CARIBBEAN FOOD CROPS SOCIETY

30

THIRTIETH ANNUAL MEETING 1994

ST. THOMAS, U.S.V.I.

Vol. XXX

AN EVALUATION OF THE REGIONAL EFFECTS OF NEW CITRUS DEVELOPMENT ON THE ECOLOGICAL INTEGRITY OF WILDLIFE RESOURCES IN SOUTHWEST FLORIDA

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ABSTRACT

State of the art methods in landscape ecology, impact assessment and environmental planning were applied to evaluate the regional effects of citrus development on the ecological integrity of southwest Florida. The 600,000 ha study area borders the environmentally sensitive Everglades and Big Cypress areas and is prime habitat for the endangered Florida panther. Citrus development alters existing landscape conditions, and there is concern that the scale of the proposed citrus development could effect regional ecological resources. Evaluation of the effects of citrus development focused on listed species, vulnerable habitats and regional biological diversity. The foundation for the conservation of regional ecological integrity will be a mosaic of different intensity land uses.

INTRODUCTION

This study is an evaluation of the short and long-term effects of new citrus development in southwest Florida. Since the introduction of citrus to the St. Augustine region of north Florida in the 16th century the citrus industry has been moving south. Following a series of devastating freezes in the early 1980s there began a major shift in the geographic distribution of citrus within Florida. Growers, seeking to reduce the risk of freeze damage, are relocating to the Gulf Coast region of the state. Since 1980, citrus acreage in the region has doubled to the current 60,000 ha. This trend is expected to continue through the next decade with a projection of 80,000 ha in production by the year 2000 (Land, 1988). The on-tree value of this production, given current citrus prices, is estimated to be 380 million dollars annually (Behr, 1989). Therefore, this industry is a major contributor to the economic well-being of southwest Florida.

However, there is concern that the scale of these developments will significantly affect the ecological integrity of the region, which borders the environmentally sensitive Everglades National Park and the Big Cypress National Preserve (Figure 1). Much of the current and proposed citrus development is occurring in an area occupied by a diverse native flora and fauna including 31 species listed by state and federal agencies as endangered, threatened or a species of special concern, such as the Florida panther. Consequently, there is concern about what the effects of citrus developments will be on the habitat of native species.

PROJECT AREAS

There are five major aspects addressed in this report. 1) Historic and current land cover and land use of the study area including maps of *c.* 1900, 1973 and 1989 land cover, boundaries and status of permitted citrus and public land boundaries. 2) The importance of different habitats for

vertebrates within the study area based on the literature and field sampling including wildlife use of citrus groves and prairie/flatwoods ponds. 3) A citrus feasibility evaluation in which each section within the study area is given a ranking (high, moderate or low) of its feasibility of conversion to citrus based on soil characteristics and landownership. 4) An evaluation of the potential effects of continued citrus development on wildlife and habitats using species models and alternative development scenarios based on the citrus feasibility section. 5) Recommendations for mechanisms for integrating wildlife and habitat protection with citrus development.

Figure 2 represents the scientific approach applied during this study to integrate the conservation of ecological integrity with agricultural development.

RESULTS AND DISCUSSION

Land use and vegetation cover maps from *c.*1900 and 1973 show that historically the area was a mixture of wetlands (61% of the area) and uplands (39%) dominated by pine flatwoods (29% of the uplands) (Figure 3). By 1973, 36% of the total study area had been changed from natural to agriculture and 3% from natural to urban/industrial uses. The conversion of natural areas to improved pasture accounted for the majority of the land use change (130,294 ha, 2.4% of mapped area). Citrus made up 14,130 ha, 2.7% of the study area and 7.2% of agricultural use. These changes affected 37% of the wetlands and 43% of the uplands. Currently, the largest cover types in the Immokalee Rise area are modified land covers. Citrus and vegetable crops, and pasture/range each account for approximately 23% or 143,000 ha of the total area. Citrus makes up 10% of the total land use and 44% of agricultural lands. Forested areas are about evenly divided between pine and cypress; 72,000+ ha or 11% each of the total study area. Marsh classes make up another 10% (65,000 ha) of the total. Marsh classes are of interest because in addition to the larger sloughs, there are numerous discontigous wetland depression scattered within the pine flatland/rangeland ecosystem. These small depressions taken together, have considerable impact on the landscape. Freshwater marshes and pine forests are the areas of greatest loss since 1900 with 51% and 88% (respectively) of the 1900 area converted to other uses.

Eight percent of the study area (49,770 ha) is in public or private ownership intended for natural resource conservation and is therefore protected from development. Three percent (18,873 ha) is in public ownership with goals other than conservation (State Indian Lands). An additional eight percent (52,205 ha) has been proposed for protection by state and federal agencies. About 10% of the existing and proposed protected areas is marsh and 10% is pineland. Although similar to the current proportion of these cover types in the region the proportion of marsh and pineland cover in protected areas is less than the historical values and is unevenly distributed in the region (concentrated in the southern portion).

Three hundred eighty vertebrate taxa were identified as occurring in the region. Three hundred sixty-two are native species; 18 are non-native. Of the cover types examined, forested uplands had the most number of native species (182) using it for any activity followed by range (178), wax myrtle and willow (172), freshwater marsh (172), cypress forest (172) and pine flatwoods (169). Pine flatwoods had the most number of species (54) using it as critical habitat followed by freshwater marsh (42), hardwood swamp (31), and lakes and ponds (23). Based on a composite ranking of species use and abundance freshwater marsh, forested uplands, pine flatwoods, and range are the most valuable habitats for wildlife in southwest Florida. These are also the cover types that are most vulnerable to citrus development.

Fourteen sites were used for determination of species use of citrus groves and prairie/flatwoods ponds. Two hundred seventy-five species were observed through out the study area. Citrus groves (all cover types) have a relatively high species richness (203 species); however, the majority of species (159) were observed in agricultural reservoirs. One hundred six species were observed in grove beds of all ages; however, grove beds varied in their suitability as wildlife habitat. Sixty eight species were observed in young grove beds, 93 in intermediate-age grove beds and 68 in

mature grove beds. Factors in addition to age that may have affected the species richness of these grove beds include: size (groves ranged in size from 8 - 2,400 ha), interspersion of other critical habitats, sampling effort (the young grove was sampled continually), proximity to large natural areas (sample sites ranged from 4 - 12 km from Corkscrew Swamp or Okalacoochee Slough), visibility of wildlife in groves of different ages or effects of workers on wildlife (especially snakes). Groves less than 500 ha had fewer species than larger groves. The absence of data from groves between 1,000 to 2,000 ha limits our ability to describe species area relationships for citrus groves. Development of citrus groves does not create biological deserts. In fact citrus groves had a relatively high species richness (over 50% of the native species known to occur in the region were observed in citrus groves). However most of these species (159 out of 203) were observed in agricultural reservoirs, which in most locations are natural wetlands that have been incorporated into on-site wet detention areas. Grove beds had fewer species (103 over all ages) than reservoirs and varied in their suitability as wildlife habitat (Figure 4). The pattern observed here of intermediate aged systems having the highest species richness is not unusual (Connell 1978, Maehr 1984).

Five prairie/flatwoods ponds (temporary ponds) were sampled for wildlife use. One hundred thirty eight species of wildlife (more than one-half the species observed in this study) and 96 species of plants were observed. Ponds varied in size, shape and species composition. Fifty percent of the plant species and 31% of the animal species were found at only one pond; conversely only 3% of the plant species and 17% of the animal species were observed at all ponds. Wildlife use of temporary ponds in southwest Florida exemplifies the importance of linkages between upland and wetland cover types in providing wildlife habitat.

The citrus feasibility portion of this study was conducted to predict the extent and pattern of future development. The two major aspects of the study area that were deemed most important in determining possible expansion of citrus development were a) the likelihood of the landowner to develop land for citrus, and b) the ability of the soil to support a viable citrus grove.

For the soil feasibility ratings, 39% of the sections were rated as most feasible, 40% of the sections as intermediate feasibility, and 21% of the sections as least feasible. Most existing southwest Florida citrus groves have been planted on category 1 and 2 soils, thus these two categories may be considered together as feasible citrus sites. The majority of the sections surveyed contain soils that could support viable citrus groves, provided that proper drainage systems are in place. Most of the sections with soil ratings of 1 or 2 are located towards the north part of the study area, in Hendry and Glades counties.

Three different development scenarios were run to determine their impact on available habitat and on selected species. Under the first development scenario (Dev. 1) all land that has a final feasibility ranking of 1 is converted to citrus. In development scenario 2 (Dev. 2) land ranked 1 or 2 is developed as citrus and in scenario 3 (Dev. 3) land ranked 1 or 2 is developed as citrus and truck crops are added in areas classified as 3.

Most of the land to be converted to citrus is currently range or pasture. Uplands followed by wetlands are the cover types next most vulnerable to citrus development. Most of the current habitat is lost between development scenarios 1 and 2. In addition to loss of habitat another consequence of citrus development will be fragmentation of the remaining habitat patches. It is important to emphasize that these effects on existing habitat conditions (amount and contiguity) are predicted to occur in the absence of any environmental planning and regulation and overestimate the losses of wetlands that will actually occur.

Thirty-five evaluation species were selected to forecast the effects of citrus conversion on wildlife. Evaluation species were selected on the basis of being important ecologically, and/or economically, and representing important habitats or habitat relationships. To focus on particularly important ecological relationships sandhill crane, panther and wading birds were chosen for species modeling.

The status and habitat relationships of the 35 evaluation species (or groups of species) and the probability of species persistence in groves, with and without new design recommendations was based on field observations and expert opinion. With no further design changes, nine of the evaluation species are likely to persist in groves and an additional eight may persist. By making changes in grove and reservoir design 13 of the key species will be likely to persist in a citrus grove and 15 might be able to. The species not likely to persist within a citrus grove are those with very large home ranges (panthers) and/or those that require large intact old growth forested areas (hairy woodpeckers). The single most important feature for grove design is to encourage the incorporation of uplands into the grove landscape whenever possible. Permanent water holes should be created where appropriate to further enhance habitat diversity in agricultural reservoirs.

RECOMMENDATIONS

To be successful, an ecological conservation plan has to be implemented in an arena influenced by economic, legal, social and political factors. Efforts to conserve the ecological integrity of southwest Florida can ill afford the adversarial relationships that too often characterize participants in environmental planning. Mechanisms must be found to compensate (or provide incentives for) landowners asked to forgo intensive development of their land. Only in this manner is it possible to avoid the issue of the taking of property rights, and to change a normally win-lose situation into a win-win one.

1. Forested upland habitats, especially pine flatwoods, must be protected to conserve the ecological integrity of southwest Florida. Protecting uplands not only protects species but also is essential to maintain significant wetland wildlife functions.

2. The foundation for the conservation of fish and wildlife resources with continued citrus development will be a regional landscape that is a mosaic of different intensity land uses.

3. Whenever possible the issue of the taking of property rights should be avoided by providing compensation or incentives to landowners asked to forgo more intensive development of their property.

4. Develop a comprehensive plan for the conservation of ecological resources, with regional policies and measurable goals for the conservation of ecological resources.

5. A system for evaluating the ecological functions of an area should be developed and applied to provide more detailed inventories of predevelopment ecological conditions and to provide a more complete evaluation of the "success" of mitigation.

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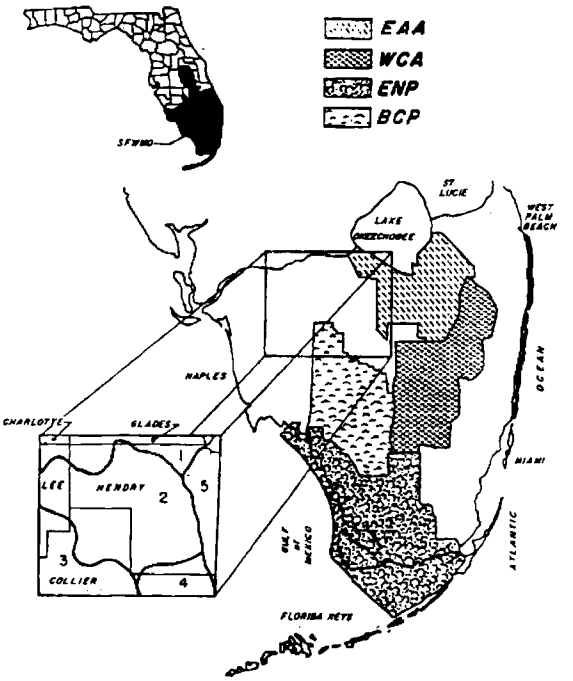

Figure 1: Relationship of study area to neighboring ecological and agricultural areas (EAA-Everglades Agricultural Area, WCA - Water Conservation Areas, ENP - Everglades National Park, BCP - Big Cypress National Preserve) and physiographic regions (1 - Caloosahatchee Valley, 2 - Immokalee Rise, 3 - Southwestern Slope, 4 - Big Cypress Spur, 5 - Everglades, SFWMD - South Florida Water Management District).

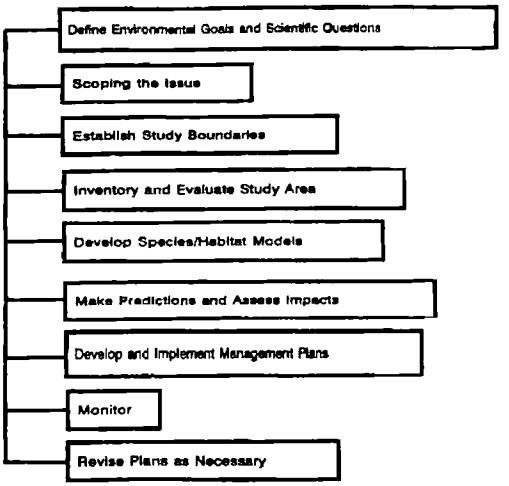

Figure 2: Scientific framework for integrating conservation of ecological integrity with agricultural development

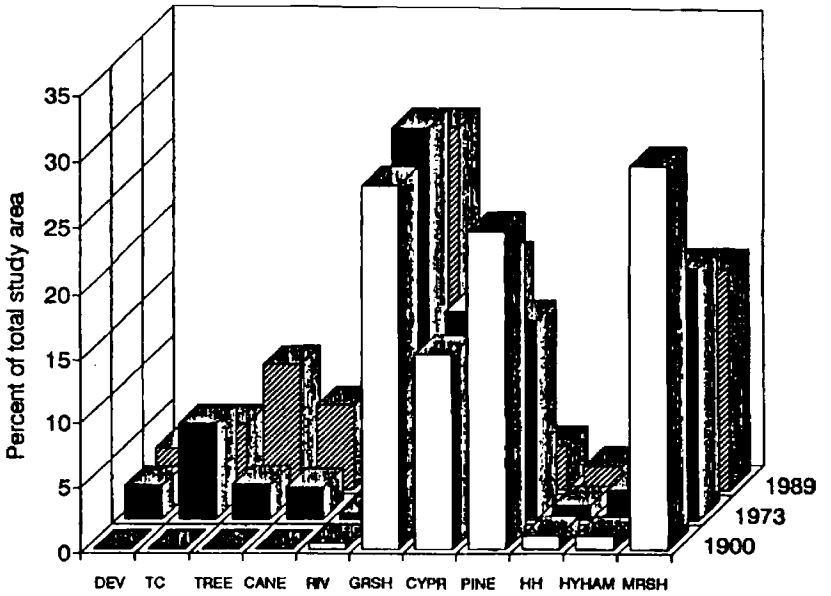

Figure 3: Percent change in selected cover types from 1900 to 1989. DEV - developed areas, TC = truck crop, TREE - tree crop, CANE = sugar cane, RIV - laucustrine and riverine systems, GRSH = grassy shrub, CYPR = cypress, PINE = pineland systems, HH = hardwood hammock, HYHAM = hydric hammock, MRSH = freshwater march systems.

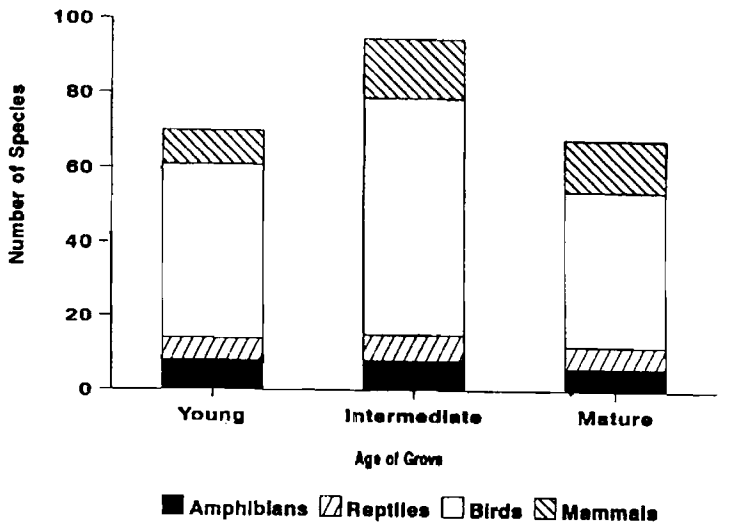

Figure 4: Number of vertebrates observed in different age groves from June 1990 through June 1991.