NDVI Analysis of Deforestation in Étang Saumâtre Watershed, Haiti: 1984-2014

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Tropical Lakes & Watersheds

- Temperate lakes
  - More of them; result of past glaciation
  - Better studied
- Tropical lakes
  - Fewer of them
  - Less studied

  - Lewis 1987: the information on tropical waters is so diffuse and fragmentary that it is difficult to use. Comprehensive or sustained studies have been few, and description rather than analysis has absorbed much of the energy of those who have worked in the tropics.
  - Lewis 1996: ... complete mystery up to 30 years ago. Study of tropical lakes essential if these waters are to be protected and used in wisest way.
  - Lewis 2000: reiterates importance in “Tropical Lakes: how latitude makes a difference.”
Haiti and Tropical Lakes

- Haiti occupies the western 1/3 of the Caribbean island, Hispaniola.
- It is the poorest country in the western hemisphere and the second poorest in the world.
- Haiti is affected by natural and anthropogenic global drivers.
- Étang Saumâtre, Haiti’s largest lake, is a natural resource.
Étang Saumâtre

- Latitude 18° 39’ 30”, 18° 28’ 40”; longitude 72° 4’ 0”, 71°53’ 0”
- The lake is ~ 26 km long and ~10 km wide with an area of 140 km²

- Located in Hispaniola Rift Valley - east/west trending depression
- West of and intersecting border with Dominican Republic
- Topography - mountainous terrain to north and south
- Geology - marine strata; limestone bedrock & weathered basalt
- Climate – arid microclimate
Lake Expansion - Haiti

- 3 lakes in Rift Valley - no outlets – expanding
- Lakes with outlets expanding due to sediment damming of outlet rivers
- Historical expansion/contraction over past 10,000> years studied by Higuera-Gundy and Hodell
  - Sediment cores low latitude lakes – best records - climate change since Pleistocene
  - $^{18}O/^{16}O$ ratios in ostracod shells
  - Related to E/P records
  - Similar Africa same period
  - Explained by Milankovitch cycles
Temperature & Precipitation

World Bank

- Temperature

- Precipitation
Natural Drivers

- Climate
  - Tropical storms/hurricanes
  - Trade winds
  - Warming more moisture

- Geography
  - Mountains north & south
  - Low lying rift valley depression
  - Rain shadow effect

- Geology
  - NA & Caribbean plates converging ENE/WSW
  - Crustal strain folds/faults
  - Limestone & basaltic rock
    - Soluble > caverns
Anthropogenic Drivers

- Deforestation
  - Burning trees for fuel
- Land use
  - Subsistence agriculture
  - Sand & gravel mining
  - Ill-defined & insecure property rights
- Migration
  - Internal/forced external
  - Further deteriorates land
  - No sustainability practices
Develop the Context of the ES Watershed

- Data creation in a data desert
- Quantification and analysis of deforestation via NDVI
- Located areas remaining with forest
- GIS allowed integration of RS images with GIS to develop statistical analysis
GIS Advantage

- Geodatabase
- Visual analysis
- Seamless integration of multiple data types
Geospatial/Temporal Analysis

- Temporal and spatial analysis of Landsat images over a 30 year time period: 1984-2014
- Analysis of vegetation as a proxy for deforestation of Étang Saumâtre watershed
Methods

- NDVI
Results

- Quantify loss of vegetation/deforestation over 30 years
- Correlation with lake level rise and climate data
Broader Impact

- Where little or no data exists?
- Difficult/expensive to access locations
- Time series analysis
Future Work
Thank you… enjoy the conference!