Comparing Land use changes of the watersheds of Lake Azuei -Trou Caiman and Lago Enriquillo - Raguna del Rincon by utilizing Google Earth Engine

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Abstract

Lake Azuei is the largest lake in Haiti and is contributing a vital source for a livelihood in the area. The lake swollen this decade similarly with Lago Enriquillo, There are possibility of urbanization impacts, earthquake-induced groundwater change, climate change induced precipitation change or extreme weather. The purpose of the study is to reveal the impact of deforestation in lake water body change by comparing lakes in Haiti and the Dominican Republic. I utilized AWEI nsh to deliver the water body changes from 1987-2018 with the changes in Land use maps (1984, 1991, 2002, 2003, 2013 and 2018) to see how both watersheds experienced differently. From the results, there are significant lake level rises in Lake Azuei (21% from 1990-2013) and Lago Enriquillo (101% from 2003-2013) started around 2005-7. Trou Caiman decreased its waterbody by 43% from 1992 to 2015. No trend that can be detected in Raguna del Rincon. There is an interconnectivity between Lake Azuei and Trou Caiman throughout the study period. Inversely, Lago Enriquillo and Raguna del Rincon did not show any relationships. In land cover changes, baresoil was increased over time in both Haiti (20% increase) and Dominican Republic (5% increase). Dominican Republic did not show dramatic change, but grassland transformed into baresoil. On the other hand, Haiti experienced the greater expansion of baresoil transformed from grassland, forest, and urban. The Dominican Republic basin have land cover change somewhat less pattern, while Haiti has experienced significant increasing trends in baresoil and urban and decreasing trends in grass and forest land over time. There is a possibility of human intervention which might have affected the lake level change such as clogged canals in Lake Azuei.

Study Area

Haiti and the Dominican Republic shared the island of Hispaniola. Both countries experienced lake level rise in this decades. The study areas are grouped by watersheds/basins: Haiti - Lake Azuei and Trou Caiman, Dominican Republic- Lago Enriquillo and Raguna del Rincon

Fig 1. Study area

Methods

To compare both watersheds and lake water body changes, I utilized AWEI nsh to deliver the changes. After the delivery, I imported shapefile of both watersheds and compared its changes in land use to see how both watersheds experienced differences (Fig.2).
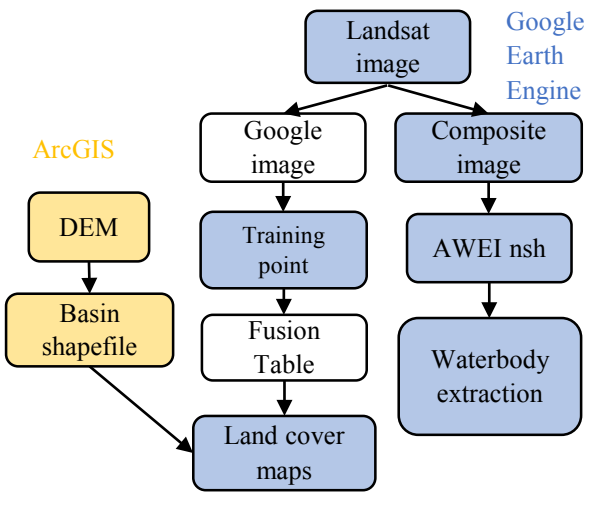
- **Water body change**

I utilized Landsat 4, 5, 7, and 8 to examine water body change from 1984 to 2018 specifying dry season such as November to February. Each year generates composite images, so the problem with Landsat 7, a line sensor failure, is most successfully covered and delivers a single image that can extract water pixel counts. Nonetheless, as you can see from figure 3, there is still a line effect on the water classification.
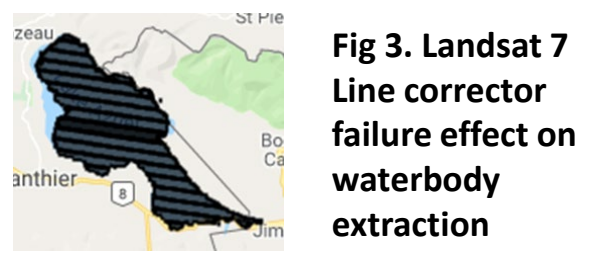

Fig 2. Flow chart

Fig 3. Landsat 7 Line corrector failure effect on waterbody extraction

- **Land cover**

Land cover map was generated by sampling classification training sites from visual detection over Google's add map function and then added each classification number into the data (Figure 4). After creating and assigning the point data, the table was exported as a KML file to be available to make a Fusion table which can be utilized directly into GEE function from extracting Fusion Table ID. The total training point in this study was about 500-800 points classifier into 8 categories- forest, agricultural land, water body, bare soil, grassland, cloud, shadow and urban for 1984, 1998, 2013, and 2018 extracting through boundaries of the basins (Fig.5, 6).

Fig 4. Training points for land cover classification
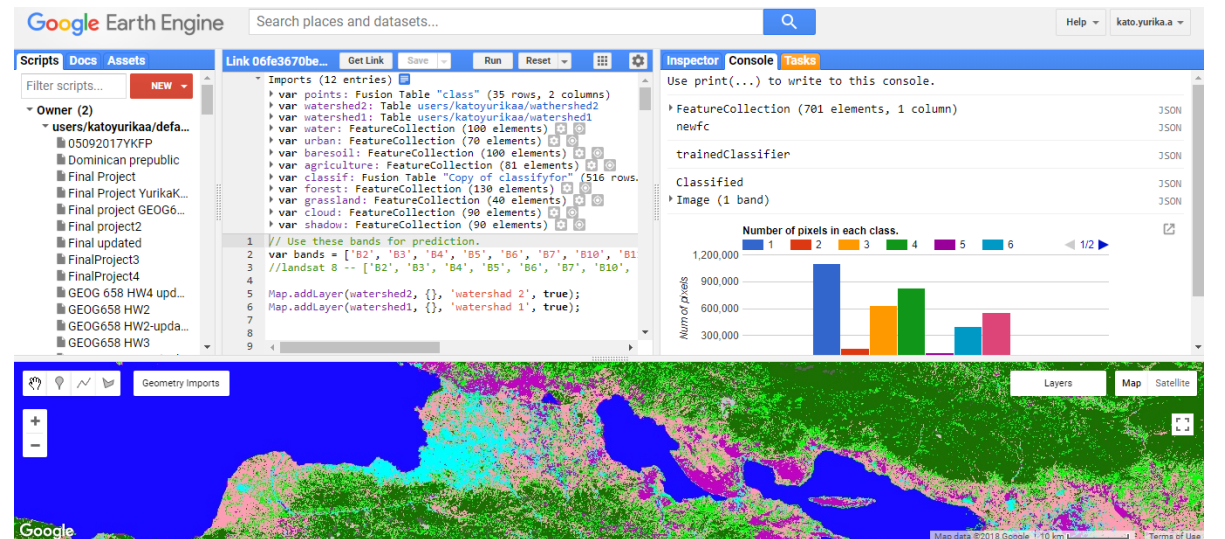

Fig 5. Basins in Haiti and Dominican Republic

Fig 6. Land cover classification on Google Earth Engine
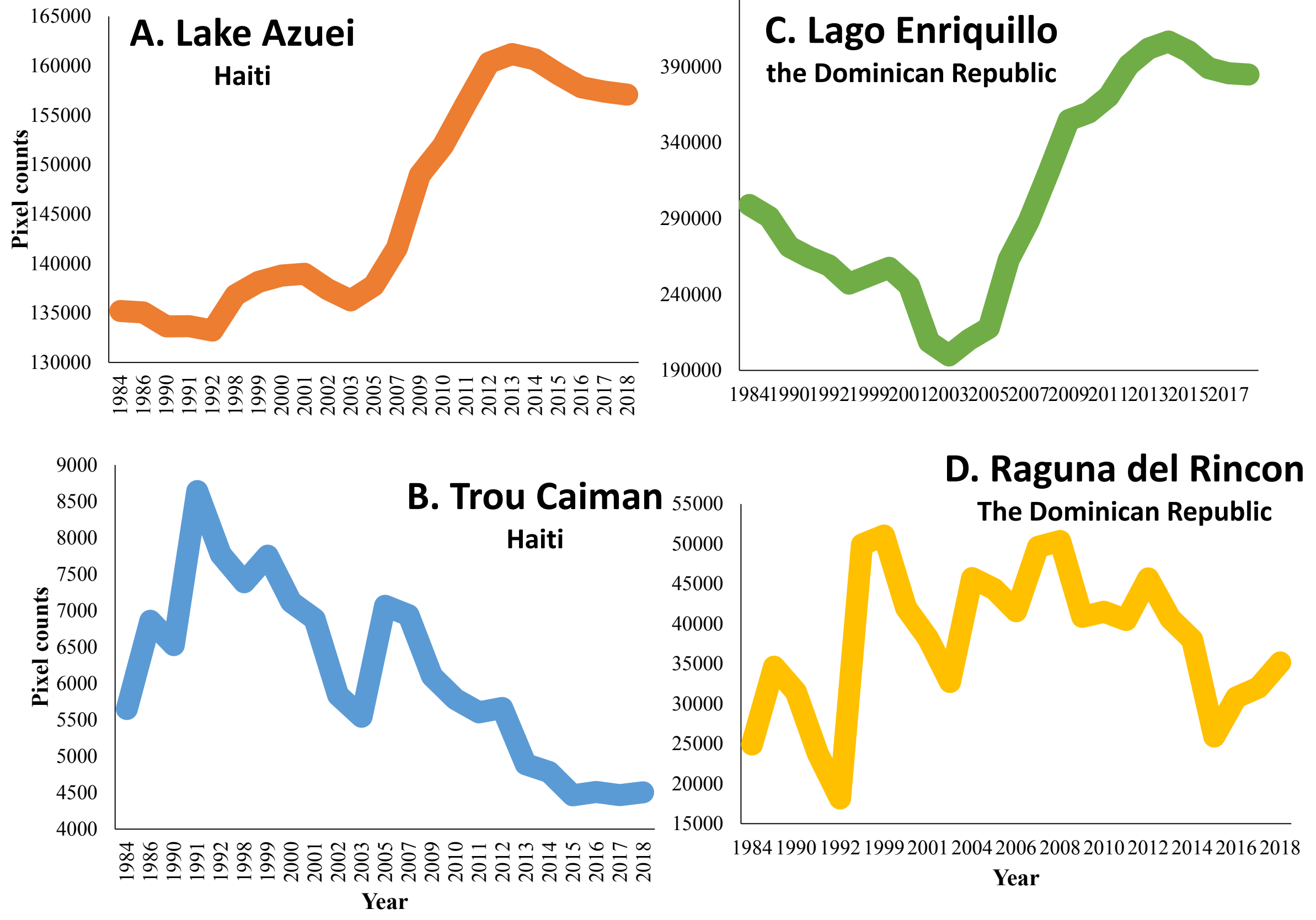
Results

Fig 7. Waterbody changes from 1984 to 2018 in : A) Lake Azuei, B) Trou Caiman, C) Lago Enriquillo D. Raguna del Rincon
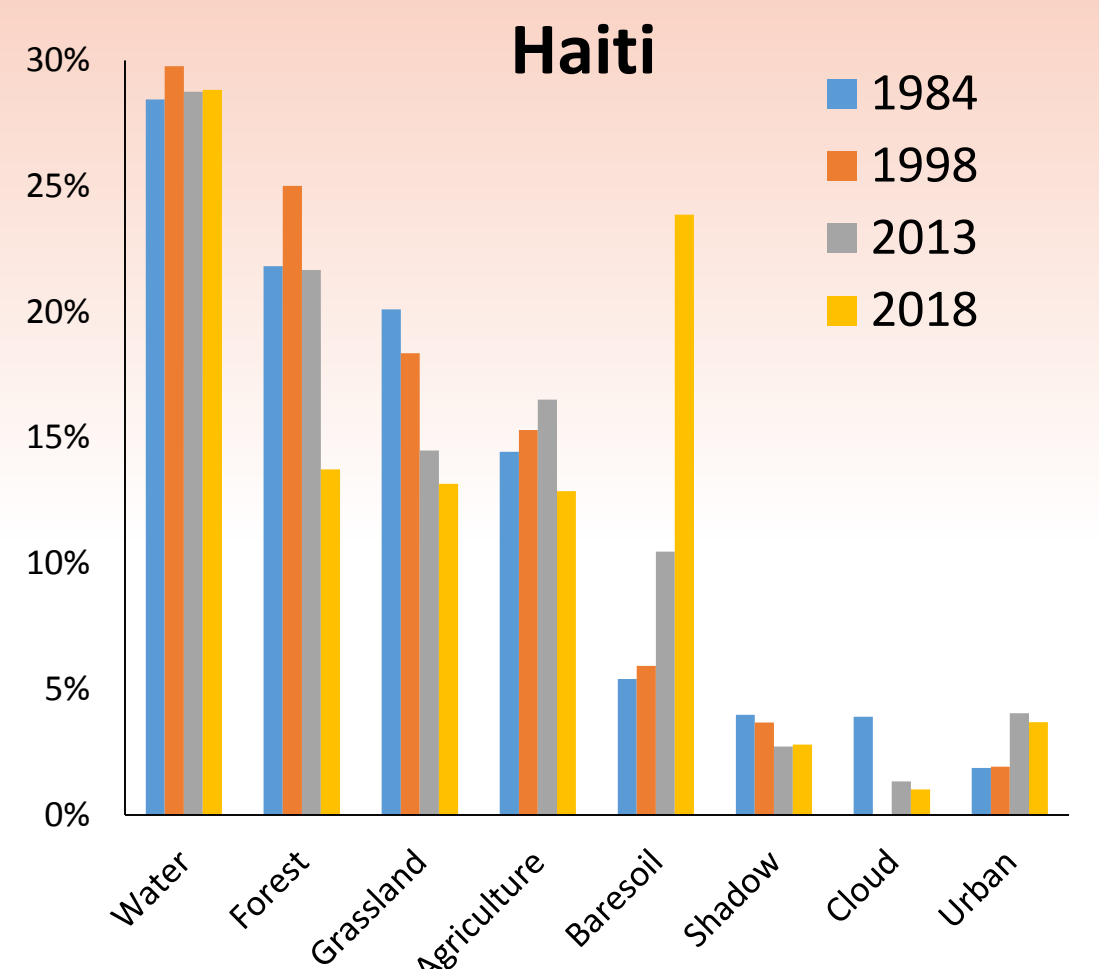

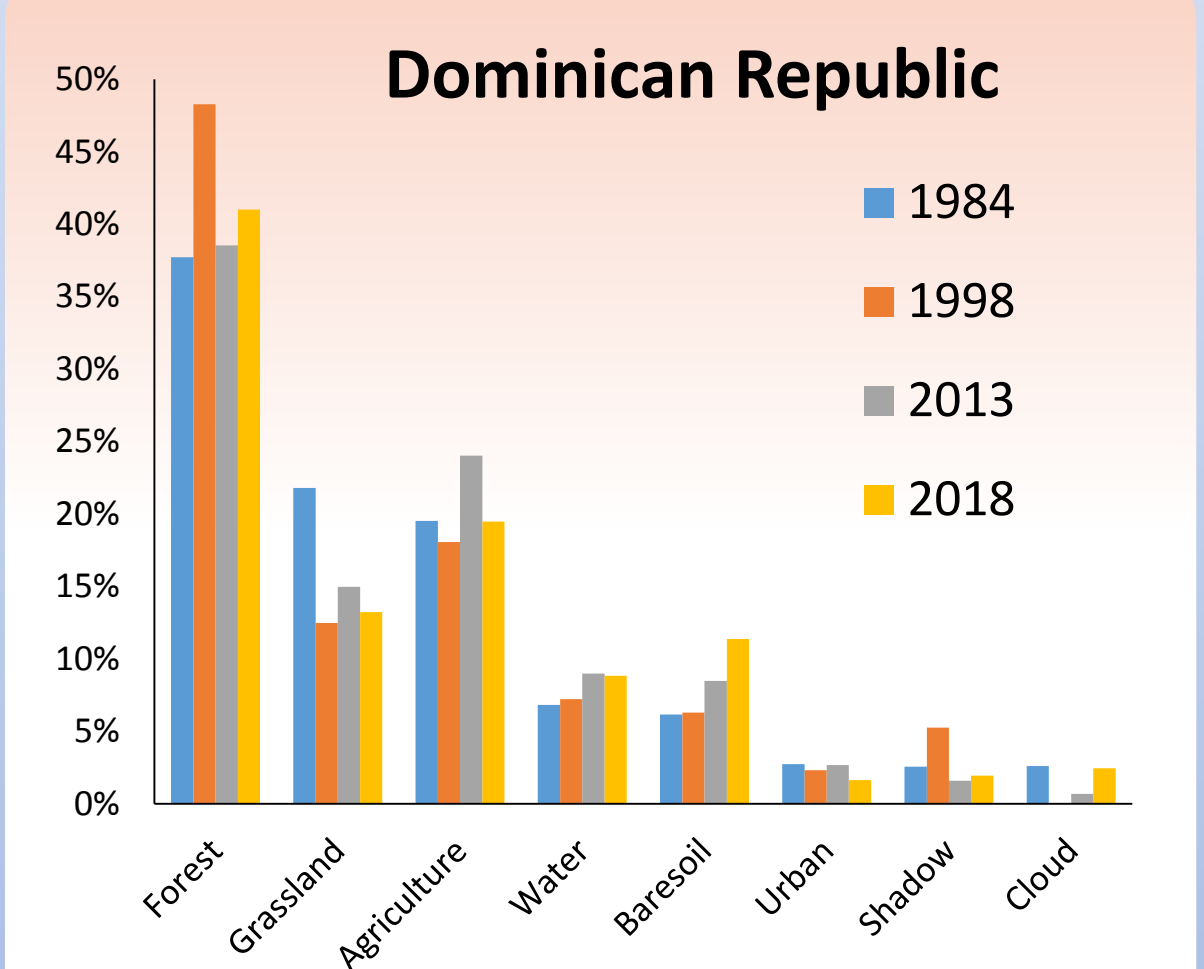Fig 9. Land cover change in 1984, 1998, 2013 and 2018 in Lakes in Haiti watershed

Fig 8. Land cover change in 1984, 1998, 2013 and 2018 in Lakes in Dominican Republic watershed

Conclusions

- **Significant lake level rises in Lake Azuei (21% from 1990-2013) and Lago Enriquillo (101% from 2003-2013) started around 2005-7.**
- **Trou Caiman decreased its waterbody by 43% from 1992 to 2015.**
- **No trend that can be detected in Raguna del Rincon.**
- **There is an interconnectivity between Lake Azuei and Trou Caiman throughout the study period. Inversely, Lago Enriquillo and Raguna del Rincon did not show any relationships.**
- **Land cover in Haiti- Baresoil increased by about 20%, grassland decreased 7%, Forest decreased 8%, Urban expanded 2times in 15 years from 1998**
- **Land cover in the Dominican Republic – About 8 % grassland decreased, while baresoil increased 5%, so transformed grassland into baresoil**
- **Less patterns of land cover changes were observed in the Dominican Republic, while Haiti has clear trends. This trend is somewhat similar to then lake levels trend that Haiti shows a clear change, whereas the Dominican Republic lake, Raguna del Rincon, shows no patterns.**
- **There is a possibility of human intervention which might have affected the lake level change such as clogged canals in Lake Azuei.**

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