Small Changes in the Environment Can Have Large, Unexpected Consequences

A few years ago it was fashionable for people, wanting to sound familiar with the then-new theory in mathematics and physics called the “Chaos” theory, to talk about how a butterfly flapping its wings in Brazil could be the cause of a tornado in Texas. This was not really a serious thought but rather an attempt by some to explain a complex theory for laymen, the theory being that small changes in initial conditions could result in large changes far removed in time and space, and weather predictions were frequently cited as an example. But in thinking about the consequences small changes in the environment can have on future conditions, the butterfly analogy seems appropriate.

A balanced, highly-interconnected ecosystem can be thought of as a bit like the old Rube Goldberg cartoons where sunlight (a) coming through a window (b) shining on a magnifying glass (c) burns a string (d) that drops weight (e) slamming door (f) thus pulling string (g) and yanking out a man’s tooth. Here are some real-life ecological sequences where a change in one thing brings about unanticipated changes elsewhere.

Shoot a wolf, kill a fish: Shooting wolves in one area allowed the deer population to increase. The hunters were excited, which is why the wolves were shot in the first place. But as the deer population increased, they began to exhaust their favorite foods, then their less-favorite food, then most of the remaining vegetation. With no vegetation covering the ground, erosion began to take place, causing rainwater to run off the land carrying heavy loads of silt and soil and exposing rocks which increased the flooding. This silted in creeks, rivers, lakes and ponds, killing fish.

Settlers cause trees to grow in the grasslands: As settlers of European ancestry moved into the Hill Country, they caused two changes in the ecosystem. Their livestock continually overgrazed the land and reduced the amount of grass. The settlers moving in caused the Native Americans to be displaced or to spend less time in the area. Both of these changes reduced the frequency and extent of wildfires, frequently set by Native Americans. With fewer fires burning less intensely in shorter grass, more woody plants survived from not being burned up and became established in grasslands.

Introducing wolves to Yellowstone increases beaver dams: The introduction of wolves into Yellowstone National Park had the expected effect of reducing the elk population. But then the reduced elk population, being afraid of the newly introduced predators, tended to spend more time in open areas where they could better see and flee from the predators. This meant they spent less time along the stream banks eating willows. The number of willows then increased, which is a favorite food of beavers. This allowed the beaver population to increase and build more dams, which are actually beneficial for many different forms of wildlife.

Eliminating screw-worm flies reduces hardwood trees: The elimination of the screw-worm fly not only saved many thousands of ranchers' livestock, but it also removed the last natural predator of the white-tailed deer. The deer population has increased significantly since then. The higher deer population means there is not enough browse (woody plant leaves) for the population, so that every leaf of most all woody plants below the browseline is eaten, thus preventing any replacement hardwood trees from surviving to become mature trees. Without replacements, the number of hardwood trees will continue to decline. Since Ashe juniper is about the last thing deer will eat, cedar is not declining and continues to encroach on most Hill Country properties.

The point of all of this is that, as Aldo Leopold said, we don't know enough about Nature to tinker with it. There are unintended consequences to just about every action that we take in terms of the Natural World, so that our goal should be to make as few changes as possible and to make them as small as possible.

The folks that dumped the giant salvinia from their aquarium didn't intend to for it to choke out whole lakes, but it did. Similarly, when people imported and starting planting Vitex, Chinese tallow, Chinaberry, giant reed and salt cedar, they didn't intend for any of these species to take over whole creek sides and crowd out the native vegetation. But that is what happened.

Just a reminder, I will be at Riverside Nature Center from 10 to 12 on Fridays, so people can come with questions, concerns, etc. about our native environment.

Until next time…

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