SOUTH FLORIDA ECOSYSTEM RESTORATION
TASK FORCE / WORKING GROUP

SCIENCE COORDINATION TEAM

GEER-2000 Science Conference
DRAFT Science Information Needs

*This **DRAFT** document is a work-in-progress by the Science Coordination Team. Information expressed in this document resulted from the Greater Everglades Ecosystem Restoration – 2000 Science Conference. The theme of the GEER-2000 Science Conference was* "Defining Success". *Conference participants were challenged to assess and evaluate relevant previous and ongoing research within the framework of the following overarching questions:*

- *How does our science explain the physical, hydrological and biological features that created and sustained the pre-drainage Everglades? Does that information help us in* defining success *as well as in laying the foundation for* measuring success *of restoration?*
- *How does our research contribute to understanding the interrelationships between resource demands and the greater Everglades physical and biological components, to identifying trends which may impede restoration progress, and, to measuring restoration success from an ecological, social, cultural and economic perspective?*

The GEER-2000 Science Conference was concluded with a closing plenary session dedicated to identifying the immediate [I = next 2 years] and near-term [N = next 5 years] information needs critical to successfully implementing greater Everglades restoration. Below is a draft of that work-in-progress. This is an FYI document; comments are welcome.

1. Ecology and Ecological Monitoring

The goal of ecologists working in the Everglades is to understand key ecosystem patterns, processes, and attributes to be able to predict how restoration will affect areas of the system that will experience changes in patterns of land and water use. Much of the ecological research will focus on water depth, water quality, and flows attendant to CERP de-compartmentalization. There are time-sensitive research opportunities that will arise during the Everglades Restoration Project. For example, ModWaters will increase the depth in WCA3B and flows will be introduced into parts of WCA3B that have been relatively static for many years. This change offers a management experiment. If we can design an appropriate monitoring scheme, we can test existing models to learn much about the system and improve our predictions.

In addition the population of South Florida will continue to grow causing changes in land and water uses and changing the landscape mosaic upon which many species depend. For example, Florida panthers depend on a landscape mosaic of upland, wetland and agricultural areas that are very sensitive to development pressures in Southwest Florida. Snail kites depend on wetlands distributed spatially in the South Florida landscape so that "good" conditions for snail kite nesting can be distributed temporally. We need to be able to model land use as well as water use changes to help us predict and plan for the impacts of land and water use changes regionally.

In all cases we will be making management decisions based on some degree of uncertainty. Uncertainty can be reduced prior to making management decisions by conducting experiments. Also, as part of an adaptive management scheme we should treat management decisions as hypotheses of ecosystem response and monitoring programs as experiments designed to test management experiments.

Ecologists can best serve the task of Everglades restoration in the following ways: (1) Improving understanding and reducing uncertainty of the Everglades ecosystem in crucial subject areas. (2) Developing new and improving existing models using empirical and experimental data to enhance the forecasting capabilities of the models. (3) Defining ecological integrity and developing a suite of indicators that can be monitored to provide indications (at varying spatial and temporal scales) of changes in the Everglades that result from restored hydrology. (4) Analyzing model output, experimental, and monitoring results in an adaptive management scheme.

1.1 Improving understanding and reducing uncertainty of the Everglades ecosystem in crucial subject areas.

1.1.1 Understand the present effects of system compartmentalization and the implications for reconnection. – N

1.1.2 Effects of water flow on ecological processes and attributes. – N

1.1.3 Linkages between freshwater, estuarine, and coastal systems. – N

1.1.4 Linkages between the littoral landscape in Lake Okeechobee, and nutrients, hydrodynamics, and the associated food web. – I

1.1.5 Linkages between the fish community and lower trophic levels (aquatic insects and other invertebrates, etc.). How will hydrologic changes affect these lower levels and, hence, fishes? This will require a better understanding of the lower trophic-level food web.

1.1.6 Linkages between the fish community and natural landscape features, such as alligator ponds and solution holes or artificial features, such as canals, that may provide refugia, sinks, paths of movement, etc., depending on circumstances.

1.1.7 Effects of artificial landscape features, such as canals, on alligators and subsequent effects on the biota that relate to the alligator.

1.1.8 Linkages between nutrients (P, S, N especially) and vegetation and the ecosystem as a whole.

1.1.9 Linkages between particular pairs of species, such as snail kites and apple snails.

1.1.10 Effects of extreme events (hurricanes, fire, droughts, floods, freezes…) on ecological processes and attributes. – N

1.1.11 Effects of contaminants on all parts of the system.

1.1.12 Effects of invasive exotic species (plants and animals) on ecological integrity.

1.2 Developing new and improving existing models using empirical and experimental data to enhance the forecasting capabilities of the models.

1.2.1 Develop new models to forecast impacts of land use changes on components of ecological integrity. – N

1.2.2 Better understanding and models of changes in topographic features and vegetation including: peat accumulation, ridge and slough development, tree islands, and succession of marsh and prairie vegetation types, especially those affecting key higher trophic level species, such as the Cape Sable sparrow and snail kite.

1.3 Defining ecological integrity and developing a suite of indicators that can be monitored to provide indications (at varying spatial and temporal scales) of changes in the Everglades that result from restored hydrology.

1.3.1 Develop an index of ecological integrity for Greater Everglades Ecosystems. – N

1.3.2 Identification of key indicators for assessment of system recovery. These include the following, though many more should be identified: changes in the microbial community, changes in periphyton, changes in nesting patterns of wading birds, condition and importance of tree islands, distribution, abundance, and conditions of alligators, changes in spatial patterns of snail kites, changes in densities and spatial patterns of white-tailed deer, and changes in numbers and spatial distribution of Cape Sable seaside sparrows.

1.4 Analyzing model output, experimental, and monitoring results in an adaptive management scheme.

1.4.1 Collect baseline data for key ecological indicators. -N

2. Water Quality and Water Treatment Technologies

2.1 Status and Trends

2.1.1 Research/monitoring to support THDL development (at watershed levee, establish ideal conditions first)

2.1.2 Expand water quality monitoring to ecosystem approach – beyond just water column (e. g., plant tissue, morphology, soils, microbial)

2.1.3 Work towards nutrient budgets for entire system – look at surface and ground water as well as atmospheric inputs

2.1.4 Assess how changes in water levels and flows (including pulsed flows) affect processes (e. g., nutrient cycling, retention, weathering, DOM)

2.1.5 Causes of mercury methylation; including role of S and microbial dynamics

2.1.6 Reassess impact of N on Florida Bay; variations with flow, sources of N in the Everglades

2.1.7 Review overall water quality monitoring programs across agencies. The need for resources to analyze and synthesize huge amounts of data. Improve techniques and consistency of methods

2.2 Treatment Technologies – most short-term, immediate needs

2.2.1 Bioassay of chemical treatment outflow

2.2.2 Disposal/application of residuals

2.2.3 Speciation of P; bio-availability

2.2.4 Focus on non-chemical addition technologies

2.2.5 More information on N and S removal

2.2.6 Removal of constituents of non-nutrients

2.2.7 Influence of soil types/topography on treatment efficiency

2.3 Related Topics

2.3.1 Determination of longevity of STAs

2.3.2 ASR-related water quality treatment

2.3.3 Performance of urban stormwater detention facilities

2.3.4 Mixing zone impacts; modeling

2.3.5 STA design/performance N of L. O.

2.3.6 Enhance BMPs; source control

3. Hydrology and Hydrologic Modeling – Summary of Critical Immediate (2-year) & Near-term (5-year) Science and technical Needs

3.1 Hydrologic Modeling

3.1.1 Estimation and management of uncertainty (or certainty) of hydrologic modeling - I

3.1.2 Determination of hydrologic effects of roadways and other barriers across the remnant greater Everglades – I

3.1.3 Development of improved hydrologic performance measures and their linkage to ecosystem restoration science – I

3.1.4 Develop both regional and local-scale models of ASR, flows to the coast, and ridge& slough – I

3.1.5 Link both types of models to evaluate alternative scenarios – I

3.1.6 Development of high-resolution hydrologic models (include major community types) – N

3.1.7 Development of unstructured grid models – N

3.1.8 Develop variable-density salinity intrusion models to understand the freshwater/saltwater interface in coastal environments – N

3.1.9 Perform additional sensitivity analyses of the CERP components – N

3.1.10 Models need to produce flow magnitude, velocity, and direction accurately – N

3.1.11 Investigate climate change (i. e., sea-level rise) on estuaries and upstream wetlands – N

3.1.12 Develop consensus protocols for modeling: calibration, sensitivity analyses, validation, parameterization - N

3.2 Hydrologic Science

3.2.1 Understanding how the ridge & slough system is maintained – I

3.2.2 Understand the fate and transport of slough sediments – I

3.2.3 Coastal interface: flow vs. salinity vs. vegetation and feedbacks – I

3.2.4 Understanding the role of extreme flows in the generation and maintenance of Everglades landscape patterns (e. g., ridge & slough pattern) – I

3.2.5 Determine the importance of maintaining the ridge & slough pattern across artificial barriers (e. g., major roadways) – I

3.2.6 Perform scientific research necessary for understanding the linkage between ecolologic and hydrologic effects and incorporate these into modeling and PMs – I

3.2.7 Investigate the role of surface water/ground water interactions in the Everglades – N

3.2.8 Further develop methods for estimation of regional evapotranspiration including effects of different vegetation patterns – N

3.2.9 Investigate the relationship between hydrology and the restoration of organic soils – N

3.2.10 Better understand vegetation resistance to flow - N

3.3 Hydrologic Data

3.3.1 Develop a consistent data set for high-resolution topography in the greater Everglades, including the correction for datum change – I

3.3.2 Adjust all water surface elevation data sets and rating curves to reflect datum change

3.3.3 Flow velocities in the Everglades – I

3.3.4 Improved soil surveys in state/federal lands: types, subsidence, history, and depth – I

3.3.5 Groundwater seepage: soil properties, transport studies - I

4. Information Systems

We succeed when our clients find and obtain quality, timely and comprehensive information to: conduct an investigation, make a decision, devise a plan, avoid a conflict, and make a better world. In today's landscape, there are

- Many products and services
- Diverse approaches and practices
- Information is now born digital
- Lack of coordination leads to overlaps, unnecessary duplication and holes
- Legacies arte being forgotten
- Information overload
- What do folks need?

4.1 Issues and Needs – All Immediate

4.1.1 Leadership and common forum for information efforts across agencies

4.1.2 Promotion, identification and creation of standards

4.1.3 Resources and funding for information: coordinated, stable, and extending beyond the science

4.1.4 Build in human assistance – computers alone can't do it!

4.1.5 An information plan for the GEER effort

4.1.6 Marketing through examples

5. Social and Human Sciences

5.1 Immediate – Short Term (1- 2 years) Critical Needs for Measuring Success – Baseline Data - (provides basis for future assessments, model input, demand projections, and decision making): - I

5.1.1 Measuring population and trends, including the diversity of the population

5.1.2 Updated and standardized water use, population, water conservation and land use data, assessment of current levels of service

5.1.3 Socio-economic impacts of restoration activities

5.2 Long Term (next 5 years) Needs for Enhancing Public Acceptance, Decision Making and Socio-Economic Monitoring

5.2.1 Measuring community values, and willingness to pay over time and location

5.2.2 Assessment of water pricing and land taxation as tools for conservation/ restoration

5.2.3 Assessment of who is being left out and/or significantly impacted (environmental justice)

5.2.4 Extent of public engagement in restoration decision and planning

5.2.5 Measuring values, perceptions and goals of decision makers and resource managers

5.3 Research and Model Applications

5.3.1 Improved forecasting techniques/data integrated into current conceptual models

5.3.2 Develop a Human System Model, analogous to the existing Total Ecosystem Model for South Florida

5.3.3 Need for economic growth model for S. Florida, economic and statistical models

5.3.4 Increase use of anticipatory tools such as GIS future land use

5.3.5 Develop information and training for managers and the public on land and water use affects on the restoration efforts

5.3.6 Use of interdisciplinary models and data, use of GIS overlays

5.3.7 Survey research (value perception, willingness to pay, awareness, etc.)

5.3.8 Benchmarks of public opinion

5.3.9 Development of Report Card Indicators and performance measures

5.3.10 Quantification, demonstration and public understanding of benefits and costs of restoration effort

5.4 Outreach and Public Participation Methods

5.4.1 Identification of all citizens and broadcast to a broader audience

5.4.2 Need for research for best methods and tools

5.4.3 Develop a strategic plan for outreach/public participation

5.4.4 Funding for outreach/public participation

5.4.5 Improve immediate methods such as “useable tools” maps, use of imagery in communication medium

5.5 Institutionalize Communication/Evaluation Processes

5.5.1 Improve internal communication between and within agencies

5.5.2 Increased use of collaborative processes through interdisciplinary teams

5.5.3 Objective evaluation of intergovernmental coordination and cooperation

5.5.4 Need for external Peer Review of applications and effectiveness (CROGEE?)