

AN UNBALANCED RECOVERY APPROACH THREATENS THE FLORIDA PANTHER

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Since the publication of "The theory of island biogeography" by MacArthur and Wilson (1967), the spatial attributes of autecology have received increasing attention by researchers. Theoretical and applied approaches to mammalian landscape ecology emerged in the early 1970s as the result of work primarily on rodent pests (Hansson 1995). In recent years, numerous papers, an entire book, and a special journal section have been devoted to the theory and practice of mammalian landscape ecology, and the importance of this new field to conservation efforts (Lidicker 1995, Bowers 1997). Still, most work, because of the logistic difficulties involved with studying wide-ranging mammals, has focused on small mammals and invertebrates (Pastor et al. 1997). The relation of the Florida panther (Puma concolor coryi) to the landscape has been examined (Maehr and Cox 1995), but the simple discovery that the subspecies is inextricably linked to forest cover has been insufficient to compel land managers to plan beyond the boundaries of existing public preserves.

This paper examines the evolution of recovery efforts for a geographically isolated large carnivore, and looks beyond current management activities to seek a landscape solution to the Florida panther's tenuous existence. Recent recovery planning by the Florida Panther Interagency Committee (composed of two state and two federal natural resource agencies) has reduced the possibility that a landscape approach will be used to manage the Florida panther. Original recovery objectives such as the establishment of a captive breeding program, and the reintroduction of panthers to north Florida have been scuttled in favor of a more expedient approach that primarily involves the introduction of individuals from another subspecies into the single known population (Maehr and Caddick 1995). These actions bode poorly for the eventual return of an animal that now occupies about 5% of its original range (Maehr 1997c). As one of North America's first multi-regional natural landscape planning efforts (Carr et al. 1998), the Florida Greenways Project promises to provide the framework necessary to retrofit the state into

a system of interconnected conservation areas that will facilitate panther population expansion. We will examine the potential for this greenways project to facilitate the expansion of panther numbers and to reinvigorate conservation efforts on behalf of the species. Florida panther recovery efforts must transcend the boundaries of protected lands in south Florida, and shift toward a regional landscape strategy that will ensure the panther's future in Florida and the southeastern United States.

The global adoption of the park paradigm, based on the Yellowstone model (Wright and Mattson 1996), reflected an attempt to save vignettes of outstanding scenic beauty, and to provide aesthetic and spiritual benefits to park users. Planning for the long-term viability of complete species assemblages or for the integration of each park with the surrounding landscape was seldom attempted (see Wright et al. 1933, Wright and Thompson 1934, and Shelford 1936 for early criticism of the park paradigm). Although the park mission has grown to include the protection of biota, U.S. parks and park-like preserves are primarily set-asides for human recreation (Wright and Mattson 1996). From a landscape perspective, the traditional park paradigm is insufficient to provide the long-term security of species and biotic communities (Harris et al. 1996). Today, at least in a design sense, there is growing interest in the integration of parks with larger scale plans that incorporate landscape connectivity and population considerations that span entire states and continents (Harris and Hoctor 1992, Foreman et al. 1992).

The leading wildlife policy maker in the United States, the U.S. Fish and Wildlife Service (USFWS), is traditionally a steward of biodiversity from a single-species management perspective. Although much of its efforts focus on habitat protection, this has stemmed largely from a mandate to focus on individual game species, nuisance species, and especially endangered species (Foin et al. 1998). Recently, this tradition has grown to include entire communities, ecosystems, and multi-species recovery plans (USFWS 1998) - changes that reflect a move toward ecosystem-level thinking (Agee 1996). Nonetheless, this approach still employs the species as its basic currency, and organisms such as the Florida panther will continue to be

The earliest radio telemetry studies revealed a population that appeared old, reproductively stagnant, and susceptible to mortality ranging from malnutrition and highway collision, to intraspecific aggression and capture accidents (Belden 1986, Roelke et al. 1986). These impressions, based on fewer than 10 animals, resulted in the development of management and recovery guidelines designed for a crisis situation. Captive breeding was believed to be the surest approach to avoid complete extinction - it would create opportunities for both population augmentation and reintroduction (USFWS 1987). Although 10 panther kittens were removed from the wild and placed in captivity by 1992, and these removals had little impact on the reproductive output of the population (Maehr 1997a), the captive breeding program was abandoned two years later in favor of in situ genetic augmentation. In 1994 eight adult female Texas cougars (Puma concolor stanleyana) were introduced into south Florida panther range. To date, these females have produced a minimum of 12 hybrid kittens, *only a few of which are collared and being monitored* (E.D. Land pers. comm.). It is unclear as to what philosophical shift occurred in recovery planning, especially in light of the demographic stability exhibited by the population over a seven year period (*Maehr citation?*), but the introductions have occurred with little long-term planning. The robust nature of the panther's overall population status prior to this policy about-face seems to contradict the extreme actions taken. In this context, Maehr (1998:182) observed;

"The long-term demographic studies of the Florida panther can be boiled down to a few generalities. Florida panthers inhabit an area of about 1.5 million ha that is bounded on four sides by water and human developments. Not all of south Florida is equally capable of supporting panthers: habitat quality declines from northwest to southeast. The largest public expanses of south Florida (Everglades National Park and eastern Big Cypress National Preserve) support the fewest panthers per unit area of any known occupied range. Immigration into the south Florida population is unknown, but search efforts to the north of the Caloosahatchee River have been insufficient to rule out the possibility of ties to

another population. Demographics of the Florida panther are similar to those of un hunted western cougar populations: overall survival is high and the bulk of mortality likely occurs in the dispersing, non-resident, non-reproducing segment of the population. These conclusions are supported by the observation that the greatest known cause of mortality among radio-collared study animals is intraspecific aggression (i.e. resident adult males killing dispersing subadult males), not highways. Females are readily recruited into the population, and they conceive their first litters before they are two years of age. Litter size averages two – the norm for the species. Adult turnover in the population is low, and home ranges are stable unless a vacancy is created by death or abandonment of the occupant. Reproduction occurs at a rate that exceeds deaths of resident adults. These are not characteristics of a disappearing population.”

The only demographic dysfunction that emerges from an examination of the panther research record is that the population appears to be effectively land-locked south of latitude 26°60' N - a line that coincides with the artificially dredged Caloosahatchee River, the south rim of Lake Okeechobee, intensive agriculture, and urban sprawl. In nearly 20 years of intensive study of Florida panthers, only one subadult male is known to have crossed to the north of this dispersal filter. Krebs et al. (1969) found that reduced dispersal in voles resulted in abnormal population dynamics. Gaines et al. (1991) and Lidicker (1995) have suggested that such “frustrated dispersal” can lead to population crashes due to the saturation of marginal habitat and the negative feedback on source habitat. The Florida panther would certainly appear to be susceptible to such problems. However, successful reproduction in the panther’s core range (source habitat) has been sufficient to compensate for the loss of juveniles to the aborted captive breeding program, and it has continued to force dispersal-age males into inhospitable fringes of the species’ distribution. These young males continuously attempt to escape the confines of the local population - as in Puma concolor throughout its range - but have been stymied by anthropogenic changes to the landscape. Today, the path of least resistance is the

Caloosahatchee River itself, the artificially dredged channel that now bisects a 30 km-wide land bridge that linked south Florida with central Florida until the late 1800s.

MacArthur (1972:151) noted that dispersing individuals will be favored if they can colonize nearby superior habitat. Such dispersers are also the most likely to maintain genetic variability and reclaim vacant range (Joule and Cameron 1975, Lidicker 1975). Because much of the landscape to the north of the Caloosahatchee River is considered good panther habitat (Maehr et al. 1992, Cox et al. 1994), dispersing panthers would experience increased "reproductive value" (MacArthur 1972:151) if they could routinely access this area of abundant food and suitable cover. Existing landscape filters (the river, human infrastructure, and scattered forest on either side of the river) allow only the occasional male disperser into an area without a proven population. A valuable enhancement to panther recovery would be to retrofit the landscape in such a way to not only encourage male dispersal, but to facilitate female colonization. The result would be the creation of a naturally-occurring metapopulation of panthers, and a significant increase in the survival probabilities of the subspecies.

That Florida panthers have not fluctuated out of existence may be due in part to a long history of local adaptation, the elimination of lethal alleles, and a presently tolerable arrangement of habitat patches in south Florida. Within the area immediately adjacent to the habitat core (Fig. 1; Maehr 1997a), one would expect, and finds, high reproductive rates and frustrated dispersal. Moving as little as 10 km away from the core in any direction, dispersing panthers encounter increasingly patchy forests (Maehr 1997a, 1998) and a predominantly hostile landscape matrix. Whether it is due to urbanization, agriculture, or plant communities dominated by sedges and grasses, panthers in these peripheral areas exhibit higher individual mortality rates and exist in subpopulations that are more susceptible to extinction than panthers in the core population (Bass and Maehr 1991).

When south Florida panther range is examined along the forest gradient recognized by Maehr (1997a) and three representative areas along this gradient are subjected to ROMPA (ratio of optimal to marginal patch area; Lidicker 1988) analysis, the relation between forest cover and

the ephemeral status of panther occupation away from the core becomes clearer. Maehr and Cox (1995) and Kerkhoff (1997) demonstrated that panther habitat was not dependent on a particular type of vegetation but was related almost solely to the extent of available forest cover. This makes the application of a ROMPA panther model a relatively simple task. We used Landsat Thematic Mapper satellite imagery (Kautz et al. 1993) and ArcView GIS to delineate forest cover in areas of occupied and unoccupied panther habitat in Florida. Representative, 64 km² landscape blocks were then selected and a 1 km² network was superimposed over these projections. Optimal habitat units (1 km² subblocks) were considered those that contained a minimum of 50% forest cover. All others were considered marginal. The size of blocks was convenient from an analytical perspective, but this size also approximates the minimum size of adult female home ranges in good quality habitat (Maehr et al. 1991), and 100 m (1000 m?) approaches the minimum distance that panthers will routinely venture from preferred forest cover (Maehr and Cox 1995). In areas where the panther population has remained stable for decades, ROMPA values are well above 50% (Fig. 2). A fluctuating population typifies the area of moderately low forest cover (ROMPA = 47%), and a population susceptible to extinction (Bass and Maehr 1991) occasionally inhabits an area of very low ROMPA (1.6%). These findings agree with the suggestion by Lidicker (1988:229) that for populations in landscapes with high ROMPA "multiannual cycles are less likely because so much optimal habitat is available that harsh season populations are not reduced sufficiently to prevent complete recovery of the population during the following breeding season." Certainly, because panthers are longer lived, and because they do not appear to respond to seasonal variation in the landscape (Maehr et al. 1991), panthers interact with their landscape at a different temporal scale than the microtine populations for which ROMPA was first applied. In this sense Florida panthers are less likely to experience superannual cycles in areas with extensive continuous forest. On the other hand, one would expect that in marginal habitat patches, panthers respond to fluctuations in environmental conditions such as food supply more severely than in optimal patches. Indeed, food (ungulate prey) appears to be limiting in lower ROMPA landscapes such as the eastern Big Cypress

Swamp and the Everglades (Maehr et al. 1990) where white-tailed deer (Odocoileus virginianus) densities are several times lower than in high ROMPA landscapes (McCown et al. 1991, Smith and Bass 1994). Clearly, high ROMPA panther habitat represents that part of the subspecies' range that serves as a population source (Pulliam 1988) and the origin of frustrated dispersers.

This discussion is not intended to minimize other problems associated with small populations - the best prospects for the recovery of a small population would stem from a rapid and significant increase in numbers. This was the original intent of the captive breeding program. However, individual demographic stochasticity (Goodman 1987a, 1987b) has not had a measurable influence on the Florida panther up to now. Certainly, a variety of environmental influences, even in the absence of habitat loss, could increase the extinction probability of an isolated population (Caughley and Gunn 1996). For example, in a nearby study of a very small population (<20; Cox et al. 1994) of Florida black bear (Ursus americanus floridanus), two out of three litters were lost during unusual El Nino-induced winter flooding during 1998 (Maehr *et al.* unpubl. data). Consecutive wet winters could alter the age structure of this isolated population and introduce an element of variability that might not be compensated for (Brussard and Gilpin 1989). Although the panther is similarly long-lived and slow to reproduce ($\square=2$ offspring every other year), it appears less susceptible to environmental variance. Fluctuating water levels do not affect movements (Maehr et al. 1991), and even if a litter is lost due to a short term event such as a hurricane, panther reproduction is not locked into a single seasonal pulse as is bear reproduction. Panthers can reproduce throughout the year. The lack of response by panthers to Hurricane Andrew in 1992 supports the notion that they are resilient to certain natural environmental extremes. In addition, while panthers are susceptible to a number of endemic and naturalized diseases in south Florida (Forrester 1992, Forrester et al. 1985), none have caused epizootic mortality as has been observed in a nearby bobcat (Lynx rufus) population (Wassmer et al. 1988). The panther's inherently low density and infrequent encounters with conspecifics likely reduces the rate of disease transmission in the species.

Perhaps the most difficult elements of stochasticity to evaluate with regard to panther

management are those related to genetics. While some arguments have been compelling enough to replace captive breeding plans with genetic augmentation (Seal 1992), there is some sense that the rate at which these genetic changes are taking place is unwarranted (Maehr and Caddick 1995). The essence of this debate is simply that observed patterns of genetic variability in the Florida panther are not paralleled by the demographic performance of the population. And, without knowing the historical genetic make-up of the population, and considering the isolated nature of any population at a distributional extreme (and, in this case, at the end of a peninsula), it is difficult to conclude just how different contemporary Florida panthers are from pre-European-settlement stock. Nonetheless, although inbreeding has not been shown to affect the demographics of the Florida panther, any significant increase in their numbers would certainly reduce the potential for genetics (or any other factor) to negatively influence its survival. Because occupied range south of the Caloosahatchee River is likely saturated (Maehr 1997c), the best prospects for population increase are either in captivity or north of the river.

A Regional Landscape Approach for Conserving the Florida Panther

The Florida panther is an obligate forest animal, and Florida, with urbanization and agriculture notwithstanding, is still primarily a forested state (Fig. 3). A ROMPA analysis of landscape patches in central and north Florida suggest that vast areas contain sufficient forest to satisfy panther needs (Fig. 4). Thus, panthers should have ample resources to survive outside of south Florida. So is it possible for us to facilitate a natural expansion of the existing population to the north?

Despite the local, symptom-oriented approach to panther recovery, and the tendency for agencies to deal with individual panther management rather than the root of the problem, there has been a growing focus on a landscape-scale perspective, even if such an approach has not been officially adopted. The importance of corridors and private land ownership to the panther were recognized well before genetic augmentation was implemented (Maehr 1990), and the relation between landscape productivity and panther occurrence has been understood for nearly a decade (Maehr et al. 1989, Smith and Bass 1994). However, even though there is no doubt that

the panther is a wide-ranging species, it has yet to be managed as a landscape creature. As official plans evolved to manage a single population within the confines of an artificial landscape island (Seal 1992), empirical analyses demonstrated the existence of panther habitat outside of south Florida (Cox et al. 1994, Maehr et al. 1992, Maehr and Cox 1995), and suggested the presence of other populations in the state (Maehr 1996, Belden et al. 1994). Although habitat preservation has been identified as an important component of panther recovery (Logan et al. 1994), little progress has been made toward the expansion of protected areas and toward a metapopulation approach to panther management. The single land acquisition proposal that acknowledges the panther as a potential primary beneficiary of land purchases near the Caloosahatchee River (Eller et al. 1996) has been given a low priority ranking by a recent project assessment. (Florida Natural Areas Inventory 1997). The apparent disdain of a landscape approach for the Florida panther must end before recovery can be achieved.

Panther Habitat and the Caloosahatchee River

The Florida Panther Habitat Preservation Plan identified approximately 300,000 hectares of private land as potentially significant panther habitat in south Florida (Logan et al. 1994). Most of this habitat leads north from Big Cypress National Preserve and surrounds the Caloosahatchee River basin (Fig 3). Telemetry studies centered on the northern Big Cypress Swamp have regularly demonstrated panther use of habitat on private lands directly north of the BCNP complex (Maehr and Cox 1995). However, despite the evidence of panthers noted earlier, the status of the panther in this area is equivocal, and a reproducing population may not exist (Maehr et al. 1992) even though forest cover appears adequate to support a population. *(Strike preceding sentence? Even though this may be true, doesn't it potentially conflict with several points in the paper—such as sufficient forest cover should mean good panther habitat?)*

Reintroduction of Panthers in North Florida

A Florida panther recovery objective has been the re-establishment of two other populations within its historic range in the southeastern United States (USFWS 1987). The first site chosen after review of various candidate sites was the Okefenokee National Wildlife

Refuge/Osceola National Forest complex in northeast Florida and southern Georgia (Belden 1987; Fig.3) where 15 Texas cougars (Puma concolor stanleyana) were experimentally released into north Florida from 1988 through 1994 to test the potential for this large forested landscape to support a panther population (Belden and Hagedorn 1993, Belden 1994). Results indicated that reintroduction was ecologically feasible and that there was a much larger area capable of supporting panthers than just the original target zone. Some of the cougars settled to the west in the Suwannee River basin - an area of abundant prey and cover. However, several other individuals engaged in long distance dispersal events, including several that entered southeast and south central Georgia (Belden 1994) suggesting additional habitat beyond the state line. Mortality included at least one road kill and two poaching incidents. One other cat was removed for depredation on an exotic game farm. All other animals were removed from the wild at the end of the study. The most significant obstacle to reintroduction has been the development of a local minority that opposes reintroduction due to fears of livestock depredation, land regulation, and danger to children. Otherwise, even though fragmentation due to major highways and road densities are general concerns, north-central Florida and southern Georgia have been proven to provide enough resources to support a panther population. What is missing is the political will to work with opponents of reintroduction and to begin controlled re-establishment.

Toward a Statewide Conservation System - the Florida Greenways Initiative

As efforts to address panther recovery from a landscape perspective have limped along, the state of Florida has initiated an ambitious program to implement an integrated statewide conservation program that is unrelated to this endangered subspecies. This was preceded by activities to educate Floridians on habitat fragmentation issues and the need for an integrated habitat conservation system (Harris 1984; Harris 1985; Harris and Gallagher 1989; Harris and Scheck 1991; Harris and Atkins 1991). After years of baseline funding for acquisition of ecologically sensitive lands, the state began a three billion dollar, ten year program in 1990 called Preservation 2000 to protect ecologically sensitive lands. Then, at the urging of conservation groups, the governor established the Florida Greenways Commission to consider

the protection of an ecological and recreational greenways system to integrate land protection efforts (Florida Greenways Commission 1994, Carr et al. 1998). In their concluding report in 1994 the commission recommended the establishment of an ecological greenways system that:

- (1) conserves critical elements of Florida's green infrastructure of native ecosystems and landscapes; (2) restores and maintains essential connectivity among diverse native ecological systems and processes; (3) facilitates the ability of these ecosystems and landscapes to function as dynamic systems; and (4) maintains the evolutionary potential that will allow the components of Florida's ecosystems and landscapes to adapt to future environmental changes.

Clearly, the needs of the Florida panther can be neatly integrated into this statewide conservation effort.

Based on the above recommendations, the Florida legislature agreed to the development of a statewide greenways system in 1995. As part of an effort to develop a plan before the year 2000, an interdisciplinary team at the University of Florida has been using GIS data and landscape modeling to identify a statewide ecological network consisting of large areas of ecological significance and landscape linkages. Whenever possible, this network will incorporate core reserves, corridors, and buffers through an increasingly hostile landscape matrix (Harris 1984, Noss and Harris 1986, Noss 1992). Ecological greenways modeling has offered an opportunity to identify a physically linked ecological conservation system composed of both public and private lands that can meet biological diversity conservation objectives despite explosive human population growth (Florida currently has a population of 14 million people and has a net population growth rate of approximately 275,000 people per year). The Florida legislature is now considering a 10-year renewal of the P-2000 program with an increased emphasis on the purchase of easements that would keep undeveloped land in private ownership. Although development is rapid, Florida has the opportunity to protect a truly integrated conservation system that could significantly benefit panther recovery efforts as well as the rest of the state's biodiversity.

Getting Panthers Out of South Florida

Analysis of lands north of the core population of panthers in southwest Florida indicate fair to excellent opportunities for range expansion and the re-establishment of other populations. Florida has been fortunate in regards to the relative wealth of information on its ecologically significant lands and biodiversity. The Florida Game and Fresh Water Fish Commission produced a report (Cox et al. 1994) on the habitat needs for over 30 focal species, which included recommendations for land purchases that are needed to meet minimum viability criteria for species and communities not adequately protected on existing public lands. The Florida Natural Areas Inventory (Cite—Not that I know of ?) has recently developed a geographic catalog of areas of conservation interest based on analysis of aerial photography, biotic occurrence records, and field surveys. These data are primary inputs into the ecological greenways model being conducted at the University of Florida. Existing and potential ecological connectivity on the Florida peninsula is readily apparent when Strategic Habitat Conservation Areas and Areas of Conservation Interest are combined with existing and proposed public conservation lands and private preserves (such as The Nature Conservancy preserves) (Fig. 5).

The Colonization Potential Exists

Although panthers have periodically been documented to the north of the Caloosahatchee River (Maehr 1997), none of their origins was known, and only one was captured and radio-collared in the area (Maehr et al 1992). The panther that recently crossed the river and left the area of frustrated dispersal has shed new light on the potential for the population to expand and to take advantage of a developing statewide conservation system. After crossing the Caloosahatchee River, this radio-collared subadult male traveled north approximately 250 km in proximity to the proposed landscape linkage paralleling the Lake Wales Ridge and Kissimmee River basin. Its movements have included patchy forests in the vicinity of one of the world's busiest entertainment attractions - Disneyworld (Fig. 6).

Though it is impossible to confirm the cause of this long distance event, we suggest that it is very likely related to a lack of, or extreme low density of female panthers north of the

Caloosahatchee River. Dispersing males in south Florida generally leave occupied range, but eventually return to seek a mate (Maehr 1997a). Females are philopatric and usually disperse no farther than the width of their mothers home range. Regardless of the cause of this dispersal, panther recovery might benefit greatly if both males and females were encouraged to make the Caloosahatchee crossing. Options to ameliorate the opacity of this landscape filter include a variety of strategies:

- 1) protecting and restoring forest along a strategic stretch of the waterway, and establishing protected forested corridors that link panther habitat on both sides of the river;
- 2) decreasing the effective width of the dredged channel by installing vegetation-protected ramps on either side of the river;
- 3) introducing females to suitable habitat north of the river;
- 4) constructing a permanent river-spanning structure that supports vegetation that is suitable for panther travel.

These landscape retrofits would be valuable not only for re-establishing a population in south-central Florida, but for creating a stepping stone in a statewide conservation system that would facilitate dispersal and establishment of new populations to the north. The northern half of the state still has extensive forested uplands and includes several large hubs of public conservation lands (Fig. 5). Based on availability of large patches of potentially suitable habitat, existing conservation areas, roadless areas, and generally low human population density, much of north Florida may be capable of supporting panthers (Cox et al. 1994). A reintroduced population in the Okefenokee National Wildlife Refuge and Osceola National Forest could recolonize suitable areas in the in the panhandle, central Georgia, and possibly the Ocala National Forest in north-central Florida.

The Florida Panther as Cornerstone for a Statewide Conservation System

Although much of the work on Florida panther recovery has rightfully concentrated on the only documented population in southwest Florida, there has been a tendency to ignore the landscape considerations that are essential for the panther's future. Continuing to focus on micro-

management of the existing population on public lands denies the fact that much of the panther's habitat is still on private lands, that there are suitable lands north of the Caloosahatchee River that could support a supplemental population in south-central Florida, and that there is a need (and recovery plan mandate) to establish additional populations within the panther's historic range (USFWS 1987).

We suggest that much of this inertia is due to a general unwillingness by administrators responsible for panther recovery to deal with private land issues (see Maehr 1997d). However, panther conservation provides a real opportunity to guide efforts to design and protect a Florida statewide conservation system. Although the "coverage" of umbrella species is rarely complete (Simberloff 1998), the addition of land protected as part of panther recovery efforts will protect many other species. Cox et al. (1994) identified at least 53 animal and plant species of conservation interest within the Strategic Habitat Conservation Areas identified for panthers near the Caloosahatchee River. Efforts to address private property issues for panther conservation could also serve as a head start for dealing with similar problems that will be encountered in a statewide conservation system. However, action must be quick. Though there is ample opportunity to restore the panther to significant parts of its former range through a statewide conservation system, the pace of development requires that land protection efforts happen soon. Private lands in southwest and south-central Florida are threatened by conversion to agriculture and residential/urban development. Lands in north Florida also face pressure as development shifts from south and central Florida. If panther conservation is to fulfill its promise as a biodiversity-saving tool, a landscape approach must be adopted by natural resource management agencies. The myopia of the current recovery paradigm is as much a threat to the panther's existence as is its inability to escape the confines of a finite, south Florida landscape.

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