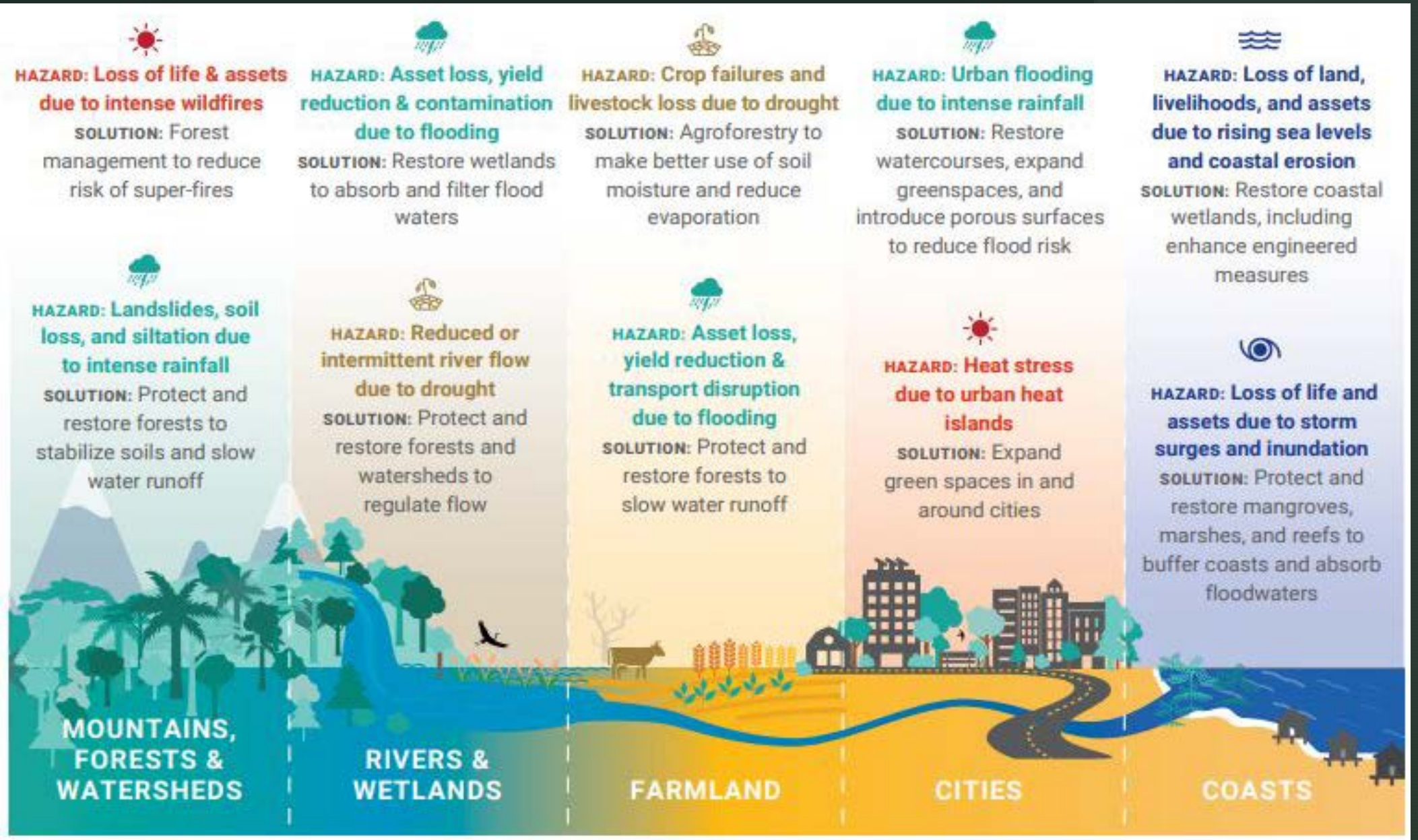
Nature-based Solutions for

Climate Change Adaptation (CCA)

Across Landscapes

Different Nature-based Solutions Can Work Together Across Landscapes to Build Resilience

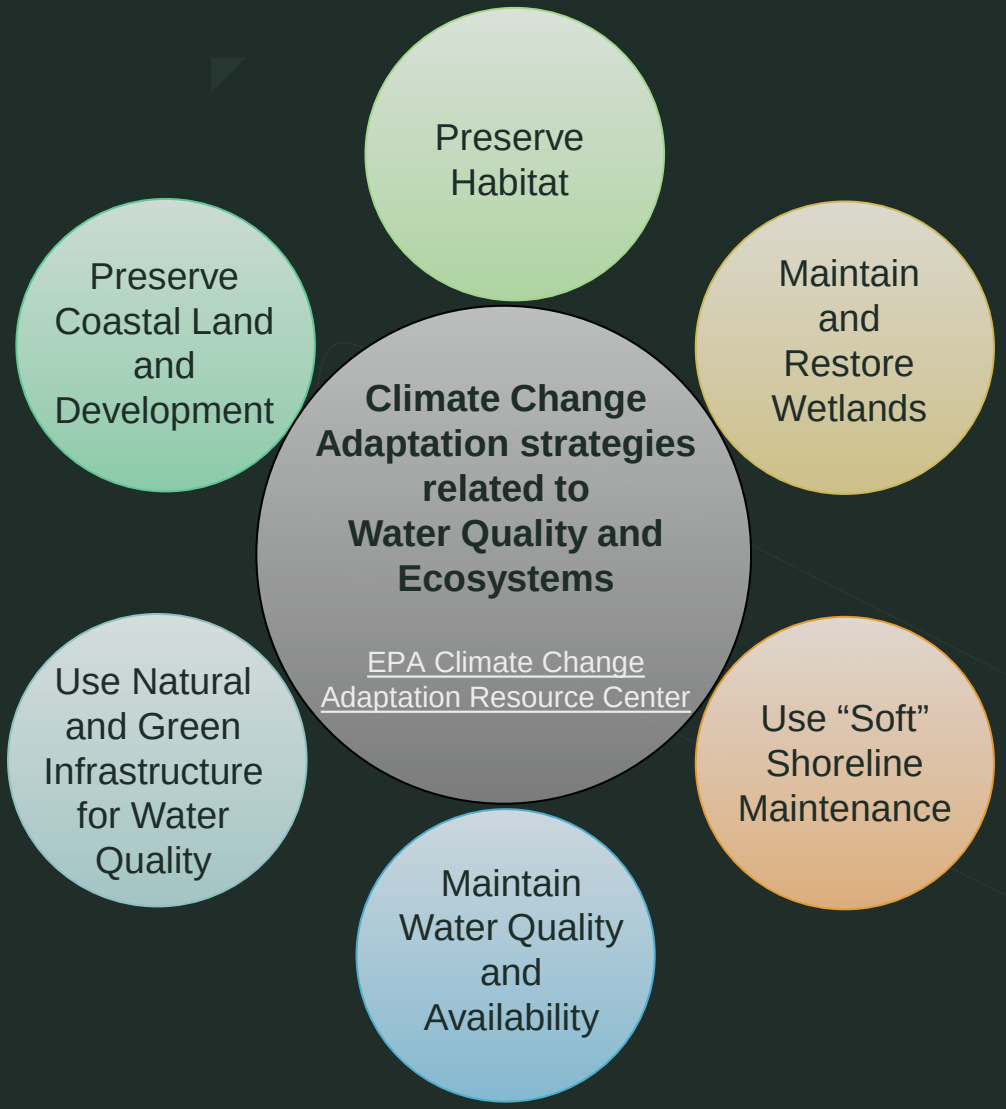


Source: Authors.

NbS for Climate Change Adaptation

EPA CCA Resource Center

EPA Climate Change Adaptation Resource Center (ARC-X)



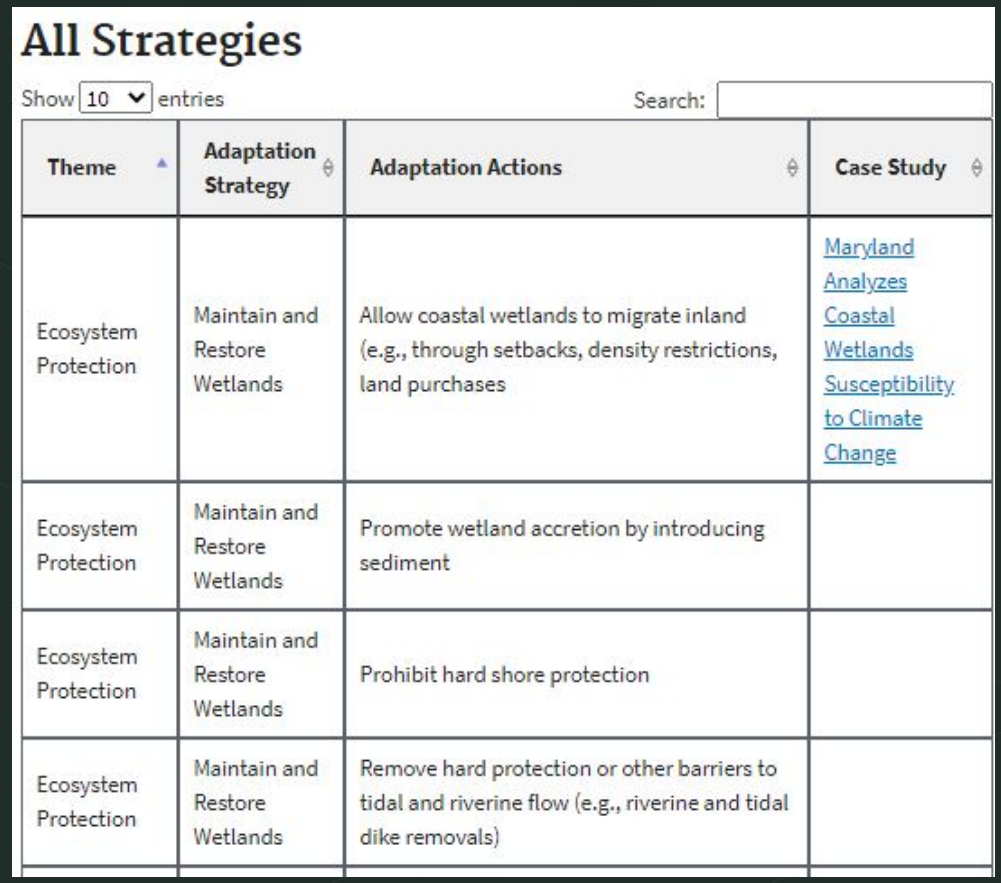
Climate Change Adaptation Resource Center (ARC-X) Home
Your Climate Adaptation Search
Implications of Climate Change
Adaptation Planning
Adaptation Strategies
Case Studies
Tools
Training
Federal Funding & Technical Assistance

Strategies for Climate Change Adaptation

Select a particular area of interest or explore a list of all adaptation strategies. Learn more about adaptation strategies.

On this page:

- Air
- Water
- Waste
- Public Health
- All Strategies
- About Adaptation Strategies



All Strategies

Show 10 entries Search:

Theme	Adaptation Strategy	Adaptation Actions	Case Study
Ecosystem Protection	Maintain and Restore Wetlands	Allow coastal wetlands to migrate inland (e.g., through setbacks, density restrictions, land purchases	Maryland Analyzes Coastal Wetlands Susceptibility to Climate Change
Ecosystem Protection	Maintain and Restore Wetlands	Promote wetland accretion by introducing sediment	
Ecosystem Protection	Maintain and Restore Wetlands	Prohibit hard shore protection	
Ecosystem Protection	Maintain and Restore Wetlands	Remove hard protection or other barriers to tidal and riverine flow (e.g., riverine and tidal dike removals)	

NbS for Climate Change Adaptation

Maintain and Restore Wetlands

- Allow coastal wetlands to migrate inland
- Create a regional sediment management (RSM) plan
- Develop adaptive stormwater management practices
- Establish rolling easements
- Identify and protect ecologically significant ("critical") areas such as nursery grounds, spawning grounds, and areas of high species diversity
- Incorporate wetland protection into infrastructure planning
- Maintain Sediment Transport
- Preserve and restore the structural complexity and biodiversity of vegetation in tidal marshes, seagrass meadows, and mangroves
- Prohibit hard shore protection
- Promote wetland accretion by introducing sediment
- Remove hard protection or other barriers to tidal and riverine flow
- Trap or add sand through beach nourishment – the addition of sand to a shoreline to enhance or create a beach area
- Trap sand through construction of groins – a barrier type structure that traps sand by interrupting longshore transport

Preserve Habitat

- Adapt protections of important biogeochemical zones and critical habitats as the locations of these areas change with climate
- Connect landscapes with corridors to enable migrations
- Design estuaries with dynamic boundaries and buffers
- Expand the planning horizons of land use planning to incorporate longer climate predictions
- Purchase upland development rights or property rights
- Replicate habitat types in multiple areas to spread risks associated with climate change
- Retreat from, and abandonment of, coastal barriers

Maintain Water Quality and Availability

- Create water markets – transferring land and water from agricultural to community use
- Design new coastal drainage system
- Develop adaptive stormwater management practices (e.g., remove impervious surface, replace undersized culverts)
- Establish or broaden "use containment areas" to allocate and cap water withdrawal
- Incorporate sea level rise into planning for new infrastructure (e.g., sewage systems)
- Integrate climate change scenarios into water supply system
- Manage water demand (through water reuse, recycling, rainwater harvesting, desalination, etc.)
- Plug drainage canals
- Prevent or limit groundwater extraction from shallow aquifers

Preserve Coastal Land and Development

- **Create permitting rules that constrain locations for landfills, hazardous waste dumps, mine tailings, and toxic chemical facilities**
- **Incorporate consideration of climate change impacts into planning for new infrastructure (e.g., homes, businesses)**
- **Integrate coastal management into land use planning**
- **Integrated Coastal Zone Management (ICZM) – using an integrated approach to achieve sustainability**
- **Land acquisition program – purchase coastal land that is damaged or prone to damage and use it for conservation**
- **Land exchange programs – owners exchange property in the floodplain for county-owned land outside of the floodplain**
- **Manage realignment and deliberately realign engineering structures affecting rivers, estuaries, and coastlines**

Use Natural and Green Infrastructure for Water Quality

- Urban Environment
  - Plant Trees
  - Build swales and raingardens
  - Stormwater retention ponds
  - Stormwater tree trenches
- In-Stream Measures
  - Remove un-needed dams and impoundments
  - Control stream bank erosion
  - Create deep pools or artificial logjams
- Groundwater Measures
  - Control groundwater withdrawal
  - Promote stormwater infiltration
  - Remove un-needed channelization
- Land Use Measures
  - Plant forests and floodplain habitat
  - Control soil erosion in the watershed
  - Control stormwater runoff

Soft Shorelines

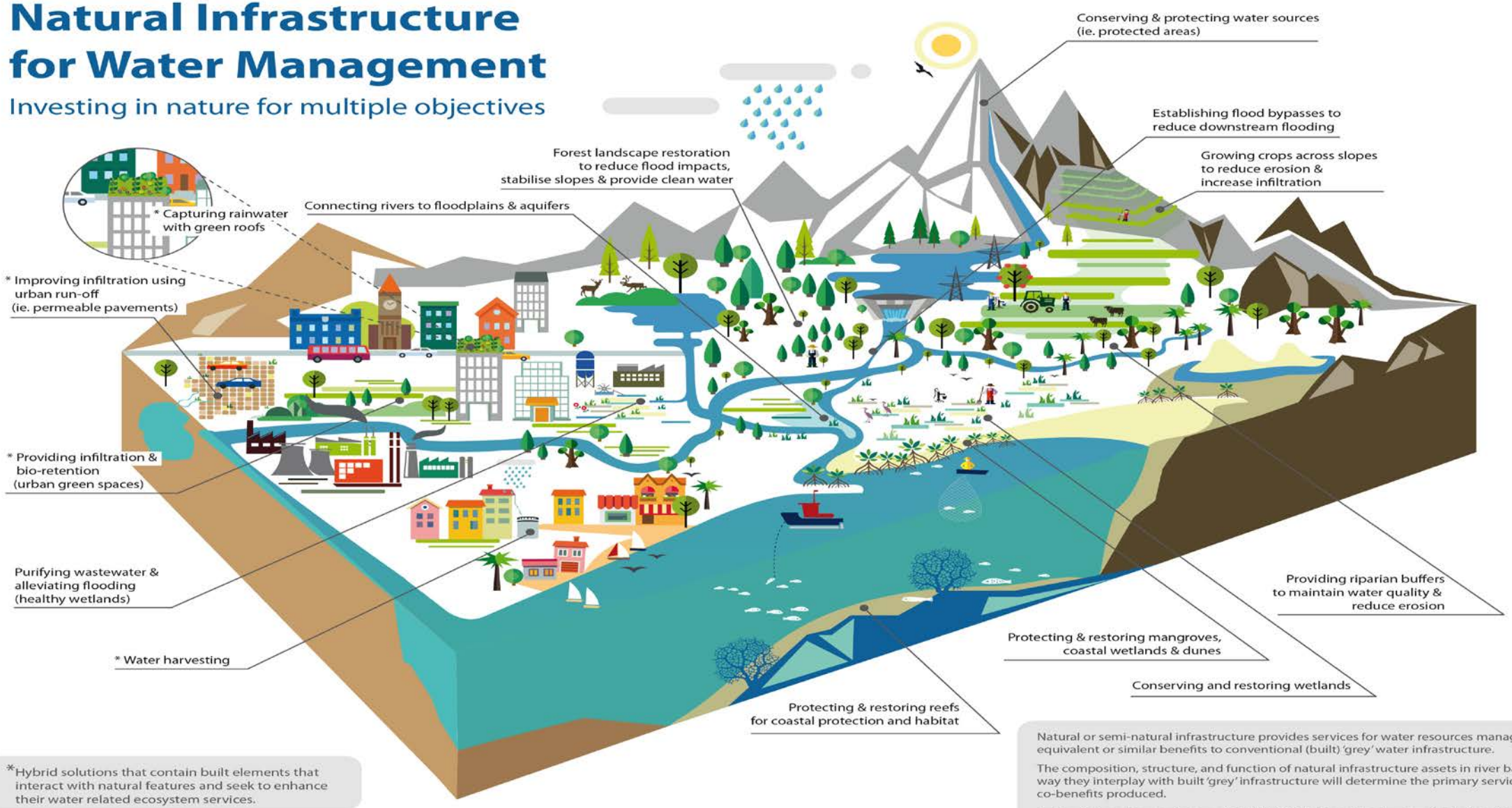
Before (2000) | After living shoreline installation (2014)

Use “Soft” Shoreline Maintenance

- Composite systems – incorporate elements of two or more methods (e.g., breakwater, sand fill, and planting vegetation)
- Create dunes along backshore of beach; includes planting dune grasses and sand fencing to induce settling of wind-blown sands
- Create marsh by planting the appropriate species – typically grasses, sedges, or rushes – in the existing substrate
- Increase shoreline setbacks
- Install rock sills and other artificial breakwaters in front of tidal marshes along energetic estuarine shores
- Plant SAV (e.g., sea grasses) to stabilize sediment and reduce erosion
- Redefine riverine flood hazard zones to match projected expansion of flooding frequency and extent
- Remove shoreline hardening structures such as bulkheads, dikes, and other engineered structures to allow for shoreline migration
- Replace shoreline armoring with living shorelines – through beach nourishment, planting vegetation, etc
- Restrict or prohibit development in erosion zones
- Use natural breakwaters of oysters (or install other natural breakwaters) to dissipate wave action and protect shorelines

Natural Infrastructure for Water Management

Investing in nature for multiple objectives



*Hybrid solutions that contain built elements that interact with natural features and seek to enhance their water related ecosystem services.

Natural or semi-natural infrastructure provides services for water resources management with equivalent or similar benefits to conventional (built) 'grey' water infrastructure.

The composition, structure, and function of natural infrastructure assets in river basins, and the way they interplay with built 'grey' infrastructure will determine the primary services and co-benefits produced.

Further information can be found in UNEP (2014) Green Infrastructure Guide for Water Management: Ecosystem-based management approaches for water related-infrastructure projects.

Urban Planning with Nature-based Solutions for Adaptation

Source: Authors, based on Chu, E., Brown, A., Michael, K., Du, J., Lwasa, S., and Mahendra, A. 2019. "Unlocking the Potential for Transformative Climate Adaptation in Cities." Washington, DC: Global Commission on Adaptation and World Resources Institute.

References

Slide 2: NbS Across Landscapes

Global Commission on Adaptation. (2019) *Adapt Now: A Global Call for Leadership on Climate Resilience.* [Fig 3.2, p 38] https://cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf

Slides 3 through 6:

U.S. EPA (2020, Nov 19) Strategies for Climate Change Adaptation. *Climate Change Adaptation Resource Center* (ARC-X). Retrieved from https://www.epa.gov/arc-x/strategies-climate-change-adaptation

- Slide 5 muted background image: "Willamette Confluence Middle Fork Restoration" via OWEB
- Slide 6 image: "NOAA Pivers Island, Beaufort, NC: Before living shoreline installation in 2000 (left of slider bar) and after in 2014 (right of slider bar)."

Slide 7: Natural Infrastructure for Water Management

IUCN (2020, Mar 25) Visual Story. *Nature-based Solutions for Water Infrastructure at your service.* Retrieved from https://digital.iucn.org/water/nature-based-solutions-for-water/

Slide 8: Urban Planning with NbS

Ibid. [Fig 5.2, p 47]