

Improving Resilience to Climate Change through the Enhanced Monitoring of Aquatic Ecosystems

Introduction

Wetlands and Climate Change



- Wetlands often exist at the threshold between terrestrial and aquatic ecosystems, and as a result their existence and the ecosystem services they provide are closely tied to weather.
- Since wetlands are one of the most climate change sensitive ecosystems, they portend climate change impacts.

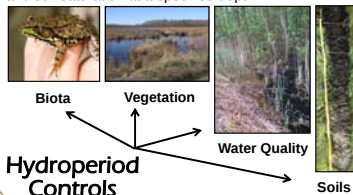
- Wetlands can also provide a mechanism to mitigate climate change impacts through the provision of multiple services including
 - climate regulation
 - natural hazard regulation
 - water purification
 - fresh water storage

Monitoring Key Drivers

- Accurate, dynamic wetland maps can improve society's resilience to climate change through
 - early detection and improved understanding of climate change effects
 - enhanced management of wetlands to target desired ecosystem services
- Wetland hydroperiod is the most important abiotic factor controlling wetland extent and function.



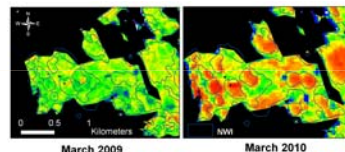
HYDROPERIOD: Duration and frequency of flooding and soil saturation at a specified depth



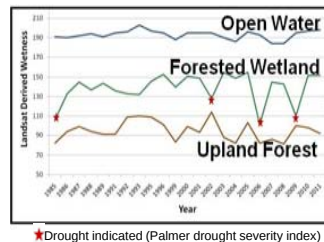
Applications (1)

Monitoring the Connection between Weather and Hydroperiod

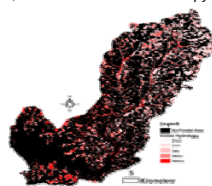
- Although many types of wetlands were difficult to map, advancements in remote sensing support improved mapping and monitoring of wetlands to guide environmental management.



Note that a wetness index, based on Landsat, (above) is markedly different between years (inundated = red / non-inundated = green) and that fluctuations in wetness are well correlated with the Palmer Drought Severity Index (below).



Synthetic aperture radar allows direct assessment of hydroperiod, even under the forest canopy (below).

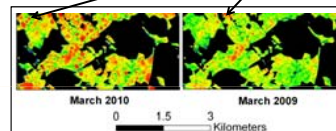


Applications (2)

Mapping Ecosystem Services

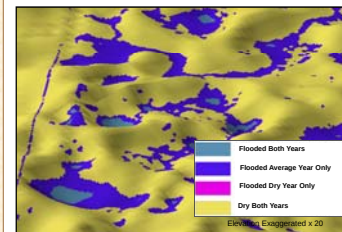
- Improved ability to map and monitor wetlands supports the prediction of ecosystem service provision under different climate scenarios.

Note below that some wetlands are more dependent on weather (variable) than others (stable).

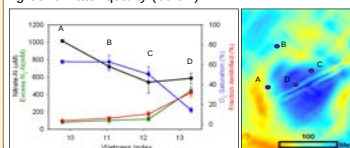


Soil organic carbon storage > 3-4 times higher in stable wetlands versus variable

Spatial patterns in water storage and connectivity vary considerably with predicted climate changes.

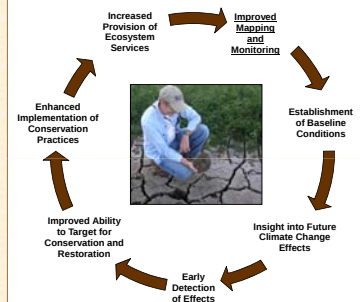


Topographic indices can produce accurate wetland maps, infer hydroperiod and are correlated with ground water quality (below).



Outcomes

- Use of remotely-sensed data to produce dynamic maps of wetland extent and key functional drivers supports the **adaptive management of wetlands**



Opportunities

- USDA is addressing wetland management in different landscapes (e.g., forested, agricultural, and urban) across the US.
- Techniques are being developed to improve environmental outcomes while balancing the need for food shelter, and other necessities.
- Many of these techniques rely on innovative use of remotely sensed data.
- Opportunities include technique development and technology transfer.

For more information please contact:

Megan Lang
USDA Forest Service
Northern Research Station
mwlang@fs.fed.us
(301) 504-5138

