

# A new way of thinking about climate adaptation

by John Morton



*Underpasses to help wildlife move across the Sterling Highway is one way to resist changing conditions.*

Last week I was in Madison, Wisconsin, at the National Adaptation Forum. This is an invigorating conference, powered by almost 1,000 passionate people who seek and offer solutions to address rapidly changing climate.

The session I helped facilitate was about a new decision framework for responding to the ecological effects of a warming climate. This framework puts the burden on the land manager to make a RAD choice: resist, accept or direct that change. To resist change means to try to maintain historic conditions despite changing conditions. To direct change means to try to influence the system's trajectory towards a desirable future condition. To accept change is to accept the outcome, perhaps because it's infeasible to manage the change (glaciers melting) or because nobody really cares (migratory birds arriving earlier in the spring).

I have already found the RAD framework use-

ful in thinking about changes on the Kenai National Wildlife Refuge. Here, we have documented dramatic rates of treeline and shrubline rising into alpine tundra, wetlands drying in the Kenai Lowlands, the Harding Icefield receding, nonglacial streams warming, and spruce trees dying in response to bark beetle attacks. We have implicitly (and now explicitly) accepted these changes because of our legislative purposes to manage most of Kenai Refuge as Wilderness and the entire refuge for "natural" diversity, even when we know that contemporary climate change is mostly driven by humans and their activities.

To date, the refuge has worked hard to resist change by maintaining landscape-scale connectivity. The underpasses that the Alaska Department of Transportation is currently installing where the Sterling Highway bisects the refuge are a means of maintaining north-south movement of wildlife. The Kenai Moun-

tains to Sea partnership (<https://kenaiwatershed.org/science-in-action/mountains-to-sea/>) is an effort to maintain connectivity along streams as they flow through a parcelized landscape from federally-protected lands to the ocean.

Elsewhere on the Kenai Peninsula, others have begun to resist these directional and sometimes transformational changes. The Ninilchik Native Association and Kenai Peninsula Borough planted lodgepole pine in many previously-forested areas that had been salvage cut in the aftermath of the 1990's spruce bark beetle outbreak. These plantations were started with more traditional silvicultural goals in mind, setting the stage for a renewable forest industry.

Several Alaska Native corporations have submitted forestry projects to receive money for carbon offset credits. These carbon credits originate from the cap-and-trade legislation California passed in 2013 that applies to large electric power plants, large industrial plants, and fuel distributors. The goal in this context is to sustain existing forests that will sequester carbon over the next century to offset carbon produced above the cap. Nathan Lojewski, the forester at Chugachmiut, tells me that 25.9 million offset credits have been issued in Alaska to date.

Here on the Kenai Peninsula, four projects submitted by English Bay Corporation, Seldovia Native Association, Port Graham Corporation, and CIRI total at least 100,000 acres of trees with an average carbon stock of 85 metric tons of carbon dioxide per acre. Valued at \$10–15 per metric ton, that's a good reason to conserve forests.

Sue Mauger, with the Cook Inletkeeper, came up with a novel resistance approach. She used aerial thermal imagery to identify “cold seeps” in the Anchor River where groundwater cools streams being warmed by hotter air. Working with the Kachemak Heritage Land Trust, they have targeted these riparian parcels for purchase to help ensure that the nonglacial Anchor River remains refrigerated in years to come.

A group called Climate Action Team Seldovia has taken a more aggressive approach, planting Siberian larch along the Otterbahn Trail in Seldovia this past Arbor Day. Because larch is deciduous, it reflects less light in the winter (reduced albedo) and sheds wet snow better than the native Sitka spruce that holds its needles all winter. In the summer, when trees are needed to shade warming nonglacial streams, larch does infinitely better than blown-down, beetle-killed spruce.

A great outcome of making a choice in the RAD framework is that it makes you think about the other two choices. Under what conditions would we stop accepting a change? Refuge ecologist Dawn Magness and I recently published a study in *PLOS One* that uses climate-envelope modeling to show that rising treeline may ultimately replace alpine tundra on the peninsula. It doesn't take much thought to conclude that alpine-dependent species like caribou, Dall sheep and ptarmigan may disappear in that forecasted future. Would the threat of losing these iconic species push us to do something about rising treeline?

Similarly, while trying to slow glaciers receding seems ridiculously daunting, consider what salmon populations on the Kenai Peninsula would be without meltwaters from the Harding Icefield. A group (<https://www.ice911.org/>) that includes Stanford University researchers has proposed to arrest meltdown of the arctic ice cap with hollow glass balls the width of a human hair. Just offshore from Utqiagvik, they've spread a thin layer of these balls over an area the size of three football fields to test their theory that enough sunlight can be reflected to dramatically slow ice loss. Perhaps this might work better on our local glaciers?

As far-fetched as all of this seems, remember we are just beginning to see the ecological consequences of a climate that is expected to warm for several centuries. Just 11 months after the Army Corps of Engineers spent \$14 billion on a network of levees and floodwalls to protect New Orleans after Hurricane Katrina, the same agency now says that accelerating sea level rise and land subsidence will make the city vulnerable in just four years. Change is coming faster than most people could have imagined when Al Gore described climate change as “an inconvenient truth” in 2006.

The hidden problem with managing ecological systems is that they are systems. Local-scale adaptation, like introducing new species, can have rippling effects that go beyond the target site. Also, in a perfect world, local adaptation should be networked over a broader landscape to ensure that actions are not at cross-purposes to one another.

We are entering a brave new world whether we like it or not.

*John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more Refuge Notebook articles (1999–present) at [https://www.fws.gov/refuge/Kenai/community/refuge\\_notebook.html](https://www.fws.gov/refuge/Kenai/community/refuge_notebook.html).*