



## *Salinity and Salinization Overview*

### **Why is salinity and salinization important?**

Salinity and salinization can impact working lands in many ways. Elevated salinity levels cause crop yield declines, coastal forest loss, salt-tolerant invasive species takeover, eutrophication and marsh migration. Few crops can grow in areas with salinity levels that are constantly greater than 2 parts per thousand, which is a lower concentration than you'd typically find in a salt water intruded field. Vegetation stressed by salinization impacts are also more susceptible to mortality by events such as drought, hurricanes, and fires. Other impacts from salinity and salinization include clay dispersion that reduces the hydraulic conductivity of soils and drainage capacity, nutrient release that can lead to algal blooms and cause fish death, and degraded groundwater for irrigation.

### **What are the drivers of salinization in uplands?**

Factors that contribute to the vulnerability of lands to saltwater intrusion and salinization include the elevation of the land and its rate of subsidence, in addition to the following drivers.

- Sea level rise: Rise relative to land and water table elevation, higher sea levels increase the reach of tidal influences and king tides, pushes the salt water– fresh water interface inland
- Storms and Tides: Frequency and intensity, tides and wind can push saltwater far inland, storm surge inundates land with salt water
- Drought: Frequency and duration can lead to saltwater incursion, unable to leach salts from soil
- Water management: Ground and surface water extraction for human use, reduced freshwater discharge allows for intrusion
- Connectivity: Water control structures; tide gates, levees, canals, ditches, tidal creeks



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### **References:**

Tully et al. (2019). The Invisible Flood: The Chemistry, Ecology, and Social Implications of Coastal Saltwater Intrusion. BioScience

White, E., & Kaplan, D. (2017). Restore or retreat? saltwater intrusion and water management in coastal wetlands. Ecosystem Health and Sustainability

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## What are the chemical processes of salinization?

The chemical processes that occur in the soil during salinization are increased ionic strength, alkalization, and sulfidation. Increased ionic strength causes osmotic stress in plants and the ion exchange causes nutrient mobilization. Alkalization changes soil pH which releases phosphorous from acid soils, causes clay dispersion, and bridges cations which changes carbon dynamics. Sulfidation reduces carbon storage, causes sulfide toxicity and plant stress, and releases phosphorous through formation of iron-sulfur minerals.

## What are the forms of salinity?

- Natural salinity - salinity caused by natural processes such as salt water inundation from sea level rise, sea spray, storm surge, and accumulation of salt from rainfall or weathering of rocks over thousands of years.
- Groundwater salinity- salinity coming up from the groundwater when its levels rise and bring accumulated salts to the surface. Groundwater salinity also occurs in aquifers contaminated by salt water intrusion.
- Irrigation salinity– when reused or saline water is irrigated onto crops or horticulture, or when saline groundwater is used for irrigation.



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## What do we expect to happen with salinity in the future?

Salinization is expected to increase in vulnerable areas as the sea level rises. Rising sea levels will inundate lands, increase tide and storm surge levels, and push salt water farther inland through ditches and tidal creeks. Natural leaching of salts from soils is expected to decrease as precipitation patterns change to greater periods of drought along with more frequent and intense storms. Working land profitability is expected to decline with increasing salinity. Areas with high rates of sea level rise are expected to see salt water pushed farther inland. The North Carolina Albemarle-Pamlico Peninsula has a high rate of sea level rise and is projected to lose about half of its land area to open water with a 3-foot rise in sea level.