

Menu of Adaptation Strategies and Approaches

Developed for Great Lakes Coastal Ecosystems

Strategy 1: Maintain and enhance fundamental hydrologic processes and sediment dynamics.

Approach 1.1 Maintain or restore natural sediment transport processes

Approach 1.2 Maintain and restore hydrological connectivity between hydrological features

Approach 1.3 Maintain and enhance infiltration and water storage capacity of soils

Strategy 2: Maintain and enhance water quality

Approach 2.1 Moderate water temperature increases

Approach 2.2 Reduce sediment deposition

Approach 2.3 Reduce loading and export of nutrients and other pollutants

Strategy 3: Maintain, restore, and manage coastal vegetation

Approach 3.1 Retain coastal wetlands and estuaries

Approach 3.2 Minimize non-climate physical damage to coastal ecosystems

Approach 3.3 Establish living shorelines by maintaining and restoring coastal vegetation

Approach 3.4 Maintain and enhance species and structural diversity in coastal ecosystems

Approach 3.5 Prevent invasive plant and animal species establishment and minimize their impacts where they occur.

Approach 3.6 Maintain and establish refugia for plants and animals

Approach 3.7 Maintain and increase connectivity of coastal habitats

Strategy 4: Alter coastal ecosystems to accommodate changing hydrology and shoreline erosion.

Approach 4.1 Manage coastal systems to accommodate increased frequency and duration of low water levels

Approach 4.2 Manage coastal ecosystems to accommodate increased frequency and duration of high-water levels

Approach 4.3 Promote features that reduce damage from coastal erosion

Approach 4.4 Manage sediment to respond to fluctuating water levels.

Approach 4.5 Reduce or manage surface water runoff

Approach 4.6 Maintain and create conditions for inland/waterward plant & animal movement

Approach 4.7 Manage impounded wetlands to accommodate changes in hydrologic variability

Strategy 5: Facilitate transformation of coastal ecosystems by adjusting plant species composition

Approach 5.1 Favor or restore native species and genotypes with wide moisture and temperature tolerances

Approach 5.2 Increase genetic diversity of seed and plant mixes

Approach 5.3 Disfavor species that are distinctly maladapted

Approach 5.4 Introduce species that are expected to be adapted to future conditions

Approach 5.5 Move at-risk species to locations that are expected to provide more suitable habitat

Strategy 6: Design and modify infrastructure to accommodate future conditions

Approach 6.1 Reinforce infrastructure to meet expected conditions

Approach 6.2 Design infrastructure with low impact or ecologically friendly features

Approach 6.3 Adjust placement, design, and planned lifespan of infrastructure

Approach 6.4 Remove infrastructure and readjust systems

Source: Schmitt, K.M., et al, 2021. **More information:** forestadaptation.org/coastal

This is a supplemental topic to be used in the Adaptation Workbook decision-support framework – Swanston et al, 2016. Forest Adaptation Resources: climate change tools and approaches for land managers, 2nd edition.

*<http://www.treesearch.fs.fed.us/pubs/52760> **More information can be found at** www.forestadaptation.org/strategies*

Setting the context: community engagement, planning & policy actions

The Adaptation Strategies and Approaches have been designed primarily for those planning and implementing on-the-ground management actions. However, many adaptation actions will require or benefit greatly from community engagement, regionally coordinated planning, or changes in policy (Kraus & Klein 2009, Franks-Taylor et al. 2010, Pearsall et al. 2012a, Pearsall et al. 2012b). For example, many of the listed strategies would be bolstered by planning or policy decisions that can address issues like zoning, water quality and sediment management at a broader scale.

These actions will involve many other people and organizations beyond the coastal practitioners traditionally charged with executing treatments on the ground. In coastal ecosystems, past management decisions have often failed to consider a systems perspective, leading to unintended consequences. Engaging a variety of stakeholders and diverse perspectives can help practitioners consider the range of both positive and negative outcomes from management actions. It will be vital to engage with the community, tribes, policy makers, and different disciplines to optimize effective climate change adaptation across large scales (NOAA 2010). Though the full range of strategies involved in working with these other groups are beyond the scope of this document, we have provided some ideas from expert input and from documents that cover coastal adaptation through a planning and policy lens. Many of these ideas can be incorporated into the adaptation planning processes like the Adaptation Workbook.

1. Promote community engagement in coastal management decisions.

- Carefully consider how and when to collect input and/or conduct outreach on project goals, climate vulnerabilities and adaptation responses.
- Gather input from community members with a diverse range of perspectives, for example indigenous communities, landowners, recreational users, policy makers, and others.
- Respect and incorporate values of indigenous communities in management decisions.
- Support facilitated visioning exercises or other processes to lay out and discuss shared group values (Mangham et al. 2018).
- Support public-private partnerships that can help with efforts such as hazard mitigation and recovery or low-impact development and green infrastructure (Mangham et al. 2018).
- Explicitly consider socioeconomic and community benefits when weighing pros and cons of adaptation actions.
- Enhance knowledge, technical skills and information exchange to build capacity of local policy and land use planning authorities (Franks-Taylor et al. 2010)
- Develop new coastal homeowner tutorials to highlight appropriate erosion solutions, methods, and materials (Mangham et al. 2018).

2. Revise ordinances and permitting to be more responsive to coastal ecosystem changes.

- Revise rules and permitting processes to allow breakwater structures that can lower wave energy and allow the installation of living shorelines (Mangham et al. 2018).
- Add fees to coastal structures that would restrict or trap sediment and use the proceeds for beach nourishment or other sediment management activities (Mangham et al. 2018).

- Develop a review and response mechanism for municipal ordinances - review policies and make changes that would allow for more sensible development either periodically or after certain criteria are met (e.g. coastal erosion reaches a certain threshold (Mangham et al. 2018).
- Develop flexible county ordinances to implement greater setbacks for developments where risks are high. Fund coastal erosion studies identify risk (e.g. erosion rates vary with substrate, elevation, and slope - see Bayfield County, WI as a model).
- Require risk assessments for coastal properties prior to sale (Mangham et al. 2018).

3. Coordinate planning across ownership and scales to respond to coastal ecosystem vulnerabilities.

- Coordinate coastal ordinances among municipalities (e.g. bluff vegetation ordinances - Mangham et al. 2018).
- Create a regional sediment management plan (Pearsall et al. 2012b).
- Develop growth management plans (Mangham et al. 2018).
- Develop and implement collaborative watershed plans that integrate green infrastructure principles (Pearsall et al. 2012b).
- Promote policies and programs that reduce nutrient losses and delivery (Pearsall et al. 2012a).
- Promote ecosystem-based watershed planning to foster closer cooperation between local towns and higher levels of government (Kraus & Klein 2009).
- Modify zoning and restrict development in sensitive areas.
- Map and prioritize refugia-retreat areas for unimpeded upland wetland migration under sustained high-water level scenarios (Morelli et al. 2016).
- Designate protected coastal sediment feeder areas and prohibit armoring of those areas to promote sediment movement (Mangham et al. 2018).
- Adjust ballast water regulations to decrease risk of invasion from aquatic invasive species (Magee et al. 2019).

4. Employ incentives to minimize coastal ecosystem vulnerabilities.

- Employ rolling easements that can help coastal ecosystems respond to fluctuating water levels (EPA 2009).
- Employ easements (or transfer of development rights) to promote undeveloped shoreline (Mangham et al. 2018).
- Purchase land that is at risk of flooding, storm damage, erosion or bluff collapse, and use it for conservation.
- Employ land exchange programs – owners can exchange property in a flood risk area for other land, allowing ecosystems to adapt to changes.
- Establish payments to farmers to implement BMPs to reduce sediment, phosphorous, and nitrogen pollution in priority watersheds (Franks-Taylor et al. 2010).
- Promote incentives like the 4R certification approach to help increase farmers' profits while also reducing agricultural nutrient runoff (Kerr et al. 2016).

See more ideas in (Mangham et al. 2018) and the Lake Biodiversity Conservation Strategies (Kraus & Klein 2009, Franks-Taylor et al. 2010, Pearsall et al. 2012a, Pearsall et al. 2012b). For more on funding, see (Mangham et al. 2018, NOAA 2021).