Maximizing Sustainable Production: The Role of Wetlands in Regional Sustainability

David Pfahler
PhD Candidate
University of Florida
Problem Statement

- How can we predict a maximum sustainable production level within a regional watershed?

Approach:
- A question of sustainable scale involving both environmental and economic production
- Model the regional product using a land use optimization approach
- Incorporate ecosystem services as sustainability constraints
Peace River Region

- Peace River basin in southwest Florida
- Boundaries expanded to include entire county area
- Water use caution area
- Extensive phosphate mining within the watershed.
Land Use Change

1940  1999

1%  -  10% Urban
8%  -  17% Intensive Ag
3%  -  27% Improved Pasture
.5% -  10% Mining

Peace River Cumulative Impact Study, 2007. FDEP
Methods

- Regional EIO-LCA Model
  - IMPLAN regional economic model baseline
  - Development of regional resource intensity vectors using public data
  - Accounts for both direct and indirect impacts
- Land Use Optimization Model
  - Collapse industries to major land uses
  - Separate out indirect inter-industry impacts
  - Use average environmental water and energy budgets for land uses
Sustainability Constraints

- Groundwater balance
  - Based on minimum flows and levels
- Storm runoff storage
  - Based on 24 hour 25 year return storm
- GHG emissions
  - Based on meeting Kyoto protocol reduction targets
- Renewable energy
  - Based on proposed renewable energy standard and RFS
Focusing on the Role of Wetlands

- How do wetlands provide value in the regional production system?
- Value is defined as an increase in the optimization goal
Run 1: Ground Water Constraint

Initial Land Use
- Water: 10%
- Wetland: 17%
- Forest: 12%
- Cattle: 30%
- Citrus: 10%
- Open: 9%
- Com/ind: 2%
- Residential: 5%
- Mining: 3%
- Ag crops: 2%

Total Output: $M 26,271

GW constraint
- Water: 10%
- Wetland: 25%
- Cattle: 2%
- Ag crops: 53%
- Residential: 5%
- Mining: 3%
- Com/ind: 2%

Total Output: $M 27,791
Run 2: Market Growth Limits

GW constraint
- water 10%
- ag crops 53%
- wetland 25%
- cattle 2%
- com/ind 2%
- residential 5%
- mining 3%

Limits to Market Growth
- water 10%
- ag crops 2%
- citrus 6%
- wetland 25%
- cattle 36%
- com/ind 2%
- residential 5%
- mining 3%
- forest 11%

Total Output: $M 27,791
Total Output: $M 26,612
Run 3: No Wetland Area Limit

Limits to Market Growth

- com/ind: 2%
- residential: 5%
- mining: 3%
- ag crops: 2%
- water: 10%
- citrus: 6%
- wetland: 25%
- forest: 11%

Total Output: $M 26,612

No wetland area limit

- com/ind: 2%
- residential: 5%
- mining: 3%
- ag crops: 2%
- water: 10%
- citrus: 8%
- wetland: 35%
- cattle: 36%

Total Output: $M 26,688
Regional Impact

![Graph showing percent change over time for Population, $ Output, and $/person. The graph compares initial to Run 1, Run 2, and Run 3, with Population peaking at Run 1, $ Output also peaking at Run 1 but decreasing at Run 2, and $/person decreasing at Run 2 and remaining steady at Run 3.]}
Discussion

- Wetland area increases to provide sustainable ground water recharge
- The region appears to be close to the maximum production level already
- An implementation of this model could be used to test future development scenarios
Acknowledgements

Thank you to the Adaptive Management of Wetlands, Water, and Watersheds IGERT and the University of Florida Center for Environmental Policy for support for this research effort.