



Soil Salinity and Salinization

Why is salinity and salinization important?

Salinity and salinization can impact working lands in many ways. Elevated salinity levels can cause crop yield declines, coastal forest loss, salt-tolerant invasive species takeover, and eutrophication and marsh migration. Few crops can grow in areas with salinity levels that are consistently greater than 2 parts per thousand, which is a lower concentration than you'd typically find in a saltwater-intruded field. Vegetation stressed by salinization impacts are also more susceptible to mortality from 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 degradation of groundwater used for irrigation.

What are the drivers of salinization in upland areas?

Factors that contribute to the vulnerability of working lands to saltwater intrusion and salinization include the area's elevation and its rate of subsidence, in addition to the following drivers:

- Sea level rise: Higher sea levels increase the reach of tidal influences and king tides, and push the saltwater-freshwater interface inland.
- Storms and Tides: Storm frequency and intensity, tides, and wind can push saltwater far inland; storm surge can inundate land with salt water.
- Drought: Frequent, severe, or long-lasting droughts can result in saltwater incursion, and reduce the soils ability to leach away salts.
- Water management: Ground and surface water extraction for human use, and reduced freshwater discharge increase the potential for saltwater intrusion.
- Connectivity: Water control structures, such as tide gates, levees, canals, ditches, and tidal creeks, allow salt water to move further inland.



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: caused by natural processes such as saltwater 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: the addition of salts to the soil from groundwater following a water table rise, or from an aquifer contaminated by saltwater intrusion.
- Irrigation salinity: when reused or saline water is irrigated onto crops or horticulture, or when saline groundwater is used for irrigation.



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 increased saltwater inundation. For example, 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.

What can you do?

Contact your local Extension agent if you suspect your land is being or will be impacted by soil salinization.

Download *Identification, Mitigation, and Adaptation to Salinization on Working Lands in the U.S. Southeast*: <https://www.climatehubs.usda.gov/hubs/southeast/topic/saltwater-intrusion-and-salinization-coastal-forests-and-farms>

For more information, visit our website at: <https://bit.ly/saltysoil>

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