

Wetlands and Climate Change: The Challenge Before Us

This synopsis was developed with reference to the 2006 paper: "Common Questions: Wetland, Climate Change, and Carbon Sequestering" written by Jon Kusler, Association of State Wetland Managers (ASWM). The document condenses knowledge from numerous climate workshops and symposia, with a scientific literature review. Action steps are from "Draft Recommendations for a National Wetlands and Climate Change Initiative" by the ASWM. To access the full documents go to <http://www.aswm.org/>



Wetlands are particularly vulnerable to changes in climate and hydrology.

Changes in water level alter or eliminate wetlands. Compared to deeper river, stream and lake systems, wetland species are especially sensitive to small permanent changes in water levels. A few inches of variation in water level within a wetland means the difference between forested, shrub, emergent, or mudflat types...or, no wetland at all.

Lowered biodiversity reduces resiliency. Many wetlands currently lack the ecological health to adapt to increased climate perturbations as lowered biodiversity, from non-native species invasion, reduces resiliency.

Land use alterations limit species mobility. Wetland species need open ecological corridors to migrate when conditions change.

Climate change factors that can affect wetlands adversely:

Temperature. Increased atmospheric carbon dioxide increases air, water, and soil temperatures. This challenges the adaptive capabilities of temperature sensitive species found in wetlands.

Precipitation. Unlike lakes or river systems where depth of water is greater, a small reduction in a wetland's water volume can spell immediate disaster. Should evaporation and evapotranspiration rise (due to elevated temperatures) in combination with reduced precipitation, problems increase for wetlands.

Storm Events. With the intensification of climatological events (thunderstorms, hurricanes, tropical storms) higher temperatures and faster water cycling, due to increased evaporation and precipitation, are likely. Severe rainfall from these events would bring more sediment into some wetlands (e.g. alluvial & estuarine) while severely eroding others (riparian and floodplain areas.) [Note: for Hawaii, this equates to more sediment impacts to coral reefs and the shoreline intertidal zones.]

Sea Level Rise. Sea level rise is caused by thermal expansion of water and glacial melting. Rising water will inundate coastal ecosystems. [In Hawaii, according to Dr. Charles Fletcher of the University of Hawaii, in an internet webcast (at current.com), the elevation of sea level rise will be accentuated 100-fold by tidal surge. The result is even greater shoreline retreat and erosion impacts.]

Climate change will have the following direct impacts on wetlands.

Increased carbon dioxide = increased productivity of plants, where they are not hindered by low sunlight, temperature, or drought. This may enhance or detract from wetland habitat value based on the degree of shift to non-native dominance.

Decreased precipitation = fewer wetlands. Reduced surface and ground water levels either reduce wetland size or eliminate smaller wetlands.

Increased precipitation = more wetlands or different types. This would result in increased ground water levels and expansion of wetland systems. Shifts in wetland type may also occur with associated vegetation changes.

Increased severe weather = irreversible damage to some wetland systems. Under increased frequency and severity of severe weather, with no recovery time, wetlands may experience sediment overloads, greater invasive species invasion, and native or rare species loss. Extreme events in combination with sea level rise will increase shore erosion and coastal land loss.

Sea level rise = impacts to coastal and estuarine wetlands. These impacts will be most severe where landscapes fragmented by development prevent wetlands from migrating landward. For each foot of sea level rise tidal surge will amplify the water effects further inland. Accelerated rise will likely result in species shifts, decreased marsh productivity and potential marsh destruction from submersion. But it could also mean the opening up of new wetland areas landward or revitalizing of older previously converted wetland areas.

Increased air, water, and soil temperatures = both direct and indirect impacts. At a 2-8°F increase, the International Panel on Climate Change concludes that “composition and geographic distribution of many ecosystems ... will shift as individual species respond to the changes in climate [and] there will generally be reductions in biological diversity and in the goods and services that ecosystems provide.”



Wetland types most likely to be significantly impacted:

Coastal and estuarine wetlands can easily be flooded out with sea level rise.

Montane wetlands may see “relic” plant and animal species lost.

Seasonal and temporary wetlands are very sensitive to increased evaporation.

Depressional, slope, and fringe wetlands would have impacts from precipitation

Effects of climate change on wetland functions.

Fisheries and shellfish production. Loss of estuarine wetlands would reduce rearing and food chain support for ocean and estuarine fish species, lowering yields. Estuarine wetland loss and increased water depths would reduce shellfish yields.

Waterfowl support. The seasonal availability of wetlands for breeding and foraging will likely change, with potential conversion of open wetlands to other types. [Loss of already-limited coastal and estuarine wetland habitats in Hawaii would severely hinder the recovery of many waterbirds currently struggling to exist here.]

Habitat for rare and endangered species. Biodiversity will be compromised if species that depend on specific hydrologic and temperature conditions can't migrate freely.

Food chain support. This would be reduced if coastal & estuarine wetlands contributing detritus and nursery areas for marine fish and wildlife are lost.

Water quality filtration, wave attenuation, and groundwater recharge. These functions would be compromised or lost with reduction or loss of wetlands.



Koloa maoli, photo courtesy of USDA NRCS

Action Steps for Coastal and Estuarine Wetland Protection during Climate Change

- ✓ **Undertake restoration, and enhancement of wetlands most threatened by climate change.**
- ✓ **Identify and map species and systems most at risk from climate change.** (Species with limited range or poor distribution and systems needing migration options.)
- ✓ **Undertake long term planning and priority research to manage for wetland evolution.**
- ✓ **Control invasive species in climate-stressed wetlands**
- ✓ **Acquire upland buffers to afford wetland migration with sea level rise.**
- ✓ **Divert sediments to nourish wetlands experiencing sea level rise.**
- ✓ **Establish on-the-ground protection priorities for wetlands.** (Especially those with high potential for adaptability, upland migration with sea level rise, and restoration.)
- ✓ **Incorporate wetland and climate change ecosystem protection goals into coastal zone regulations, watershed management and land planning.** (Planning needs to take place at greater spatial and temporal scales.)
- ✓ **Prevent further wetland fragmentation.**
- ✓ **Implement low-risk wetland protection land use options** (Such as building setbacks, more stringent control of drainage, & purchase of wetlands for their function as green infrastructure.)