



# GIS and RS Analysis of Flood Risk Areas Abutting Étang Saumâtre, Haiti

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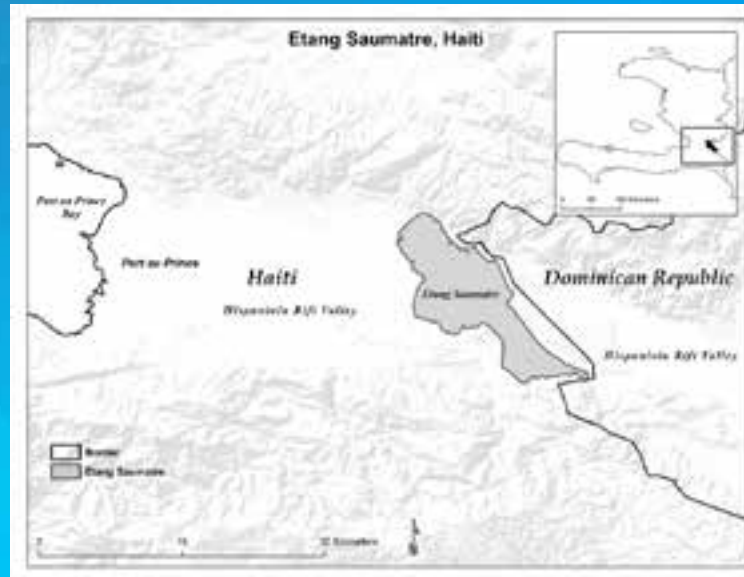
# Background



- Haiti, located on the Caribbean island of Hispaniola, is the poorest country in the western hemisphere and the second poorest in the world.
- Haiti is affected by global drivers of natural and anthropogenic origins.
- Since 2004, increased incidence and intensity of tropical storms has resulted in a 20.6% lake level rise of Étang Saumâtre, Haiti's largest lake.
- Landsat imagery and topography are analyzed to assess lake expansion and to locate areas most at risk for flooding.

## Region of Study

- Latitude  $18^{\circ} 39' 30''$ ,  $18^{\circ} 28' 40''$ ; longitude  $72^{\circ} 4' 0''$ ,  $71^{\circ} 53' 0''$
- The lake is ~ 26 km long and ~10 km wide with an area of 140 km<sup>2</sup>



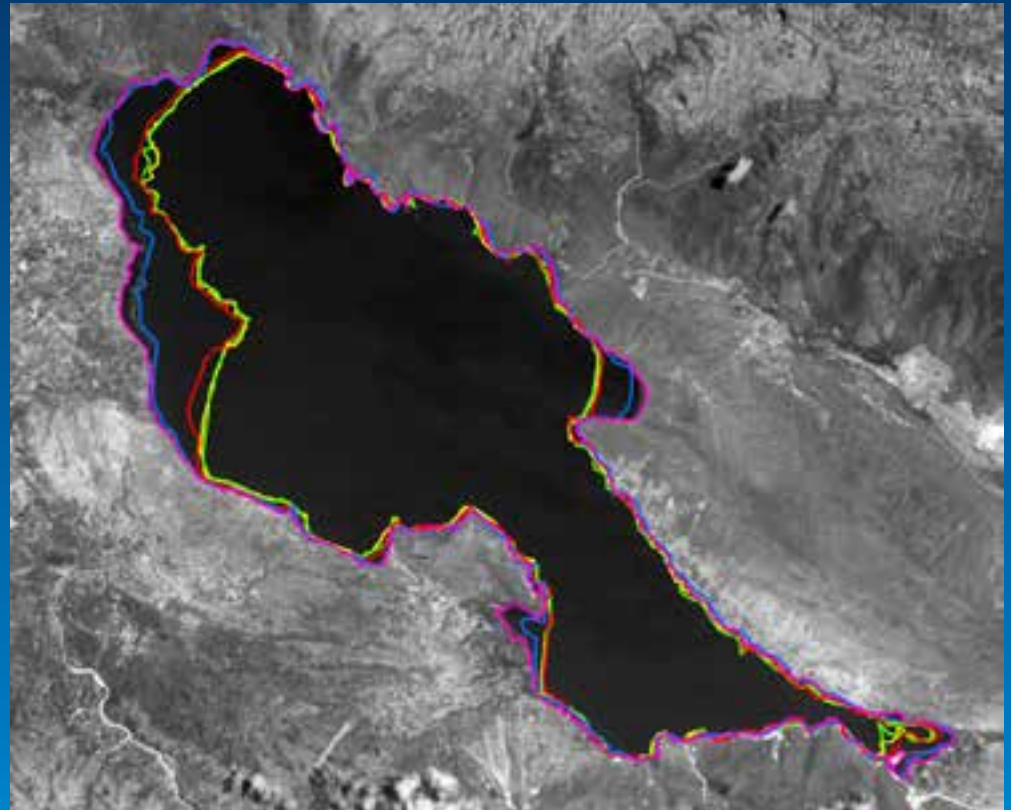
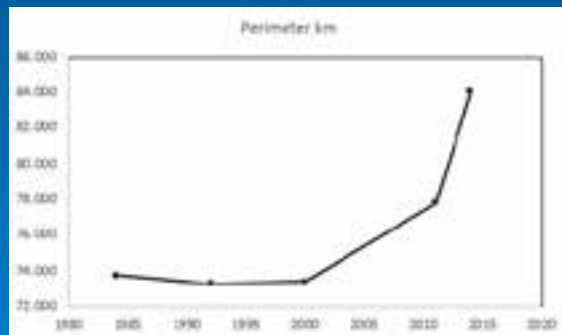
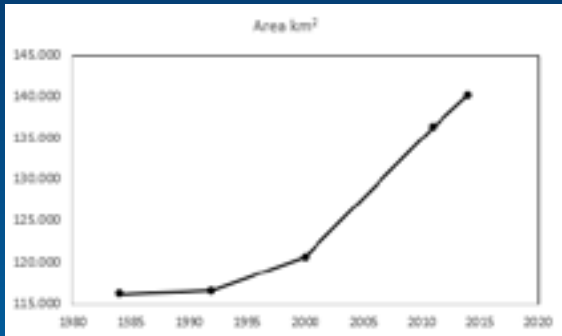
- Topography consists of mountainous terrain to north and south
- Located in Hispaniola Rift Valley - an east/west trending depression
- West of and intersecting border with the Dominican Republic
- Uplifted marine strata - limestone bedrock and weathered basalt
- 2010 earthquake - east/west movement along the fault of 30 cm



- Arid micro climate in Rift Valley
- Burn wood for fuel
- Sand and gravel mining
- Ill- defined and insecure property rights



# Expansion Etang Saumatre 1984-2014



Year	Area sq km	% change	Cumulative % change	Perimeter km
1984	116.178	NA	NA	73.749
1992	116.581	0.346	0.346	73.269
2000	120.639	3.480	3.839	73.384
2011	136.374	13.043	17.383	77.819
2014	140.115	2.740	20.603	84.045

# Approach

- Contours 0-20
- Deforested slopes
- Slope angle – grade by angle
- Proximity to lake
- Define land use/land cover
- Rank areas
- Define areas most at risk



# Locating Areas Most at Risk

## Deforestation

- **NDVI** -values between -1 and 1, values 0.5 indicating dense vegetation
- ArcGIS Spatial Analyst (map algebra & raster calculator) and Landsat TM
- NDVI is calculated from bands 3 & 4 (Band 3 = red; Band 4 = near infra-red)
- NDVI formula:  $NDVI = \frac{NIR - R}{NIR + R}$

## Land Use/Land Cover

- ArcGIS Image Analysis and Landsat TM
- Land cover derived from composite of 7 layers
- Color symbology “saved” composite is changed to: Red = 3; Green = 2; Blue = 1
- Categories of signatures for this analysis are: agriculture; urban; forest; water; dry river bed
- Determined from onsite/ground trothing of land cover during field research in Haiti - November 2013 and June, 2014

# Results

- Cul de Sac region west/northwest is enduring the greatest expansion
- West expansion in the rift valley is toward Port au Prince
- PAP is at sea level -subject to sea level rise - only 20 meter topographic difference ES to Port au Prince
- No impoundment to stop or impede water flow
- In the future, it appears water will be encroaching on the Cul de Sac plain from both the west and the east
- Eastern shoreline expanding to southeast in the rift valley
- Southeast expansion on both sides of Haiti 8
- south east/east expanding into Dominican Republic.