Evento Regional: Conmemoración del Día Mundial del Suelo

fao.org

Soil Salinization in Caribbean SIDS
A looming threat to Livelihoods

World Soils Day 2021

'Halt soil salinization, boost soil productivity.'

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#DíaMundialDeLosSuelos

The flow of things…

- ❖ Geographical Background of the Caribbean SIDS
  - The Insular Dilemma
  - Soils
  - Land Use

- ❖ Causes of Soil Salinization in the Caribbean
  - Land Use Change
  - Climate

- ❖ Threats of Soil Salinization for the Caribbean
  - Food
  - Water
  - Ecosystem

Geographical Context

Source: St. Lucia National Competitiveness and Productivity Council (2017)

The Insular Dilemma of Caribbean SIDS

- Small habitable space
- Limited natural resources
- Fragile economies
- Fragile environments
- Weak against larger external actors
- Heavily dependent on imported goods
- Electricity generation is costly
- More vulnerable to environmental disasters
- Easily affected by financial shocks

Soils of Caribbean SIDS

Deriving from old and recent alluvial sediments

Inceptisols, Entisols, Vertisols

- Nutrient rich
- Occurring in areas of flat relief
- Flood plains of main rivers of Guyana, Trinidad, Belize, Cuba and Domin Republic

Soils (cont'd)

Soils derived from calcareous material

(Oxisols, Alfisols, Mollisols)

- Good drainage
- Good amount of organic material
- May exhibit dark subsurface colour, organic material
- Stained red by oxides , e.g. bauxite areas in Jamaica

Soils (cont'd)

Sandy soils

- Rapid leaching
- Good drainage
- Very little nutrients at subsurface layer
- Rapid breakdown organic material

Volcanic Soils

- Andisols
- Very good properties
- Usually fertile
- Leached rapidly if located in areas of high precipitation

Soils (cont'd)

Derived from in-situ weathering of igneous and metamorphic rock

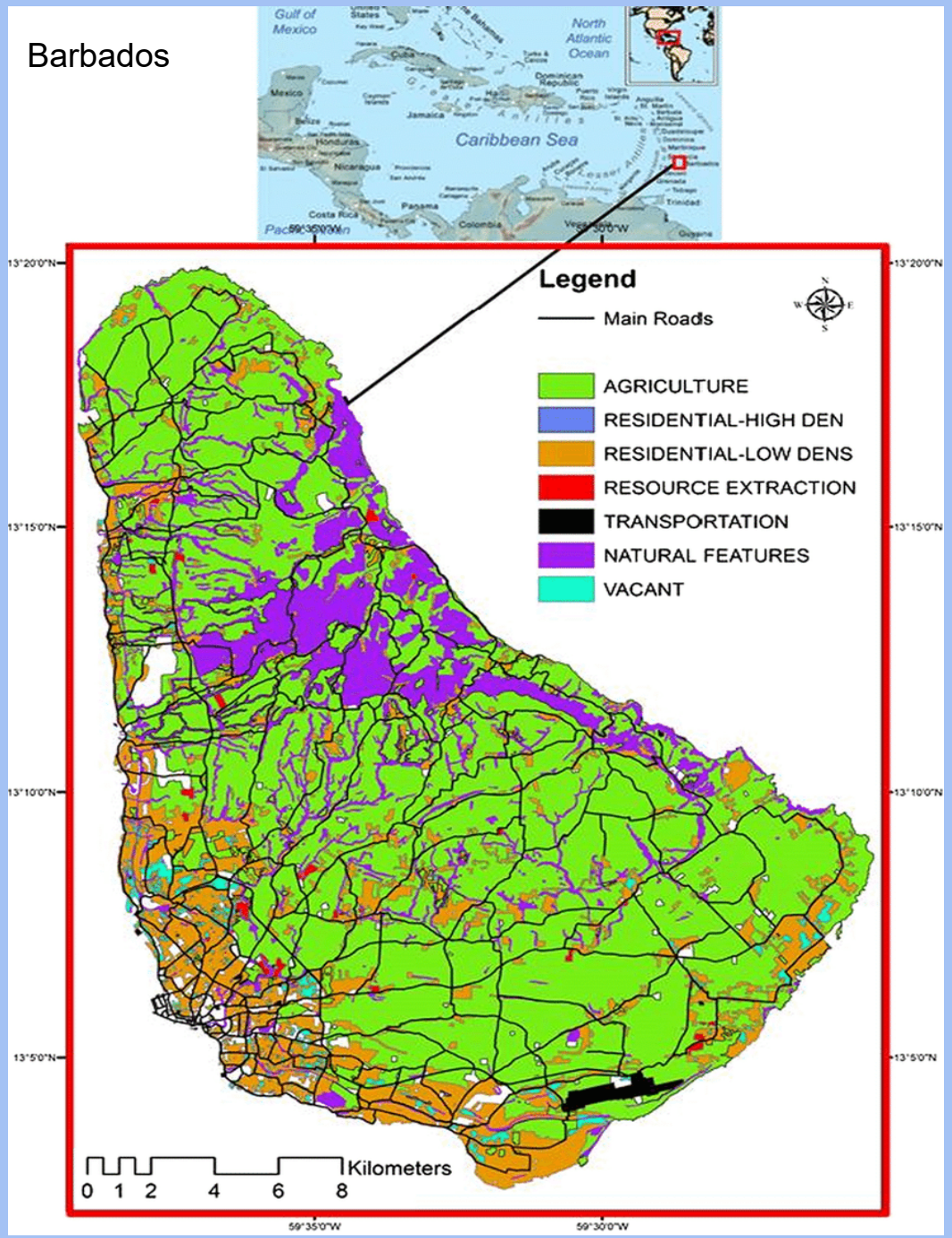
Ultisols, Alfisols

- Interior mountainous regions of most Caribbean SIDS
- Closely associated with rainforest biomes

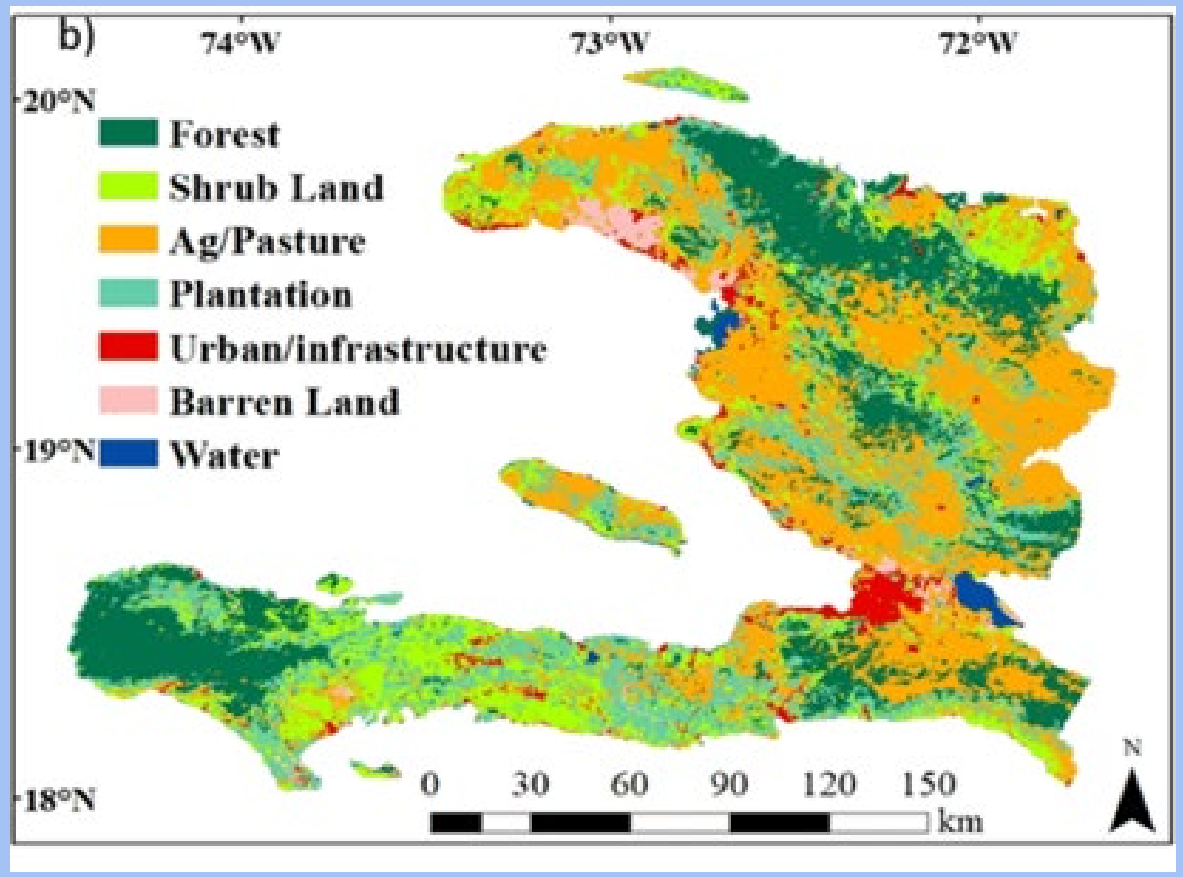
Current Land Use Patterns

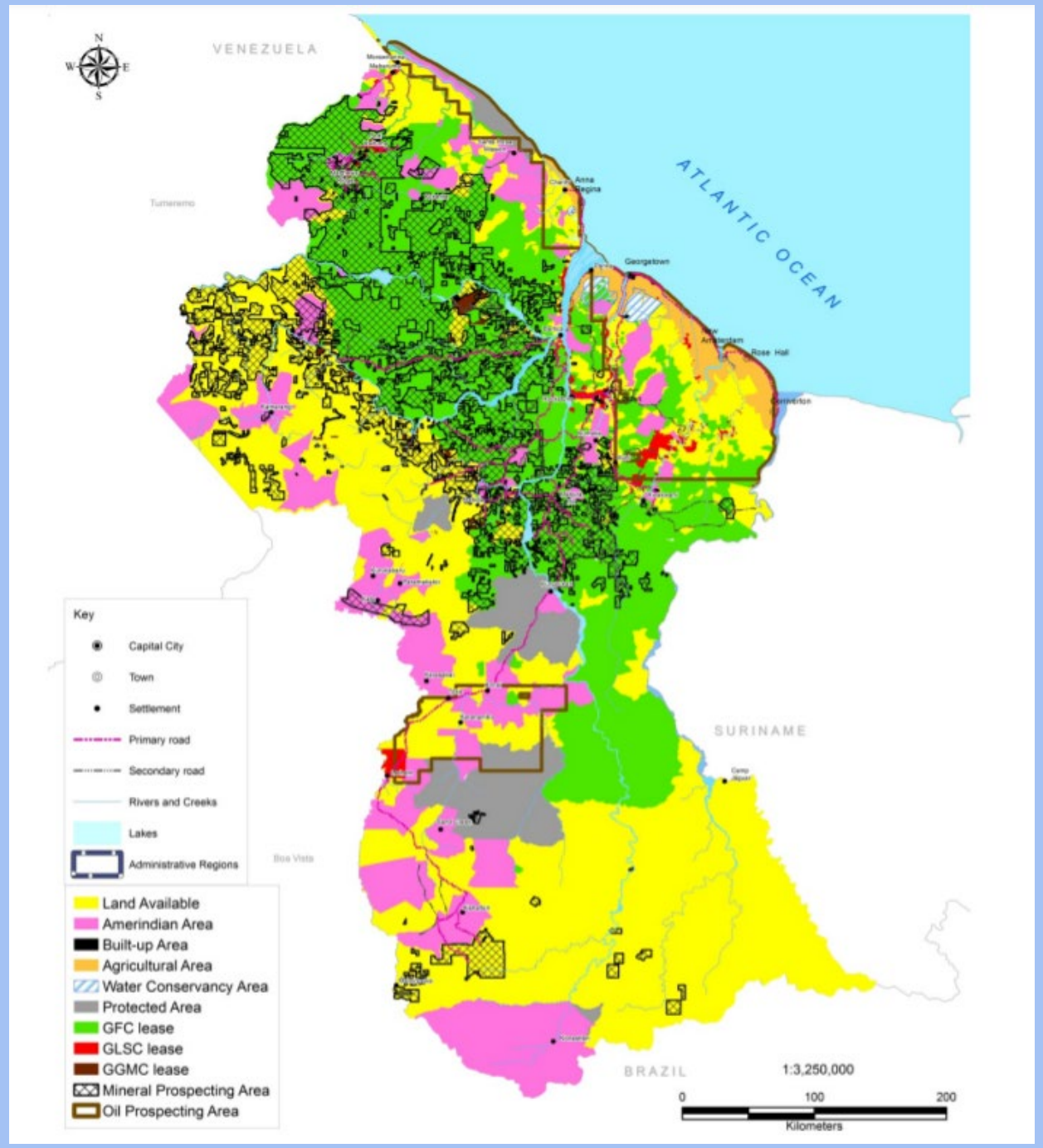
- Majority of the Population live on the thin, low lying coastal areas
- Most of the industrial activity also occur on or close to this fragile coastal plain
- The interior lands are used for extractive industries (bauxite, sand, limestone, gold, diamond and other mineral mining)
- Agriculture is practiced in river valleys, on interior slopes and grasslands
- Some amount of eco-tourism occurs in the interior highlands.

Barbados



Haiti (2015)





(Guyana Lands and Surveys Commission)

Soil Salinization

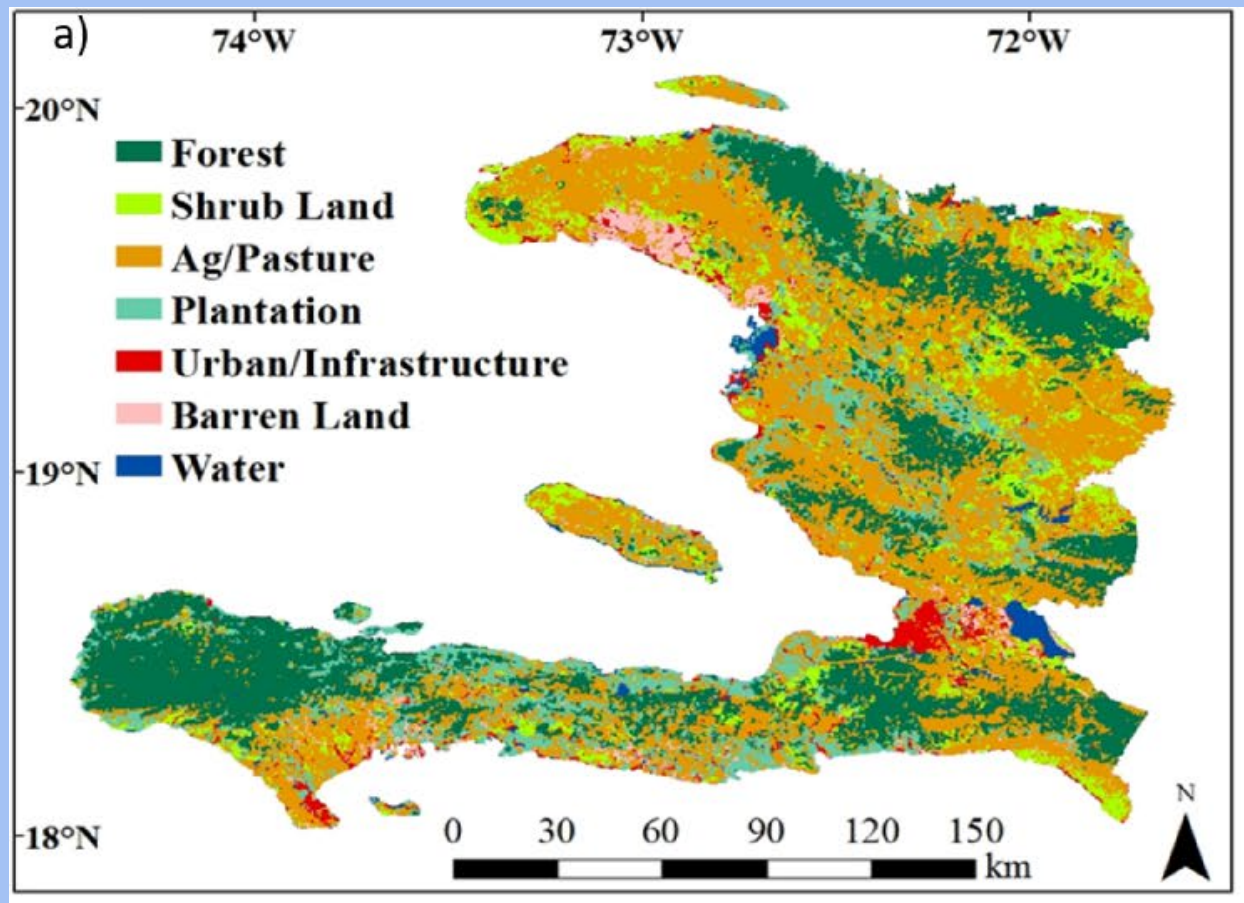
- Soil salinization is an excessive accumulation of water soluble salts.
- Most times these salts originate from the Earth's Crust through weathering and erosion (phosphorous, sulphur cycles)

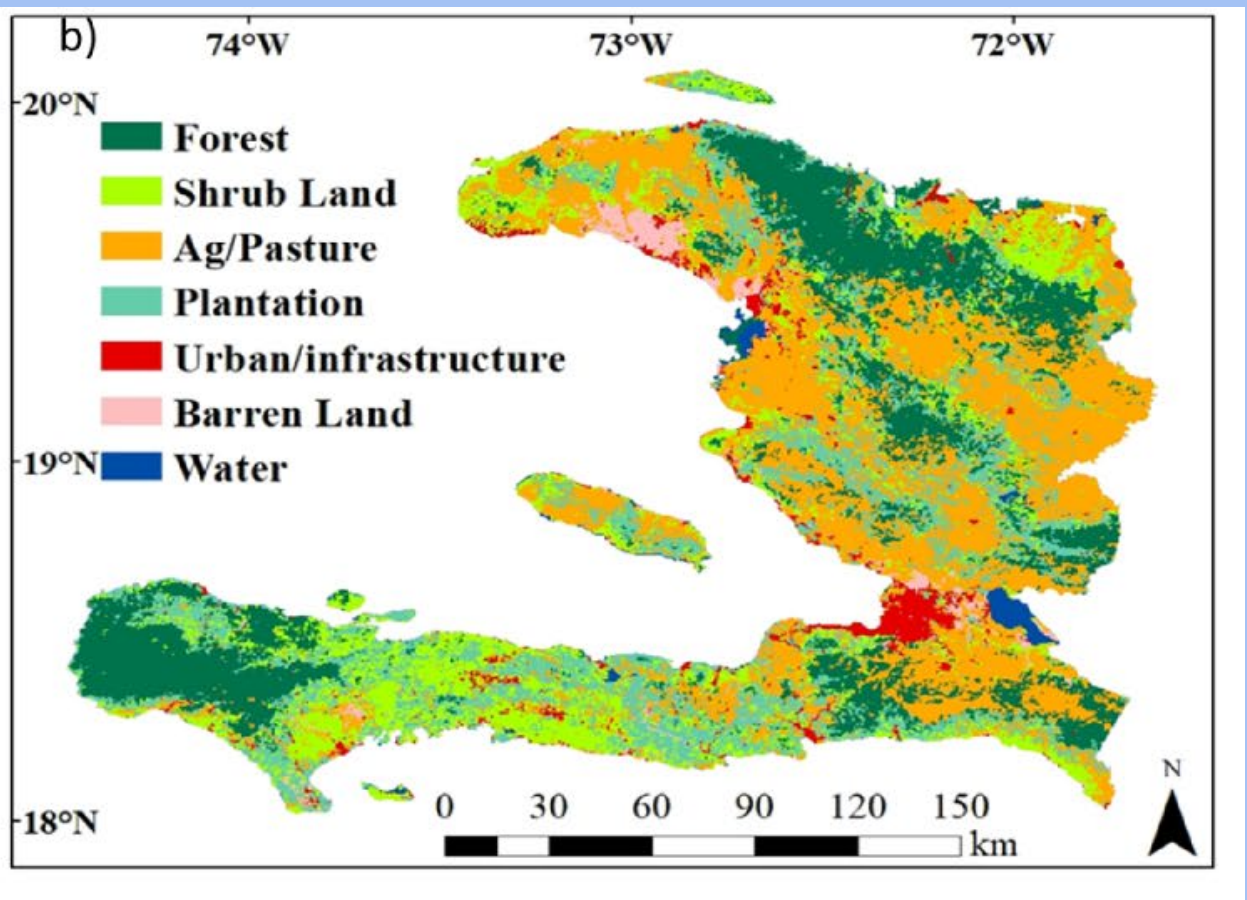
Degrees of Soil Salinization

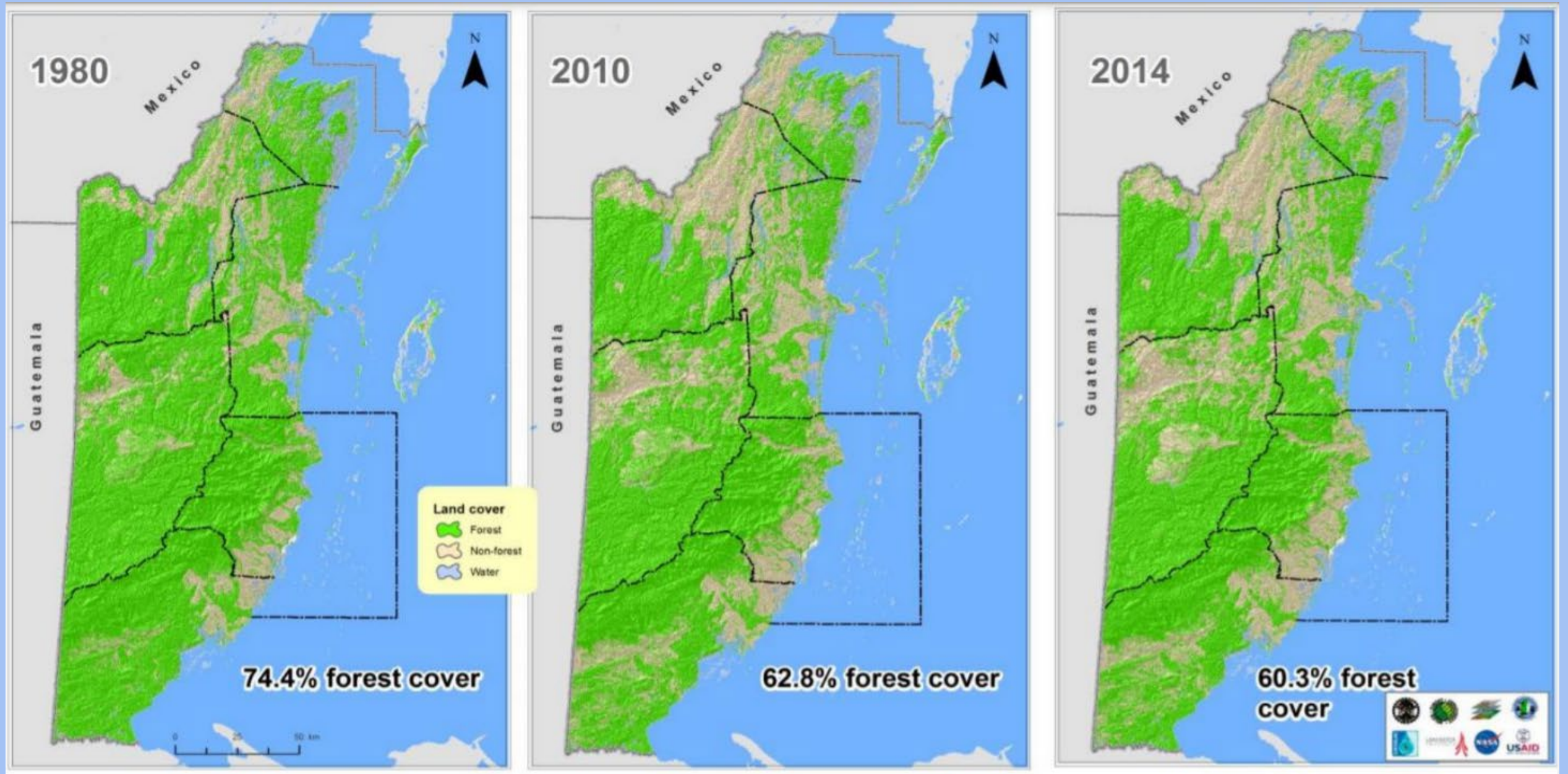
Saline Soils	Saline-sodic soils	Sodic Soils
- having enough soluble salts to injure plants - pH generally below 8.5 - white or light brown crusts - Ca and Mg salts are high enough to offset negative effects of Sodium	- high concentrations of sodium relative to Ca and Mg. - pH generally below 8.5 - the exchangeable sodium percentage is >15% of the CEC	- low in soluble salts - relatively high in exchangeable sodium - pH between 8.5 and 12 - severely disrupts plant root activity - disrupts the physical and chemical properties of clays

Land Use Change

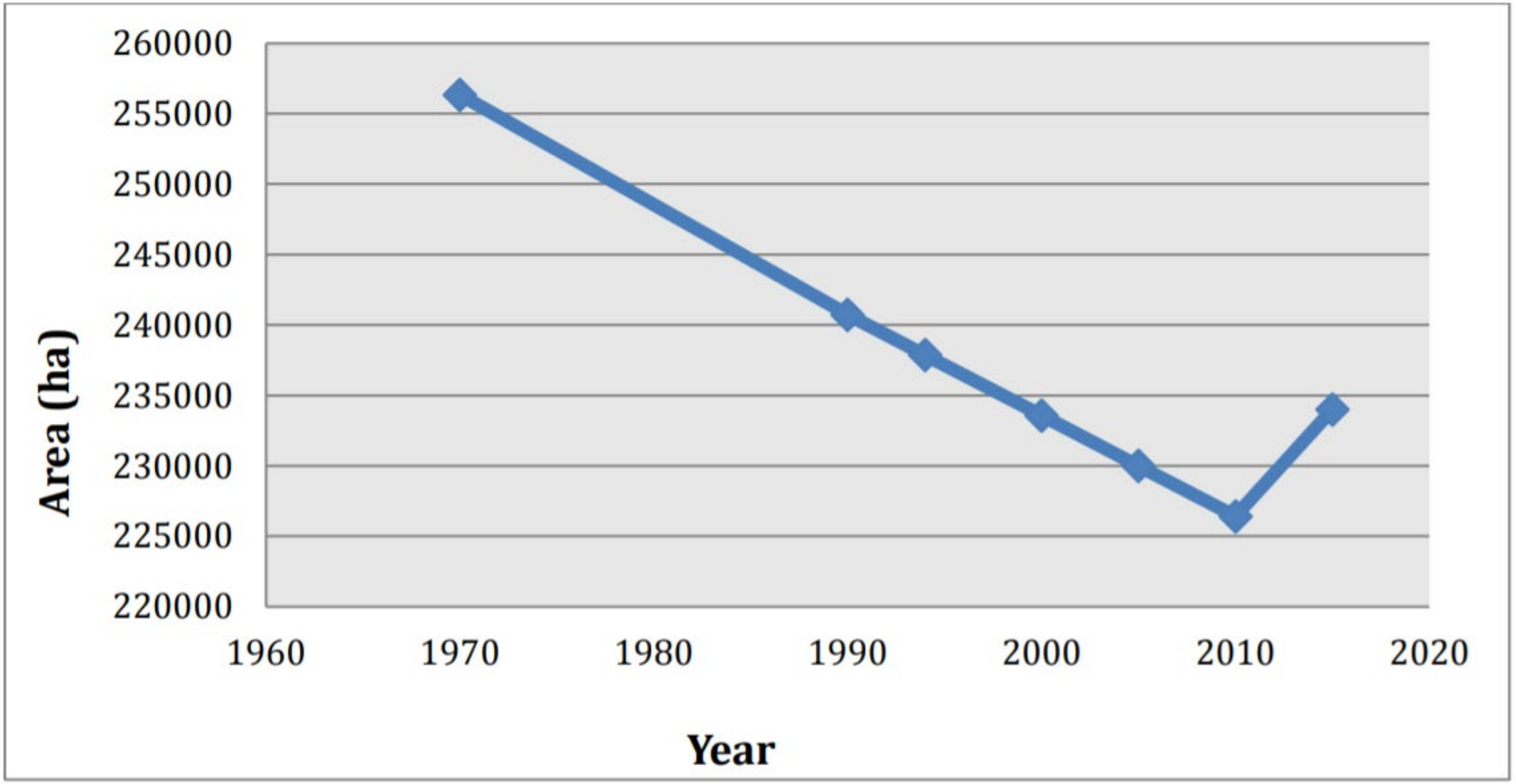
- Removal of natural vegetative cover





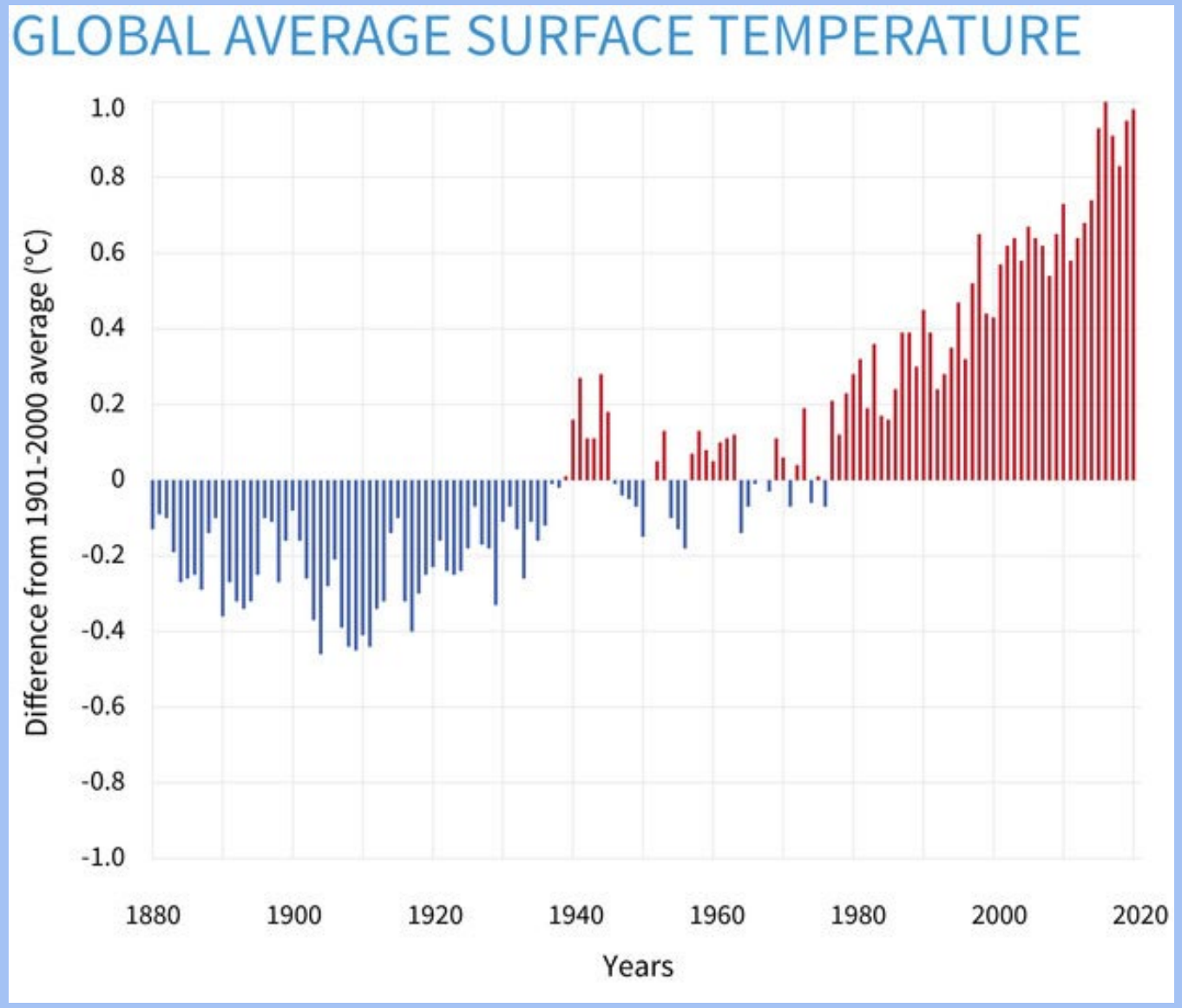


Land use change across Belize, 1980 – 2014 (Data from Cherrington, 2015; Adapted from Cherrington et al. 2012)



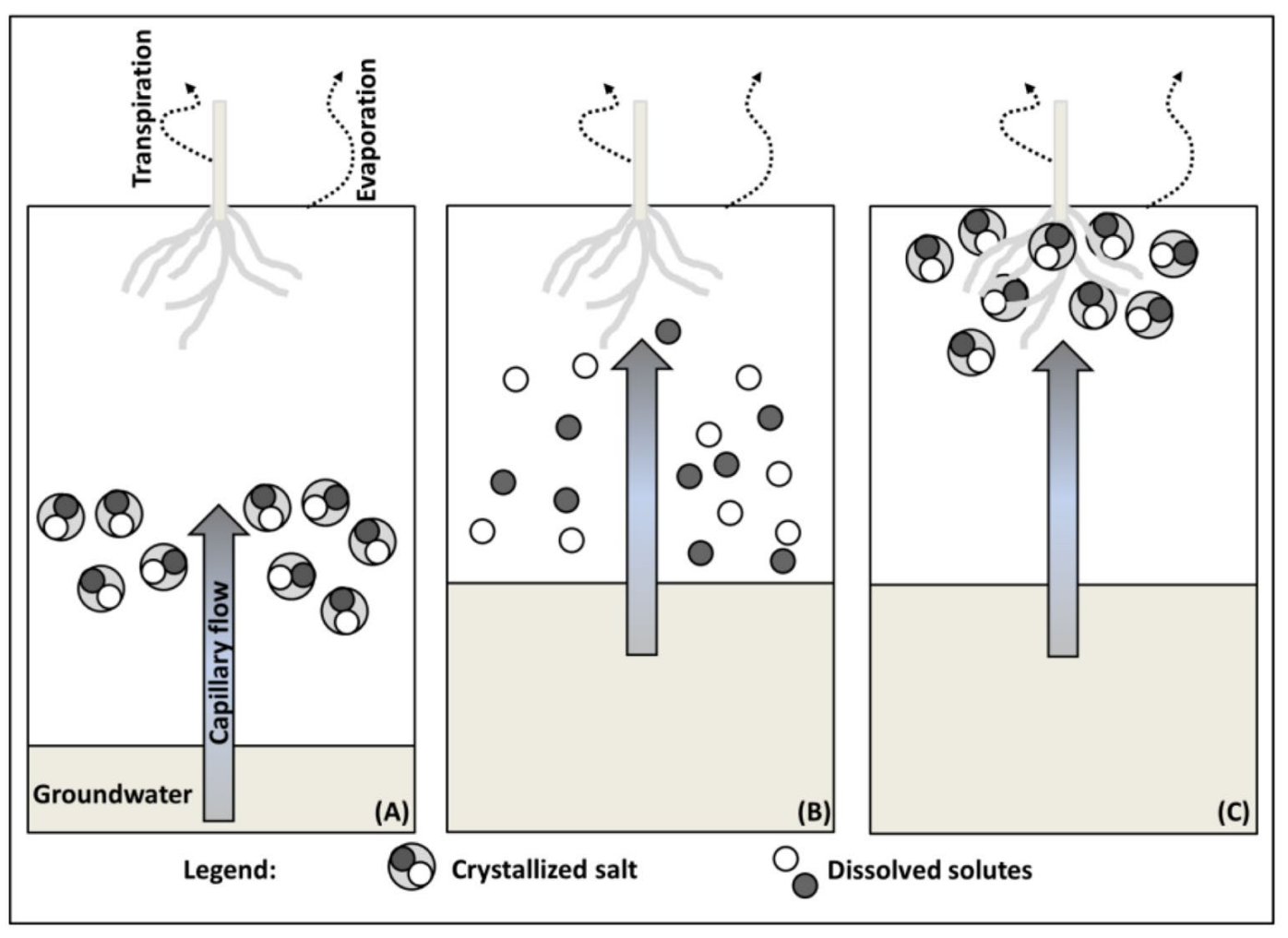
Change in Forest Cover from 1970 - 2015 - *Source CBD Fifth National Report- Trinidad and Tobago*

Climate



Source; NOAA Climate.gov

- High temperatures drive more evapo-transpiration
- More evapo-transpiration leaves salts in the root zone

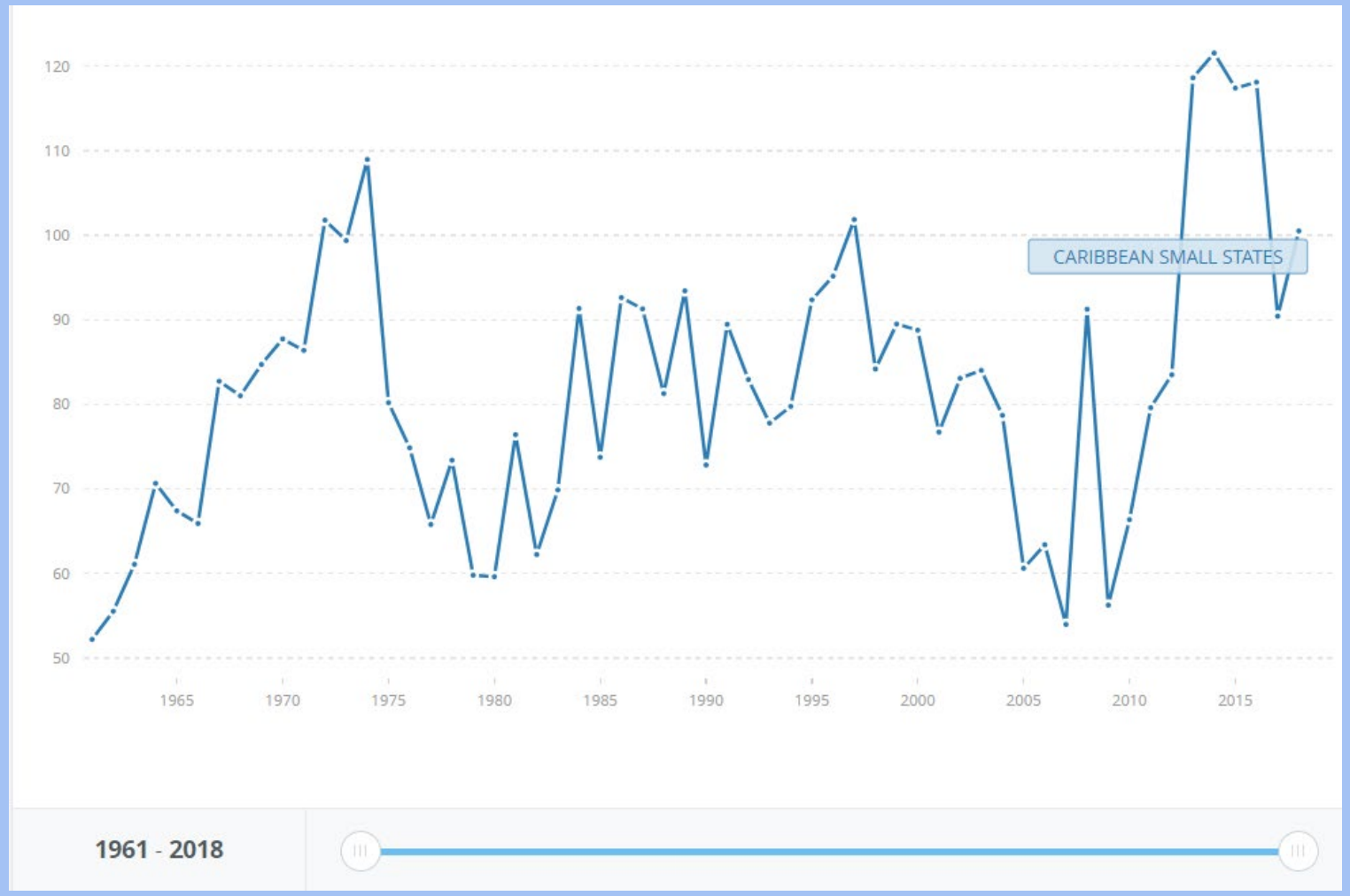


Source: https://www.mdpi.com/2073-4441/10/8/1030/htm

- Changing climatic patterns bring prolonged periods of drought
- Hotter oceans strengthen hurricanes which cause coastal flooding
- Rising sea levels cause more saltwater to encroach on land

Coastal flooding at Dantzig, Mahaicony, GUYANA.
On the left -2019.
https://www.morayhousetrust.com/events/climate-change-in-guyana-effects-and-responses/
On the right - 2020.
https://guyanachronicle.com/2020/07/11/protecting-guyanas-coastline/

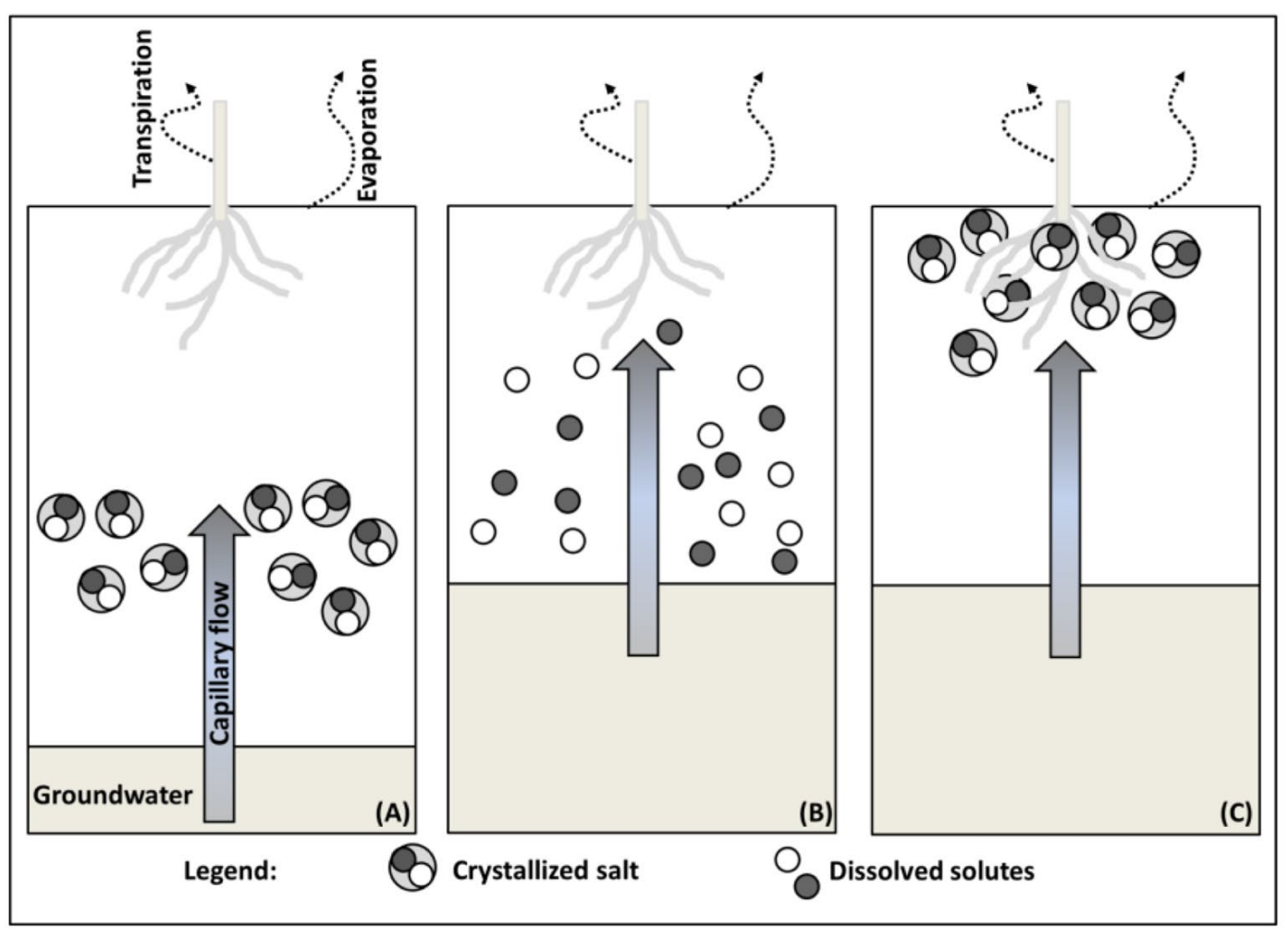
- Fertilizer application adds to the saline nature of soils



Consumption of fertilizers by Caribbean Small States (kg per hectare of arable land)

Source: https://data.worldbank.org/indicator/AG.CON.FERT.ZS?locations=S3

Effects on Plants (Agriculture and Forestry)



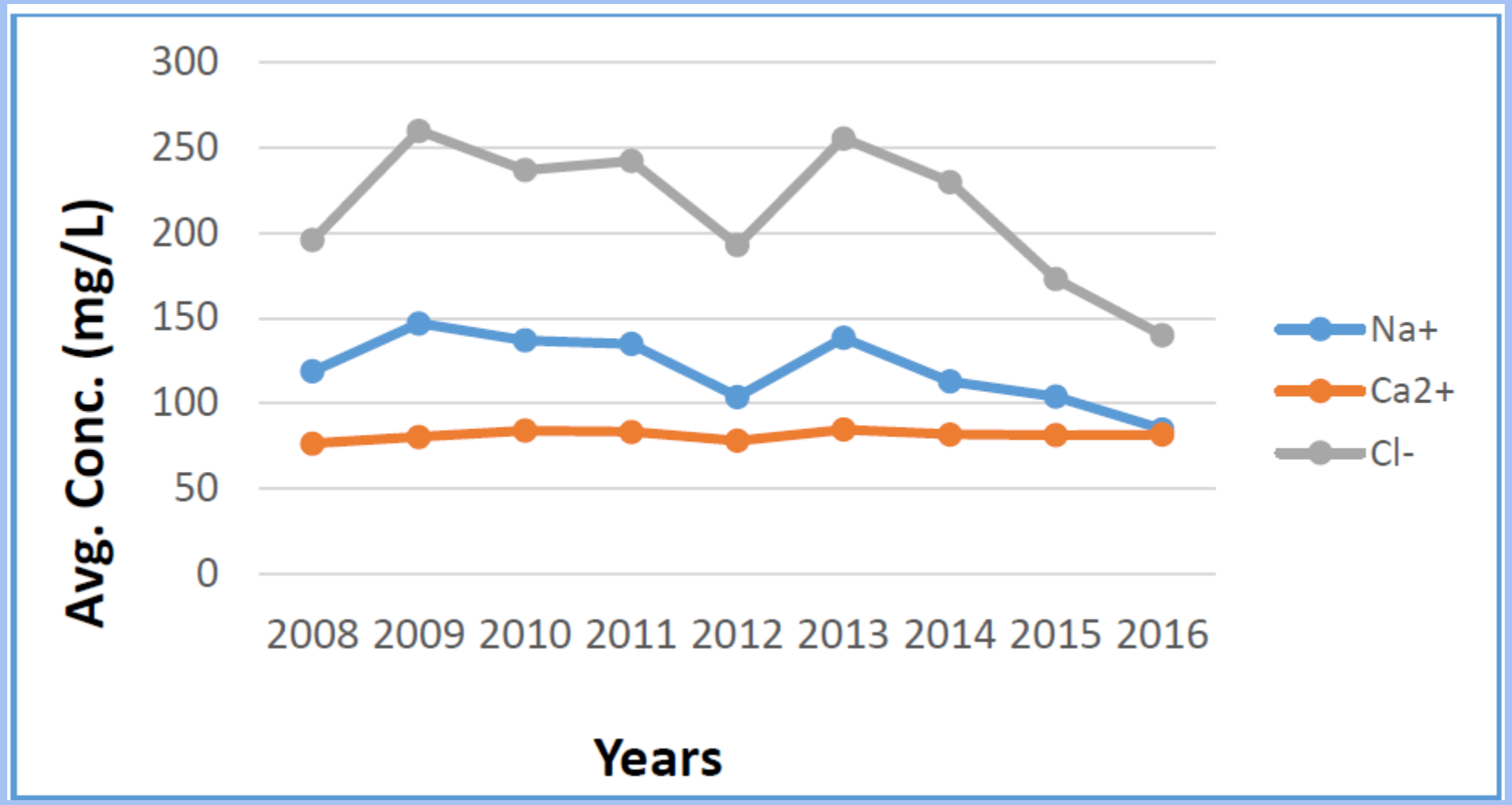
Too much salts around the root environment increases the osmotic pressure and pulls water out through the roots.

Case Study: Grand Bahama

- Study showed that the salinity levels were 3 times greater in surge affected areas that those unaffected.
- The previously dominant *Pinus caribaea* species was not present but rather more woody understory species

2013

2018



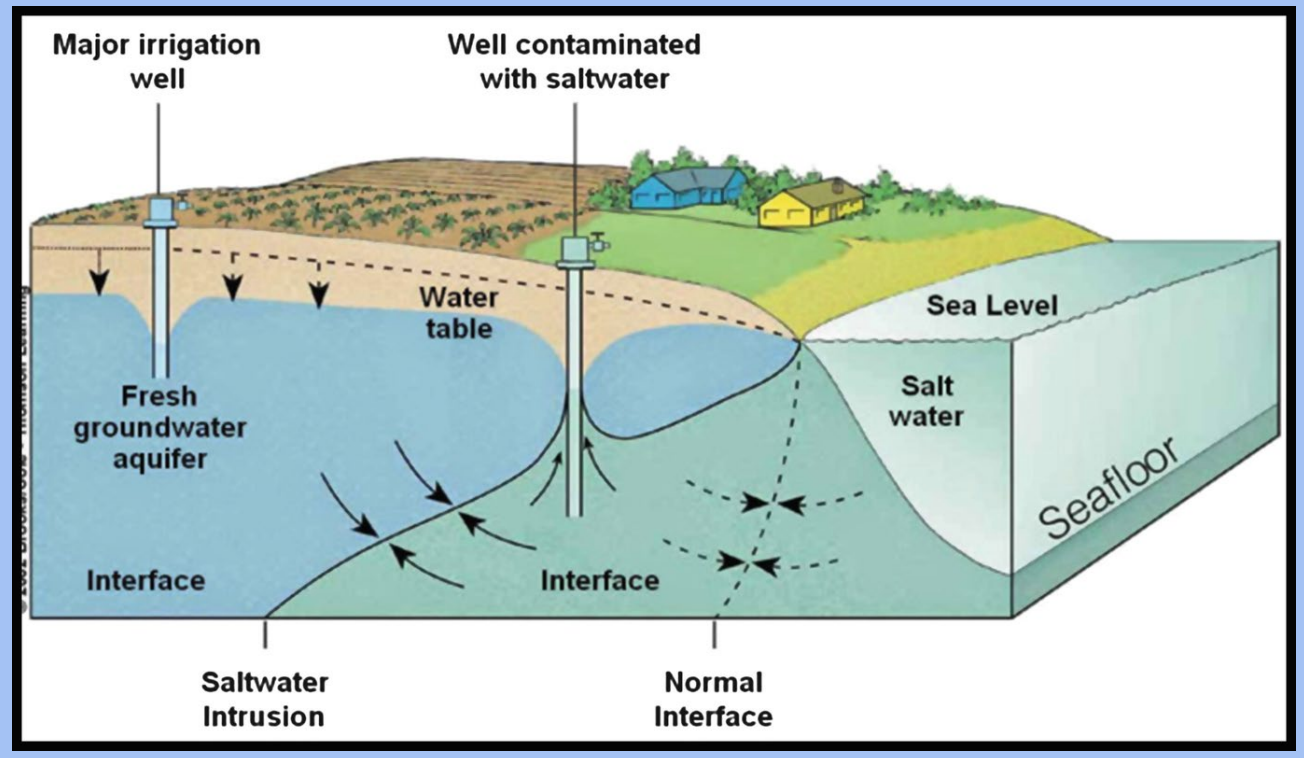
Ion Analysis shows elevated levels of Sodium and Chloride ions over Calcium

Saltwater intrusion due to two flooding events in 2019 and 2020 has led to the destruction of over 3000 acres of previously occupied rice lands. Dantzig, GUYANA

Source: https://guyanatimesgy.com/mahaica -farmers -residents-face-more-flooding/

Effects on Freshwater Supply

- Caribbean SIDS are usually water stressed as they are surrounded by salt water.
- Excess withdrawals from aquifers result in salt water intrusion
- Irrigation with saline contaminated water leads to further soil salinization



How Can we Combat Soil Salinization?

- Very Simple...

  SUSTAINABLE LAND MANAGEMENT!

  PLANT MORE MANGROVES!

  USE ORGANIC FERTILIZERS!

  REDUCE DEFORESTATION!

THANK YOU!


Food and Agriculture Organization of the United Nations
5 DECEMBER 2021
World Soil Day
Halt soil salinization, boost soil productivity
GLOBAL SOIL PARTNERSHIP
Thanks to the financial support of
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation

References

Francis,D. ; Theophille B. (2010). *In a Nutshell - Save our Soils.* https://cgspace.cgiar.org/bitstream/handle/10568/63660/SoS_Nutshell.pdf;jsessionid=7303A2B061F8726505691303AD609EC6?sequence=1

Moxey, A. (2018). *Ocean Incursions into the Caribbean Pine (Pinus Caribaea) forests on Grand Bahama island: Impact on Soil Chemistry, vegetation profile and aquifer salinity* .

Simpson, L. (2015) *Status of soil resources in the Caribbean and experiences of its sustainable management.* https://www.slideshare.net/FAOoftheUN/status-of-soil-resources-in-the-caribbean-and-experiences-of-its-sustainable-management-leslie-a-simpson-phd-natural-resources-management-specialist-cardi-jamaica-unit

Soil Salinization Causes & How To Prevent And Manage It (2021). https://eos.com/blog/soil-salinization/