Being Prepared for Climate Change

A Workbook for Developing Risk-Based Adaptation Plans

Checklists of Potential Climate Change Risks, from Step 3

EPA
United States
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Agency

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The full workbook is available through the Climate Ready Estuaries website, www.epa.gov/cre.

CLIMATE READY ESTUARIES

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Table 3-1a. Potential climate change risks for pollution control

Clean Water Act goals	Warmer summers	Warmer winters	Warmer water	Increasing drought	Increasing storminess	Sea level rise	Ocean acidification
Controlling point sources of pollution and cleaning up pollution		☐ Loss of melting winter snows may reduce spring or summer flow volume, and raise pollutant concentration in receiving waters	☐ Temperature criteria for discharges may be exceeded (thermal pollution) ☐ Warmer temperatures may increase toxicity of pollutants	☐ Critical-low-flow criteria for discharging may not be met ☐ Pollutant concentrations may increase if sources stay the same and flow diminishes	☐ Combined sewer overflows may increase ☐ Treatment plants may go offline during intense floods	☐ Treatment plants may not be able to discharge via gravity at higher water levels ☐ Treatment infrastructure may be susceptible to flooding ☐ Sewage may mix with seawater in combined sewer systems ☐ Contaminated sites may flood or have shoreline erosion ☐ Sewer pipes may have more inflow (floods) or infiltration (higher water table)	
Controlling nonpoint sources of pollution	☐ Wildfires may lead to soil erosion	☐ Longer growing season can lead to more lawn maintenance with fertilizers and pesticides	☐ Higher solubility may lead to higher concentration of pollutants ☐ Water may hold less dissolved oxygen ☐ Higher surface temperatures may lead to stratification ☐ Greater algae growth may occur ☐ Parasites, bacteria may have greater survival or transmission	☐ Pollution sources may build up on land, followed by high-intensity flushes	☐ Streams may see greater erosion and scour ☐ Urban areas may be subject to more floods ☐ Flood control facilities (e.g., detention basins, manure management) may be inadequate ☐ High rainfall may cause septic systems to fail	☐ Tidal flooding may extend to new areas, leading to additional sources of pollution	☐ Decomposing organic matter releases carbon dioxide, which may exacerbate the ocean acidification problem in coastal waters

Table 3-1b. Potential climate change risks for habitat

Clean Water Act goals	Warmer summers	Warmer winters	Warmer water	Increasing drought	Increasing storminess	Sea level rise	Ocean acidification
Restoring and protecting physical and hydrologic features	☐ Higher temperatures may lead to greater evaporation and lower groundwater tables ☐ Switching between surface and groundwater sources for public water supplies may affect the integrity of water bodies ☐ Greater electricity demand may affect operation decisions at hydropower dams	☐ Less snow, more rain may change the runoff/infiltration balance; base flow in streams may change ☐ A spring runoff pulse may disappear along with the snow ☐ Rivers may no longer freeze; a spring thaw would be obsolete ☐ Marshes and beaches may erode from loss of protecting ice	☐ Warmer water may lead to greater likelihood of stratification	☐ Groundwater tables may drop ☐ Base flow in streams may decrease ☐ Stream water may become warmer ☐ Increased human use of groundwater during drought may reduce stream baseflow ☐ New water supply reservoirs may affect the integrity of freshwater streams	☐ The number of storms reaching an intensity that causes problems may increase ☐ Stronger storms may cause more intense flooding and runoff ☐ Coastal overwash or island breaching may occur ☐ Turbidity of surface waters may increase ☐ Increased intensity of precipitation may yield less infiltration	☐ Shoreline erosion may lead to loss of beaches, wetlands and salt marshes ☐ Saline water may move farther upstream and freshwater habitat may become brackish ☐ Tidal influence may move farther upstream ☐ Bulkheads, sea walls and revetments may become more widespread	
Constructing reefs to promote fish and shellfish			☐ Desired fish may no longer be present ☐ Warmer water may promote invasive species or disease		☐ Stream erosion may lead to high turbidity and greater sedimentation ☐ Lower pH from NPS pollution may affect target species	☐ Light may not penetrate through deeper water ☐ Higher salinity may kill targeted species	☐ Long-term shellfish sustainability may be an open question ☐ Fish may be adversely affected during development stages

Table 3-1c. Potential climate change risks for fish, wildlife and plants

Clean Water Act goals	Warmer summers	Warmer winters	Warmer water	Increasing drought	Increasing storminess	Sea level rise	Ocean acidification
Protecting and propagating fish, shellfish and wildlife **Controlling nonnative and invasive species** **Maintaining biological integrity and reintroducing native species**	☐ Species that won't tolerate warmer summers may die/migrate; biota at the southern limit of their range may disappear from ecosystems ☐ Species may be weakened by heat and become out-competed ☐ Essential food sources may die off or disappear, affecting the food web ☐ Species may need to consume more water as temperature rises	☐ Species that used to migrate away may stay all winter ☐ Species that once migrated through may stop and stay ☐ Pests may survive winters that used to kill them ☐ Invasive species may move into places that used to be too cold ☐ Some plants may need a "setting" cold temperature ☐ A longer growing season may lead to an extra reproductive cycle ☐ Food supplies and bird migrations may be mis-timed	☐ Newly invasive species may appear ☐ Habitat may become unsuitably warm, for a species or its food ☐ Heat may stress immobile biota ☐ Dissolved oxygen capacity of water may drop ☐ Some fish reproduction may require cold temperatures; other reproductive cycles are tied to water temperature ☐ Coral bleaching episodes may increase ☐ Parasites and diseases are enhanced by warmer water	☐ Species may not tolerate a new drought regime ☐ Native habitat may be affected if freshwater flow in streams is diminished or eliminated ☐ Changing freshwater inputs may affect salinity distribution in estuaries (especially of interest with regard to shellfish habitat)	☐ Greater soil erosion may increase turbidity and decrease water clarity ☐ Greater soil erosion may increase sediment deposition in estuaries, with consequences for benthic species	☐ Sea level may push saltier water farther upstream (especially of interest with regard to shellfish habitat) ☐ Light may not penetrate through the full depth of deeper water ☐ Greater coastal wetland losses may occur	☐ Corrosive waters may impact shellfish development ☐ Shellfish predators may not survive the disappearance of shellfish ☐ Fish may be adversely affected during development stages by changes to water chemistry ☐ The effect of ocean acidification on calcifying plankton may lead to cascading effects in the food chain

Table 3-1d. Potential climate change risks for recreation and public water supplies

Clean Water Act resource goals	Warmer summers	Warmer winters	Warmer water	Increasing drought	Increasing storminess	Sea level rise	Ocean acidification
Restoring and maintaining recreational activities, in and on the water	☐ More people using water for recreation may raise the potential for pathogen exposure		☐ Harmful algal blooms may be more likely ☐ Jellyfish may be more common ☐ Fishing seasons and fish may become misaligned ☐ Desired recreational fish may no longer be present ☐ Invasive plants may clog creeks and waterways	☐ Freshwater flows in streams may not support recreational uses ☐ Increased estuary salinity may drive away targeted recreational fish	☐ More frequent or more intense storms may decrease recreational opportunities ☐ Greater NPS pollution may impair recreation	☐ Beaches or public access sites may be lost to coastal erosion or inundation ☐ Clearance under bridges may decrease	☐ Eco-tourism resources or attractions (e.g., birding, diving, fishing) may be degraded ☐ Recreational shellfish harvesting may be lost
Protecting public water supplies	☐ Warmer temperatures may drive greater water demand ☐ Evaporation losses from reservoirs and groundwater may increase	☐ Summer water supplies that depend on winter snow pack may disappear ☐ Cold places may see more freeze/thaw cycles that can affect infrastructure	☐ Changes in treatment processes may be required ☐ Increased growth of algae and microbes may affect drinking water quality	☐ Lower freshwater flows may not keep saltwater downstream of intakes ☐ Groundwater tables may drop ☐ Coastal aquifers may be salinized from insufficient freshwater input ☐ Coastal aquifers may be salinized from higher demand on groundwater ☐ Maintaining passing flows at diversions may be difficult	☐ Water infrastructure may be vulnerable to flooding ☐ Flood waters may raise downstream turbidity and affect water quality	☐ Sea level may push salt fronts upstream past water diversions ☐ Water infrastructure may be vulnerable to inundation or erosion ☐ Saltwater intrusion into groundwater may be more likely	