Establishing Agricultural Partnerships In the Context of Everglades Ecosystem Restoration: An Assessment of Potential Partners in South Florida

An Internal Report for the World Wildlife Fund

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I. Executive Summary

World Wildlife Fund's (WWF) Agriculture and Sustainable Development Initiative (ASDI) has identified collaborative relationships with agricultural partners as an effective strategy for protecting wildlife and wildlands. With a two year grant from the W. K. Kellogg Foundation, the ASDI is working in collaboration with the Everglades Ecoregion Office to identify and establish an agricultural partnership in South Florida. The goal of the partnership is to foster environmentally and economically viable crop production systems, which are compatible with Everglades' ecosystem restoration and protection of Florida's sensitive marine ecosystems. The first step in this process is to conduct an assessment of agricultural enterprises in the region, reviewing their relationship to Everglades' ecosystem restoration issues and determining the potential for partnering with WWF.

The methodology employed for this assessment includes information collection and information synthesis. The information collection approach is based on participatory rural appraisal (PRA)—a method that enables the rapid collection and analysis of ecological, economic, and social information for use in project design and execution. This involved the review of websites and published materials as well as eight site visits and numerous meetings and telephone and email correspondence with key stakeholders and contacts. The information synthesis approach is based on a qualitative weight and sum (QWS) evaluation technique that pulls together information pertaining to the merit or value of project dimensions. It is used in this context to choose amongst several different potential agricultural partners so as to be explicit and transparent about the underlying values fueling the decision-making process.

In order to assess the merits of potential agricultural partners, WWF developed a set of nine criteria that reflect the critical factors important for a successful partnership between WWF and agricultural interests. These criteria reflect the lessons learned from WWF's collaboration with the Wisconsin Potato and Vegetable Growers Association (WPVGA) over the course of the five-year WWF/WPVGA/UW collaboration. These nine criteria are: 1) compatibility with ecosystem restoration, 2) common ground, 3) industry leadership, 4) better management practices (BMPs), 5) opportunities to improve financial performance, 6) environmental regulations, 7) communication infrastructure, 8) resources, and 9) WWF priority.

Five agricultural commodities/regions were selected for review, including a variety of cropping systems in Miami-Dade County, sugar grown in the Everglades Agricultural Area (EAA), cattle ranching and dairy production North of Lake Okeechobee and citrus grown in the Indian River area. These commodities/regions were selected because of their direct inter-relationship with the Everglades' ecosystem. The exception to this is citrus, which was selected because of its impact on an associated sensitive marine ecosystem. These five commodities/regions are assessed according to the nine selected criteria. The criteria are weighted as to their importance or value and measures are developed to provide a transparent method for scoring.

This assessment is ultimately an iterative process that continues as new information about agricultural communities and practices emerges and as WWF's experience helps to further refine the parameters of successful partnerships. The outcome of the assessment at this juncture is the identification of citrus and cattle ranching as the most viable partners for WWF. Sugar and Miami-Dade County agriculture were not selected because they failed one or more criteria. Specifically, sugar production is not compatible with restoration of the Everglades ecosystem. Furthermore, there is limited common ground between WWF and sugar producers. Similarly there is not sufficient common ground between WWF and Miami-Dade County agriculture. This agricultural production region was also identified as having fractured industry leadership. While dairy did not fail any criterion, it did not score as highly as cow/calf and citrus.

This assessment indicates that given staff's enthusiasm for working North of Lake Okeechobee, WWF should begin exploring the potential of developing a partnership with cattle ranchers. Cattle ranches have the added advantage of being able to provide an important source of wildlife habitat, a subject not included in this assessment but of obvious value to WWF. This recommendation does not negate the very real potential that at a future date, WWF could engage in a viable partnership with Florida citrus growers.

The remainder of this document describes: 1) an overview of Everglades' ecosystem restoration history and issues, 2) the methodology employed for assessing potential agricultural partners, 3) the major agricultural industries in South Florida and their relationship to Everglades' restoration issues, 4) an assessment of each potential partner, and 5) suggested next steps.

II. Overview of Everglades' Ecosystem Restoration History and Issues

South Florida's Everglades ecosystem encompasses 18,000-square miles of subtropical uplands, wetlands and coral reefs. It stretches from the Chain of Lakes south of Orlando and continues through to the reefs southwest of the Florida Keys. At one time, the Everglades were considered one of the largest wetlands in the continental U.S. and were part of the Kissimmee-Okeechobee-Everglades watershed that extended for more than half the length of the Florida peninsula. These wetlands and the entire watershed provided the freshwater that sustained the high productivity and abundant fisheries of the coastal waters (McPherson and Halley 1996).

Prior to the latter part of the 1800s, the system was connected hydrologically. South of Orlando, almost everything was a low-lying, seasonally flooded wetland, stretching 60 miles wide and 300 miles long. The flow of water began with the Kissimmee River, which moved in a meandering fashion into Lake Okeechobee, the second largest freshwater lake located wholly within the contiguous U.S. The Lake was shallow and when water levels rose, would slowly breach its bank, spilling into wide floodplains full of saw grass. Thus began what Marjorie Stoneman Douglas called the "River of Grass," a slow southward flow of water to the ocean.

Wet and dry seasons define the Everglades ecosystem. All plant and animals species that live in the Everglades tolerate, and in some cases require, seasonal hydro-periods. Saw grass seeds, for example, germinate on dry ground even though the plants themselves survive under flooded conditions. The endangered Cape Sable Seaside sparrow requires both the right amount and timing of water in order to be able to nest and reproduce.

The Everglades is now considered to be one of the most threatened ecosystems in the U.S. The Everglades has lost 90 percent of its wading bird populations. There are 69 species on the federal endangered or threatened list. Biscayne and Florida Bays have experienced serious declines in commercial fisheries. Living coral reefs have been reduced by 19 percent. Groundwater is threatened by saltwater intrusion and other pollutants (Light and Dineen 1994). And, ironically, given that Florida receives an average of more than 55 inches of rainfall a year, some predict that South Florida may soon run out of water for its residents (Levin 2001).

Why is the ecosystem imperiled? Engineered flood control and water distribution systems for agriculture and urban development have resulted in massive disruptions in the natural hydrology. Construction of water control structures began over 100 years ago as developers initiated early efforts to "reclaim" Everglades' swampland. Successive hurricanes and droughts plagued the region and fueled the demand for flood control. A 1928 hurricane caused Lake Okeechobee to overflow its banks, drowning roughly 2,400 people. In 1947, as much as 90 percent of South Florida was under water (South Florida Ecosystem Restoration Task Force 2000).

In 1948, Congress authorized the Central & Southern Florida (C&SF) Project to be jointly managed by the U.S. Army Corps of Engineers (ACE) and the South Florida Water Management District (SFWMD). The goal of the C&SF project was to provide flood control for urban populations and agricultural lands and to ensure a water supply for Everglades National Park (ENP), a federally-protected wilderness area created in 1939. The C&SF Project achieved the first two goals by building and successfully diverting water through 1,800 miles of canals and levees and 200 water control structures. On average, the C&SF system now diverts 1.7 billion gallons of freshwater per day into the ocean and gulf. Upon completion of the project, half of the original Everglades were drained thus allowing for expansion of agriculture south of Lake Okeechobee (now known as the Everglades Agricultural Area) and growth of cities on the lower east coast (South Florida Ecosystem Restoration Task Force 2000).

The latter goal—ensuring adequate water to ENP—was never achieved by the C&SF Projectand, with the population of South Florida today over two times greater than that which the Corps originally intended to serve, it is virtually impossible for the Project to protect ENP without large scale modifications. The Comprehensive Everglades Protection Plan (CERP), a $7.8 billion, 38-year restoration program signed into law in 2000, is intended to restore the hydrology of much of the remaining Everglades ecosystem. The CERP is the largest ecological restoration project in history and consists of 68 separate components, each of which is a massive engineering project that together

will restore the flow of water back into the Everglades, while reducing the dependence of human users on the natural system for water supply. WWF staff has worked to ensure that CERP is developed and implemented appropriately, while recognizing that many of the battles over water quality, timing and distribution will be fought during the 30-year CERP implementation time frame.

III. Project Goal

It is in this complex, highly-charged scientific and political context that WWF proposes to work with an agricultural partner in South Florida. The purpose of this assessment is to identify potential partners—an agricultural commodity or group of agricultural interests—that WWF could work with to identify and work toward implementing food production systems that are compatible with Everglades ecosystem restoration.

IV. Methodology

The methodology employed for this assessment of agricultural enterprises includes two components: 1) information collection, and 2) information synthesis.

A. Information Collection

The information collection component of the feasibility assessment is based on participatory rural appraisal (PRA)—an approach that enables the rapid collection and analysis of ecological, economic, and social information for use in project design, execution, and evaluation. This approach was pioneered by Gordon Conway, current president of the Rockefeller Foundation, and other sustainable development practitioners as an alternative to traditional social science methods (e.g. extensive surveys, formal focus groups, etc.) when time and financial resources are limited (Conway 1990; Dlott et al. 1994). PRA typically includes the review of published materials, interviews with key contacts, site visits, and meetings with key stakeholders.

Information collection involved the review of websites and published materials as well as site visits, numerous meetings, and telephone and email correspondence with key stakeholders and contacts. Refer to Appendix A for a detailed accounting of meetings and site visits. The Project Consultant, Jennifer Curtis, participated in eight monthly site visits to select locations in South Florida. On several occasions, Jennifer was joined by one or more WWF colleagues, including Sarah Lynch, Project Manager, and staff in the Fort Lauderdale and Florida Keys ecoregion offices (Shannon Estenoz, Debbie Harrison, and David Bogardus).

The focus of this information gathering process was to:

1. Identify ecologically and economically important agricultural enterprises in south Florida;
2. Determine the relationship between agricultural operations and practices to water quality, timing and distribution issues;

3. Assess the potential compatibility of agricultural enterprises in a restored Everglades ecosystem;
4. Determine the availability of crop-specific better management practices (BMPs) that help address key water quality, timing and distribution concerns;
5. Understand the regulatory context for agriculture's relationship to Everglades ecosystem restoration issues;
6. Identify potential incentives to encourage BMP adoption;
7. Gauge areas of common ground between WWF and potential agricultural partners; and
8. Elicit the leadership and communication strengths and weaknesses of select agricultural enterprises.

B. Information Synthesis

The information synthesis approach developed for this assessment is based on a qualitative weight and sum (QWS) technique developed by Michael Scriven, Professor at Claremont Graduate University. QWS is used when it is necessary to pull together information pertaining to the merit or value of multiple aspects of a project. It is designed as a process for drawing conclusions based on numerous qualitative dimensions. QWS is helpful for determining the merit of an overall package, as opposed to looking solely at individual components. And it is helpful for choosing amongst several different potential projects (Scriven and Davidson 2002).

QWS was selected as an approach in order to be explicit and transparent about the values fueling WWF's assessment and the decision-making process. Furthermore, it provides a mechanism for identifying the likely strengths and weaknesses of potential partnerships, thereby helping to pinpoint areas that will need attention and focus.

QWS requires the identification and clear articulation of:

1. Criteria

Criteria are dimensions of merit. WWF staff and consultants selected criteria to reflect critical factors important for a successful partnership between WWF and agricultural interests. These criteria reflect the lessons learned from WWF's five-year partnership with the Wisconsin Potato and Vegetable Growers Association and are adapted for application in South Florida. The relevant question in this case is what factors contribute to the development and maintenance of agricultural partnerships designed to foster changes in production practices to address Everglades ecosystem concerns? Another way to say this is: given limited time and resources for developing trust, what criteria can be used to assess the potential for selected partnerships to be initiated and maintained? And what criteria can be used to measure the likelihood that growers can and will change their production practices? The nine critical criteria used in this assessment are listed below and described in greater detail in Appendix B.

- **Compatibility with Ecosystem Restoration**—agricultural production systems that can withstand or adapt to changes in water levels and flow regimes and that can ameliorate water quality impacts.
- **Common Ground**—a shared responsibility and vision for the need to change farming operations to achieve ecological and economic viability.
- **Industry Leadership**—strong leaders that mobilize others to change.
- **Availability of Better Management Practices (BMPs)**—practices that ameliorate water quality, timing and distribution problems.
- **Opportunities to Improve Financial Performance**—programs or practices that reduce costs, increase quality or yields, and/or open up access to new markets.
- **Environmental Regulations**—laws or regulations that force or encourage changes in practices and/or achievement of specific water quality, timing or distribution goals.
- **Communication Infrastructure—**system of communication and information-sharing within the industry.
- **Resources—**public and private sources of funding to support project implementation and management.
- **WWF Priority**—an area or commodity of importance to the Agriculture and Sustainable Development Initiative (ASDI).

2. Weights and Ratings

Each criterion is weighted according to its importance or value. The symbols and meanings of these weights are listed in Table 1.

Table 1: Weighting Symbols and Meaning

Weighting Symbol	Meaning
*	Critical
#	Important
~	Desirable

Table 2 displays the five commodities/agricultural areas evaluated in this assessment along with the nine criteria and their weights.

Table 2: Criteria and Weights

		Commodities/Agricultural Areas

Criteria	Weight	Sugar	Dade County	Citrus	Cow-Calf	Dairy
Compatibility with Ecosystem Restoration	*					
Common Ground	*					
Industry Leadership	*					
Availability of BMPs	#					
Opportunities for Financial Improvement	#					
Environmental Regulations	~					
Communication Infrastructure	~					
Resources	#					
WWF ASDI Priority	*					
Total						
*						
#						
~						

Potential agricultural partners are then rated or scored according to each of the criterion. The symbols used for different ratings are listed in Table 3. A partner that fails any one of the criterion is not considered. Failure designations thus act as the minimum level or "floor" for performance.

Table 3: Rating Scores and Meaning

Rating Symbol	Meaning
*	High
#	Moderate
~	Low
?	Not enough information to evaluate
-F-	FAIL

3. Measures

Measures describe the level of performance for each rating. For example, the following measure would constitute a high score for the availability of BMPs: commercially-tested, off-the-shelf techniques, evaluated by a reputable scientific organization that are already being used by at least one grower.

A rating cannot exceed the value of its weight. For example, a criterion weighted as important (#) cannot receive a rating greater than important (#).

The measures for each rating are described in Table 4.

Table 4: Description of Measures

Criteria	Rating	Measure
Compatibility with Ecosystem Restoration	*	Potential to adapt to necessary changes in water flow, levels and quality; most preferred land use.
	#	Potential to adapt to necessary changes in water flow, levels and quality; not preferred land use.
	~	Cannot adapt to all necessary changes in water flow, levels and quality; not preferred land use.
	F	Cannot adapt to changes in water flow and levels or address water quality concerns; not preferred land use.
Common Ground	*	Accepts partial responsibility for ecosystem problems; willing to change practices; committed to viable agriculture (ag) in region.
	#	Acknowledges problems; see need to make changes; committed to viable agriculture in region.
	~	Acknowledges problems; not sure about making changes; committed to viable ag. in region.
	F	Does not acknowledge problems or need to change; may or may not be committed to ag. in region.
Industry Leadership	*	Grower association with progressive leader and vision for environmental stewardship; interest within research community.
	#	One or more influential growers with vision for environmental stewardship; interest in research community.
	~	One or more growers with an open attitude.
	F	No growers or buyers with a vision.
Financial Performance	*	Three of: a) BMPs improve bottom-line, b) market incentives possible, c) increased research is benefit.
	#	Two of: a) BMPs improve bottom-line, b) market incentives possible, c) increased research is benefit.
	~	One of the above.

(continued next page)

Criteria	Rating	Measure
Better Management Practices	*	Three to four of a) BMPs improve bottom-line, b) tested by reputable organization, c) off-the-shelf, d) evaluated on commercial scale.
	#	Two of above.
	~	One of above.
	F	No BMPs exist.
Environmental Regulations	*	Regulation(s) mandate specific changes in practices or achievement of specific environmental goal.
	#	Regulation(s) encourage changes or achievement of goal; threat of regulation exists.
	~	No environmental regulations/lawsuits exist or are pending.
Communication Infrastructure	*	Well-funded commodity association exists; regular publications and meetings; well connected to university and/or buyer.
	#	Commodity association or other organization exists; some publications and meetings; loosely connected to university and/or buyer.
	~	No commodity association; no other types of on-going communication.
Resources	*	Potential for three to four of following: public grants, private grants, cost-share assistance, in-kind from partners.
	#	Potential for one to two of following: public grants, private grants, cost-share assistance, in-kind from partners.
	~	None of above available.
WWF Priority	*	Eco-region staff focus on region and/or crop; priority of Agriculture and Sustainable Development Initiative (ASDI).
	#	Priority of ASDI.
	~	None of the above.

Each potential agricultural partner is rated according to the nine criteria. Partners that receive a failure mark for any criterion are automatically not considered. The next step is to eliminate ratings for desirable, but not critical, criteria. In addition, criteria are eliminated for which there is insufficient information to assess. For the remaining partners and criterion, the number of high, moderate and low scoresare summed. Each potential partner then has a total of three scores for the remaining criteria. This enables a close examination of a relatively few number of partners according to the most important criteria.

V. Results

Florida is the nation's ninth-ranked agricultural state and is home to 40,000 commercial farmers. One-third of the state's total land area, or approximately 10 million of Florida's 30 million acres, is used for agricultural production. Florida leads the country in production of at least 20 commodities: oranges, sugarcane, fresh tomatoes, grapefruit, bell peppers, sweet corn, cut ferns, fresh cucumbers, fresh snap beans, tangerines, tropical fish, temple oranges, fresh squash, radishes, gladioli, tangelo, eggplant, escarole/endive, watermelons and house plants and foliage. Florida produces 20 percent of the nation's vegetables. Sales of agricultural products in 1998 were over $6.6 billion (Florida Department of Agriculture and Consumer Services 2000).

Five agricultural commodities or regions are reviewed in this report, including Miami-Dade County, sugar, cow/calf, dairy and citrus. These commodities or regions were selected because of their direct inter-relationship with the Everglades ecosystem. The exception to this is citrus produced in the Indian River Lagoon and Saint Lucie River watersheds. This crop was evaluated because of its impact on an associated sensitive marine ecosystem. The section below does the following: 1) profiles key commodities, 2) describes the connection between agricultural production and the Everglades ecosystem, and 3) assesses each commodity or region according to the nine criteria discussed above. Summaries of the QWS assessment are provided in Tables 6, 7, and 8 in Section VI.

Miami-Dade County Agriculture

1. Commodities Profile

Miami-Dade County comprises over 2.2 million acres, with a little over 60 percent designated as protected areas, including federal, state and local preserves, water conservation areas and parks. Agriculture accounts for a little over seven percent of the total land area and close to 20 percent of the non-protected lands (Degner et al. 2002). Agricultural production is bordered on the west by the Everglades National Park and on the East by Biscayne National Park. There are over 2.2 million permanent residents in Miami-Dade County. The county's population has increased over 16 percent in the last 10 years and there is tremendous pressure to develop southern agricultural parts of the county (Degner et al. 2002).

Agriculture in Miami-Dade county is extremely diverse. Winter "row" or vegetable production accounts for close to 42 percent of total land in agricultural production, with 10 species of particular commercial importance, including snap beans, tomatoes, potatoes, squash, and sweetcorn. Tropical fruit trees account for 16 percent of total agricultural lands, with 10 species dominating commercial production, including avocadoes, mangos, and lychee. Nursery plants, including those grown in the field and in containers, account for 12 percent of total land in production. Hundreds of nursery crop species are of commercial importance. The remaining agricultural land is either used for animal agriculture, particularly horses, or has been taken out of production (Degner et al. 2002).

Farm size in Dade County is quite disparate, with many small farms and a few very large farms. For example, close to 60 percent of the farms are less than ten acres and another 28 percent are less than 50 acres. When combined, farms less than 50 acres represent 87 percent of the farming operations but only 14 percent of the total acreage farmed. Nineteen farms, just one percent of the farm operations, consume 33 percent of the total land in production (Degner et al. 2002). Information about land ownership, including the amount of land that farmers lease was not readily available. It is generally understood that there is considerable foreign ownership in Miami-Dade county.

The numerous smaller farms in Miami-Dade County are generally viewed as lacking the scale of production to be low cost and highly competitive. Indeed, a full 49 percent of farms in Dade county average gross sales less than $10,000. Forty-seven percent of Miami-Dade farmers report having other primary sources of income (Degner et al. 2002). As a generalization, at least half of farmers in Dade county can be considered "hobby" farms.

2. Ecosystem Restoration Issues

Miami-Dade agriculture is directly adjacent to the Everglades National Park and not far from Biscayne and Florida Bays, both sensitive marine ecosystems. Over the next several years, implementation of CERP and other projects (i.e., Modified Water Deliveries Project, the C-111 Project, and the Experimental Program of Water Deliveries to ENP), are intended to modify the current water control system to encourage the natural hydro-periods once found in the Everglades. These changes are likely to have a significant impact on agricultural production in Miami-Dade County.

It is anticipated that water tables will rise in some agricultural areas, particularly in the southern part of the County. The groundwater aquifer beneath Miami-Dade County is between 0 and 4 feet thus the water level does not need to rise very high for it to effect crops. Soils are predominantly porous limestone and rocks can comprise as much as 75 percent of the soil content (Yuncong Li 2001). Higher water tables increase the frequency and duration of crop flooding. Crop flooding is a major risk to many crops because it increases the severity of diseases, induces nitrogen deficiencies and creates hormone imbalances (Rao and Li 2001).

3. Miami-Dade Agriculture Assessment

i. Compatibility with Ecosystem Restoration

To date, there has not been an assessment of which crops in which locations are likely to be effected by structural and operational changes to the existing water control system. A recent University of Florida report, *Miami-Dade Agricultural Land Retention Study*, suggests that 59 percent of the fruit groves, 50 percent of the container nurseries, 93 percent of the field nurseries, and 85 percent of the vegetable crop acreage are within the 100 year flood zone (Degner et al. 2002). This kind of statistic for South Florida provides limited insight into how regular seasonal and managed fluctuations in water tables will affect agriculture.

In the late 1990s, the University of Florida attempted to model the impact of changes in the C-111 drainage district and found that there was no way to model this future scenario without information on how the system would actually be operated at the management level (Graham 1997). While the design of impending infrastructure changes can be described, no one can predict how the new water control system will actually be implemented. In other words, will the SFWMD, when push comes to shove, favor water tables conducive to Everglades restoration or to flood protection or water supplies for agriculture and urban constituents? Without an understanding of the underlying operational procedures, it is impossible to model or predict the likely impact infrastructure changes (Graham, 1997).

Furthermore, topographical data are not yet available at a meaningful scale to be able to determine what will happen to individual parcels. Without this information, it is very difficult to determine what kind of agriculture will likely be able to compatible with restoration of the Everglades.

Information about crop tolerance to flooding provides some insight into the compatibility of agriculture with higher water tables. The following table provides a definition of low, moderate and high tolerance to flooding:

Table 5: Flood Tolerance Definitions and Example Crops (Garafolao et. al. 2002)

Level of Tolerance	Meaning	Example Crops
Low	Plants are not tolerant of flooded or wet soil conditions and may sustain heavy damage or be killed from one or more days of wet soil conditions. In addition, root disease may develop resulting in plant damage or death.	▪ Most nursery Ccops ▪ Vegetable crops ▪ Avocado
Moderate	Plants can survive several days of excessively wet or flooded soil conditions. However, the stress of wet conditions may reduce plant growth and root disease may develop.	▪ Mango ▪ Field-grown palm trees
	Plants can survive excessively high water	▪ Coconut

High	tables and flooded conditions for several days to a few weeks. Again, wet conditions may reduce plant growth and/or contribute to infection.	▪ Guava

Vegetable crops, except for taro root and watercress, are considered to have no tolerance for flooding (O'Hair et. al. 2002). Fruit crops have varying tolerance levels. Avocado, which comprises close to 50 percent of the fruit groves in Miami-Dade County, has a low tolerance to flooding. Mango, which comprises 12 percent of the fruit groves in the County has a moderate tolerance to flooding. Coconut and guava are the only fruits that have a high tolerance to flooding. A variety of research trials are underway to improve the flood tolerance and reduce the damage caused by flooding within different crops. For example, there are trials underway to test the viability of grafting the tropical fruit Anona, which is very flood sensitive, to Pond Apple rootstock, which has a high flood tolerance (Schaefer 2001).

Crop flood tolerance information suggests that if there are significant changes in the amount and duration of flooding in agricultural areas of Miami-Dade County, that more than half of existing agricultural acreage, principally vegetable crops, avocado, and many nursery crops would not be able to adapt. While most of Miami-Dade County is at or close to sea level, there is the potential that some flood-sensitive crops could be moved to higher ground. This would most likely be possible for vegetable and container nursery crops.

There are concerns about water quality associated with crop production in Miami-Dade County. With very porous soils and a water table close to the surface, it is highly likely that agricultural chemicals are leaching into ground water. The agricultural chemicals of concern are phosphorus, nitrate, insecticides and herbicides (Graham 1997). Little is understood, however, about the flow of water.

ii. Common Ground

Two of the important and distinct types of agricultural producers in Miami-Dade County are the small hobby farmers and the larger landholders. Unfortunately, there are serious divisions between these two types of producers.

Hobby farmers are typically tropical fruit growers who generate a significant portion of their income off-the-farm. Some have just a few trees in their yard, which they harvest and sell to area markets. For others, their farm is a second career or retirement venture that is run as a business. Hobby farmers are perceived as interested in maintaining their lifestyle in a rural setting. They want to save agricultural areas in the face of immense population growth and urbanization pressure. WWF shares these latter concerns and supports efforts to preserve farmland and reduce sprawl in Miami-Dade County.

However, many other larger farmers, principally the fewer than 20 vegetable farmers in the County who control more than 30 percent of the acreage, are opposed to farmland

preservation efforts. The future outlook for vegetable production in Miami-Dade County is weak due to competition from foreign producers and the impact of NAFTA. In addition, these farmers no doubt anticipate that vegetable production will be impeded by Everglades restoration efforts and that, at the very least, growth pressures will spur the conversion of farm land to development. Thus, for these farmers, improving bottom line profits is the primary concern, not preserving farmland. Furthermore, many of these farmers are perceived to be in significant debt and local bankers who own the mortgages on these lands are fueling land speculation frenzy because they stand to benefit (Dlott and Lynch 1999).

This kind of a polarized situation within the agricultural community makes it very difficult to determine who WWF would establish a partnership with. A partnership with hobby farmers focused on farmland preservation is one option but it is unlikely to be successful because of the powerful political influence of conventional farmers and lending institutions. Furthermore, it is important to point out that that the American Farmland Trust (AFT), the nation's premier farmland preservation organization, opened an office in Miami-Dade County in 1997 and closed it within two years due to the lack of support within the agricultural community for farmland preservation. Furthermore, AFT found that when they aligned themselves with one type of farmer, they were vilified by the other (Craig Evans 2001).

In addition, the farm community generally disagrees with WWF that restoration of the Everglades will change their reality. Throughout the history of water management in this County, farmers have been able to overtly and covertly control water management decision-making. So called "normal" water levels have been slowly but steadily ratcheted down and farmers have adapted to ever increasing amounts of flood control security. This demonstrates how the impact of "re-plumbing" on agriculture depends entirely on how water managers decide to operate water control structures on a day-to-day basis.

Given this history, farmers predict, and potentially rightly so, that they will be able to ensure adequate flood protection despite hydrologic changes mandated by ecosystem restoration concerns. Thus, a productive partnership and dialogue with the farm community about adapting to hydrologic changes is not likely at this time.

iii. Industry Leadership

For many of the reasons articulated in the above section, it is difficult to identify agricultural leaders who share WWF's interest in sustaining economically and ecologically viable agriculture in the context of Everglades restoration. This is not to say, however, that WWF could not initiate another type of project in which the purpose was to engage in a long-term dialogue with agricultural producers and cultivate growers with an open attitude.

iv. Availability of BMPs

There is considerable work underway to develop and refine BMPs to address changes in water timing, distribution and quality. For example, researchers at the Tropical Research and Education Center have identified and are evaluating, nursery crops that can be grown organically in extremely wet conditions in the Frog Pond, a farming area directly adjacent to the ENP that is flooded a significant portion of the year (Jorge Pena 2001). These production systems are a few years away from being adopted on a commercial scale.

Research is underway to perfect grafting techniques to improve the flood tolerance of certain fruit trees (Shaefer 2001). Again, new stock is a few years away from being available commercially.

Work is underway to refine and help growers adopt methods for determining how much water and nutrients their crops need prior to fertilizer applications and irrigation events. Currently, growers use qualitative observations to determine a crop's irrigation and nutrient needs. This reduces the efficiency of water and fertilizer use and invariably leads to unnecessary leaching of contaminants (Yuncong Li 2001). Because of their focus on improving efficiency, it is likely that, if adopted, these latter BMPs could reduce grower costs. Some of these techniques are already being used by growers and are being evaluated on a commercial scale.

v. Opportunities for Improving Financial Performance

Some of the BMPs being evaluated are likely to enhance the financial performance of growers' operations. Market-based incentives could be potentially developed for all of the crops grown in Miami-Dade County. Research directed toward greater water and fertilizer use efficiency is perceived as a benefit to growers.

vi. Environmental Regulations

There are a number of programs forcing changes in water distribution, timing and quality in Miami-Dade County. Of particular importance are the Modified Water Deliveries Project, the C-111 Project, and the Experimental Program of Water Deliveries to ENP.

vii. Communication Infrastructure

This aspect of Miami-Dade County agriculture was not thoroughly evaluated. It can be said that given the fractious nature of the agricultural community in Miami-Dade County, it is not considered particularly well organized (Degner et al. 2002). The Dade County Farm Bureau, for example, is largely controlled by a relatively small number of individuals, namely 17+ vegetable growers and two local bankers. The Farm Bureau continues to present itself as the "voice of agriculture" in Dade County when publicly expressing its political opinions. And for the most part, the ornamental horticulture and exotic tree fruit and specialty crop growers have not significantly challenged that voice publicly (Dlott and Lynch 1997).

viii. Resources

This aspect of Miami-Dade County agriculture was not evaluated.

B. Sugar

1. Commodity Profile

Florida is the country's leading producer of sugar, ahead of Louisiana, Hawaii and Texas. In Florida, sugarcane is produced in the Everglades Agricultural Area (EAA), an area of approximately 700,000 acres bordered on the North by Lake Okeechobee and to the south and east by Water Conservation Areas. It includes four counties—Glades, Hendry, Martin and Palm Beach. (Insert picture).

Sugar production became the dominant crop produced in the EAA following Castro's rise to power in Cuba in the late 1950s. In the past 40 plus years, sugarcane production in the EAA increased over 10-fold. There have been as many as nine working sugarcane mills in the EAA and seven are still in operation today (Synder and Davidson 1994).

In 1998, sugar was grown on 447,000 acres. Close to 18 million tons of sugar and 109 million gallons of molasses were produced. Florida's sugar crop is valued at over $472 million, which is 53 percent of the value of the total U.S. sugar crop (Florida Department of Agriculture and Consumer Services 1998).

Sugar is produced by three principal companies. The largest is Florida Crystals, owned by the Fanjul brothers, which produces sugar on 180,000 acres. Florida Crystals grows and harvests rice every three years as a rotation crop with sugar. They also produce rice organically on 4,000 acres (Florida Crystals 2002). The U.S. Sugar Corporation produces 800,000 tons of raw sugar on 165,000 acres. They also produce citrus south of Lake Okeechobee on 29,000 acres, which represents the largest grove under single management in Florida. Sugar is also produced by the Sugar Cane Growers Cooperative of Florida, a grower cooperative. However information about this company was not readily available.

2. Ecosystem Restoration Issues

The EAA occupies what was once a soggy pond apple forest that opened into a vast and impenetrable sawgrass prairie. The ecological purpose of this area was to store water, and to slow it down enough to begin its wide and shallow flow south into the central Everglades. Water levels fluctuated naturally with the wet and dry seasons, sinking to six inches and rising as high as two feet. With the building of the comprehensive flood control project in the 1950s, the area was drained for agricultural production and this critical storage function was lost (Estenoz 2000).

Sugar production required further drainage and today water levels are almost always drawn down well below the ground surface to protect inundation of the root zone. Management of water distribution and timing by the South Florida Water Management District for sugar is so comprehensive and effective that sugar production is unaffected by dramatic fluctuations in rainfall and drought conditions. Water is diverted by the District to Lake Okeechobee, the central Everglades and coastal estuaries, where it can cause severe ecological consequences (Estenoz 2000).

Sugar production also requires the application of phosphorous. The Everglades ecosystem is a phosphorous-limited system. Higher than normal phosphorous levels creates drastic changes in the plant and animal communities. Normal historical "background" levels of phosphorous in a healthy Everglades are estimated to have been ten parts per billion or less. Sugarcane runoff can have phosphorous in the hundreds of parts per billion. This is why just south of the EAA, cattails have replaced native sawgrass and the impact on micro-organisms has disrupted the entire food chain (Estenoz 2000).

Lastly, sugarcane production has exacerbated the rate of soil subsidence. The "muck" soils which characterize the EAA are extremely high in organic matter. Historically, under flooded conditions, these soils removed nutrients from the water. Now that they are drained and cultivated, the organic matter breaks down when exposed to oxygen. In 1912, 95 percent of the soils in EAA were greater than five feet. In the early 1990s, it was predicted that 45 percent of the soil would be less than one foot by 2000 (Snyder and Davidson 1994). A more recent assessment of subsidence rates shows that they have decline somewhat. Between 1978 and 1997, soils in the EAA were found to subside at a rate of 1.47 cm per year, which is close to 28 cm or one foot during that nineteen year period (Snyder 2002).

3. Sugar Assessment

i. Compatibility with Ecosystem Restoration

From an ecosytem restoration perspective, it would be ideal to maximize the amount of land in the EAA to be taken out of production and restored to wetland function that provides for water storage and filtration for downstream users, including the remainder of the Everglades. Currently, the CERP plan takes only 60,000 acres within the EAA out of production for use as reservoirs to aid the restoration effort. The debate over how much, if any, more land should be converted from agriculture to wetland continues even within the context of CERP, because the CERP is a conceptual restoration plan and could be legally changed in the future if the politics or economics of sugar cultivation in the EAA change. No matter how this debate is resolved in the end, there is little chance that agriculture in the EAA will disappear entirely, and that which remains must, if it is to be ecologically sustainable: 1) adapt to changes in water levels that are necessary to restore Lake Okeechobee's health, 2) preferably act as a net exporter, and certainly not an importer, of phosphorous and other potentially damaging nutrients, pesticides and other inputs, and 3) be compatible with wet summers and dry winters.

While there may be sugarcane production systems that can be developed to adapt to these conditions, the current system of production cannot be considered compatible with Everglades ecosystem restoration. In addition to its dramatic ecological consequences, current sugar production systems in the EAA are not profitable without a massive public subsidy. This subsidy includes a flood control system (C&SF Project) and federal sugar price support program, which sets the U.S. sugar price at close to twice the world price. According to Shannon Estenoz, Director of WWF's Everglades Program,

> *The sugar program is not compatible with restoration because it distorts the economics of growing sugar in the EAA by artificially inflating land values, and creating the public impression that growing sugar on these lands is of greater "value" than using it for water storage, which without the program, simply may not be true.*

ii. Common Ground

It is difficult, if not impossible, for WWF to develop common ground with the sugar industry given that the two parties completely disagree about how the EAA should function. In addition, compared to WWF, the sugar industry is extremely powerful and well-connected politically, at both the state and federal levels. A trusting partnership would be difficult to form in the context of this power imbalance.

iii. Industry Leadership

The leadership potential of the sugar industry was not evaluated in-depth. It should be noted, however, that the sugar industry has demonstrated leadership in addressing at least some environmental concerns. For example, Florida Crystals now produces certified organic sugar and rice. Both Florida Crystals and U.S. Sugar produce all of their electrical needs using a co-generation facility to burn sugarcane waste. Excess electricity is sold into the public electric grid.

iv. Availability of Better Management Practices (BMPs)

Ecologically sustainable crop production in the EAA needs to be compatible with wet summers and dry winters and to thrive in low-phosphorous conditions. Researchers with the University of Florida have conducted preliminary investigations of selected food and fiber crops to determine their adaptability to flooded-conditions. A number of crops, including water chestnuts, water celery, taro root, rice, aquatic perennial grasses and different sugarcane cultivars showed great potential. While there are relatively small markets for some of these crops (e.g., water chestnut, water celery, taro, etc…), others warrant more in-depth investigation (Porter 1991).

v. Opportunities to Improve Financial Performance

This criterion was not evaluated.

vi. Environmental Regulations

This criterion was not evaluated.

vii. Communication Infrastructure

This criterion was not evaluated.

viii. Resources

This criterion was not evaluated.

ix. WWF Priority

Sugarcane is a priority crop of the Agriculture and Sustainable Development Initiative.

C. Cow/Calf

1. Commodity Profile

Close to half of Florida's 40,000 commercial farmers are cattle ranchers. In 1998, 90 percent of agricultural land or 9 million acres was used for cattle ranching, either as pasture, forage production or grazed rangeland (Swisher et al 2000).

In 1999, Florida was ranked as the 11th largest producer of beef cattle in the U.S, with approximately one million head of cattle. Ranch size varies. In the northern part of the state, ranches and herd size are typically small. In the southern part of the state, ranch and herd size are typically larger (Swisher et al 2000). The number of acres used to manage herds ranges from 10 to over 600 acres. Herd sizes in Florida range from less than 10 to as many as 35,000 cows. The average herd size per producer is 55. Close to 40 percent of the herds are between 100 and 1,000 cows (Aerts and Neisham 2000).

There are approximately 18,000 cattlemen in Florida. Cattle are produced in every county in the state but production is concentrated in the rolling grasslands of the Kissimmee River Basin, north of Lake Okeechobee. The top counties are, in order of the number of cattle produced in 1999: 1) Okeechobee (118,000 cows), 2) Highlands (105,500 cows), 3) Hendry (97,000 cows), 4) Osceola (96,000 cows) and 5) Polk (90,800 cows) (FDACS 2000).

Florida ranchers run calf/cow operations. This means that calves are raised until weaning (approximately 400-500 pounds), at which point they are sold to cattle ranchers in the Plains area. Over 85 percent of the cows are sold to four states: Texas, Oklahoma, Kansas, and Alabama. These states produce significantly more feed and thus it is more cost-efficient to "background" or "finish" (i.e., put weight on) cows in these states.

Like most commodity markets, the cattle market is cyclical. Some years ranchers realize gains and other years they realize losses. The long term trend has been a decrease in the number of ranches and amount of land in cattle ranches each year (Swisher et al 2000). Until two years ago, the market for Florida cattle was quite bad. Prices rebounded in 1999, lifting cash receipts to nearly $310 million (Aerts and Neisham 1999). In recent years cattle ranching has been shown to provide a one percent profit margin, which explains why a growing number of ranchers are getting out of the business or diversifying into other crops such as citrus and/or sod.

To enhance production, Florida cattle ranchers focus on: 1) producing one calf a year for each bred heifer or female cow, 2) maximizing the weight of steers, castrated males, before they are weaned and shipped, and 3) providing adequate and cost-effective nutrition. Ranchers try to schedule calves to be born within a 75 day period. Calves are typically born in the fall and winter and are sold in the late summer or fall (Aerts and Neisham 2000).

Cows are grazed on one of three types of pasture:

- **Improved pasture,** which has been planted to an introduced grass that is more productive and of higher quality than native grasses,
- **Unimproved pasture**, which includes an introduced grass but is not managed for high production, or
- **Rangeland**, which is a natural resource consisting of native plant communities.

Improved pastures produce about 5,000 pounds of forage per acre per year whereas native range produces about half that much. The more forage available per acre, the more cows can be grazed. The number of cows that can live on an acre of land is referred to as the "stocking rate." In Florida, this can range from as low as 18 to as high as 320 cows per acre, depending on the quality and amount of the forage (Swisher et al 2000).

Forage is derived from grasses or legumes and can be either perennial (semi-permanent) or annual (temporary). Most improved and unimproved pastures in south Florida have been planted to perennial warm season grasses; bahiagrass is the predominant choice. Cows are grazed on improved pastures during much of the year. In the winter months when the bahiagrass dies back, ranchers graze their cows on native rangeland. In addition, supplemental feed, such as molasses produced by the sugar industry, is provided at this time (Aerts and Neisham 2000).

Ranchers typically invest a significant amount of time and resources in managing grazing land, whether it is native or improved. Typical practices include prescribed burning, roller chopping and controlled grazing. Burning is used to increase forage quality, encourage desirable plants, and reduce the fuel load that can contribute to destructive wildfires (Swisher et al 2000).

2. Ecosystem Restoration Issues

Lake Okeechobee, located in the center of south Florida, is considered the heart of the interconnected Everglades ecosystem. Water quality in the Lake affects that of the Everglades. Lake Okeechobee naturally, like most freshwater lakes and streams, has very low phosphorous levels. Slight changes in phosphorous concentrations can result in dramatic changes to biological communities. Increasing dissolved phosphorous levels by three parts per billion can cause eutrophication, the unwanted growth of algae (floating single-celled plants) and aquatic weeds.

Historically, in-lake total phosphorous levels were at or below 40 ppb. In the past 30 years, in lake phosphorous levels have almost tripled (Lake Okeechobee Issue Team 1999). Phosphorous levels far exceed that which can support a healthy Lake. Indeed, in the 1980s, algal blooms became quite common, covering as much as 40 percent of the Lake. Water quality degradation is exacerbated by the impact of hydrologic changes on lake levels and the introduction of exotic invasive species.

Excess phosphorous levels in Lake Okeechobee are largely the direct result of agricultural activities, including decades of phosphorus fertilizer use on improved pastures (SFERWG 1999; Steinman et al 1999). For many years it was believed that improved pastures required application of phosphorous fertilizers. University of Florida research indicates, however, that most pastures do not need phosphorous because a mature grass can extend its roots deep down to tap phosphorous that is bound to soils higher in organic matter. Indeed at the MacArthur Agroecology Center, commercial cattle ranching pastures have not been fertilized with phosphorous in over 14 years. This has had no effect on grass yields or cow/calf production (Bohlen 2002).

Interestingly, research at the MacArthur Ranch also shows that eliminating fertilizer use has had no impact on phosphorous levels in water leaving the farm. This is because phosphorous binds to soil and accumulates, resulting in what is known as “legacy” phosphorous. When water moves through the soil profile, phosphorous is released. This same phenomenon exists in sediments at the Lake bottom. When sediment is disturbed, during events such as a hurricane, phosphorous is released back into the system. Some experts predict that if all sources of phosphorous (e.g., in fertilizer, feed, and manure) were eliminated tomorrow, it would take centuries to begin to see a decline in Lake phosphorous levels (Paul Grey, 2001). Thus it is essential to eliminate current phosphorous applications and to begin to address legacy sources, including to the greatest extent possible phosphorous bound to Lake sediments (e.g., by dredging Lake sediments).

The ultimate goal is to get in Lake phosphorous levels back down to 40 ppb. Toward this end, in the early 1980s, the Surface Water Improvement (SWIM) Act set a target goal of reducing phosphorous loading (concentration x flow) by 40 percent down to approximately 300 metric tons per year. Since the early 1990s, the rate of phosphorous loading has exceeded the SWIM target by 100 metric tons. Under the Total Maximum Daily Load (TMDL) requirements of the federal Clean Water Act, a new phosphorous

loading target of 140 metric tons is being established. It is widely understood that to achieve the 40 ppb target, more drastic actions must be taken to reduce phosphorous loading (Lake Okeechobee Issue Team 1999).

3. Cow/Calf Assessment

i. Compatibility with Ecosystem Restoration

Cow/calf operations are generally viewed by environmental and conservation organizations as the most preferred land use in the Lake Okeechobee watershed. In general, cattle ranching can be described as low-input and non-intensive, particularly compared to fruit and vegetable production. In contrast to other forms of agriculture, the landscape of a cattle ranch is the most likely to resemble the natural wetland and upland habitat found in the region.

As described below in "Availability of BMPs," there are a variety of practices that cattle ranchers can employ to address water quality problems. It should be noted, however, that phosphorous source reduction in cow/calf operations will only address part of the problem. Macro-level phosphorous reduction initiatives, such as regional storm water treatment areas (STAs), are necessary.

ii. Common Ground

This criterion is still being evaluated. However, in general, cattle ranchers North of the Lake have a strong sense of place, many having farmed in the region for generations. For the time being, land values in the region are steady because surrounding urban centers have not yet begun to exert development pressure on agricultural areas. Ranchers are viewed as individuals who want to be in the business of ranching, live on the land, and stay in the area. At least two ranchers appreciate that there are water quality problems in Lake Okeechobee and they are interested in changing practices to address these concerns. There is enough common ground for WWF to begin a dialogue with cattle ranchers.

iii. Industry Leadership

This criterion is still being evaluated. At first brush, however, there are at least two progressive ranchers with a vision for a healthy Lake Okeechobee and an environmentally sustainable ranching industry. Sonny Williamson, of Williamson Cattle Company, is a self-proclaimed environmentalist and has taken a leadership role in the state to craft solutions to the regions water quality problems. He serves on the Board of The Nature Conservancy (TNC) and has been interested in participating in a pilot project designed to reimburse ranchers for unplugging ditches and creating more wetlands on their ranches. Mr. Williamson also serves on numerous advisory committees, including his recent appointment to the Water Resources Advisory Committee (WRAC) where he is held in high regard by WWF staff.

On his own ranch, Mr. Williamson and his son Wes have stopped applying phosphorous to all but his new improved pastures. They participate in University research to find new grass varieties that have high yields with no phosphorous. Wes has developed a phosphorous budget and is attempting to understand all of his phosphorous imports (e.g., feed and mineral supplements) and exports (e.g., the cows themselves, turf, etc...). His preliminary budget indicates that the Williamson's export (i.e., take out of the watershed rather than releas to the environment), more than they import. Both Williamson's have expressed considerable interest in working with WWF around sustainable agriculture issues.

Mike Milosevic, ranch manager for the Lykes Brothers, one of the largest ranches in the country, is also interested in adoption of BMPs and improvements in production efficiency. He is hailed as having authored the bulk of the newly released BMP Manual for cow/calf. He too is interested in discussing these issues further with WWF.

iv. Availability of Better Management Practices (BMPs)

The cattle industry has developed a manual of BMPs, largely derived from Natural Resource Conservation Service (NRCS) recommendations for protection of water quality and reduction in phosphorous loading. These practices include:

- Maintaining adequate vegetative cover to filter pollutants from runoff and reduce soil erosion
- Minimizing cow concentrations around watering and feeding sites to reduce pollutant loads
- Re-establishing natural water flow patters to enhance natural wetlands
- Increasing on-farm water retention to reduce pollutant movement off-site, and
- Minimizing fertilizer use.

WWF is in the process of evaluating this manual to determine it comprehensiveness. From WWF's perspective, for example, it does not address several other issues of concern, including opportunities for practicing rotational grazing and improving wildlife habitat management and alternatives to the use of antibiotics and synthetic hormones.

Pest management is also not adequately addressed. Certain insects and weeds can be a problem for ranchers and require management. Of particular importance are flies and lice on cattle and armyworms, mole crickets and fire ants in pastures. Nearly 99 percent of Florida's cattle producing operations report using pesticides to protect their cattle, facilities, and/or pastures from pests. Insecticides are applied by nearly all cattlemen to their animals, and most apply insecticides to their pastures. In addition, weeds such as tropical soda apple, smutgrass, and dogfennel, compromise pasture health and require a variety of management strategies, including post emergent herbicide applications (Aerts and Neisman 1999).

Despite these deficiencies, the manual includes an important first set of practices to reduce phosphorous loading and improve the compatibility of cow/calf operations within a healthy Everglades ecosystem.

It is important to note that TNC has conducted extensive research and determined that in terms of restoring the wetland and upland habitat in the watershed, the most important practice for cattle ranchers is to unplug their ditches and revitalize natural water flow patterns. This serves to both create invaluable wildlife habitat and sequester phosphorous. TNC is currently engaged in a pilot project (FLOW) with two ranchers in which it is: 1) purchasing conservation and flowage easements to allow for flooding on part of the property, 2) paying for restoration of wetlands on the property, and 3) paying the ranchers to manage the wetlands (Danter 2002)

v. Opportunities to Improve Financial Performance

Economic information about BMP implementation was either not available or not yet evaluated. Some of the practices would clearly increase ranchers' costs (e.g., fencing canals), thus necessitating external resources or incentives. Some practices may reduce, or at least not increase, rancher costs. For example, Mr. Milosovic, mentioned that he now mechanically dredges canals and removes vegetation rather than spraying with herbicides and leaving the vegetation to decay inside canals. This practice avoids "spikes" in phosphorous levels following vegetation decay and costs no more than herbicide spraying. While it is commonly understood that ranchers no longer apply phosphorous fertilizers, there are no base-line data to document extent of BMP practices.

Market-based incentives may be difficult in Florida cow/calf operations simply because the cows are shipped to other states for "finishing" and slaughter. For example, an eco-label that requires certain production practices in Florida would have to develop, require and verify stringent practices employed in other states. This is not to say that such an approach is not worth exploring. For example, there are increasingly sophisticated methods of tracking cattle, and various and related production practices, from birth to sale, thus enabling a credible chain of custody procedure. Furthermore, there may well be a niche market in Florida for cattle raised and "finished" in Florida and fed a grass-based diet.

vi. Environmental Regulations

Cattle ranchers North of the Lake are being "quasi-regulated" under the Lake Okeechobee Protection Act. This law requires the development and voluntary adoption of BMPs. If ranchers show a good faith effort to adopt selected BMPs, they are presumed in compliance with state water quality standards. If they do not implement BMPs, they are required to conduct and report the results of water quality monitoring. Cattle ranchers are concerned that they will share a similar fate to that of the dairy industry in the region. Due to high phosphorous outputs, the dairy industry has downsized and been required to implement relatively expensive BMPs. The BMP adoption requirements in the Lake Okeechobee Protection Act have heightened concern in the cattle industry about compliance with environmental regulations.

vii. Communication Infrastructure

This criterion is still being evaluated.

viii. Resources

This criterion is still being evaluated. The Rural and Family Lands Protection Act, recently passed by the Florida legislature, authorizes the use of state funding to purchase conservation easements, with a particular focus on promoting natural resource uses on cattle ranches. This is one source of funding that may useful in working with ranchers. Further, cost-share assistance will soon be available from FDACs for implementation of BMPs, as required by the Lake Okeechobee Protection Act.

It should be noted that TNC has received extensive private funds to conduct its FLOW project. TNC is engaged in extensive lobbying at the state and federal level to direct public dollars toward expanding the reach of its pilot project.

ix. WWF Priority

Cattle ranching is a priority of the Agriculture and Sustainable Development Initiative.

D. Dairy

1. Commodity Profile

Florida is considered the leading dairy producer in the southeast. In 1998, the most recent year data were available, there were 231 dairies with over 160,000 cows. Over 270 million gallons of milk, valued at over $423 million, were produced. The top five milk-producing counties are: 1) Okeechobee, 2) Gilchrest, 3) Lafayette, 4) Hardee, and 5) Levy. In 1998, Okeechobee County led the state in the number of cows (36,000) and the amount of milk produced (61,000,000) (Florida Department of Agriculture and Consumer Services 1999).

Dairy production north of the lake has become increasingly confined, as dairy farmers are forced to address water quality problems. Whereas in the past, dairy cows grazed on pasture and received daily feed rations, they are increasingly being taken out of the pastures and confined so that waste can be controlled and treated.

Dairy farmers' top priority is nutrition since it has implications for cow health and milk yields and quality. Cows are fed a wide variety feed items, including alfalfa hay, corn, corn silage, soybean and cottonseed hulls, citrus waste, and molasses. Cows are milked twice a day and produce between 4 and 12 gallons of milk per day. To produce maximum yields, an individual cow needs to consume approximately 100 pounds of dry matter per day.

Dairy farmers north of the Lake are part a dairy cooperative and their milk is pooled and processed together (i.e., butter fat removed, homogenized, and pasteurized). Most of the milk is marketed and consumed in South Florida, principally to Miami. The dairy market has rebounded recently after a bout with low prices in the 1990s.

2. Ecosystem Restoration Issues

Like cattle ranching, the dairy industry has a similar impact on Lake Okeechobee (See Section XX for a discussion of water quality in Lake Okeechobee). However the concentrations of phosphorous coming off of dairy operations are much higher than those coming off of cattle ranches. The highest concentrations of phosphorous entering the Lake--in the 600 to 1000 ppb range--are associated with dairy operations (Lake Okeechobee Issues Team 1999). This is largely because the number of cows per acre is much higher in dairy operations thus cow waste (urine and manure) and its associated phosphorous become a major issue.

Close to 90 percent of the phosphorous "imported" into a dairy, comes from purchased feed and mineral supplements. Fertilizers, which are applied to pastures, are another important source. Phosphorous is "exported" off the dairy primarily in the milk produced. The reason that phosphorous is so high coming off dairy farms is that the amount of phosphorous exported does not equal the amount imported. This means a significant portion is left on the farm and can end up in runoff.

In the late 1980s, the Department of Environmental Regulation initiated a "Dairy Buyout" program, in which they required dairy operators to either build the capacity to treat cow waste or leave the area. This resulted in a downsizing of the industry. Whereas in 1987, there were 49 dairies and 42,600 cows in the Lake Okeechobee watershed (an area encompassing 6 counties north of the Lake), there are now 25 dairies and 25, 520 cows (Finch 2001).

3. Dairy Assessment

i. Compatibility with Ecosystem Restoration

The dairy industry is in the process of adapting to Everglades' ecosystem restoration needs. Thus far, the adoption of "best available technologies" in the dairy industry has resulted in minimal reductions in phosphorous discharges.

Whether dairy production will be ultimately compatible with Everglades' restoration is the subject of much discussion. There are some who argue that concentrated dairy production in an extremely wet environment such as Florida is inherently incompatible with eliminating phosphorous discharges. Thus the only way to truly protect the Lake is to eliminate dairy production. There are others who argue that while dairy production may be inherently polluting, it does not make sense to push dairy producers into another part of the state where similar water quality issues are likely to exist. Furthermore, without downstream treatment such as the construction of regional stormwater treatment areas proposed under such projects as CERP, agriculture alone cannot ameliorate phosphorous problems.

ii. Common Ground

The dairy industry has demonstrated its willingness to bear some responsibility for Lake Okeechobee phosphorous problems and to implement best management practices. For those dairies that stayed after the buy-out program, they have invested in keeping dairy production an economically viable business in the region. If WWF were interested, there is enough common ground to begin a dialogue.

iii. Industry Leadership

This criterion was not fully evaluated. However, Larsen Dairy, one of the two largest dairies in the watershed, demonstrates leadership potential. They have hired a full-time environmental engineer to oversee structural and management changes necessary for regulatory compliance. His attitude is, "Just tell us what to do to make a difference and we'll do it."

In addition, the Larsen's are innovative. Some members of the Larsen family are working collaboratively with a Biomass Plant to develop innovative methods for utilizing yard waste and manure. The Larsen's provide the manure, which will be suctioned off feedlot floors and trucked to the plant. The manure is combined with yard waste to grow yeast. The yeast is an edible product that can be consumed by baby calves and other animals. The other by-products, specifically carbon and hydrogen, are a renewable resource that can be utilized in a cogeneration facility to produce electricity.

iv. Availability of Better Management Practices (BMPs)

Historically at least some dairy barns were purposely built next to creeks in order to drain manure away from barns. Lagoons and seepage drainage systems were installed in the 1970s and these systems were further updated to come into compliance with FDEP's Dairy Rule, which required dairies to develop comprehensive nutrient plans and implement appropriate best available technologies. The basic intent of BATs is to concentrate animal activities away from creeks and canals and treat dairy waste. The following are examples of BATs implemented by the dairies in the early 1990s (Soil and Water Engineering Technology, 2001):

- Installation of perimeter ditches around High Intensity Areas (HIAs), where lactating cows are fed and watered. Drainage water is pumped into waste storage ponds and anaerobic lagoons
- Enlargement of storage ponds and anaerobic lagoons.
- Establishment of spray fields where effluent from drainage ponds is sprayed using a center pivot irrigation system. The field is planted to grasses that are harvested for silage, which is feed for dairy cows.
- Establishment of sediment basins prior to storage ponds to remove solids.

The SFWMD is funding examination of additional BATs to improve the phosphorous reduction performance of dairies. Once approved, it is anticipated that implementation of further BATs will be required (Soil and Water Engineering 2001).

While there has been significant exploration of BATs, it is unclear whether these and future approaches will be sufficient to adequately address dairy's contribution to the Lake Okeechobee phosphorous problem. It can be said that the current set of BATs is not sufficient.

v. Opportunities to Improve Financial Performance

The BATs implemented thus far by the dairy industry were costly. Larsen Dairy reportedly spent $1.5 million to upgrade one of their five barns. Some of this cost was shared by the state. Economic data evaluating the costs and benefits of implementing BATs were either not available or were not reviewed in this assessment.

There should be opportunities for creating market-based incentives, such as through an eco-label.

vi. Environmental Regulations

As described above, the dairy industry is regulated under several programs, including FDEP's Dairy Rule.

vii. Communication Infrastructure

This criterion was not evaluated.

viii. Resources

Cost-share assistance is available from FDACs and other agencies for implementation of BATs. Other opportunities for public and private funding were not investigated.

ix. WWF Priority

Dairy production is not a priority of the Agriculture and Sustainable Development Initiative.

E. Indian River Citrus

1. Commodity Profile

The term citrus includes oranges, grapefruits, tangerines, tangelos, and limes. Florida is the number one citrus producing state in the country, producing close to 80 percent of all U.S. citrus. In 1997/98, Florida's citrus crop was valued at over $1.5 billion. In 1999, citrus was produced on over 832,000 acres throughout 33 Florida counties. There are five production regions throughout the state and the top three producing counties, in terms of total acreage, are Polk, Hendry, and St. Lucie (Commercial Citrus Inventory 2001).

Over 95 percent of the citrus crop is processed into juice. Last year, Americans consumed 1.6 billion gallons of orange juice, 1.4 billion of which were produced by Florida farmers. The remaining supply comes from Brazil. Production in both Brazil and Florida is expected to decline in the next five years due to the disease, citrus canker. The industry welcomes this downturn in supply because it means prices will likely rise (Florida Agricultural Facts 1999).

Florida produces more than 75 percent of the U.S. supply of grapefruit and grapefruit products. Roughly half of the grapefruit is processed. The Indian River citrus region produces about 60 percent of the grapefruits grown in Florida and about 65 percent of the region's grapefruit production is shipped to Europe and Japan (Nelson 2002)

The Indian River Lagoon (IRL) region is recognized as producing some of the highest quality citrus in the world. The majority of the citrus is produced in three counties: Martin, Indian River and St. Lucie, most of which is contained within the St. Lucie Estuary watershed. Eighty-two percent of the land use in the watershed is for agriculture. The remainder is urban, with 300,000 people living in the watershed (Boman, et. al.

2000). IRL grapefruit is branded, thus only grapefruit produced in the region can be labeled as "Indian River Grapefruit."

2. Ecosystem Restoration Issues

The Indian River Lagoon (IRL) and Saint Lucie Estuary (SLE) were selected for review because it is a biologically rich and sensitive marine ecosystem that is inter-related to the Everglades ecosystem and dominated by agricultural production. The IRL and SLE are not technically within the Everglades' ecosystem. However, due to the C&SF Project, it has been linked to Lake Okeechobee and suffers the consequences of water management decisions made within the Everglades' ecosystem. The IRL is located in a region where tropical and temperate climates meet, thus making it a lagoon with rich biodiversity. Indeed, the IRL contains more species than any other North American estuary (Indian River Lagoon National Estuary Program 1996).

The IRL is a long lagoonal system that comprises more than one-third of Florida's east coast, extending for 156 miles from Volusia to Palm Beach counties. As an estuary, it is defined as a semi-closed body of water with free connections to the open sea that is measurably diluted by freshwater. Historically, the IRL drainage basin experienced a gentle, meandering drainage pattern through sloughs, creeks, rivers and wetlands. Since 1916, with the passage of the Drainage Acts of Florida, the area has been extensively drained, permanently lowering groundwater levels to allow for agricultural and urban development (Indian River Lagoon National Estuary Program 1996).

The Saint Lucie canal (C-44) was originally a river, which drained in a meandering fashion into the SLE. During the construction of the levee around Lake Okeechobee, the River was converted to a canal for the purposes of draining the Lake to the Atlantic for flood protection. Through the C-44 canal, the SLE system is now connected to the Lake. In the El Nino year of 1998, the SFWMD decided to lower unusually high Lake Okeechobee levels in anticipation of hurricane season. This released 7,500 cubic feet of water per second or 15,000-acre feet per day into the SLE, resulting in severe ecological impacts on the ecosystem (Goodman 2002).

The water moving toward the Atlantic through C-44 and other canals goes through thousands of acres of citrus groves. The impact on the ecosystem is: 1) an excessive volume of fresh water, 2) transport of sediment, pesticides, and nutrients moving off-site, and 3) proliferation of aquatic plants in waterways. Particular contaminants of concern that are related to historical and/or current citrus production practices, include: 1) nutrients, including nitrogen and phosphorous, 2) heavy metals, including arsenic and copper, 3) herbicides, including atrazine and simazine, and 4) other pesticides, including diazinon, ethion, and endosulfan.

3. Citrus Assessment

i. Compatibility with Ecosystem Restoration

The Indian River area is experiencing rapid population growth and development pressure. From a water quality and wildlife habitat management perspective, this makes citrus a preferred but still problematic land use compared to urban and suburban sprawl. Citrus is an intensive crop produced in a monoculture, which compared to cattle ranching for example, limits its capacity to provide varied habitat for wildlife. There are a wide variety of BMPs available to enable citrus production to adapt to needed changes in water quality, timing and distribution.

ii. Common Ground

Citrus has been produced in this region for generations. The primary industry association, The Indian River Citrus League, has openly acknowledge that citrus has an impact on water quality. As a commodity branded by its location, they are particularly sensitive to accusations of mistreating the local environment. The industry has taken an extremely proactive stance to improve the environmental performance of citrus production.

iii. Industry Leadership

The Executive Director of the Indian River Citrus League is progressive. In the face of public outcry over water quality degradation in the IRL, he worked with his 1,200 members to develop a research and education program to improve citrus production practices. Working with growers, regulators and academics, they developed a BMP Manual. They have supported the hire of an Associate Professor working full-time on citrus water quality BMPs as well as a full-time outreach coordinator to help growers develop and then adopt site-specific BMPs. They have worked with the state to receive cost-share assistance to help growers implement BMPs. Their approach has been thorough and most growers feel a sense of ownership and pride in their achievements.

iv. Availability of Better Management Practices (BMPs)

IR citrus is dominated by about 10 major companies or property owners that hire out grove managers. As a general rule, citrus landowners and grove managers approach citrus production as a business and focus on maximizing the efficiency of each planted tree. They are comfortable and enthusiastic about utilizing the latest technology to understand the productivity of their operations. Several grove managers are in the process of utilizing GIS technology to map soil types throughout their groves. This is intended to help in the selection of varieties and the location of plantings to minimize problems related to fluctuations in water levels. At least three of the grove managers already utilize some of the BMPs described below.

There is a wide variety of water quality BMPs described in the Indian River Citrus BMP Manual (Bowan et al 2000). These include, but are not limited to:

- Minimizing sediment loss through:
  - Installation of riser board water control structures
  - Creation of settling basins (sumps) to trap sediments
  - Encouraging vegetation on bare soils and ditch banks
  - Contouring ditch banks and cleaning ditches to reduce water velocities

- Minimizing nutrient use through:
  - Analyzing tissue and soil samples to avoid over-fertilization
  - Calibrate application equipment to improve application efficiency
  - Mixing and loading away from canals and waterways to avoid spills
  - Incorporating organic matter into soil to retain nutrients and improve soil quality

A number of these practices are already being used by area growers. Indeed, it is suspected that the pest management section of the manual is extremely conventional and focuses on 1) improving spray application approaches (e.g., calibration of equipment) and 2) minimizing spills, particularly during mixing and loading. There is no discussion of biological controls or other "reduced-risk" approaches to replace conventional pesticides. For example, as much as 60 percent of the pesticide applications made to citrus are for pests that cause superficial scarring or cosmetic injury but that do not harm fruit destined for processing (Nelson 2002). Furthermore, new research suggests that the copper applications may be able to be reduced significantly. Copper is applied to control the fungus, melanose. To the naked eye, copper injury (resulting from over-application) mimics melanose damage. Extensions specialists are looking into revising copper spray recommendations downward (Stover 2002).

This indicates that the IR Citrus BMP manual is incomplete as a description of the full range of practices available to improve the capacity for citrus production to address water quality, timing and distribution problems.

v. Opportunities to Improve Financial Performance

It can be assumed that the BMPs that have already been adopted by large citrus growers are associated with efficiency improvements and thus bottom-line cost savings. This is particularly true for practices that reduce input costs.

Market-based incentives such as an eco-label are potentially viable for Indian River Citrus since much of the grapefruit is sold fresh. A significant portion of the fresh fruit is shipped to Europe, a market that is increasingly interested in certification of sustainable production practices. The industry might also perceive that it gives them a competitive advantage over Brazil, their most important competitor. Citrus growers and academics

were very interested in public recognition, particularly in the marketplace, from WWF for their adoption of BMPs.

vi. Environmental Regulations

Environmental regulations have been a major driver for change in the IR citrus industry. The 1999 Florida Watershed Restoration Act required the Department of Agriculture and Consumer Services and Department of Environmental Protection to implement and apply the federal Clean Water Act to agriculture by creating a presumption of compliance if growers implement BMPs. DEP is in the process of developing Total Maximum Daily Loads (TMDLs) for nutrients, and other contaminants of concern in the SLE. Rather than have to comply with these TMDLs, citrus growers will have an opportunity to be granted a presumption of compliance by demonstrating adoption of BMPs.

vii. Communication Infrastructure

This criterion was not fully evaluated. However, the IR Citrus League appears to be well organized and funded. They publish a newsletter, host a web site, and coordinate a variety of industry conferences and meetings. They are well connected with the University research and extension community.

viii. Resources

An increasing amount of public dollars will be devoted to addressing water quality problems in the IRL and SLE. The St. John's Water District and the SFWMD are in the process of finalizing a re-study of the water control changes that need to be made in this region. This region is about to have its own comprehensive restoration plan, which will generate resources and enthusiasm for addressing water quality, distribution and timing issues.

Cost-share funding for citrus BMP adoption is just now being made available through the state and federal governments.

ix. WWF Priority

Citrus is a crop of importance to the Agriculture and Sustainable Development Initiative. However the IRL and SLE region are currently NOT a high priority for local eco-region staff.

VI. Assessment Summaries

Table 6: Ranking By Commodity/Region

An Evaluation of Potential South Florida Agricultural Partners						
Criteria	**Weight**	**Cow/Calf**	**Citrus**	**Dairy**	**Dade County**	**Sugar**
Compatibility with Ecosystem Restoration	*	*	*	~	?	F
Common Ground	*	*	*	*	F	F
Industry Leadership	*	*	*	#	F	?
Financial Performance	#	~	#	~	#	?
Better Management Practices	#	#	#	~	#	?
Environmental Regulations	~	~	~	~	~	?
Communication Infrastructure	~	?	?	?	?	?
Resources	#	?	?	?	?	?
Totals						
*		4	3	1	0	0
#		1	3	1	3	0
~		2	1	5	1	0
?		2	2	2	2	6

Weights

*	critical
#	important
~	desirable

Ratings

*	high
#	moderate
~	low
?	not enough information to evaluate
F	fail

Table 7: Eliminating Fail Scores and Condensing to Key Criteria

An Evaluation of Potential South Florida Agricultural Partners						
Criteria	**Weight**	**Cow/Calf**	**Citrus**	**Dairy**	**Dade County**	**Sugar**
Compatibility with Ecosystem Restoration	*	*	*	~	?	F
Common Ground	*	*	*	*	F	F
Industry Leadership	*	*	*	#	F	?
Financial Performance	#	~	#	~	#	?
Better Management Practices	#	#	#	~	#	?
Environmental Regulations	~	~	~	~	~	?
Communication Infrastructure	~	?	?	?	?	?
Resources	#	?	?	?	?	?
WWF Priority	*	*	#	~	#	F
Totals						
*		4	3	1	0	0
#		1	3	1	3	0
~		2	1	5	1	0
?		2	2	2	2	6

Weights

*	critical
#	important
~	desirable

Ratings

*	high
#	moderate
~	low
?	not enough information to evaluate
F	fail

Table 8: Final Synthesis

An Evaluation of Potential South Florida Agricultural Partners				
Criteria	**Weight**	**Cow/Calf**	**Citrus**	**Dairy**
Compatibility with Ecosystem Restoration	*	*	*	~
Common Ground	*	*	*	*
Industry Leadership	*	*	*	#
Financial Performance	#	~	#	~
Better Management Practices	#	#	#	~
WWF Priority	*	*	#	~
Totals				
*		4	3	1
#		1	3	1
~		1	0	4

Weights

*	critical
#	important
~	desirable

Ratings

*	high
#	moderate
~	low
?	not enough information to evaluate
F	fail

VII. Recommendation and Next Steps

This assessment indicates that cow/calf, citrus and dairy are potentially viable partners. Sugar and Dade County agriculture were both eliminated from the running for failing one or more criteria. Specifically, sugar production in the Everglades Agricultural Area is not compatible with restoration of the Everglades ecosystem nor is it a priority crop identified by WWF at the local level. Furthermore, there is limited common ground between WWF and sugar producers. Dade County agriculture failed because there is not

sufficient common ground between producers and WWF and because there is fractured leadership within the industry. While dairy did not fail any criterion, it did not score as highly as cow/calf and citrus.

In terms of choosing between citrus and cow/calf, it is our recommendation that WWF focus on the latter. Given WWF Everglades staff new initiative for working on Lake Okeechobee and its interest in forming a partnership with agriculture, it is a natural next step for WWF to begin forming a partnership with ranchers. Cattle ranches have the added advantage of being able to provide an important source of wildlife habitat, an issue not included in this assessment but of obvious value to WWF. This recommendation does not negate the very real potential that at a future date, WWF could engage in a viable partnership with Florida citrus growers or dairy farmers.

Next steps could include, but are not limited to:

1) Initiating casual conversations with many more stakeholders in the ranching community, including within the research and grower communities to identify areas of common ground,

2) Organizing a joint workshop with cattle ranchers and other allied industries to more publicly explore areas of common ground,

3) Collecting and analyzing the full range of water quality and wildlife habitat BMPs available in cow/calf,

4) Developing a component of the WWF Lake Okeechobee web site that addresses the importance of economically and ecologically viable agriculture North of the Lake, with a specific focus on cow/calf operations,

5) Engaging in a brainstorming session with technical and other experts to build an understanding WWF's partnership model with the ranching community, and

6) Developing a set of joint goals and activities with the cattle industry.

Appendix A: List of Interviews and Meetings

September Site Visit	
Person(s)	**Affiliation**
Paul Grey	Audubon Society, Okeechobee
Herb Zebuth	Florida Department of Environmental Protection, West Palm
Sonny Williamson	Williamson Cattle Ranch, Okeechobee County
Patrick Bohlen	MacArthur Agroecology Center, Okeechobee County
Don Fox	Florida Department of Fish and Game, Okeechobee City

October Site Visit	
Person(s)	**Affiliation**
Charlie and Madeline Mellinger	Glades Crop Care, Jupiter
Woody Larsen	Larsen Dairy, Okeechobee City
Mitch Flinchum	University of Florida, Belle Glade Research Station, Belle Glade
Chris Darien, Peter Rosenstahl, Tim Lange, Russell Nagata, Ron Rice, George Snyder, Richard Rade	University of Florida, Belle Glade Research Station, Belle Glade
John Riffle	Hydromentia, Okeechobee County

November Site Visit	
Person(s)	**Affiliation**
Chris Wadill, Van Wadill, Frank Mazzotti, Bruce Shaefer, Jorge Pena, Don Pybas, Jonathan Crane, Wendy Graham, Bob Degner, Yuncong Li, Rafael Munoz-Carpena, Catherine Mannion, Randall Stockard	University of Florida, Tropical Research and Education Center, Homestead
Tom Jones	Collier Enterprises, Dade County
Erin Deady and Staurt Strahl	Audubon Society, Miami
Joe and Colleen Griffin	Dade County

December Site Visit	
Person(s)	**Affiliation**
Jorge Pena	University of Florida, IFAS, Tropical Research and Extension Center, Homestead
George Baker	Grower, Homestead
Jorge Dominicis	Florida Crystals, Belle Glade

January and February Site Visits	
Person(s)	**Affiliation**
Jeff Danter	The Nature Conservancy, Kissimmee
Doug Bournique	Indian River Citrus League, Fort Pierce
Ed Stover, Chris Wilson, Brian Bowan, Jack Hebb, Joanne Jolley	University of Florida, Indian River Research and Education Center, Fort Pierce
Jeff Cussons	Becker Groves, St. Lucie County
Stan Carter	MacArthur Farms, St. Lucie County
Pete McClure	Evans Properties, St. Lucie County
Ron Hamel	Gulf Citrus Growrs, Hendry County
Paul Parks	Florida Wildlife Federation, Okeechobee City
Jora Young	The Nature Conservancy, Okeechobee City
Tom Hill	Florida Farm Bureau Federation, Homestead

March Site Visit	
Person(s)	**Affiliation**
Rich Buddell	Florida Department of Agriculture and Consumer Services, Fort Pierce
Al Goldstein	South Florida Water Management District, Fort Pierce
Joel Sellers	Oceanspray, Inc., Fort Pierce
Kim Shugar	Florida Department of Environmental Protection, Fort Pierce
Thomas Stopyra	Diamond Fertilizer Company, St. Lucie County, Fort Pierce

May Site Visit	
Person(s)	**Affiliation**
Wes Williamson	Williamson Cattle Ranch, Okeechobee County
Jim Alderman	President, Florida Cattleman's Association, Okeechobee County

Dr. Frank Mazzotti,	University of Florida, IFAS, Ft. Lauderdale Research and Education Center, Fort Lauderdale
Dr. Kenneth G. Rice	U.S.G.S., Fort Lauderdale

Interviews	
Person(s)	**Affiliation**
Bill Summers	Cattle rancher, Indiantown Florida
Louis Provencher	TNC
Mark Jennings	FDACS
Kim O'Dell	SFWMD
Craig Evans	Florida Stewardship Foundation
Scott Kuipers	Natural Resources Conservation District
Chuck Aller	FDACS
Erin Deady, Stuart Strahl and Paul Grey	Audubon
Wes Williamson	Williamson Cattle Company
Jim Fryer	TNC
Greg Nelson	DNE Fruit
Ann Sorensen	American Farmland Trust
Al Goldstein	SFWMD
Paul Parks	Florida Wildlife Federation
Gary Ritter	SFWMD

Appendix B: Assessment Criteria

1. Compatibility with Ecosystem Restoration

Recent passage of the Water Resources Development Act of 2000 signals that over the course of the next 30 years, hydrologic conditions in much of South Florida are likely to change with the goal of restoring the Everglades ecosystem. It is anticipated that water tables and flows will be significantly altered, particularly in the southern reaches of the system in Dade County. Additional laws and regulations stipulate improvements in water quality. Compatible agriculture is that which can withstand these changes either because it adapts to changes in water levels and flow regimes or because it is removed enough to not be significantly affected. Furthermore, compatible agriculture is that which can minimize environmental impacts from pesticides, fertilizers and other contaminants likely to impact water quality.

2. Common Ground

Successful partnerships are developed around common ground, which can stem from a sense of place or community, joint goals or fears or a shared vision (Wondelleck and Jaffee 2000). Common ground is not necessarily instantaneous but can be built over time. Common ground is easier to achieve when there is a mutual understanding of the problem. In the case of natural resource and environmental problems, it is beneficial to have a mutual understanding of the underlying science describing and documenting the problem.

It is highly desirable for growers and industry leaders to bear at least partial responsibility, where it is due, for water quality, timing and distribution problems and to be willing to make cost-neutral changes. This is not absolutely necessary, however, as long as growers and other key individuals believe it is in their best interest to address these ecosystem protection issues given that others (e.g., the public, environmentalists, etc.) are concerned. It is also important that growers are committed to keeping agriculture productive in the region. It is not desirable to work with landowners who rent their land to growers but who are really in the business of land speculation.

3. Industry Leadership

Partnerships are ultimately made up of people, not institutions. Collaborative partnerships can be difficult to initiate and maintain without individual leadership from within different stakeholder groups. The literature on collaboration and cooperation suggests that a strong leader is desirable because their energy and vision mobilizes others to participate (Wondelleck and Jaffee 2000). Effective leaders are willing to acknowledge the problem, take some responsibility for it and help people focus on proactive rather than reactive responses.

Determining leadership strengths can be difficult when dealing with an agricultural community that is highly fractured by many different types of growers and landowners with numerous and competing agendas. In a partnership in which the goal is to encourage a substantial number of growers to make changes, the growers engaged in the collaboration need to be as broadly representative of the larger grower community as possible.

Farmers that demonstrate leadership in the arena of adopting better management practices are often motivated by a personal ethic of environmental stewardship. Farmers are prompted to make changes because of a personal belief that making changes that improve the environmental performance of farming practices is "the right thing to do." Such an attitude often reflects a farmer's openness to understanding how an environmental problem personally affects them and to seeing how changing will work to their advantage (Curtis 1999).

4. Opportunities to Improve Financial Performance

Farmers are in the business of food production and they need to make a profit. Changing practices to address ecosystem restoration concerns can potentially involve either or both, 1) an initial transition cost, and 2) longer term costs associated with more intensive management requirements. To address cost increases, farmers usually need to realize some kind of financial gain. There are several types of opportunities that translate into potential financial gains for farmers and these include, but are not limited to: 1) better management practices that either or both reduce costs or improve quality or yields, 2) marketplace incentives, including access to new markets and/or premium prices, and 3) research and technical assistance that focuses on developing and extending useful tools and strategies.

6. Availability of Better Management Practices (BMPs)

Better management practices that help ameliorate the water quality, timing and distribution problems need to be available in order for farmers to change production practices. Farmers need to have a certain level of comfort that the desired practices have been evaluated and are proven to be effective. This often requires that practices have been tested on commercial scale farms and evaluated by scientifically reputable organizations, including but not limited to, the Land Grant University system. It is highly desirable for practices and techniques to be essentially "on the shelf" and ready to be implemented. Furthermore, it is always advantageous for practices to help farmers reduce production costs and/or otherwise improve bottom-line profits.

7. Environmental Regulations

Many farmers choose to farm because they enjoy being their own boss and prefer work that enables them to be strongly independent. They often experience government regulations as an anathema to their way of life. Thus environmental regulations, whether they are in effect or impending, are often a disincentive to continuing business as usual.

In many instances where agricultural activities are associated with environmental harm, government regulations are an important, albeit unpopular, driving force for change.

Furthermore, farmers are potentially more willing to make changes to their operations if these changes are seen as a way to achieve environmental goals but within a time-frame and in a manner that avoids or reduces government mandates.

8. Communication Infrastructure

It is desirable, although certainly not mandatory, to work with agricultural partners who have their own internal system of communication. This is particularly true because farmers are inherently independent people and are not inclined to share information and initiate collaborative ventures. In addition, in some agricultural communities, farmers are not connected via the internet and other efficient forms of communication. It is extremely helpful if growers have already adapted to communicating with each other and industry members such as through their own commodity association, a single buyer, or the University extension system.

9. Resources

A project designed to achieve behavior change cannot be successful without funding. Support from both public and private sources is ideal as is in-kind or direct monetary donations from participating partners. Funding is necessary for 1) stakeholder planning and meeting coordination, 2) project coordination and management, 3) education and outreach, 4) technical assistance, 5) research and 6) documentation and evaluation. In this case, funding is inclusive of cost-share assistance from publicly-funded programs that reimburse farmers for all or partial costs for adopting environmentally-beneficial practices.

10. WWF Priority

A partnership with agriculture requires that both parties commit time and resources. WWF is more likely to contribute to the partnership if it is working with an agricultural commodity that has been identified as of importance within their Global Strategic Agriculture Initiative. This initiative is targeting the following crops:

- Palm oil
- Soy
- Cocoa
- Banana
- Orange/citrus
- Beef/pasture
- Shrimp aquaculture
- Cotton
- Sugar

The following crops are also of interest:

- Coffee
- Corn
- Sorghum
- Tea
- Rice
- Tobacco
- Manioc/cassava
- Rubber
- Cashew
- Wheat

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