

UC Davis

Recent Work

Title

Planning a sustainable community: infrastructure development and natural areas management

Permalink

<https://escholarship.org/uc/item/5s63243h>

Authors

Swanson, Sherri R.
Kurz, Raymond C.

Publication Date

2005-08-29

PLANNING A SUSTAINABLE COMMUNITY: INFRASTRUCTURE DEVELOPMENT AND NATURAL AREAS MANAGEMENT

Sherri R. Swanson (Phone: 941-650-3529, Email: sswanson@scgov.net), Project Scientist, Sarasota County Government, 2817 Cattleman Road, Sarasota, FL 34232, Fax: 941-861-6270

Raymond C. Kurz (Phone: 941-320-5995, Email: rcurz@pbsl.com), Program Manager, West Florida Sciences, PBS&J, 2803 Fruitville Road, Suite 130, Sarasota, FL 34237, Fax: 941-951-1477

Abstract: Sarasota County is a Florida gulf-coast community working to alleviate growth and development pressures and provide a balanced community of citizen amenities, economic growth, and a healthy natural environment. To meet this end, county government has been pursuing two main objectives: the acquisition and protection of ecologically significant lands and the minimization of roadway impacts in ecologically valuable areas. In 1992, a committee of citizens was appointed to evaluate the ecological value of undeveloped lands and facilitate a land-acquisition program. Subsequently in 1999, Sarasota voters approved a referendum to fund the Environmentally Sensitive Lands Protection Program (ESLPP). This program has since enabled the acquisition of over 15,000 acres of environmentally sensitive habitat for a total of nearly 105,000 acres of protected land throughout the county. In 2003, the land-acquisition agenda was expanded through the development of the Regional Environmental Mitigation Program, which was designed to facilitate the purchase and restoration of natural lands as compensation for unavoidable environmental impacts associated with county infrastructure projects. Despite protections afforded lands acquired by these land-protection programs, fragmentation continues to threaten ecologically intact landscapes in the county. To address this matter, the Board of County Commissioners initiated an investigation of the habitats and wildlife fragmented by transportation infrastructure. Field-investigation methods have involved reviews of aerial photography with local data overlays (e.g. Florida scrub-jay habitat, panther sightings, etc.), evaluation of significant habitats and protected wildlife, use of motion-sensory cameras, creation of animal-track sand pits, and incorporation of mortality surveys. Data collected continue to be used to identify and recommend promising areas for innovative design of infrastructure, land-acquisition priorities, and habitat-restoration measures. As a result of the current initiative, road projects are increasingly scrutinized for alternative alignments, sound ecological improvements, and defragmentation opportunities. Sustainable design is now a bona fide consideration of Sarasota County road-design teams.

Introduction

Population growth and development are threatening the quality of Florida's natural ecosystems and native wildlife. As a government entity, Sarasota County is working to alleviate these pressures and encourage a sustainable community of citizen amenities, economic growth, and a healthy natural environment. To this end, county government has been pursuing two main objectives: the acquisition and protection of ecologically significant lands (Natural Ecological Corridors) and the minimization of roadway impacts in ecologically valuable areas (Artificial Ecological Corridors).

Sarasota County government understands the inherent value of protecting native landscapes. This value is realized through the establishment of two significant land-protection initiatives: the Environmentally Sensitive Lands Protection Program (ESLPP) and the Regional Environmental Mitigation Program (REMP). Ultimately, however, local government is responsible for providing public infrastructure to reduce traffic congestion and ensure evacuation routes from coastal communities, as well as convenient access to interstate highways. Despite protections afforded environmentally sensitive public lands and parks, fragmentation from infrastructure provisions continues to threaten ecologically intact landscapes, inevitably impacting habitat corridors and wildlife populations. Realizing this threat, the Board of County Commissioners (BCC) initiated a countywide investigation of the habitats and wildlife affected by transportation infrastructure. To better evaluate the effects of road projects on these ecological communities, county staff, alongside PBS&J (private) consultants, conducted three ecological evaluations between 2003 and 2005 along future and existing transportation corridors: the Englewood Interstate Connector, Honore Avenue-Pinebrook Road Extension, and Interstate 75.

The purpose of these evaluations was to identify significant ecological features and critical landscape corridors and to discover opportunities for defragmentation of isolated habitats. An equally important aspect was to facilitate improved inter-agency and departmental coordination during the design and permitting stages of road-improvement projects. It was presumed that the identification of important ecological corridors would allow more efficient planning, permitting, and resource-management activities on a landscape scale.

Several county and state road-improvement projects currently in the planning and design stages are situated adjacent to environmentally significant lands (protected and unprotected). Consequently, these projects have precipitated the collection of field data with the hope of identifying critical areas for ecosystem connectivity and to recommend areas for innovative design of future infrastructure, land-acquisition priorities, corridor restoration, and mitigation opportunities.

Land-Acquisition Programs (Natural Corridors)

Environmentally sensitive lands protection program

Initiated in 1992, the Environmentally Sensitive Lands Protection Program (ESLPP) has become one of Sarasota County's most celebrated land-acquisition programs. In 1999, Sarasota voters approved two referenda to help fund ESLPP: one approving an increase in the ad valorem tax and the second to approve bonding. The county also passed Ordinance 99-004, establishing the citizen-appointed Environmentally Sensitive Lands Oversight Committee to facilitate the program and evaluate the ecological value of undeveloped lands. Working with willing-seller property owners,

the Nature Conservancy (TNC), the Southwest Florida Water Management District (SWFWMD), and several other state partners, the program has enabled the acquisition of over 16,000 acres of environmentally sensitive habitat for a total of nearly 105,000 acres of protected land throughout the county.

Parcels are nominated for the ESLPP program based on habitat quality, connectivity, habitat and species rarity, water-resource protection, and manageability. The ESLPP program has had great success in acquiring environmentally sensitive lands through obtaining supplemental grant funding and developing partnerships with state agencies, non-profit organizations, and other county divisions and departments. Even with these successes, numerous challenges face the ESLPP program, including competition with developers, an escalating real-estate market, and management and security costs.

Regional environmental mitigation program

Sarasota County's land acquisition agenda was expanded in 2003 through the development of a Regional Environmental Mitigation Program (REMP). The program was designed to promote ecologically significant mitigation facilities to compensate for unavoidable environmental impacts associated with Sarasota County infrastructure projects. A regional-mitigation perspective represents an environmentally and fiscally responsible approach to mitigating unavoidable environmental impacts. Traditionally, environmental compensation for jurisdictional wetlands, mesic hammocks, and listed wildlife focused on small, ecologically fragmented tracts adjacent to the project impacts. Unfortunately, this dogma often restricted the mitigation projects to areas with limited landscape value at best. The regional approach provides an avenue to fund land acquisition in concert with significant habitat creation, enhancement, restoration, and preservation projects.

REMP benefits from economies of scale in terms of land-acquisition costs. In addition, as the cost of vacant land continues to rise, the purchase of land in anticipation of future needs has already resulted in considerable savings to the county. Furthermore, the mitigation program should derive significant reimbursement funds by selling mitigation and floodplain credit for county infrastructure projects, selling excavated fill, and through mitigation funds derived from the Florida Department of Transportation for local interstate-mitigation needs. Additional savings include consolidations of design, permitting, construction, and maintenance. Finally, planning and building mitigation facilities today, as compensation for impacts anticipated over the next 10 to 20 years, should expedite the permitting and construction of future county-infrastructure projects.

To date, two parcels (totaling 160 acres) have been acquired through this program, based largely on landscape position, location with respect to watershed basin, and regional ecological value. A third mitigation parcel was purchased prior to the establishment of REMP, but has since served as a mitigation facility for the federally threatened Florida Scrub-jay (*Aphelocoma coerulescens*) impacts. Sarasota County exists within four state-recognized watershed basins, two of which comprise significant portions of the county. The currently permitted regional-mitigation parcels exist within the Southern Coastal Watershed Basin, and include Curry Creek Regional Mitigation Site, Fox Creek Regional Mitigation Site, and Lemon Bay Preserve. Acquisition and permitting of additional vacant lands within the Myakka River Watershed Basin are under evaluation at this time. These could serve as future mitigation facilities to offset impacts associated with infrastructure projects occurring within that watershed.

Curry Creek Regional Mitigation Site

The 19.2-acre Curry Creek Regional Mitigation Area, located adjacent to Curry Creek in Venice, Florida, was the county's first permitted regional mitigation facility. At a cost of approximately \$500,000, the county acquired the Curry Creek parcel in 1997 to accommodate stormwater. Prior to purchase, this coastal site faced strong development pressure due to an adjacent navigable waterway.

Aerial photography dating to 1948 was used in developing the design for this historically human-altered area, with the final layout designed to mimic site conditions similar to those existing prior to human disturbance. Currently under construction, this project involves conversion of two excavated finger canals into an emergent saltmarsh habitat and the creation of a meandering tidal creek. In addition to the hydrologic restoration of wetland habitats, the Curry Creek effort will result in the preservation, enhancement, and management of native uplands. Once complete, the site will provide a mosaic of habitat types, including mangrove forest, estuarine marsh, tidal creek, hydric flatwoods, oak hammock, and scrubby flatwoods.

The restoration of historical hydrologic conditions at the Curry Creek site will improve both onsite and adjacent offsite aquatic environments, as well as compensate for unavoidable wetland impacts associated with multiple county road projects. The preservation of upland and wetland communities along Curry Creek will also protect a riparian habitat corridor connecting adjacent ESLPP lands, provide a buffer for Curry Creek, and prevent coastal development of the parcel.

Fox Creek Regional Mitigation Site

The Fox Creek Regional Mitigation Site consists of 140 acres of restoration and enhancement opportunities. In 2003, the county purchased this property, originally slated to become a residential development for about \$4 million. Once completed, the site will comprise a network of freshwater marshes, forested wetlands, pine flatwoods, wet prairies, estuarine marshes, and scrubby flatwoods. The site will also feature several unique aspects, including large

compensation areas for the state-protected Sherman's Fox Squirrel (*Sciurus niger*) as well as the Florida Scrub-jay. The Fox Creek site will derive phased-mitigation credit for unavoidable wetland and wildlife impacts associated with county-infrastructure projects.

Existing aquatic landscape features directly contiguous to the parcel include Fox Creek, Shakett/Salt Creek, and Cow Pen Slough. The utilization of these waterways by wildlife has been documented (see the Honore Avenue-Pinebrook Road Extension ecological evaluation below). Although Interstate 75 creates an impediment to wildlife movement at the eastern border of the Fox Creek site, one of the reasons for acquiring this parcel was to protect a vital piece of the natural linkage between estuarine areas of Shakett Creek to the southwest, and protected lands to the east (Knights Trail Park, Pinelands Reserve, and Myakka River State Park).

Lemon Bay Preserve

As part of a multi-departmental effort, Sarasota County purchased the Lemon Bay Preserve (LBP) in 1998 for \$3.9 million. This 165-acre coastal scrub and estuarine parcel is bordered to the west by the intercoastal waterway and connects to a series of conservation easements, private preserves, and ESLPP parcels that together comprise an area primarily focused on affording protection to the Florida Scrub-jay. Currently, LBP supports two scrub-jay families, as well as sporadic transient birds. One family has served as compensation for impacts associated with a county road project and the parcel has received "credit" for one future scrub-jay impact. Land management efforts have included prescribed fires, scrubby flatwoods enhancement, exotic plant control, hydrologic restoration, and coastal upland and wetland plantings.

Infrastructure Development (Artificial Corridors)

Despite the protection afforded ESLPP and REMP lands, fragmentation continues to threaten ecologically intact landscapes in the county. In response to this concern, the Sarasota Board of County Commissioners (BCC) called for evaluations of the habitats and wildlife affected by transportation infrastructure. To address this BCC directive, county staff has been working closely with PBS&J consultants to evaluate local road-improvement projects currently in the planning and design phases. Specifically, three ecological evaluations were initiated in 2003 focusing on three prominent roadway arteries: the Englewood Interstate Connector, the Honore Avenue-Pinebrook Road Extension, and Interstate 75. Through these evaluations, data regarding the effects of existing and future infrastructure alignments on habitat connectivity and wildlife mortality may help identify significant ecological features, critical landscape corridors, and opportunities for defragmentation of isolated habitats.

Ecological evaluations

Englewood Interstate Connector

Design for this hurricane evacuation route began late in 2004. The ecological evaluation was conducted beginning in June 2004 and the final report concluding the study (Kurz et al. 2005a) was completed in July 2005. The ecological evaluation at this site focused on wildlife utilization of all culverts (of varying hydrologic function) along this rapidly developing corridor. Key habitat zones severed by the roadway, but not currently connected by culvert were also monitored. Large tracts of protected public land exist along this roadway (including ESLPP parcels, the Jelk's Preserve, and Myakka State Forest). Ecologically significant private land is also present and was evaluated with respect to quality and connectivity potential. Other ecologically significant features (the Myakka River and Sweetwater Gully) exist along this transportation corridor, and all features, severed or otherwise, were evaluated for defragmentation opportunities.

Honore Avenue-Pinebrook Road Extension

A two-year, ecological evaluation was conducted along this future road corridor as part of the planning process, ultimately to serve as a guide during roadway design. The study, paid for by the Honore Avenue-Pinebrook Road project, involved evaluation of lands and highway projects surrounding the proposed road extension. Surrounding road projects concurrently evaluated included the Central Sarasota Parkway Interchange and Interstate 75. The Honore Avenue-Pinebrook Road is being designed to help alleviate transportation demands currently plaguing the adjacent Interstate 75.

Interstate 75

The widening of Interstate 75 through Sarasota County has prompted county-funded ecological evaluations along two environmentally sensitive segments of this highway: one adjacent to the future Honore Avenue-Pinebrook Road Extension and the second, further south between ESLPP and publicly owned lands. The Interstate 75 upgrade is proposed to accommodate traffic projected through the year 2020. Communications between Sarasota County, the Florida Fish and Wildlife Conservation Commission, the Water Management District, The Nature Conservancy, and the FDOT have ensued as part of the PD&E along this stretch of highway to help establish a coordinated effort.

Evaluation Methods

The three major road-expansion projects mentioned above were chosen for habitat and wildlife evaluations based on their proximity to ecologically important landscape features (e.g. ESLPP and public lands, Myakka River, etc.). For each roadway-expansion project, data were collected from adjacent public lands, drainage easements, and undeveloped lands. Data consisted of historical accounts and aerial photography, on-site field assessments of habitats and wildlife (including field identification of tracks and helicopter over-flights), use of motion-sensory cameras, and

mortality surveys. Field-investigation methods were primarily intended to note the occurrence of certain habitats and wildlife, identify zones of high wildlife mortality, and recognize species-movement patterns across the study areas. The evaluations were also intended to assess the benefits and drawbacks of incorporating artificial-wildlife corridors into roadway-expansion projects. Publicly owned lands, drainage easements, or areas under conservation easement were often given higher priority in terms of recommendations for defragmentation, but private land-development plans and specific infrastructure-project needs (mitigation, stormwater, and floodplain) were also considered.

Historical Accounts and Aerial Photography

Wildlife-species lists for Sarasota County were referenced from the Florida Natural Areas Inventory (FNAI), United States Fish and Wildlife Service (USFWS), and Florida Fish and Wildlife Conservation Commission (FWC) databases (see also Kurz et al., 2005a). Local wildlife data were obtained from Sarasota County Natural Resources' databases. Aerial photographic images augmented by local data overlays (e.g. those for the Florida Scrub Jay and Florida Panther (*Felis concolor coryi*) were referenced during the course of each evaluation. Project Development and Environment (PD&E) studies, conducted as part of each infrastructure project, included threatened and endangered species surveys and wetland- and water-quality evaluations. Data from the PD&E studies were evaluated to help clarify field data-collection efforts associated with each ecological evaluation.

On-Site Field Assessments

Both terrestrial and aerial surveys were conducted to evaluate wildlife use broadly in each study area. Terrestrial surveys were conducted on foot and/or from off-road vehicle and were focused on habitat quality evaluations, identification of restricted corridors (dense exotic vegetation), presence of wildlife tracks, and general evidence of wildlife use. Aerial surveys via helicopter were conducted during the spring and summer of 2003 and 2004, with wildlife (predominantly mammals and birds) and nests quantified and their coordinates recorded during each flight (see also Kurz et al. 2005a).

Motion-Sensory Cameras

Remote cameras (DeerCam and Moultrie Feeders cameras) were used to document wildlife utilization of existing culverts and suspected game trails (see also Kurz et al. 2005a). DeerCam 35-mm cameras housed in camouflaged plastic cases and equipped with "passive" infrared/heat sensors were installed at major creek crossings and drainage-conveyance structures. Cameras were carefully mounted on fence posts, tree branches, shrubs, stakes, and concrete pillars, regardless of the limitations the area posed to wildlife movement. Camera locations were modified seasonally based on the success/failure of previous surveys. Wildlife utilization and avoidance was documented at existing span underpasses, wet and dry culverts, and along bisected wetland boundaries. In certain instances, sand pits were installed in conjunction with cameras in areas where capturing wildlife images proved challenging. Each sand pit consisted of a layer of sand placed on a suspected game trail that appeared to be frequently utilized by wildlife.

Mortality Surveys

Road-kill surveys were conducted to evaluate wildlife presence and movement associated with each study area. Due to seasonal changes in wildlife behavior, hydrology, and plant-community composition, surveys were conducted intermittently from summer through autumn in 2003, all year in 2004, and during winter and spring in 2005. Surveys were conducted only sporadically during 2003, while four to seven surveys were conducted during each season in 2004 and 2005. Surveys were conducted by vehicle, driving at 5-10 mph along the roadway shoulders. Safety measures were utilized during data collection to ensure the protection of motorists and field staff. At each road kill site along the survey route, the animal was identified and the coordinate recorded using a hand-held Global Positioning System (GPS) unit. GPS data were organized into a master file in ArcGIS 9.0 (ESRI 2004), enabling statistical comparisons. Digital photographs were also taken of certain representative species (see also Kurz et al. 2005a).

Results and Discussion

Ecological evaluations and data-collection efforts have thus far been only cursory, spanning the last 1-2 years (depending on location). Although largely anecdotal, interpretations of the data collected over the course of these evaluations have started proving valuable for identifying existing impediments to wildlife posed by roadway infrastructure. Subsequent recommendations to road-design teams will likely focus on the realized need for improvements in habitat connectivity and reductions in wildlife mortality. All three roadway evaluations (the Englewood Interstate Connector, the Honore Avenue-Pinebrook Road Extension, and Interstate 75) have provided unique contributions to the combined data.

Englewood Interstate Connector

It is believed that the existing highway corridor extending along River Road and Winchester Boulevard has impacted historic wildlife movements within the Myakka River floodplain. Currently, the Englewood Interstate Connector (EIC) corridor is marked by a number of hydrologic culverts beneath the road; however, the majority of these culverts appear inadequate for wildlife utilization due to restrictions imposed by construction activity, high water, or impenetrable vegetation. Despite the paucity of suitable crossings, wildlife was nonetheless documented utilizing two existing concrete culverts (24" and 36" diameter) within the study area (Kurz et al. 2005a).

Future and existing development has limited the scope of wildlife-amenity recommendations proposed along this corridor. Many properties along the EIC are under private ownership, and a growing number of these parcels are

currently under construction or have submitted plans for development approval. Since so much of the area is slated for development, creating linkages to and from these areas may be counterproductive to protecting wildlife (as many local populations would likely be lost to road mortality and/or habitat destruction, Kurz et al. 2005a). Recommendations to the EIC design team for artificial wildlife corridors and advanced land acquisition were prioritized based on a number of factors including proximity to public lands, drainage ways and easements, acquisition potential, and mitigation opportunity.

Two artificial wildlife passages have been proposed as part of the design phase of the road. The first, involving the connection of a conservation easement to the Jelk's Preserve along a forested waterway, proposes a small mammal shelf to allow animal passage during a range of seasonal water fluctuations. Foresman (2004) showed that species prone to use culverts opted to use shelves when water was present. In fact, the same study explained that activity in experimental culverts (with shelves) remained high or even increased when water levels rose, due to consistent use of shelving by wildlife (Foresman 2004). The second artificial wildlife corridor proposes the connection of a different conservation easement to the Jelk's Preserve through a residential development. This second passageway is intended to restore an east-west habitat corridor from the Jelk's Preserve to a series of preserved "residential" habitat corridors west of the interstate highway.

Another effort underway as part of this road project is the advanced acquisition of two parcels naturally contiguous to the Jelk's Preserve. These priority sites were initially identified by the ESLPP due to their connectivity, habitat value, and location along the Myakka River. The parcels are of dual interest to the EIC design team due to mitigation potential for stormwater, wetlands, floodplain and mesic hammock impacts. The county's road-program team anticipates additional value to other road projects "on line" for the future.

Honore Avenue-Pinebrook Road Extension

Several landscape corridors were identified throughout this project area; however, due to the extent of existing and future infrastructure, their suitability for wildlife utilization is currently limited. Historic aquatic landscape features that exist in this area include South Creek, Fox Creek, Cow Pen Slough, and Shakett/Salt Creek. Utilization of these waterways by wildlife was documented during the study, but historic wildlife movement has also likely been altered by infrastructure. Undeveloped lands bordering the area include the Fox Creek REMP, Oscar Scherer State Park, and a Sarasota County buffer parcel. The protection and enhancement of vital habitat linkages between these lands west of Interstate 75 and protected lands east of the Interstate (e.g. Knights Trail Park, Pinelands Reserve, and Myakka River State Park) was an important consideration during this study and will remain a high priority during the design phase of the Honore Avenue-Pinebrook Road Extension. In addition, coordination with FDOT on wildlife improvements along Interstate 75 is anticipated.

Several artificial wildlife corridors have been proposed as part of the Honore Avenue - Pinebrook Road Extension project, although land-ownership obstacles continue to hinder the establishment of finalized locations and make determination of the magnitude of improvement difficult. The focus during the design process will be toward the restoration of historic corridor linkages. This may include continued negotiations with land owners, establishment of conservation easements, removal of restrictive fencing, installation of appropriately placed barrier fencing, upgrades to culverts, incorporation of mammal shelves, creation of earthen bridges, and design of span bridges suitable for unrestricted wildlife movement.

An upgrade to an existing span bridge at Fox Creek was requested by local wildlife agencies as part of the Interstate 75 PD&E study through this area. Additional improvements to this bridge must include the reconfiguration of barrier fencing to direct (rather than prohibit) wildlife movement beneath the roadway and modest management of vegetation. Agreements with adjacent landowners will also be necessary for this passage to reach its full potential, ensuring connection with protected lands east of Interstate 75. Sarasota County has agreed to match all upgrades proposed at Fox Creek by FDOT, as well as at other nearby span bridges. For example, considerable wildlife utilization of the floodplain under the Salt Creek span bridge has been documented, with noticeable reductions in wildlife mortality on the roadway above. The county has proposed a wide span crossing over this creek. Additionally, a dual-purpose earthen bridge is proposed at Cow Pen Slough, a deeply cut, human-altered canal. Finally, barrier fencing at wetland-highway interface zones and culvert upgrades with mammal shelves will be considered at specific locations along the Honore Avenue - Pinebrook Road Extension.

Interstate 75

Ecological evaluations have been conducted along two environmentally sensitive segments of Interstate 75: the segment associated with the Honore Avenue - Pinebrook Road Extension, and a six-mile segment further south which bisects large expanses of publicly-owned lands adjacent to the Myakka River and Deer Prairie Creek. In the southern area, Florida Panther sightings have been documented one mile north of the I-75 corridor on the T. Mabry Carlton Memorial Reserve and on Schewe Ranch, while a Scrub-jay family has been recorded along Deer Prairie Creek, a tributary of the Myakka River. Florida Scrub-jays have also been documented using span bridges beneath the interstate at Fox Creek in the northern study zone.

The Interstate 75 expansion project provides an opportunity to restore crucial habitat connectivity between state-owned and ESLPP lands. Continued infrastructure expansion (I-75 and EIC) and development (North Port) have

inadvertently isolated these environmentally sensitive habitats. Failure to take advantage of the I-75 widening to restore connectivity will likely have long-term ecological implications for the success of wildlife populations dependent on movement across this barrier. Large-scale artificial-corridor enhancements will therefore be important to improving habitat connectivity between these otherwise separated areas. In particular, artificial corridors should be designed to accommodate wildlife requiring larger geographic ranges, such as is required by the rare Florida Panther.

Overall

Data collected as part of the three ecological evaluations have provided evidence of a variety of wildlife utilizing areas beneath span bridges, low water hydrologic culverts, and one specifically designed small mammal crossing. Data have also suggested substantial wildlife mortality associated with unsuccessful roadway crossings. Currently, road-design engineers and environmental staff are working together to design artificial wildlife corridors to help allow safe wildlife passage around, under, and through barriers at each of the three road-expansion projects.

Road-kill mortality surveys documented impacts to at least 70 different species of wildlife. These species include white-tail deer (*Odocoileus virginianus*), river otter (*Lutra canadensis*), coyote (*Canis latrans*), flying squirrel (*Glaucomys volans*), American woodcock (*Scolopax minor*), American alligator (*Alligator mississippiensis*), gopher tortoise (*Gopherus polyphemus*), eastern diamondback rattlesnake (*Crotalus adamanteus*), and pig frog (*Rana grylio*). In addition to resident wildlife, migratory species such as the American Robin (*Turdus migratorius*) were significantly impacted as they moved through the area. Although road kill surveys were conducted over the course of two years, the frequency of surveys was not sufficient to evaluate fully the consequences of roadway expansion on local wildlife populations. Often, animal remains were unidentifiable by species, suggesting that additional species (beyond those recorded) were likely affected. The data also do not account for injured wildlife that expired in areas beyond the survey zones, predation by scavengers, removal by collectors, or disintegration caused by weather or traffic. Nonetheless, these data suggest that animal dispersal into habitats separated by roadway barriers is reduced, as documented for small mammals by Oxley et al. (1973).

Wetlands bisected by roadways appeared to affect movement patterns of herpetofauna noticeably. Air temperature also played an important role in the activity levels of many animals, particularly ectotherms (Kurz et al. 2005a). During the course of the surveys, an increase in herpetofauna mortality occurred during summer and fall, with a noticeable increase in frog mortality during October. This may coincide with precipitation events and nesting and breeding behaviors, but such was not specifically examined. Water levels for many of the wetlands in the study area were at or near their seasonal high levels during October of both 2003 and 2004, and thus were situated closer to the highway interface (Kurz et al. 2005b). Although amphibian and reptile mortality was documented, few specific recommendations have thus far been made to accommodate these animals' movements. At this time, culvert materials appropriate for use by these species are being considered and barrier wall-culvert systems and culvert size are being researched for use along the Honore Avenue-Pinebrook Road Extension.

Small mammals were negatively affected annually throughout the evaluated areas. Studies have shown that the effects on small mammals are magnified when highways bisect unique habitats such as wetland communities or forested areas historically serving as wildlife corridors (Foresman 2004). The implications of these findings are quite relevant to our evaluations given the abundance of wetlands, waterways, and forested lands associated with potentially impacted areas throughout Sarasota County. Although higher wildlife mortality was expected at wetland-highway interfaces in our evaluations, differences in mortality between these and more upland areas were not always observed. However, vegetated drainage swales established parallel to highways may artificially inflate the prevalence of persistent wetland-highway interface zones.

A noticeable reduction in mammal mortality was observed in a few key areas. These areas appeared to correspond to span bridges over creek corridors. Six span bridges exist in the evaluated areas, but fencing restrictions and human use may limit exploitation by wildlife. Seasonal fluctuations in water level and artificial and vegetative barriers appeared to influence small mammal use of artificial structures (culverts) negatively, while the size of the structure and the "tunnel effect" appeared to have less of an influence. Small mammals appeared to favor dry or mostly dry culverts. Given the success of capturing motion-sensory camera images at several dry (passable) span bridges, the failure to capture images of wildlife at other crossings suggests that those structures may not be as conducive to wildlife movement (Kurz et al. 2005a). One particular well-used dry culvert (36") was devoid of vegetation (other than sod) and extended beneath four lanes of roadway ("tunnel-effect"), while other unused culverts (>1 m) were often full of water and/or impeded by dense populations of Brazilian Pepper (*Schinus terebenthifolius*) or cattail (*Typha sp.*). Game trails leading to the road surface were often observed bypassing these "unacceptable" culverts.

Summary

Sarasota County continues to strive toward a balance between ecological sustainability and economic growth. The acquisition and protection of ecologically significant lands (Natural Corridors) and the minimization of roadway impacts in eco-geographically valuable areas (Artificial Corridors) have become top priorities of elected officials, planners, road-design, engineers and county environmental staff. Community support for these approaches has also been overwhelming, providing continued momentum toward their success.

The county's land-acquisition programs continue to move ahead. ESLPP has realized great successes over the past year, boasting critical land-acquisition achievements along the Myakka River corridor. The REMP program has employed unique and creative permitting approaches (generating healthy discussions) to pursue fiscally (and ecologically) appropriate land acquisitions with high restoration potential for use in future infrastructure projects.

The three county-initiated ecological evaluations (EIC, Honore Avenue-Pinebrook Road Extension, and Interstate 75) were chosen based on their proximity to ecologically important landscape features and continue to provide road design teams and environmental staff with a better understanding of the environmental challenges posed by development. Unfortunately, creating and improving wildlife corridors and avoiding ecologically valuable lands is often complicated by property ownership, development plans, political lines, and fiscal limitations. Designing a road incorporating every possible artificial-corridor improvement can be cost-prohibitive. Instead, publicly-owned lands, drainage easements, or areas under conservation easement were often given higher priority for defragmentation, but specific infrastructure project needs (mitigation, stormwater, and floodplain) and private land-development plans were also considered.

As long as county ecological evaluations continue to identify priority areas for advanced land acquisition, mitigation, and innovative design of future infrastructure, these programs should continue to move forward in spite of the challenges. This new county initiative has resulted in increased scrutiny of county infrastructure projects through alternative road alignments, sound ecological improvements, and defragmentation proposals. Sustainable design is now a genuine consideration of county road-design teams. It is our hope that Sarasota County can provide a model for sustainable development applicable to other communities across the country.

Acknowledgments: This poster is the result of collaborations between various Sarasota County departments. Special thanks go to Alissa Powers for encouragement, Warren Reuschel for conceptual ideas, and to PBS&J consultants Michael Conn, Wendy Hershfeld, and Jackie Dracup for their dedication to creating a meaningful project. Additional thanks go to Natalie Howden for collecting and organizing field data, Evan Brown for GIS expertise, Brooke Elias for providing background information on the Environmentally Sensitive Lands Program, and Anne Francoeur for graphic vision. Additionally, the acceptance and support of Sarasota County Mobility has been essential to this project's success.

Biographical Sketches: Sherri R. Swanson is a project scientist for Sarasota County Natural Systems Management. Her professional responsibilities involve project management and oversight of the county's Regional Mitigation Program, through which she serves as liaison between transportation and natural-resource interest groups. She holds a bachelor of science degree in environmental, soil and water science from the University of Arkansas. Her professional experiences involve permitting and natural resource and wildlife management.

Dr. Ray Kurz is a senior environmental scientist and program manager for PBS&J's West Florida Sciences program based in Sarasota and Tampa. He currently serves as a project manager to several public-agency clients for projects related to transportation improvements, watershed management and restoration, water-quality evaluations, and natural-resource management. He holds a bachelor of science degree in zoology and a master of science in fisheries and aquatic sciences, both from the University of Florida. He earned his Ph.D. in public health, with a focus on environmental health, at the University of South Florida in 1998.

References

- Environmental Systems Research Institute. 2004. ArcGIS: Release 9.0 software. Environmental Systems Research Institute, Redlands, California.
- Foresman, K.R. 2004. *The Effects of Highways on Fragmentation of Small Mammal Populations and Modifications of Crossing Structures to Mitigate Such Impacts*. University of Montana, Missoula, Montana.
- Kurz, R.J., M. Conn, and W. Hershfeld. 2005a. *Englewood Interstate Connector (EIC) Corridor: Wildlife Mitigation Preliminary Design Investigation*. PBS&J, Sarasota, Florida.
- Kurz, R.J., M. Conn, W. Hershfeld, and J. Dracup. 2005b. *I-75/SR 681 Cost Analysis and Follow-up Monitoring*. PBS&J, Sarasota, Florida.
- Oxley, D.J., M.B. Fenton, and G.R. Carmody. 1973. The effects of roads on populations of small mammals. *Journal of Applied Ecology* 11: 51-59.