

# Resist-Accept-Direct Framework:

## *A Tool to Address Ecological Transformation*

During the past few decades, extended droughts, massive floods, intense hurricanes, and catastrophic wildfires are happening with increasing intensity and frequency. The impacts from rapid climate change are challenging traditional wildlife management strategies that were based on a stable, stationary baseline condition.

Habitats are changing in dramatic ways. They are shifting in multiple ecological characteristics, resulting in a high degree of turnover in species composition, rather than just loss or decline of a single species. **Ecological Transformation** is change that re-arranges historical species composition and the ecological function of habitats. For example, overall warmer temperatures - particularly warmer winters – are allowing the colonization of Florida mangroves north of their historical range, converting salt marshes into mangrove forests.

Transformation of an ecosystem can also occur because of changes in land use, expansion of invasive species and habitat fragmentation. Although any of these impacts may transform a

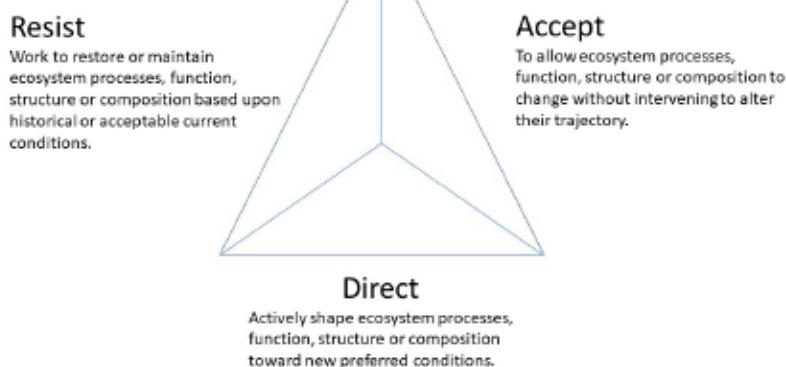
system, anthropogenic climate change is an extremely powerful driver that can increase the rates and intensity of transformation dramatically and multiplies other driver impacts.

Climate change presents a complex management problem because it combines a persistent, yet variable, change across landscapes and is very difficult to predict or mitigate locally. Although climate change leads to undesirable conditions for many ecosystems, a new trajectory can result in novel conditions that may be favorable for some species, habitats, or human communities. The Resist-Accept-Direct (RAD) framework provides a way to respond to ecological transformation, especially to new unexperienced conditions (Figure 1). Management often incorporates two or three RAD elements rather than just one discrete use. For example, we may resist a change in the short-term (10-20 years) to provide habitat until we can direct habitat into a desired type. We may also need to accept change in some locations due to environmental, economic, or social constraints, but then use the resist and direct option in other locations. RAD

is a portfolio of options applied across the landscape to respond to ecological transformation for the purpose of fish and wildlife management.

Blackwater National Wildlife Refuge (BNWR) provides excellent examples of how each RAD element is applied discretely and in conjunction with each other based on a strategic portfolio approach. BNWR was established in 1933 as a migratory bird refuges and consists of over 30,000 acres of rich tidal marsh, flats, mixed hardwood and loblolly pine forests, managed freshwater wetlands and croplands. The Blackwater River spans the single largest area of brackish marsh within the Chesapeake Bay watershed and is of regional significance for its wetlands and supported wildlife. The refuge is recognized as a “Wetland of International Importance” and an “Internationally Important Bird Area”. These wetlands also provide storm protection to lower Dorchester County.

Staff at the BNWR use all three RAD strategies.. Shorter's Wharf provides a good example of successful use of the **Resist** strategy. Because marsh elevation loss is occurring across the refuge, staff piloted a project in conjunction with local NGOs to increase marsh habitat, important to many species, but particularly for sensitive species - the Eastern Black Rail and the Salt Marsh Sparrow. Shorter's Wharf location was selected because it provided important historic habitat for these species, plus was adjacent to the sediment source used to build marsh elevation (Figure 2). When using the **Resist** strategy, managers must keep in mind it may be a temporary solution. For example, if sea level rise outpaces the ability of the marsh to keep up, the project may only last a decade or two, or require continual intervention. It is important to consider long-term goals when deciding to use this strategy.



**Figure 1.** The Resist-Accept-Direct framework outlines three management responses. Management strategies may be a combination of all three responses. Definitions from Schuurman et al. 2021; design adapted from Thompson et al. 2020.

Invasive species such as phragmites affect much of the refuge, which can be very difficult to bring under control. Under these circumstances, refuge staff chose to **Accept** the change brought on by phragmites (Figure 3). While this vegetation does not provide the type of wildlife habitat needed by many species, it does reduce erosion, traps sediment and provides storm surge benefits by absorbing and dissipating surge energy.

The refuge is using the **Direct** strategy to promote upland marsh migration before phragmites can become established. At several locations, the refuge has cut ditches to bring sea water into the upslope areas, increasing soil salinity and planting salt-tolerant native plants (Figure 4). The addition of the sea water is enough to reduce the impacts of phragmites while promoting native salt marsh plants.

As demonstrated by Blackwater, managers may need to apply a portfolio of options across their local landscape to better manage wildlife that depend on marshes impacted by climate change. Regional portfolios, coordinated across the System, can reduce the risk of piloting novel actions at any one refuge and ensure that future marsh habitat can maintain associated species somewhere in North America. The RAD framework is one way to weigh the economic, ecological, and sociological costs and benefits of various management strategies that can be applied on landscapes faced with ecological transformation.

See [USGS Site](#) for a complete list of References.



**Figure 2.** Thin-layer application in action at Blackwater National Wildlife Refuge. Photo courtesy of Dave Harp.



**Figure 3.** Phragmites is an invasive species that covers much of the Blackwater National Wildlife Refuge. Photo by USFWS



**Figure 4.** Directing change by extending a tidal creek channel into upslope habitat. Photo by USFWS

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