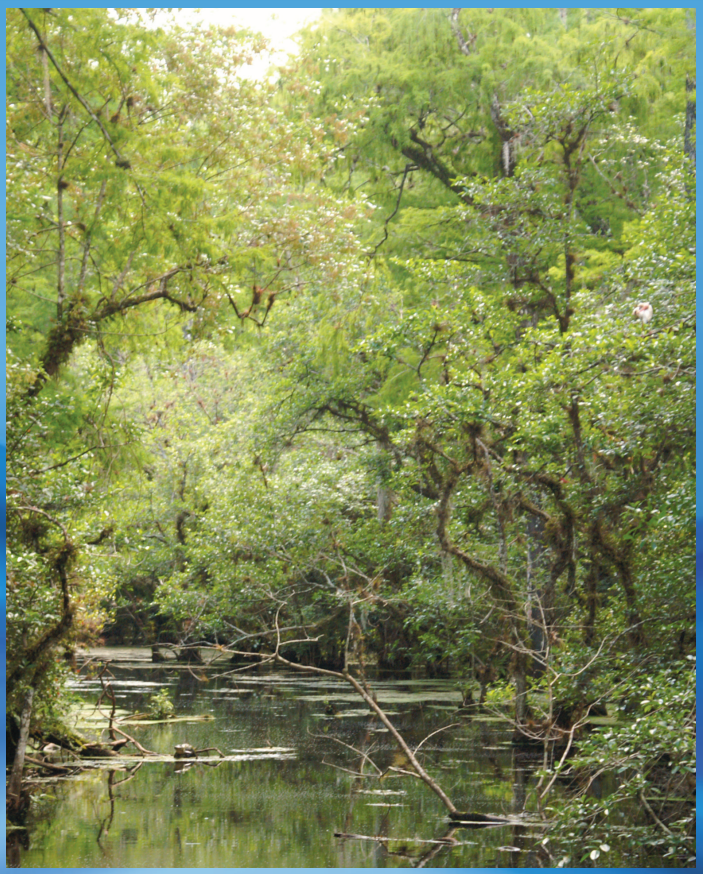
FAU SLR Workshop Seminar

Influence of Sea Level Rise
on Natural Systems of the Greater Everglades



FACTSHEET

Background

The Center for Environmental Studies (CES) at Florida Atlantic University (FAU), the Florida Sea Grant College Program (FSG) and the U. S. Geological Survey (USGS) held a workshop in April 5-7, 2011 at FAU in Boca Raton, Florida. The purpose of the workshop was to provide a common understanding of the changes in precipitation, hydrology and sea-level anticipated as a result of climate change in South Florida. Conceptual Ecological Models being used for the Everglades Restoration program were reviewed, discussed and updated. Three important ecosystems in South Florida, along with proposed guidelines for incorporating current and potential sea level rise into the models, were presented.

A series of plenary presentations provided the background to climate change issues in Florida, covering potentials for sea level rise and rates of change in the Greater Everglades Ecosystem. The biogeochemistry of accelerated carbon loss in response to increased sea water intrusion was identified as a critical new issue. Further presentations identified the hydrologic and biologic responses to changing sea levels.

Traditional resource management philosophies of restoring historic conditions and communities are, perhaps, not appropriate under projected climate and sea level changes. Rather, a paradigm shift focusing on ecosystem processes, enhancing habitats, recoverance capacity, and planning for ecological migration corridors is needed.

Ecosystem Scenarios and Issues

The three ecosystems studied provided different scenarios and issues in response to climate change.

- The **Southern Marl Prairies** have no migration possibilities, but the monitoring of the salt water front and its impacts is an important management tool.
  - The Cape Sable Sparrow is the species most at risk.
  - The most important management option for this ecotone is more fresh water as soon as possible.
  - This is best achieved through increased flow from the northern part of the Greater Everglades Ecosystem.
- The **Everglades Ridge and Slough** ecosystem is recognized as a good indicator system and community level dynamics is identified as a biotic indicator of system health.
  - Increased water storage is an important management option.
  - Conceptual Ecological Models need to include sea level rise, biogeochemical indicators, and carbon dynamics.
- The **Mangrove Estuaries** includes a range of coastal features and their maintenance is a critical issue.
  - While multiple monitoring programs are occurring, they are not coordinated with regard to objectives and protocols.
  - Vegetation succession models are important and water monitoring needs to include both ground and surface water.

Summary

Common findings and recommendations that came out of the workshop included:

- Sea level rise and climate change are important components of Conceptual Ecological Models and should be added if not already incorporated into the models.
- Biogeochemistry indicators are critical and monitoring of these processes should be included.
- A focus on ecotones is important.
- The quality, quantity, timing, and duration of freshwater are essential for successful and sustainable restoration of the Greater Everglades the sooner the better.
- Episodic/extreme events (fire, freeze, flood, drought, hurricanes) are important.
- A paradigm shift focusing on ecosystem processes, enhancing habitats, recoverance capacity, and planning for ecological migration corridors is needed.

Sea level rise and climate change are important components of Conceptual Ecological Models and should be given more importance as the models are revised. Biogeochemical indicators are critical, a focus on ecotones is the appropriate scale, the quality, quantity, timing, delivery of freshwater is essential, and the impacts of extreme events are important tipping points.

Plenary Sessions Summarized

The plenary sessions opened with a series of presentations that set the stage by providing a common basis of information for the subsequent discussion groups to draw upon. The first group of speakers provided a "Big Picture Perspective" including the state of knowledge on sea-level rise in Florida, downscaling global models, dramatic events such as hurricanes and storm surges, and accelerated carbon loss due to saltwater intrusion.

Background

The use of global projections to predict sea level rise for Florida is recommended. The first real impacts on humans will be via the hydrologic cycle, both water supply and "storminess." Rapid sea level rise is based on paleoclimatology due to rapid ice melt of the western Antarctic and Greenland ice melt, glaciers and small ice caps. Local projections are required for adaptation and mitigation decision making. Historic data is not predictive of future climate scenarios; both climate and non-climate changes must be taken into consideration. Under what storm scenarios the Everglades are most at risk is not known. The coupling of hydrodynamic models for storm events (waves, surge, currents) with ecosystem models is needed to fully understand integrated cause and effect relationships. Rates of organic matter remineralization are more rapid under sulfate reducing conditions.

Hydrologic Response

Modeling tools available have to be fitted to the unique hydrology of the Everglades including surface water and ground water hydrology, they must be able to represent hydrodynamic fluctuations, salinity transport in the surface water and aquifer, include temperature computations and simulate extended periods. Water levels in interior wetlands are rising at rates equal to or greater than those observed at Key West but with more decadal variability.

Biotic Response

The mangrove fringe on coastal islands along rivers is expanding. Coastal marshes are disappearing and tiny ponds ("Pocs") are enlarging and coalescing. Salty groundwater is "eating" peat. In many of these areas freshwater trees are dying from salt water intrusion and sea level rise. This rise leads to an increase in habitat loss, fragmentation and succession. This is caused by saltwater inundation, both continuous and periodic, groundwater intrusion, shrinking freshwater lens, habitat isolation, and interaction with climate variables. It alters long standing regimes of fire and storm surges with consequences for landscape patterns. Habitat isolation is exacerbated. These conditions cannot be addressed with traditional natural resource management techniques nor the restoration of historic conditions and communities.

Seagrasses and submerged aquatic vegetation of the greater Everglades are being affected by several factors of climate change. Instead they require a paradigm shift and integrated management tools. Presented were sea level rise and global climate change effects on submerged aquatic vegetation of the greater Everglades. The top ten factors of climate change affecting seagrasses and submerged aquatic vegetation of the Everglades were further outlined with causes and resolutions.

Everglades hydrologic and biologic response to sea level rise places a century of anthropogenic change was put into a late Holocene context. We still lack the high-resolution studies needed to understand decadal to multidecadal variability in rates of sea level rise. It is important to understand this in order to predict tolerance of coastal vegetation to different rates of sea-level rise and their resilience to a range of rates of sea level rise. Timing of Everglades wetland initiation coincides with development of swamps and peat lands through Atlantic and Gulf Coastal Plains. Anthropogenic verses natural patterns issues and resolutions were posed.

The species at risk focused on climate envelope models and Florida Keys endemics. Models can help enhance our understanding of climate change effects on species. Models can be used to predict where species may occur (through migration or translocation) under different emissions scenarios including landscape changes and connectivity, and dispersal issues. Conceptual Ecological Models and the current effort to incorporate sea-level rise and climate change into the existing Everglades models were presented. The outcome for this workshop was the identification of the ecological attributes associated with sea-level rise. The current climate change and/or sea-level rise incorporated into the Everglades models were provided.

The next 50 years will bring significant temperature increases, amplified sea-level rise, fewer freezes, changes in rainfall and storm frequencies, shifts in species ranges, and alteration of biological communities. Other current total systems stressors will also be affected by climate change and sea-level rise. We need to identify the most important causal hypotheses linking climate change and sea-level rise-related stressors with the attributes of the natural Everglades system.

The Marine and Estuarine Goal Setting for South Florida (MARES) goal is to reach a science based consensus about the defining characteristics and fundamental regulating processes of a South Florida coastal marine ecosystem that is both sustainable and capable of providing the diverse ecological services upon which our society depends. The drivers for these wetlands are: climate change, sea level rise, precipitation patterns, anthropogenic alteration, land use, and altered freshwater flow. In the Everglades sub-regions, complete loss of the ecotone is possible.

Climate change and sea-level rise scenarios for the greater Everglades landscape were demonstrated. They simulate possible future scenarios and incorporate anthropogenic impacts, biophysical and socioeconomic variables. They can project either proactive or business as usual scenarios.

Following the plenary sessions, attendees participated in discussion groups that examined the three ecological communities of the Everglades: the mangrove estuaries of the Florida Everglades, Everglades ridge and slough, and the southern marl prairies.

For more information, a full report of the workshop proceedings and discussions is available in the **Summary Report: Influence of Sea level Rise on Natural Systems of the Greater Everglades, April 5-7, 2011, Florida Atlantic University, Boca Raton, Florida.**

To obtain the report please visit
http://www.ces.fau.edu/climate_change

Photos courtesy of the South Florida Water Management District

The Florida Center for Environmental Studies
Florida Atlantic University
5353 Parkside DriveBuilding SR, RM 231
Jupiter, Florida 33458