PROJECT TITLE: **OPTIMIZATION OF BEST MANAGEMENT PRACTICES FOR BEEF CATTLE RANCHING IN THE LAKE OKEECHOBEE BASIN - PART 2.**

LEAD ORGANIZATION: **UNIVERSITY OF FLORIDA, INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES (UF-IFAS)**

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COOPERATING ORGANIZATIONS:

South Florida Water Management District (SFWMD)
Archbold Biological Station (ABS)
MacArthur Agroecology Research Center (MAERC)
Florida Cattlemen's Association (FCA)
Southern DataStream, Inc. (SDS)

PROJECT LOCATION: Site located within the **Lake Okeechobee SWIM** boundaries. **HUC Number 03090201.**

The project demonstration pastures are at the Archbold Biological Station's MacArthur Agroecology Research Center (MAERC) on Buck Island Ranch near Lake Placid, Florida (map at http://www.agen.ufl.edu/~maerc/map&events/map1.gif).

Results of this project will find direct and immediate application in the following FDEP 319(h) Priority Water Bodies where cattle ranching on south Florida flatwoods and wetlands soils is a significant land use: NEP (Charlotte Harbor); UWA (Caloosahatchee River, Peace River, Kissimmee River, Taylor Creek, Southeast Florida Coast); SWIM (Lake Okeechobee/Kissimmee River, Charlotte Harbor); and TMDL (Lake Okeechobee, Kissimmee River, Taylor Creek, Peace River, Fisheating Creek)

WATERSHED RESTORATION ACTION STRATEGY:

SFWMD identifies the MAERC stocking rate demonstration project as a high priority in its efforts to reduce phosphorus loading as part of the Lake Okeechobee SWIM plan. The MAERC project is the only comprehensive effort designed to develop cattle ranching BMPs and implement associated education programs for the cattle industry.

The above listed south Florida watersheds (Florida DEP 319(h) Priority Water Bodies) each has cattle ranching as a major land use in all or a portion of its basin. Collectively these watersheds constitute the majority of lands in south central Florida from south of the Bradenton-Merritt Island line down to the Ft. Myers – West Palm Beach line. Any efforts to improve nonpoint source nutrient runoff in this region will have to address BMPs for cattle ranching.

Some of the priority TMDL basins programs have implemented tributary monitoring programs to document the nutrient and other non-point source pollutant loads derived from predominantly agricultural lands. Subsequent TMDL plans in these areas will require BMPs and education programs specifically targeted at cattle ranching. This project will deliver tools and programs meeting that specific need.

ESTIMATED POLLUTANT LOAD REDUCTION:

The Lake Okeechobee SWIM plan calls for reductions of an additional 100 tons per year in total phosphorus load from nonpoint sources beyond the load reductions already achieved in the basin. Cattle pastures will be targeted for much of this reduction since ranching is the major land use of the basin.

Results of the current cattle stocking rate project funded by DEP and others have documented large differences in phosphorus loads from the two pasture types (summer improved pastures and winter range). The winter pastures runoff loads are 100% lower than loads from the summer pastures. During the latter part of the 1998 wet season (July-November) the improved summer pastures discharged approximately 0.44 pounds of phosphorus per acre and the winter range areas discharged effectively no phosphorus during this period.

These differences in water quality results correlate to differences in nutrient test results from the top 5 cm of the pasture soils. The winter pasture soils show a 10% DPS (degree of phosphorus saturation) while the summer pastures show a 20% DPS. These DPS levels combined with the runoff water quality results point to a threshold point between 10% and 20% at which these soils release significant phosphorus into runoff. This finding is highly significant and will be reported in the project deliverables and associated journal manuscripts. The impact of this finding has application in efforts to reduce non-point source pollutant loads from other agricultural and non-agricultural land uses. The emerging evidence of a flatwoods soils soil nutrient – water quality relationship may serve as the basis for development of innovative BMP strategies involving the soils-specific targeting of BMP programs.

It is premature to estimate the specific load reductions that can be realized by stocking rate BMP implementation throughout the Lake Okeechobee watershed and the other affected watersheds. While loads from each pasture within the summer and winter arrays have been tabulated (see project web site at http://www.agen.ufl.edu/~maerc/stocking/loading.html), these results do not as yet correlate to the stocking rate treatments being demonstrated on each pasture. This is not surprising since stocking rates treatments were implemented in November, 1998. With the onset of the dry season, no runoff has been observed at the sites since treatment implementation. All current data reflect the equilibration period prior to treatment implementation. Even with the onset of recent rains and runoff (in June, 1999) treatment effects are not expected to be visible in the short term.

The expectation of a delayed treatment effect follows from analysis of data provided by water quality and soil sampling conducted during the project equilibration period. The dramatic differences in soil P content and runoff P content between the winter and summer pastures suggest considerable storage effects of phosphorus in the pastures as a result of prior grazing and fertilization practices. It is likely to be another year before treatment effects are visible and an additional two years before reasonable confidence can be assigned to observed differences.

An eventual soil and water quality effect is expected to be observed in the pastures given the already apparent effect on the animal performance. Grazing density is having an observable effect on the cattle herds (weight, body condition, etc.). Therefore waste production effects must be accompanying these animal weight observations. This would be expected to be eventually reflected in soil and water quality measurements once the damping effects of system storage diminish over time.

OBJECTIVES:

Results from the 1998-1999 project were inconclusive because the time lag associated with soil-water responses to cattle stocking rate treatments. This time lag dictated that the project be continued for two additional years in order to yield results sufficiently conclusive to support subsequent regional BMP implementation (Capece et al., 2000). The objectives of the project are:

a) To optimize Best Management Practices (BMPs) for beef cattle ranches in Florida. The BMP demonstrated in this project is stocking rate (grazing density). Ideally, the optimized BMP must result in reduced phosphorus runoff from pastures while siumultaneously not substantially increasing net costs for the rancher.

b) To promote the adoption of the optimized BMPs by the beef cattle ranchers through workshops, presentations, extension publications or other appropriate mechanisms.

c) To demonstrate the application of a Beef Cattle Management Decision Support System to the ranch site (MAERC) where the BMP optimization project is being conducted. The Decision Support System is a management tool that, along with information provided by extension publications, allows ranchers to make more informed management decisions.

PROJECT DESCRIPTION:

The 2000-2001 project continues the surface water runoff evaluation of four cattle stocking rates begun under the 1998-1999 WM699 project. The new project also adds a groundwater analysis component and a simulation-modeling component. The optimization project infrastructure consists of 16 field-scale BMP demonstration pastures instrumented so that all surface water runoff can be captured and analyzed. These pastures are located at MacArthur Agroecology Research Center on (MAERC) Buck Island Ranch, a 10,000-acre working cattle ranch located north of Lake Okeechobee. Eight of the 16 BMP demonstration pastures were constructed on summer pastureland (improved pastures typically planted in bahiagrass and occasionally fertilized to support high stocking rates). The other eight BMP demonstration pastures were constructed on winter pastureland (native range land typically not fertilized or planted, and that supports low stocking rates). Construction and instrumentation of the BMP demonstration pastures was fully completed in July of 1998.

The three-phase BMP program is anticipated to be completed in ten years. The phased projects are designed to continually enhance BMP recommendations through optimization projects on the demonstration pastures, and through the continual enhancement of the Decision Support System. The management practices that will be the subject of the program are:

Phase 1: Optimization of beef cattle stocking rate.
Phase 2: Optimization of pasture fertilization practices.
Phase 3: Optimization of grazing and cattle rotation schemes.

This new Section 319(h) project will complete Phase 1, the field demonstration and data collection to optimize beef cattle stocking rates. In brief, cow/calf pairs are being grazed at varying stocking rates in both the summer pasture and the winter pasture. All surface water leaving each BMP demonstration pasture is analyzed for water quality parameters to determine the effect of stocking rate on runoff water quality. The optimum stocking rate (the most economically feasible stocking rate that minimizes nutrients in pasture runoff) will be determined, and communicated to beef cattle ranchers through extension publications and workshops. Also, the results will be published in technical journals, and the information will be used to test, verify, and enhance the Beef Ranch Decision Support System (BRADSS).

Regular communication of optimization project results will occur at semi-annual meetings of the Project Team and the Advisory Committee established through the Memorandum of Understanding. In addition, a continuing direct linkage to the beef cattle ranching community will communicate interim and final results to industry members. Communication of interim results will allow changes in project design to achieve optimum results, and will enable the ranching community to have regular input into the project. This direct communication linkage includes regular presentations of results at the annual meeting of the FCA.

BACKGROUND

The infrastructure necessary for implementing the proposed optimization project, except for the shallow ground water wells, was constructed with FY95, FY96, and FY97 funding provided through a Memorandum of Understanding (MOU) between the South Florida Water Management District (SFWMD), the University of Florida, Institute of Food and Agricultural Sciences (IFAS), and Archbold Biological Station, MacArthur Agroecology Research Center (MAERC). The Florida Cattlemen's Association (FCA), and the Natural Resource Conservation Service (NRCS) have also joined on as partners. Buck Island Ranch is the site for the field project. Related projects are conducted at the UF main campus in Gainesville and its participating Centers in Immokalee and Ona.

Florida ranks tenth among all states and second among states east of the Mississippi in beef production (Graetz and Nair, 1996). In 1995, Florida maintained 1.15 million beef cows, and total cash receipts from cattle and calves were $290 million (FDCAS, 1996). Florida's cattle production is dominated by cow-calf operations, so the industry has a significant impact on cattle production in other states. The vast majority of Florida's cattle is located in south and central Florida, south of a line between Daytona Beach, Orlando and Tampa. Much of what was once native subtropical wet prairie ecosystem in this region is now managed for grazing. Land use changes within these ecosystems have resulted in dramatic changes in the wildlife habitat characteristics and the patterns of nutrient flow for upland, marsh and lake ecosystems. For example, total P concentration in Lake Okeechobee has almost doubled since 1970's and chlorophyll a level significantly increased between early 1970's and 1990 (James et al., 1995a,b). Coincidental with this general area of south Florida is one of the nation's fastest growing urban populations and one of the nation's most sensitive ecosystems. This region of Florida is home to many endangered plants and animals making it a "national hotspot" for endangered species (Cox et al., 1994). Also, water from this cattle production region feeds into Lake Okeechobee and the Florida Everglades. Preservation and restoration of this unique ecosystem ranks at the top of our national environmental priority list.

In an effort to restore the Everglades/Lake Okeechobee ecosystem, the South Florida Water Management District (SFWMD) developed a Surface Water Improvement and Management (SWIM) program for the Kissimmee River Basin and Lake Okeechobee watershed. Despite reduction in phosphorus loads from Lake Okeechobee watershed, the SWIM mandated targets have not been met. Nondairy sources of P in the Lake Okeechobee drainage basin are primarily from beef cattle pasture (improved pasture and native range). Although animal densities and runoff phosphorus concentrations associated with beef cattle pastures are relatively low, the vast acreage (approximately 470,000 acres) of this land use makes them a major contributor of phosphorus. In order to achieve the phosphorus load target and to hasten Lake Okeechobee's recovery, it is necessary to find ways to reduce phosphorus in runoff from beef cattle pastures. This optimization project seeks to do so proactively, not through the regulatory framework, but through a collaborative program that seeks and includes input from the stakeholder community. A guiding principle is to protect and enhance Lake Okeechobee, while minimizing negative economic impacts on the agricultural industry.

METHODS

Stocking Rate BMP Demonstration

The cattle stocking rate optimization project infrastructure consists of multiple, field-scale pastures that are realistic in size, yet are fenced and ditched separately from each other, and are instrumented so that all surface water runoff can be captured and analyzed. The design for the improved pasture demonstration project is a completely randomized block employing four (4) stocking rate on eight pastures as described in Table 1. Stocking rates on the improved pasture plots are 0, 1.4, 2.5, and 3.3-acres/cowcalf units. The design for the native rangeland evaluation is also a completely randomized design employing four (4) stocking rates on eight plots, with the stocking rates being different than those used on the improved pasture plots. Native rangeland stocking rates are 0, 2.3, 4.0, and 5.3-acres/cowcalf units. The difference in animal densities in the summer and winter array is necessitated by differences in potential biomass production between these areas. Each animal was assigned to a stocking rate at the beginning of the demonstration project and remains at this same stocking rate for the life of the project.

Table 1. Stocking Rate Project Design.

Pasture Array	Replicates	Stocking Rates, Acres/Cow-calf Unit	Total Units*
Summer (50 acres)	2	0	0
	2	1.4	35
	2	2.5	20
	2	3.3	15
Summer Total	8		140
Winter (80 acres)	2	0	0
	2	2.3	35
	2	4.0	20
	2	5.3	15
Winter Total	8		140

*** Unit = 1 cow with calf**

These grazing areas reflect the two principal pasturing regimes of a typical central Florida ranch. One array site is located on a wetter range area containing a mixture of native grasses, along with some bahiagrass. This range area is used for winter and spring (dry season) grazing by cows immediately after calving and during breeding. The other array site is on well-drained and improved pasture with bahiagrass, which is used for summertime (wet season) grazing of cowcalf pairs. The two arrays will be similar in design and instrumentation. The winter range array consists of a 700-acre area. Within this array eight, 80-acre range plots are delineated. The winter range plots are 30 acres larger than the summer pasture plots because, in general, cattle are kept on winter range in lower densities than on summer pastures. The 80-acre plot size allows the number of cows within a grazing herd to be kept at a level that provides greater statistical significance when evaluating animal characteristics. The 500-acre summer array consists of eight, 50-acre plots. Neither the summer nor the winter pastures receive phosphorus fertilization. If an animal is grazing in a high stocking rate pasture in the summer, it will graze in a high stocking rate pasture during the winter.

The test herds were introduced to the grazing plots in November 1998 at the specified treatment stocking densities. Water quality data will continue to be collected continuously throughout the project duration.

Surface Water Measurements

Flumes for collection of all surface water runoff were constructed at the downstream end of each pasture. The pastures are hydrologically isolated from each other by ditches and berms along their margins, and livestock are isolated within each pasture by fencing. Trapezoidal flumes collect all surface drainage leaving each pasture. This type of flume is hydrologically unobtrusive and does not significantly alter water table levels or surface runoff. Peak capacity for the flumes is seven cubic feet per second; a design capacity based on prior work conducted on similar sites by UF-IFAS. Digital stage encoders measure water levels in the upstream and downstream stilling wells of each flume. These stage measurements are converted to flow values by the datalogger, which in turn records data and activates automatic water samplers based upon instantaneous flow conditions. In addition, automated meteorological stations are located within each pasture array.

Ground Water Measurements

Ground water measurements will be a new addition to the optimization project. Installation of well stations (1 per pasture for a total of 16) was completed in August 2000 through funding by SFWMD. Southern DataStream will complete installation of 16 additional ground water monitoring wells in December 2000. The wells are needed to provide both water table depth data and shallow ground water quality data. Water table depth data are essential in developing the water budget components of the Decision Support System for the project. Furthermore, given the vast number of electronic instruments and sensors in operation on the project (over 100), water table data for a pasture allow missing runoff data to be estimated with reasonable accuracy. The second purpose of the shallow wells is the measurement of ground water quality. Correlations between shallow soil phosphorus content and runoff water phosphorus content have already been documented as part of the current project. Introduction of ground water wells as part of a new DEP-funded project will allow exploration of correlations between these other measures and ground water quality.

Each well station will consist of two wells: (1) a 4-inch diameter well, 15-ft deep, screened over the bottom 5 feet of its length and (2) a 2-inch diameter well, 3-ft deep, screened over the bottom 1.5 feet of its length. The purpose of the deeper well is to allow continuous measurement of water table depth while both the shallow and deeper wells can be used for collection of ground water quality samples.

Water Quality Monitoring

A comprehensive water quality-monitoring plan will continue to monitor the effectiveness of each stocking rate scenario. Each flume is equipped with an automatic water sampler. Programmable data loggers trigger the samplers based on flow volume and hydrograph geometry. Periodic grab samples are taken during flow events by an on-site technician. These samples are analyzed to assess and compare water quality characteristics between grab samples and automatically collected samples. Flow data from the flumes are combined with chemical analyses results to determine runoff nutrient loads from the pastures. In addition, soils, and ground water will be sampled periodically within the pastures to determine if nutrients are being accumulated or depleted within the pastures. Chemical analyses of water samples are being conducted by a DEP-certified SFWMD contract lab (Tennessee Valley Authority Environmental Laboratory in Chattanooga, TN). Dr. John Capece under a DEP-certified CompQAP will supervise water sample collection and in-situ parameter measurements.

Livestock Management

The 140 breeding females needed for the optimization project were chosen randomly from the ranch's 500 breeding females. After the pool of females was chosen, they were divided into the six small herds needed for placement into each pasture (except the control pastures). Each female was marked with a number tagging system allowing that individual to be followed throughout the duration of the experiment. Females are weighed in September, March, and June. Calves are marked in March when they are worked.

Females are placed in the winter pasture array during October or November, and they calve between November and March. Bulls are placed in the pastures from February until June. The typical range of the bull-to-cow ratio is from 1:15 to 1:20. Animals are moved to the summer pastures between April and June. Each test herd is maintained and tracked as a unit when moving between pasture arrays. Calves are weighed in March, June, and August, and sold at the end of August. In September, females are checked for pregnancy. Open females are culled from the test herd and replaced with a pregnant cow randomly chosen from the ranch herd. All breeding females receive the same health care as the other herds at the ranch.

WORK BREAKDOWN STRUCTURE

Task #1: Project Work Plan, Project QAPP

A project orientation meeting will be held to discuss the project's objectives, project plans and methods, proposed project schedule, decision points, and deliverables. The team will review the draft project work plan and QAPP that describes the optimization project in detail. The project work plan will include specific project and task objectives, and deliverables associated with each task. Once revised (if needed) and approved by the project team, the project work plan will guide the continued implementation of the optimization project.

Products: 1) three hard copies and one electronic copy of the draft project work plan; 2) three hard copies and one electronic copy of the final project work plan, incorporating revisions agreed upon by the project team.

Task #2: Project Management Web Site

Implementation of the initial two-year DEP 319(h) grant (1998-2000) has demonstrated the critical importance of integrated, detailed project management. The hydrologic and water quality components of the BMP project currently requires 4 full time technicians, one full-time Ph.D. engineer, and several part-time Ph.D. scientists and engineers. In addition, the monitoring system requires the simultaneous operation of over 100 electronic sensors and controllers under adverse hydraulic conditions (high backwater, low gradient). In dealing with this challenge, the project's Internet web site has played an essential role in improving project coordination among all participants and in managing the large number of instruments and software. Initially begun in 1997 as an information dissemination vehicle for project documents (QAPP, SOPs, deliverables, etc.), use of the web site has been expanding since January 1999 to become the primary management tool. Continued expansion of this management strategy will yield increased efficiency in the conduct of this project and improved communications of results to cooperators and clients statewide and nationally.

Products: a comprehensive Internet web site containing all relevant current and previous information related to the project including DEP deliverables, public information/presentations, pending tasks, instruments/software documentation, databases, results summaries, and site photos.

Task #3: Ground Water Well Installation and Instrumentation

These wells will accommodate both water level recording and water quality sampling. Each pasture will have a single well station consisting of two wells: a shallow 3-ft, 2-inch diameter well and a deeper 15-ft, 8-inch diameter well. Sensors and dataloggers will be connected to one well per pasture (16 total) for continuous water table monitoring.

Products: a well installation report describing well locations, characteristics, instrumentation, and monitoring/sampling protocols.

Task #4: Soil & Water Quality Assessment During Stocking Treatments

Soil samples for chemical analyses will be collected semi-annually and analyzed for water-soluble phosphorus and pH by UF-IFAS laboratories. Water samples collected at the flume locations during runoff events will be analyzed for physical properties (DO, temp, EC, and pH) and chemical properties (TP, OPO4, TKN, NOx, and NH4) by the SFWMD contract laboratory. Meteorological data will be collected continuously to develop rainfall/discharge relationships for each pasture array, and to develop a long-term database needed for all phases of the project.

GROUNDWATER		
Frequency	Source	Analyte
Quarterly and Event-basis	Grab	TPO4
		OPO4
		NO3

SURFACE WATER		
Frequency	Source	Analyte
Event-basis	Auto Sampler	TPO4
		TKN
		NH4
		NOx
Event-basis	Grab	TPO4
		OPO4
		TKN
		NH4
		NO3

SOILS		
Frequency	Source	Analyte
Semi-annual	Soil Sample	pH
		Water Soluble Phosphorus

Products: 1) extension publication describing variation of soil and water quality conditions within and between pastures, and possible relationships to BMP development; 2) electronic database containing all data (these and all subsequently described databases will be accessible through Internet and the World Wide Web, or upon request from the Principal Investigators).

Task #5: Test Herd Animal Data Collection

One hundred forty breeding females were selected for the optimization project during the pasture equilibration period. These females were tagged and then randomly assigned to the individual pastures. Initial animal health data were collected at this time. Data on animal health parameters are necessary for subsequent economic analyses of BMPs. These data will be collected through the full duration of the project.

Products: electronic database containing all relevant animal identifications and health data.

Task #6: Decision Support System

Application of newly developed BMPs will be dependent on the ability of planners to evaluate both the potential nutrient load reduction benefits and the potential economic costs to the cattle ranchers. A decision support system has been created to provide this evaluation capability for regional water managers and cattle ranchers. This software system, the Beef Ranch Decision Support System (BRADSS), requires additional modification to incorporate ranch economics components and the BMP options evaluated in this project. Testing of the software package will be conducted using the data sets generated by the BMP optimization project. As part of this task additional GIS coverage will also be created to properly represent the hydrologic, soils, and vegetation systems that compose the MAERC BMP pastures. Initially BRADSS will be applied to the MAERC system to both calibrate and verify the model for subsequent application on other ranches.

Products: decision support system software executable code and report. One manuscript on this topic is ready for submission to peer-reviewed agricultural or engineering journal.

Task #7: Stocking Rate Optimization Project

The pastures will be managed in a manner that falls within or close to commonly accepted and utilized beef cattle practice standards in Florida. These practices, and the optimization project data collected, will be relevant to all beef cattle management in Florida, particularly on low topography landscapes having relatively low phosphorus retention capacities.

At the conclusion of one year of the optimization project, all data will be analyzed and published, both in extension and scientific formats. This analysis will provide information about interim results that can be disseminated through the public workshop and other distribution channels while the project continues.

Products: extension publication describing the effects of various beef cattle stocking rates on pasture runoff water quality, including specific recommendations of BMPs based on these data; manuscript on same topic ready for submission to peer-reviewed agricultural or soil science journal; electronic database containing all data.

Task #8: Phase 2 & 3 Water Quality Measurement System Design

Transition of the Phase 1 project (stocking rate BMP) to Phase 2 (fertilization practices) and Phase 3 (rotational grazing) will require modification of the pasture geometry and water quality instrumentation infrastructure. Implementation of rotational grazing will also affect the measurement and sampling strategies. Changes in technology and experience gained during the stocking rate phase may also dictate replacement of components of the measurement systems.

Products: design report describing modifications required to the pastures and to the water flow and quality measurement systems for implementation of Phase 2 and Phase 3 BMP projects.

Task #9: Regional BMP Application

Once the Beef Ranch Decision Support System is modified to incorporate the economics and BMP components, the system will be used to evaluate the impacts of application of various BMP scenarios proposed and tested in this project on individual ranches within the region. This task will require obtaining or preparing GIS coverages for land use, soils, drainage and other pertinent land attributes for ranches where BRADSS is to be applied.

Products: regional BMP application report documenting the application of BRADSS to ranches within the Lake Okeechobee Basin under BMP scenarios developed as part of this optimization project.

Task #10: Beef Cattle BMP Public Workshop and Web-based Presentations

A public workshop will be held to convey the results of the optimization project to the beef cattle ranching community, agency and governmental personnel, and any other interested parties. This workshop will consist of presenting the results of the project that were published in the extension publication described previously, and describing specific BMPs that have the potential to improve water quality in beef cattle pasture runoff. The workshop will include a panel discussion to ensure feedback from attendees. This feedback will be considered in the design of future projects, and will increase the chances for project acceptance by the affected stakeholders, and the chances for long-term project relevance and success.

The workshop will be held as an independent event, located to maximize participation by the beef cattle ranching community, or held in conjunction with the annual FCA meeting. The FCA, SFWMD, UF-IFAS, and Archbold will determine the optimum timing and location of the workshop collectively. Extension programs associated with this project are described in detail on the project web site.

Products: public workshop, including a report summarizing the workshop results and feedback. Presentations developed as part of this workshop will be available for viewing and download from the project web site.

Task #11: Final Report

Products: final report documenting all accomplishments/deliverables and summarizing the findings/experiences of the project, including implementation schedules for Phases 2 and 3 (fertilization and rotational grazing) of the BMP optimization program at MAERC. A video and slides presentation will accompany the final report. The video component will be provided in VHS as well as video CD format. The video CD presentation will also be discretized into 30-second topic sound/video bites and incorporated in the project web site using the AVI and MPEG presentation formats.

PROJECT TEAM

Project Member	Affiliation	Responsibility
Dr. Kenneth L. Campbell	UF-IFAS Agricultural and Biological Engineering Department	Project Leader, P.I.
Dr. Donald A. Graetz	UF-IFAS Soil and Water Science Department	Soil Scientist, Co-P.I.
Dr. Kenneth M. Portier	UF-IFAS Statistics Department	Statistician, cooperator
Dr. Alan D. Steinman	SFWMD Ecosystem Restoration Department	Supervising Biologist, cooperator
Dr. Patrick J. Bohlen	ABS-MAERC	Scientist, cooperator
Dr. John C. Capece	Southern DataStream, Inc.	Engineer, contractor

PROJECT TIME FRAME

DELIVERABLE	DESCRIPTION	DATE*
1	Draft Project Work Plan and project QAPP	2 Weeks
2	Final Project Work Plan and project QAPP	6 Weeks
3	Quarterly Reports. Written reports describing accomplishments for each task.	every 12 weeks
4	Public workshop, including a report summarizing the workshop results and feedback.	101 Weeks
5	Final report documenting all accomplishments and summarizing the findings/experiences of the project, including implementation schedules for the next phase of the BMP optimization program at MAERC. A video and slides presentation will accompany the final report.	104 Weeks

* Weeks after Project Initiation

LITERATURE CITED

Capece, J.C., K. L. Campbell, D. A. Gaetz, K. M. Portier and P. J. Bohlen. 2000. Optimization of Best Management Practices for Beef Cattle Ranching in the Lake Okeechobee Basin. WM699 Final Report. FDER, Tallahasse, Florida.

Cox, J., R. Kautz, M. MacLaughlin and T. Gilbert. 1994. Closing the gaps in Florida's wildlife habitat conservation system. Florida Game and Fresh Water Fish Commission, Tallahassee, Fl. 239 p.

FDACS. 1996. Florida Agricultural Statistics. 1995 Livestock, Poultry, Dairy Summary. Florida Department of Agriculture and Consumer Service.

Graetz, D.A. and V.D. Nair. 1996. Water quality impact of grazed rangelands and pastures: Literature review. Department of Soil and Water Sciences. University of Florida, Gainesville. Technical Report Submitted to South Florida Water Management District, West Palm Beach, FL.

James, R.T., B.L. Jones and V.H. Smith. 1995a. Historical trends in the Lake Okeechobee ecosystem. II. Water quality. Arch. Hydrobiol. Suppl. 107:25-47.

James, R.T., V. H. Smith and B.L. Jones. 1995b. Historical trends in the Lake Okeechobee ecosystem III. Water Quality. Arch. Hydrobiol. Suppl. 107:49-69.