Consumer Services, www.fl-dof.com/services.html and USDA local centers at: www.fl.nrcs.usda.gov/.

AGRICULTURAL CONSERVATION EASEMENTS AND LAND DONATIONS

Agricultural Conservation Easements – Florida agricultural interests have much to gain by considering options of conservation easement geared specifically toward farmers. Farm area conservation easements can ensure the continuation of farming as a permanent land use, and assist with better conservation of wildlife habitat and other vital natural resources. Easements are attractive to those looking to protect their traditional livelihood and heritage, and may also result in property and federal income tax deductions and estate tax benefits (Main et al., 2006).

Agricultural conservation easements can be written to protect such resources as fertile agricultural land, wildlife habitat, surface and ground water, historic sites and scenic viewsheds, and other possible features. They are customized to each individual land-



owner and generally focus on ensuring the continuation of available farming or forest land in conjunction with protecting or improving wildlife habitat resources.

Landowners may enter into agricultural easement agreements with several types of stewarding organizations. Federal or state agencies can include the USDA, NRCS and/or FSA, operating through such initiatives as the Wetlands Reserve Program and Conservation Reserve Program. Non-profit land conservancy organizations include Tall Timbers, The Nature Conservancy and the American Farmland Trust (see Chapter 6, Case Study, Tall Timbers Land Conservancy).

The landowner retains ownership and use of the property, and maintains eligibility to participate in state and federal funding and cost-share programs. The property remains on local tax rolls. In general, agricultural easements are created on a permanent basis, although some short-term easements have been made. Furthermore, landowners retain rights to restrict public access and farm in accordance with terms of the agreement, utilize the land as collateral, or sell the property (Source: www.farmlandinfo.org, 2004).

For more information on conservation easements, see Chapter 6.

The Florida Forest Legacy Program – The Forest Legacy Program (FLP) is a land acquisition grant program sponsored by the US Forest Service (USFS). It employs voluntary conservation easements to protect environmentally important forest areas that are threatened by conversion to non-forest uses. The Florida Division of Forestry (DOF) administers the program, identifies potential projects, and monitors conservation easements.

Performed periodically by the USFS, Florida's Assessment of Need (AON) contains an assessment of forested lands within the state and their uses. The AON identifies forests that are at greatest risk for converting to non-forest uses and the forces advancing such actions. The AON includes state-developed criteria for important forest areas eligible for designation as Forest Legacy Areas (FLAs), and guide implementation of the FLP. For example, based on its AON in 2005, Florida received \$493,000 to help fund its first Forest Legacy purchase, including a key tract of forestland near Newnan's Lake in Alachua County, acquired jointly by the water management district and the County. If continued funding for Forest Legacy is authorized by Congress, Florida will receive additional Forest Legacy funds to assist in the purchase of the crucial timberland projects (Source: www.fl-dof.com, 2008).

In general, agricultural easements are created on a permanent basis, although some short-term easements have been made. Furthermore, landowners retain rights to restrict public access and farm in accordance with terms of the agreement, utilize the land as collateral, or sell the property.

Photo Courtesy of (images left to right): Steve Ball and the Florida Wildlife Federation; Matthew Paulson and the Florida Wildlife Federation; David Moynahan; Gwen McCarthy

Landowners can protect their land by donating it to a qualified public agency, land trust, or nonprofit organization as an outright charitable gift. This can eliminate or reduce taxes associated with some or all of a landowner's holdings. Land donations may be an attractive option for farmers and rural landowners who: do not intend to pass land to heirs; possess land they no longer wish to manage; own highly appreciated property that poses a tax burden; and/or possess real estate holdings of a substantial nature and wish to reduce estate tax burdens.

THE RURAL AND FAMILY LANDS PROTECTION ACT: FUNDING FOR PROTECTION OF AGRICULTURE AND NATURAL RESOURCES IN FLORIDA

The Rural and Family Lands Protection Act is a state program that provides monetary benefit for placing land under agricultural or conservation easement to: (1) protect valuable agricultural lands in Florida; (2) design easement agreements that work in conjunction with agricultural production goals to ensure reasonable protection of environmental resources without severely limiting agricultural operations and maintaining economic viability of production interests; and (3) protect natural resources such as species habitat, groundwater recharge and natural floodplain, while ensuring agricultural economic viability.

The Rural and Family Lands Protection Act has a great deal of potential to serve agricultural interests in Florida. Funding for the program has been severely limited until 2008, when the Florida Legislature voted to support program funding. Local governments would do well to keep an eye on this program to assist rural and family landowners as well as offer support for its reauthorization and funding in the future. Check with the Florida Department of Agriculture and Consumer Services.

Potential Benefits and Drawbacks to Agricultural Easements

Benefits

- Permanent protection of valuable farmland, wildlife habitat and other resources, while simultaneously maintaining private ownership and continuance of the property on local tax rolls.
- Tax benefits in the form of advantages in federal income tax and estate taxes and local property tax reductions.

- Custom design of easements to meet the needs and goals of each specific agricultural landowner.
- Continuation of a viable and time-honored agricultural profession, with reduced pressures from the outside real estate market.

Drawbacks

- Cannot ensure that the land will continue to be farmed or that farming will remain economically viable.
- Not always the most lucrative option for farmers and landowners.
- Subsequent landowners may not have similar interests in upholding easement terms.

(Source: www.farmlandinfo.org, 2004)

Land Donations – Landowners can protect their land by donating it to a qualified public agency, land trust, or nonprofit organization as an outright charitable gift. This can eliminate or reduce taxes associated with some or all of a landowner's holdings. Land donations may be an attractive option for farmers and rural landowners who: do not intend to pass land to heirs; possess land they no longer wish to manage; own highly appreciated property that poses a tax burden; and/or possess real estate holdings of a substantial nature and wish to reduce estate tax burdens. If land donation proves a viable option, donations may be made in a number of forms including:

- Immediate donation, donating in the form of a remainder interest (reserving use of the property until he or she dies).
- Donation with a charitable remainder trust (employed most commonly on high appreciated land which would incur a large capital gains tax, requiring that the property first be placed in a conservation easement and then be placed in a trust).
- Donating land by will (request), or donations under a charitable gift annuity in which a charity agrees to make regular annuity

payments to the donor for life, continuing to protect the property after the landowner's death. (Source: Main et al., 2006)

RURAL LAND STEWARDSHIP PROGRAM

Another tool may be found in the Rural Land Stewardship Areas Program. A recent development, the RLSA program is an incentive-based tool for development processes affecting large parcels in Florida's rural areas. RLSAs encourage voluntary preservation and private stewardship of wildlife habitat and other on-site resources, retaining some current agricultural and rural land uses while seeking to accommodate a limited and prescribed diversification of land uses and development entitlements. The voluntary program extends its availability to all private agricultural and rural landowners within overlay zones delineated by comprehensive plan amendment. Overlay zones may be multi-jurisdictional, and must consist of at least 10,000 acres.

For more information on this approach see Chapter 5.

CONSERVATION AND RESTORATION TECHNIQUES

Developing a Management Plan – A wildlife conservation management plan can assist with the improvement of wildlife habitat resources on agricultural property. In fact, such a plan (or a Conservation Plan of Operation) is required in order to participate in a number of the cost-share programs described above.

In meeting production needs, agricultural practices often cause alterations in the natural landscape and ecosystem. A management plan can help to improve the coexistence of working and natural landscape features benefiting native species, helping to correct loss of habitat for certain species, and limiting the proliferation of some invasive species. A management plan can be developed by following steps:

- Identify short- and long-term goals both for agricultural

production, habitat, and wildlife protection.

- Inventory functioning or potential habitats on the land subject to management as well as neighboring lands.
- Recognize existing or potential wildlife species that the identified habitats should be able to support.
- Determine what management practices will be required to further the plan's overall production and habitat and wildlife protection goals.
- Possibly obtain some form of technical assistance through the USDA, NRCS, FDACS or FFWCC.

(Source: Marion et al., 2004).

Agroforestry – Agroforestry describes the practice of planting and growing trees and other wildlife-beneficial vegetation in conjunction with crops or livestock on agricultural land in order to develop or improve habitat. Agroforestry practices seek to maintain vital wildlife corridors and make rural and farmlands more hospitable to native wildlife. This is accomplished through optimization of biological interactions in agricultural land use, effectively cultivating the most beneficial relationship possible among trees, shrubs, crops, aquatic vegetation and the like. By fostering ecological diversity within agricultural lands, farmers, planners and communities maintain the ability to sustain traditional agricultural production in an economically viable fashion while simultaneously conserving wildlife habitat.

A variety of products generated as a result of agroforestry enable the availability of benefits associated with those products at varying time intervals. Such practices can also buffer economic risks associated with agriculture in the event of crop failure or market variability. Complimentary land uses can also effectively employ a number of beneficial layout strategies and encourage a more advantageous nutrient cycle. Plans may be established to best suit the needs of row crops, timber plantations, fruit crops,

Agroforestry describes the practice of planting and growing trees and other wildlife-beneficial vegetation in conjunction with crops or livestock on agricultural land in order to develop or improve habitat.

Agroforestry practices seek to maintain vital wildlife corridors and make rural and farmlands more hospitable to native wildlife.

Tourism shares with agriculture the distinction of being one of the top industries in Florida. “Agritourism” is the term developed to describe the strategic utilization of natural resources, forestry procedures, farming practices, lifestyle and heritage to invite visitors to experience farms for purposes of education, enjoyment, active participation in farm activities and special events. The inclusion of “agritourism” and “ecotourism” may be workable options for farmers and rural landowners.

livestock and other agricultural land uses. By providing pockets or continuous stretches of vegetative diversity, it may be possible not only to favor wildlife habitat, but also to prevent detrimental soil erosion and/or effects on riparian areas.

Agroforestry may take the form of such practices as: alley cropping (in which an agricultural crop is grown simultaneously with a long-term tree crop to provide annual income while the tree crop matures); forest farming; riparian buffer zones; silvopasture, (the integration of trees with livestock or other grassland ranch operations); windbreaks and others (Source: Workman et al., 2002). It is important to consult technical assistance in evaluating different management strategies for each individual agricultural property, as all have unique needs and goals in production and conservation.

AGRITOURISM POTENTIAL IN FLORIDA’S RURAL AND AGRICULTURAL LANDS

Tourism shares with agriculture the distinction of being one of the top industries in Florida. “Agritourism” is the term developed to describe the strategic utilization of natural resources, forestry procedures, farming practices, lifestyle and heritage to invite visitors to experience farms for purposes of education, enjoyment, active participation in farm activities and special events. The inclusion of “agritourism” and “ecotourism” may be workable options for farmers and rural landowners. An initiative to engage in agritourism or rural lands ecotourism opportunities begins with farmers and landowners, but is often assisted by agricultural extension offices.

Agritourism may take the form of heritage tourism, focusing on characteristics of farming culture and rural community lifestyle in appreciation of past life in Florida, highlighting historic sites and other types of cultural attractions or sources of interest. This may include allowance and arrangements for special events such as family reunions, festivals and other group events; participation



Photo Courtesy of Joanne Davis, 1000 Friends of Florida

in farm activities, such as demonstrating how typical farm work is carried out and providing opportunities for guests to take part; exhibition of farm heritage, through demonstrating antique tools, practices, maps, photos etc.; guided scenic and informational tours of the farm or agricultural property landscape; “u-pick ‘em” operations; hay rides; seasonal events such as a pumpkin patch or crop mazes; classes on gardening, cooking or craft-making; tasting or product sampling opportunities; gift shops and sale of other farm memorabilia; and many others.

Another branch of rural tourism takes shape as “ecotourism” on private lands. Ecotourism focuses on ecological enjoyment opportunities such as bird watching, nature trails, hiking, kayaking and canoeing, photography, camping and other sporting activities such as hunting and fishing, etc. If properly implemented under informed habitat management practices, management plans for providing the public with opportunities for ecotourism on agricultural properties, forest lands, etc. can be beneficial for landowners, nature enthusiasts and native wildlife species alike (Source: University of Florida, Institute of Food and Agricultural Sciences, 2007).

CASE STUDY**Babcock Ranch: Ecotourism Opportunities in Conjunction with Agriculture and Smart Development**

The State of Florida secured what had long been considered the “missing link” in an environmental corridor stretching from Lake Okeechobee to Charlotte harbor with creation of the Babcock Ranch Preserve in 2005. Decades of outstanding land management made the ranch a prime opportunity to preserve not just the land, but part of Florida’s ranching heritage. Kitson & Partners, a private company that facilitated the state’s purchase of 80 percent of the 91,000 acre ranch, is now working with the state to make Babcock Ranch a model for sustainable preservation from perspectives of land acquisition, sustainable development, natural resource protection, habitat management strategies and public access. Revenue-producing activities such as cattle ranching and timber harvesting will continue on the 72,000 acres purchased by the state, generating the funds needed to support stewardship activities including controlled burns and control of exotic plant species. Next door, Kitson & Partners is creating an ecologically-friendly new community that intended to showcase best practices in green building, alternative transportation and natural landscaping.

Among the benefits Babcock Ranch delivers to both



Photo Courtesy of Joanne Davis, 1000 Friends of Florida

wildlife and human residents of Florida is providing approximately 30,000 visitors per year with the opportunity to experience a unique “ecotour.” The tour showcases the property’s pristine natural resources, wildlife species in native habitat, and its working ranch including cattle, pastureland, tomatoes, watermelon, and turf-grass and pine operations. For more information, go to www.babcockranchflorida.com.

For over fifteen years Babcock Wilderness Adventure

has conducted “ecotours.” The ecotour consists of a ninety-minute swamp buggy ride, which serves to visually and intellectually engage visitors regarding the dynamic nature of Babcock Ranch and its vital importance to the protection of Florida’s freshwater ecosystems. The tour emphasizes the land’s rich historical and socioeconomic importance as an agricultural center that continues, as it has for many years, to function also as a key element in efforts toward permanent protection of large contiguous tracts of crucial wildlife habitat in Florida.

While Babcock Ranch may serve as an exemplary model for a number of wildlife habitat planning principles and strategies, its ecotour is particularly effective in illustrating the potential for agricultural and/or sustainable development interests to provide a unique environmental recreation experience. Opportunities such as the Babcock Ranch ecotour could also serve to generate additional revenue, which could potentially augment beneficial land management practices for wildlife habitat and other natural resources.

For more information see Chapter 5, Special Large Property Opportunities.



Photo Courtesy of Charles Littlewood and the Florida Wildlife Federation

Use the combination of voluntary and regulatory conservation easements within (jurisdiction's name) to strengthen the integrated linkage of green infrastructure and assist efforts to sustain and enhance habitats and wildlife benefits and ecosystem services.

FUTURE LAND USE ELEMENT (FLUE)

Background Statement: *The future land use element and the accompanying future land use map often provide the clear guidance and context for development and redevelopment in a jurisdiction. The broader themes that a community may hope to pursue should be framed in this element. In this regard, the importance of green infrastructure the supporting ecosystem services to the community should be addressed in the FLUE.*

GOAL: Develop a wildlife friendly community.

OBJECTIVE: Encourage development and management of land in a manner which sustains local wildlife, their habitat and the ecological services of the land through an integrated system of green infrastructure.

Policy: When planning for a larger parcel or multiple contiguous smaller parcels, emphasize a compact develop pattern over a sprawling one.

Policy: Preserve waterbody and riverine green edges and strive to conserve or create a combined upland buffer and in-water littoral edge that links to larger habitat patches.

Policy: Where possible, do not subdivide properties in a manner that creates multiple lots to the water's edge; instead, maintain a common community shoreline corridor with an upland component that links to larger habitat patches.

Policy: Preserve a background matrix of predominate native vegetation and habitat types. These features are adapted to local climate and soil conditions, support wildlife and likely require less maintenance and water.

Policy: Preserve forested areas, the understory and native soil associations. Minimize disturbance of such areas.

Policy: Avoid activities that dehydrate landscape features or alter the seasonal water flows or duration of inundation to wetlands, hammocks or waterbodies (e.g., diversions,

drawdown, damming effects from roads, berms, ditches and canals, etc.).

Policy: Plan within the context of natural ecological events such as floods and fires, and plan land uses around the ecological realities of smoke sheds, "firewise" community concerns, and restricting development in flood zones.

GOAL: Plan development and conservation together allowing for the provision of wildlife corridors and decreased fragmentation of habitat.

OBJECTIVE: Further the following landscape planning principles:

- Maintain large patches of natural vegetation;
- Maintain wide vegetation corridors along major water courses; and,
- Maintain connectivity for movement of key species among the large patches, either wide continuous corridors or clusters of small patches.

OBJECTIVE: Work with large acreage landowners (alone or in combination) to preserve wildlife habitat, water resources and working rural landscapes by using land planning tools such as Conservation Subdivisions, the Rural Lands Stewardship Areas, Sector Plans and DRI's when considering development of their property.

Policy: Ensure that local governmental review and approval processes for land use changes, development proposals and infrastructure projects further the above outlined objectives.

TOOLS (DISCUSSED IN CHAPTERS 5 TO 7)

CONSERVATION EASEMENTS

GOAL: Use the combination of voluntary and regulatory conservation easements within (jurisdiction's name) to strengthen the integrated linkage of green infrastructure and assist efforts to

sustain and enhance habitats and wildlife benefits and ecosystem services.

OBJECTIVE: Strive to use conservation easements (regulatory and voluntary) following a logical pattern of habitat linkages that connect habitat areas (existing or restorable) and/or support water quality and quantity protection functions of the land. Discrete, isolated small easements not part of a larger landscape logic should be discouraged.

Policy: (Local government name) will identify and map (GIS) the lands within the city/county that are already subject to conservation easements developed for conservation, mitigation, water management or right-of-way and public facility deployment purposes. Mapping effort will be directed at:

- DEP, COE and WMDS held regulatory-based conservation easements because they are often directed at preserving the land for its natural characteristics, particularly its wetland values;
- FDOT, WMDs and local government facility management and access and stormwater management facility easements; and.
- Private landowner-initiated conservation easements.

Policy: Identify and prioritize existing conservation easements relative to their value to a larger landscape level conservation effort and value toward sustaining and enhancing an area's natural resources benefits and ecosystem services.

Policy: Provide the county tax appraiser's office with GIS-mapped conservation easement data for inclusion in their data sets.

Policy: Incorporate the use of the conservation easement GIS data layer into the (City/County) comprehensive plan and development review processes to assist in logical incremental linkages and green infrastructure development

opportunities.

Policy: All areas set aside must be covered by a legal document and/or plat filed with the appropriate government entity, and a legally incorporated business, organization or government shall be designated through a binding management agreement to provide perpetual habitat maintenance. The agreement shall specify who or what other entity would take over management if the original organization defaults.

UPLAND HABITAT PROTECTION ORDINANCE

GOAL: Protect native upland habitats and their linkages to contiguous or related lowland and wetland habitats in order to retain and benefit from the community's wildlife and habitat diversity.

OBJECTIVE: Promote ecological stability and integrity by preventing the loss of native upland habitat. Ensure that native upland habitats are identified as a part of the community's comprehensive planning process and then integrated into the overall wildlife and habitat conservation design actions of the community development review and approval processes.

Policy: Develop an Upland Habitat Protection Ordinance as a tool available to provide protection of upland natural plant communities, wildlife habitat and remaining large contiguous environmentally sensitive areas within and linking to adjacent properties and jurisdictions.

Policy: In the development review process, strive to maintain an undeveloped habitat around the waterways, lakes and wetlands (aquatic, adjacent littoral edge and upland components) that link native upland habitat areas to water.

Policy: In the upland habitat protection ordinance, strive to include protection of ephemeral wetlands and ponds (small temporary landscape features that provide important wildlife rearing, feeding and life cycle opportunities for amphibians and other wildlife species).

Protect native upland habitats and their linkages to contiguous or related lowland and wetland habitats in order to retain and benefit from the community's wildlife and habitat diversity.

Enable land to be developed while simultaneously preserving community character, reducing environmental impacts and linking habitat features in a sustainable fashion, protecting the rights of property owners, and enabling development of high-quality projects.

Policy: The upland habitat protection ordinance will function to sustain and enhance native wildlife and habitats by: protecting identified ecological corridors;

- Linking patches of habitat and minimize habitat loss and fragmentation;
- Maintaining rural character and preserving agriculture and working rural landscapes;
- Preserving a background matrix of the predominate vegetation/habitat types;
- Preserving forested areas, understory and soils; and,
- Linking and adding value to waterbody and riverine green edges.

Policy: When reviewing proposed subdivision of land, planned unit developments, DRIs or other large developments, identify opportunities for linking open space, stormwater facilities and buffers to create planned separation of human and wildlife communities.

HABITAT CONSERVATION PLANS

GOAL: Work with landowners, developers and the public to develop habitat conservation plans for listed, endangered or threatened species.

OBJECTIVE: Provide a means for private landowners, corporations, state or local governments, or other non-Federal landowners who wish to conduct activities on their land that might incidentally harm (or "take") wildlife that is listed as endangered or threatened by first obtaining an incidental take permit from the U.S. Fish and Wildlife Service.

OBJECTIVE: Require private landowners, corporations, state or local governments, or other non-Federal landowners to develop a Habitat Conservation Plan (HCP) designed to offset any harmful effects the proposed activity might have on the affected species

when proposed activities on their land might incidentally harm (or "take") wildlife that is listed as endangered or threatened.

Policy: Strive to ensure that planning and development reviews within the jurisdiction as well as cooperative funding arrangements encourage the development of habitat conservation plans that protect listed, endangered or threatened as well as common plant and animal species.

Policy: Public lands within the jurisdiction with identified listed species will be managed under the guidance of a Habitat conservation plan (HCP) developed in coordination with the USFWS and the FFWCC to manage endangered, threatened and related species on the property.

Policy: Encourage that private lands within the jurisdiction that have identified occurrences of listed species develop habitat conservation plans in coordination with the USFWS, the FFWCC and the local government.

LARGE PARCEL PLANNING TOOLS

Background Statement: *Issue of concerns about the RLSA, sector plans, DRIs and conservation subdivisions are that they may contribute to urban sprawl if applied indiscriminately by the fact of their requiring infrastructure such as roads, power lines, water and sewer facilities, etc., that may perforate, dissect, fragment and shrink habitats between the existing urban core boundary and the new development.*

CONSERVATION SUBDIVISIONS

GOAL: Enable land to be developed while simultaneously preserving community character, reducing environmental impacts and linking habitat features in a sustainable fashion, protecting the rights of property owners, and enabling development of high-quality projects.

OBJECTIVE: Provide a process for the subdivision of land that:

- Clusters homes or development away from environmentally sensitive areas and permanently sets aside common open space areas;
- Coordinates development so that the natural ecosystem services of the land such as wildlife habitat connectivity and water quantity and quality protection issues are consistently addressed; and,
- Furthers un-fragmented greenway linkages and wildlife corridors (within the particular subdivision and then outward) – using riparian areas, vegetation and other natural topographic habitat features.

Policy: Encourage the use of Conservation Subdivisions wherever parent tracts have been demonstrated to contain habitat linkages, bona fide agriculture and silviculture, environmentally significant features, historically or archaeologically significant resources, or direct connections with existing or planned greenway corridors.

Policy: Conservation subdivisions may be used within residential or mixed use land use categories and should find their highest applicability at the urban fringe areas as a transition between urban and rural landscapes.

Policy: Conservation subdivisions are not to be used as a means to promote leapfrog development patterns and infrastructure development into rural areas.

Policy: Besides requiring the protection of a minimum percentage of open space, ensure that the conservation subdivision ordinances also identify a minimum percentage of developable land to be conserved. (Note: Some ordinances require that 50 percent or more of the protected open space consist of land that is suitable for building.)

Policy: Make use of low-impact development and stormwater management techniques in conservation communities. Such techniques might include bio-retention areas, vegetated swales,

permeable pavement materials, and flexible design standards for roads, parking lots, driveways, and sidewalks to minimize site or habitat impacts.

Policy: Conservation Subdivisions will provide flexibility with respect to setbacks, minimum lot sizes, street widths, and parking requirements etc., to increase the functionality of this site design option and foster the long-term viability and usefulness of the open space subject to the required conservation easement.

Policy: In the implementation of Conservation Subdivisions, ensure that all critical on-site resources that are to be preserved are of adequate size and are appropriately linked and buffered to ensure long-term protection of the resource.

Policy: In the implementation of Conservation Subdivisions, require that open space and related resources be placed under a permanent easement that runs with the land. Said easement may be assigned to (1) local government or (2) a local or national land trust that is a 501(c) (3) organization for which conservation of resources is a principal goal and which can provide reasonable assurance it has financial and staff resources to monitor and manage the easement.

Policy: Require all applications for Conservation Subdivisions to include a management plan for protected open space and habitat areas and identify a dedicated source of revenue to ensure that all appropriate management activities are undertaken on a regular basis and that all terms of the conservation easement are monitored and enforced.

RURAL LAND STEWARDSHIP AREAS

GOAL: The (local government) hereby establishes the (name) Rural Lands Stewardship Area Overlay (Overlay) to promote a dynamic balance of land uses in the delineated Rural Lands Stewardship Area (RLSA) that collectively contribute to a viable agricultural industry, protect natural resources, further desired

The (local government) hereby establishes the (name) Rural Lands Stewardship Area Overlay (Overlay) to promote a dynamic balance of land uses in the delineated Rural Lands Stewardship Area (RLSA) that collectively contribute to a viable agricultural industry, protect natural resources, further desired patterns of development, and enhance economic prosperity and diversification.

A RLSA will set up a limited trading program within the designated stewardship overlay area(s) that provides landowners within Stewardship Sending Areas (SSAs) valuable credits available to others to be used within the associated designated Stewardship Receiving Area (SRA).

patterns of development, and enhance economic prosperity and diversification.

OBJECTIVE: The name RLSA is intended to protect natural or cultural resources and to retain viable agriculture by promoting compact mixed-use development as an alternative to sprawl, and provides a system of compensation to affected property owners for the elimination of certain land uses in order to protect these resources for transferable credits that can be used to entitle such compact development.

Policy: The name RLSA will be used in careful combination with an urban development boundary (UDB), combining sizable permanent areas of separation between the UDB and the developing RLSA to control urban sprawl.

Policy: There may be instances where “leap frogging” of RLSA development may be necessary to avoid environmentally sensitive areas. To avoid impacts to intervening rural lands and natural areas, connecting transportation corridors and infrastructure will be managed to avoid intervening strip development or fragmenting of natural or rural areas.

Policy: Strive to keep rural areas remaining rural and to guide development toward suitable areas closer to urban areas.

Policy: A RLSA will set up a limited trading program within the designated stewardship overlay area(s) that provides landowners within Stewardship Sending Areas (SSAs) valuable credits available to others to be used within the associated designated Stewardship Receiving Area (SRA). Credits arise for defined resources in exchange for giving up specific uses of the land and placing a conservation easement on the land to protect the land/resources in perpetuity.

OBJECTIVE: Identified lands within a SSA will be protected from conversion to other uses by creating incentives that encourage the voluntary elimination of the property owner’s right to convert agriculture land to non-agricultural uses in exchange for compensation and by the establishment of SRAs.

Policy: Baseline standards in effect prior to the adoption of the area are the permitted uses, density, intensity and other land development regulations assigned to land in the RLSA.

Policy: Stewardship credits will be exchanged for additional residential or nonresidential entitlements in a SRA on a per acre basis. Stewardship density and intensity will thereafter differ from the baseline standards.

Policy: Stewardship credits are created from any lands within the RLSA that are to be kept in permanent agriculture, open space or conservation uses. These lands will be identified as Stewardship Sending Areas or SSAs. Land becomes designated as a SSA upon petition by the property owner seeking such designation and the adoption of a resolution by the Commission/Council.

Policy: A stewardship agreement shall be developed that identifies allowable residential densities and other land uses which remain. Once land is designated as a SSA and credits or other compensation is granted to the owner, no increase in density or additional uses unspecified in the Stewardship Agreement shall be allowed on such property.

Policy: The natural resource value of land within the RLSA is measured by the Stewardship Natural Resource Index (Index) set forth on the Worksheet. The Index establishes the relative natural resource value by measuring different characteristics of land and assigning an index factor based on each characteristic. The sum of these factors is the index value for the land. (The characteristics minimally include: Stewardship Overlay Designation, Sending Area Proximity, habitat value(s), soils/surface water value, wildlife habitat restoration/enhancement potential, and land use/land cover.)

Policy: A natural resource index map series indicates the natural resource stewardship index value for all land within the RLSA. Credits from any lands designated as SSAs, will be based upon the natural resource index values in effect

at the time of designation. The index and the index map series are adopted as a part of the RLSA overlay as a part of the local government comprehensive plan.

Policy: The land use matrix lists uses and activities allowed under the zoning district within the Overlay. These uses are grouped together in one of (X) separate layers in the matrix. Each layer is discrete and shall be removed sequentially and cumulatively in the order presented in the matrix, starting with the residential layer (layer one) and ending with the conservation layer (layer X). If a layer is removed, all uses and activities in that layer are eliminated and are no longer available.

Policy: Credits can be transferred only to lands within the RLSA that meet the defined suitability criteria and standards (SRAs).

Policy: Identified habitat and wildlife and listed animal and plant species and their habitats shall be protected through the establishment of Habitat Stewardship Areas (HSAs), as SSAs within the RLSA overlay. HSAs are delineated on the overlay map(s). HSAs are privately owned agricultural areas, which include both areas with natural characteristics that make them suitable habitat for species and areas without these characteristics. These latter areas are included because they are located contiguous to habitat to help form a continuum of landscape that can augment habitat values and separation from developable areas.

Policy: Further protection for surface water quality and quantity shall be through the establishment of Water Retention Areas (WRAs), as SSAs within the RLSA Overlay. WRAs are delineated on the Overlay Map. WRAs are privately owned lands that have been permitted by the Water Management District to function as water retention areas. In many instances, these WRAs consist of native wetland or upland vegetation; in other cases they are excavated water bodies or may contain exotic vegetation.

Policy: Priority shall be given to restoration and enhancement. In certain locations there may be the opportunity for flow-way or habitat restoration. Examples include, but are not limited to, locations where flow-ways have been constricted or otherwise impeded by past activities, or where additional land is needed to enhance wildlife corridors.

SMOKE MANAGEMENT

Background Statement: Prescribed fire is a critically important and cost effective land management tool. This tool is necessary to maintain the ecologic health and biological integrity of natural ecosystems that comprise the (local government's) public and private conservation lands network. Prescribed fire is also an effective strategy to mitigate the harmful impacts of wildfire that result from the buildup of heavy wild land fuel loads. The importance of prescribed fire has been identified through Florida Statute 590 and is considered a land owner right. The ability to effectively manage smoke resulting from the use of prescribed fire is critically important for the continued use of this irreplaceable management tool. Increasing intrusion of growth into historic smoke dispersal areas is the most significant threat to the ability of land managers to manage smoke effectively and safely. Critical Smoke Dispersal Areas (CSDAs) are those that are historically used to disperse smoke resulting from prescribed fire activity. They are down wind one mile from the burn area at a 70 degree spread radius of the burn unit width.

GOAL: Preserve as a land management tool and a land owner right the continued use of prescribed fire on public and private conservation lands within the jurisdiction.

OBJECTIVE: Plan for Critical Smoke Dispersal Areas with Compatible Land Uses. Keep incompatible land uses (schools, roads, hospitals, nursing homes, etc.) out of critical smoke disposal areas (CSDAs); if unavoidable, cluster sensitive land uses rather than spread them across the CSDA.

Prescribed fire is a critically important and cost effective land management tool. This tool is necessary to maintain the ecologic health and biological integrity of natural ecosystems that comprise the (local government's) public and private conservation lands network.

Educate the Public About the Use of Fire. The (local government) in coordination with The Nature Conservancy at Disney Wilderness Preserve (this example from Central Florida) and the developers within the CSDAs will seek ways to educate the public about the use of fire and their participation in the fire management program.

Policy: The (local government) will require all new development in the CSDAs to plan in consideration of this objective and show evidence of using it as a design tool during the early planning stages for staff review.

OBJECTIVE: Inform the public within smoke zones. Require owners of all new development to inform new owners of property within smoke sensitive planning zones that they will be exposed to smoke.

Policy: Require all new developments within the CSDAs to provide disclosure forms informing new residents that they will be exposed to smoke during burn periods. These may be presented to new residents to sign and record upon purchasing a dwelling unit and included as a part of home owner association disclosure documents.

OBJECTIVE: Educate the Public About the Use of Fire. The (local government) in coordination with The Nature Conservancy at Disney Wilderness Preserve (this example from Central Florida) and the developers within the CSDAs will seek ways to educate the public about the use of fire and their participation in the fire management program.

Policy: Require all new development in CSDAs or burn areas to be responsible for seasonal notices being sent out to all affected citizens at the beginning of the burn season. At a minimum, these notices will state that the citizens are within a burn area and that smoke may be seen in their area; if a citizen has a respiratory illness or sensitivity, that resident shall be advised to close all windows and doors and leave the area.

Policy: Study the effectiveness and implementation of the Reverse 911 system for alerting citizens of controlled burns in their area.

Policy: Meet with all affected agencies on an ongoing basis to ensure that all reasonable steps are being under-

taken to further public awareness of the fire management program.

OBJECTIVE: Design for Fire Management. Seek to implement design practices that consider the long-term use of fire as a management tool, as well as require all those that develop within the jurisdiction to give consideration to designing for fire management programs.

Policy: For all development implement planning and design tools that consider fire management programs when improving the transportation network in the burn areas and the CSDAs. Design considerations should include road placement and design, lighted signage, drop-down gates, buffers and emergency access points.

Policy: Encourage all development within the CSDAs and burn areas to follow the guidelines in the 2004 Wildfire Mitigation in Florida manual for fire wise homes and property to reduce the risk of spreading fires.

Policy: In fire dependent ecosystems, save sensitive habitat plus a minimum 30 foot buffer for a fire line to prevent the loss of saved habitat due to the construction of fire lines.

Policy: Incorporate Firewise Practices in any subdivision built within fire dependent ecosystems (www.firewise.org http://www.fldof.com/wildfire/firewise_your_home.html).

DARK SKY ORDINANCES – MANAGING LIGHT AND ITS EFFECTS ON WILDLIFE

Background Statement: Ecological light pollution has demonstrable effects on the behavioral and population ecology of wildlife derive from changes in orientation, disorientation, and attraction or repulsion from the altered light environment, which in turn may affect foraging, reproduction, migration, and communication.

GOAL: Manage outdoor lighting to limit impacts to wildlife.

OBJECTIVE: Work with residents, businesses and local government operations to limit outdoor lighting impacts to wildlife and human enjoyment of the nighttime dark skies.

Policy: Adopt a “Dark Sky” ordinance that follows Wildlife Friendly Lighting recommendations:

- Keep lights low (close to the ground);
- Keep lights shielded (minimize light trespass into the night sky or adjacent areas); and,
- Keep light long-wavelength (longer wavelengths are less likely to impact sea turtles and other wildlife).

Policy: Include a review of lighting and its impacts to wildlife and community dark skies objectives in development and comprehensive plan amendment reviews.

Policy: Work with city, county, state and other natural managed lands and parks officials to limit light pollution and its effect to wildlife.

TRANSPORTATION ELEMENT

Background Statement: A road’s environmental footprint extends far beyond the edge of its pavement and creates a “road-effect zone”. Transportation facilities by their nature allow or improve access to land that they pass through as well as to points of origin and destination. In addition, the linear nature of transportation facilities dissect and fragment natural systems and impede wildlife movement. During their planning and design, wildlife crossing points such as streams, rivers, wetlands and large habitat patches need to be properly addressed.

GOAL: Develop transportation and associated infrastructure in a manner cognizant of potential direct and indirect impacts to habitats and wildlife and plan, design and construct this infrastructure to avoid, minimize and, where necessary, mitigate impacts.

OBJECTIVE: Ensure that wildlife and habitat considerations are addressed during the planning, design and development of transportation and related facilities.

OBJECTIVE: Incorporate and support the integrated conservation of the natural landscape features, wildlife habitats, and ecological functions and services into transportation facility planning, design, development, and maintenance.

Policy: Establish local and MPO priorities that do not increase sprawl and habitat fragmentation.

Policy: To minimize and reduce wildlife and habitat impacts, transportation facility development should address the following Does the facility:

- Strive to support or promote additional development of existing approved development areas?
- Relieve or remove traffic demands from existing facilities?
- Minimize any impacts to natural habitat and species and maintain habitat connectivity?
- Minimize impacts on springshed and ground water recharge areas?
- Minimize impacts to wetlands and waterbodies?
- Avoid, or mitigate, impacts on conservation lands and their proper long-term healthy management?
- Follow, where feasible, existing road alignments through environmentally sensitive areas?

Policy: Identify and prioritize highway wildlife ecopassage retrofit opportunities (in particular, bridges and culverts).

Policy: Utilize current data and landscape ecology principles for ecopassage and site designs.

Policy: Base wildlife accommodations in planning transportation infrastructure on careful consideration of relevant

Work with residents, businesses and local government operations to limit outdoor lighting impacts to wildlife and increase human enjoyment of the nighttime dark skies.

When designing new or redeveloped transportation facilities passing over or through natural wildlife corridors, strive to design for adequate passage, habitat linkage enhancements and general habitat clearance and disturbance limitations so that wildlife will continue to traverse unimpeded.

ecological, safety, engineering, financial, and regulatory concerns associated with an area and project. Guiding information and criteria may include, but not be limited to:

- Identified chronic road-kill area, carcass data and FDOT or local wildlife-vehicle crash data and law enforcement reports;
- Known wildlife migration/movement routes;
- Predictive modeling results and identified hot spots of focal species;
- Presence of listed, rare, endemic or species population of interest;
- Identified strategic habitat conservation areas;
- Riparian corridors (new or with potential for retrofitting existing structures);
- Landscape linkages (designated greenways) and presence of core conservation areas adjacent or near the project;
- Presence of separated life cycle ecological resources for a species, or set of species (e.g., a forest patch and ephemeral wetland breeding area for amphibians that is separated by a highway);
- Dedication (or permanency) of land on both sides of the transportation facility to remain undeveloped and useful as a linkage feature. Existing and future land-use on both sides of the facility; and,
- Financial feasibility and potential to be included in proposed road improvement project.

Policy: Employ the following transportation facilities and wildlife design criteria:

- Require that wildlife habitat linkage analysis be used as a standard procedure for transportation facilities planning;
- Design crossing structures for multiple species and sustained

habitat connectivity;

- Provide an adequate number of wildlife and fish crossing structures. Every culvert and bridge within wildlife habitat should be viewed as an opportunity for multiple species crossings; and,
- Integrate transportation, stormwater and area greenway facilities design planning. Protect natural hydrologic and watershed integrity.

Policy: When designing new or redeveloped transportation facilities passing over or through natural wildlife corridors, strive to design for adequate passage, habitat linkage enhancements and general habitat clearance and disturbance limitations so that wildlife will continue to traverse unimpeded.

Policy: When designing intersections of transportation facilities with identified wildlife corridors or ecopassages, strive to accommodate continued wildlife movements cognizant of the following general guidelines when appropriate:

- Design for the species or group of species of interest;
- Use larger passages, except when being used by certain amphibians, reptiles, and small mammals which benefit from multiple smaller diameter crossings;
- Include cover at both ends of the crossing, and incorporate cover within the crossing for those species that require it;
- In long crossings, incorporate natural lighting via a skylight unless the crossing is to be used by certain reptiles or amphibians which are repelled by light;
- To the maximum extent possible, utilize crossing bottoms which mimic the substrate of the surrounding landscape;
- Use fencing or barrier walls directing wildlife to the crossing entrance; and,
- Include conservation lands on both sides of the crossing.

DRAINAGE/STORMWATER MANAGEMENT ELEMENT

Background Statement: Stormwater management facilities are ubiquitous throughout any community and comprise both small (a swale for instance) and large (a created pond, lake and stream system) facilities that are often linked in a treatment train approach to maximize water quality and quantity functions. Associated wildlife and habitat potential within these infrastructure systems may be relatively substantial and should not be overlooked. Further, public money can be saved and safety and efficiencies gained when stormwater management facilities are planned and integrated with community design and other public infrastructures (e.g., transportation and recreation facilities) to capture, conserve or enhance green infrastructure and ecosystem services benefits.

GOAL: Strive to incorporate existing or restored natural habitats and wildlife enhancement features and linkage opportunities within the (local government name) stormwater management facility planning, design and maintenance functions.

OBJECTIVE: Examine and strive to integrate stormwater, transportation and recreational infrastructure networks and proposed projects for wildlife integration/enhancement opportunities.

Policy: Identify opportunities to use backbone local watershed features (streams, bayous, wetlands, rivers, and sinkholes) to link community and regional parks, mitigation areas, greenways and forests against, etc.

Policy: Work to identify and develop cross-connections and multi-use opportunities when planning transportation, stormwater management and community recreation facilities.

Policy: Preserve waterbody and riverine green edges (a combined upland buffer and in-water littoral edge).

Policy: Work with landowners and developers to maintain a common community shoreline corridor with wildlife habitat

features instead of subdividing lots/properties to the waters edge.

Policy: When reviewing proposed subdivision, planned unit development, DRIs or other large developments, identify opportunities for linking open spaces, stormwater facilities and buffers to create planned separation of human and wildlife communities

Policy: Develop and implement reoccurring events to cross-train the jurisdiction's professional planning, engineering and related development review staff and administrators regarding linkage and integration of green infrastructure with other necessary infrastructures.

Policy: Work with landowners/developers to encourage conservation-oriented low impact development design:

- Direct more dense clustering of development on the more developable environmentally suitable areas and set-asides wildlife habitats and environmentally sensitive portions;
- Link density bonuses for tightly clustered development when environmentally logical;
- Provide for logical environmental links to adjacent parcels to extend the habitat, wildlife and natural functionality benefits;
- Integrate stormwater management early in site planning activities;
- Use natural hydrologic functions as the integrating framework;
- Emphasize simple, nonstructural, low-tech, and low cost methods that incorporate natural landscape features and functions;
- Create a multifunctional landscape; and,
- Provide for permanent set-aside of undeveloped areas via conservation easements.

Examine and strive to integrate stormwater, transportation and recreational infrastructure networks and proposed projects for wildlife integration/enhancement opportunities.

Protect natural habitats and wildlife through non-regulatory and regulatory efforts combined with incentives and education including density transfers, easements, purchase, designation as park or recreation area, development restrictions through overlay zoning or other planning mechanisms.

CONSERVATION ELEMENT

Nutrient inputs are of great concern (sources, fertilizer, septic tank drain fields, leaking sewage lines, animal waste). Excess nutrients into surface and ground waters and cause significant alteration to the natural flora and fauna. Natural chemical and biological processes within buffers alter or uptake nutrients and other pollutants before they enter a water body providing cost-effective treatment.

GOAL: Develop a wildlife-friendly community.

OBJECTIVE: Plan and maintain an overall habitat framework with identified ecological corridors, linked to larger patches of habitat around a systematic effort to minimize habitat loss and its fragmentation, which strives to:

- Link community and regional parks, mitigation areas, greenways and forests against the backbone of local watershed features (streams, bayous, wetlands, rivers, sinkholes, etc.);
- Integrate transportation and stormwater infrastructure development to capture wildlife integration/enhancement opportunities;
- Incorporate private green areas into the larger green infrastructure network (golf courses, botanical gardens, large parcel easements and set-asides).
- Strive to link community open spaces, stormwater facilities and buffers to create planned separation of human and wildlife communities; and,
- Educate the public and staff regarding conservation and enhancement themes of local green infrastructure, including cross-departmental training, integrated development and project reviews, and inter-departmental joint planning opportunities.

OBJECTIVE: Provide a logical administrative framework whereby the discreet green infrastructure elements can be managed, sustained and enhanced through use of the jurisdiction's

local comprehensive plan, development review processes and inter-departmental and inter-jurisdictional interactions.

Policy: Protect natural habitats and wildlife through non-regulatory and regulatory efforts combined with incentives and education including density transfers, easements, purchase, designation as park or recreation area, development restrictions through overlay zoning or other planning mechanisms.

Policy: Perform a green infrastructure inventory and assessment including identification of ecological services and benefits received.

Policy: Identify environmentally sensitive areas to be protected as part of the jurisdiction's green infrastructure and map the identified, inventoried and assessed resources.

Policy: Develop and provide for city/county departmental responsibilities to support green infrastructure design and management.

Policy: The jurisdiction shall coordinate local transportation, stormwater, and recreation and greenspace planning to assist in maintaining and developing a wildlife-friendly community.

GOAL: Develop and adopt a waterbody/waterways/wetlands buffering strategy.

OBJECTIVE: Provide buffer areas of native vegetation along lakes, streams and wetlands.

OBJECTIVE: Maintain or restore waterbody and wetland buffers to preserve habitat for wildlife and enhance aquatic habitat viability.

Policy: Develop mechanisms to acquire and physically link natural areas into a contiguous system

Policy: Coordinate local government resources with existing State programs such as Florida Forever, Florida Community

Trust and with groups such as the Nature Conservancy and the Trust for Public Lands to conserve wildlife and habitat.

Policy: Give priority to acquiring and otherwise protecting properties which are adjacent to or in close proximity to existing preservation areas, with emphasis on maintaining opportunities for greenways that may include a mix of flow ways, areas subject to flooding, native habitats, recreational trails and wildlife corridors.

Policy: Establish incentives for landowners to protect wildlife habitat and other natural benefits of their land rather than relying entirely regulatory actions. Such incentive can include, but are not limited to, tax incentives and provision for variable lot sizes and density adjustments for clustering.

GOAL: Develop and adopt a local xeriscape and native plant ordinance.

OBJECTIVE: Provide that new and redeveloped areas use xeriscape and native plant landscaping practices, resourceful landscape planning and installation, water-efficient irrigation, and appropriate maintenance measures to promote conservation of water resources and use of local plant species well suited to the natural weather and landscape conditions.

Policy: Follow xeriscape and native plant landscaping practices in new development and redeveloping areas.

Policy: Where practicable, provide vegetation that supplies food sources and habitat features for native wildlife.

Policy: Prohibit the use of landscape plants known to be invasive or noxious weeds in landscape ordinances for subdivisions that buffer preserved habitat.

Policy: Only plant native plants in parcels adjacent to preserved habitat.

COASTAL MANAGEMENT ELEMENT

GOAL: Appropriately restrict development in areas where such development would damage coastal resources, including wildlife habitat.

OBJECTIVE: Protect, conserve, or enhance remaining coastal wetlands, marine resources, coastal barriers and wildlife habitat from development.

Policy: Prohibit the discharge of polluted (including heat pollution) wastewater (above accepted standards) into oceans, rivers and bays.

Policy: Encourage the restoration of coastal wetlands ecosystems and habitats including submerged aquatic vegetation through re-vegetation projects and shoreline softening.

INTERGOVERNMENTAL COORDINATION ELEMENT

GOAL: Improve coordination of policies across jurisdictions that will ultimately improve the conservation of wildlife habitat.

OBJECTIVE: Identify and resolve goals, objectives and policies that are inconsistent across jurisdictions with regard to the management of natural resources.

Policy: Develop management plans for resource protection that are contributed to and administered by more than one jurisdiction and agency.

Policy: To encourage regional corridors, coordinate conservation strategies among local land conservation programs.

Policy: Coordinate with adjacent jurisdictions to ensure compatible land uses of natural resources that cross jurisdictional boundaries.

Provide that new and redeveloped areas use xeriscape and native plant landscaping practices, resourceful landscape planning and installation, water-efficient irrigation, and appropriate maintenance measures to promote conservation of water resources and use of local plant species well suited to the natural weather and landscape conditions.



Photo Courtesy of David Moynahan Photography

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