Effects of the Suwannee River Sill on the Okefenokee Swamp Hydrological Environment

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Okefenokee National Wildlife Refuge
Project Objective:
Has the Suwannee River sill affected the Okefenokee Swamp hydrological environment and vegetation distributions?
Aquatic Prairie

Forested Swamp

Upland Pine Forest

Herbaceous Prairie

Smilax spp. and shrubs
Sill Ditch, Dry Conditions
Processes Affecting the Okefenokee Landscape and the Scale of those Effects
Hydrological Features

Species’ Hydrological Environment

Physical Environment

Manipulative Processes

Vegetation History

Comparisons: HYDRO-MODEL Map Overlays Species’ Models

Landscape Patterns and Processes

Suwannee Sill Effects
**Hydrological Features**
- Weather,
- Water Level,
- Flow

**Physical Environment**
- Topography,
- Peat Thickness
Vegetation History

Pre-logging Surveys

1952 BW Photos

1977 CIR Photos

1990 Imagery
Species’ Hydrological Environments
Manipulative Processes

- 1891-1897: Suwannee Canal
- 1889-1942: Logging
- 1950s: Peat Mining
- 1960-1962: Suwannee Sill Construction
Flow Features and Directions During Average Conditions

Suwannee River Sill
Daily Water Depths in Swamp Basins (1993)

Water Depth (m)

-0.25
0.25
0.75
1.25
1.75
2.25

Month

JAN MAR MAY JULY SEPT NOV

West
East
Central
Northeast
Southeast
Swamp Topographic Surface and Hydrologic Basins
HYDRO-MODEL Steps

Water Depth
+ Rain
+ Inflow
- Outflow
- Evapotranspiration
+ Ground Surface Elevation/Roughness

Flow Direction Calculation
Amount of Water to Move
Water Movement
Model Simulations

Northeast

Water Depth (m)

West

Year


-0.25 0.25 0.75 1.25 1.75 2.25

-0.25 0.25 0.75 1.25 1.75 2.25

no sill
with sill
no outflow
75% ET
150% ET
Annual Average Water Depth
1941-1995

Water Depth (m)

Year

SCFSP

SCRA

Sill Construction
Areas Affected by Model Manipulations

Inflow
Outflow
Sill

Sill (upper basin)

ET

ET

ET
Areas Affected by Sill Operation

- **Extended hydroperiod in high water conditions**
- **Extended hydroperiod in low water conditions**
- **Reduced hydroperiod**
- **Increased outflow in very high water level conditions**
- **Flow direction reversal in very high water level conditions**
Vegetation Composition of Okefenokee National Wildlife Refuge 1890-1990

Regional Comparison of Changes in Vegetation Types, Before and After Sill Construction

<table>
<thead>
<tr>
<th>Vegetation Type in 1952</th>
<th>Sill Area</th>
<th>Southwest</th>
<th>East-Central</th>
<th>North</th>
<th>Northeast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Forest (WF)</td>
<td>WF</td>
<td>WF, S</td>
<td>WF, S</td>
<td>WF</td>
<td>WF</td>
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<tr>
<td>Shrub (S)</td>
<td>WF</td>
<td>S, WF</td>
<td>S</td>
<td>WF</td>
<td>S, WF</td>
</tr>
<tr>
<td>Prairie (P)</td>
<td>WF</td>
<td>S</td>
<td>S</td>
<td>WF</td>
<td>S</td>
</tr>
</tbody>
</table>

- Upland Pine
- Wet Forest
- Shrub
- Prairie
Proportion and Size of Wildfires by 5-Year Intervals (1855-1993)

- **Percent**
- **Area (ha)**

- **5-Year Interval**
  - 1855
  - 1925
  - 1935
  - 1945
  - 1955
  - 1965
  - 1975
  - 1985
  - 1995

- **Sill Construction**
Vegetation Succession in Okefenokee Swamp

Prairie - Shrub - Swamp

Prairie-Shrub-Swamp

Shrub-Swamp

Cypress-Bay-Blackgum Swamp

Mixed Blackgum Swamp

Bay-Shrub-Swamp

Bay-Swamp

Legend:
- no fire
- moderate fire
- severe fire + logging

1977  1990
Summary Points

• The Suwannee River sill is increasing flooding depth and duration in 18% of the refuge, primarily during periods of abundant precipitation.

• Although fire management may be affecting fire distributions, the sill has little effect of the swamp fire regime.
Summary Points (continued)

• The observed changes result from logging, fire management, hydrologic manipulations, and vegetation succession.

• The role of these processes as the primary driver of change is influenced by the location within the swamp.
Acknowledgements