Why invasive species matter

Eldan Goldenberg, April 2007

Washington has a noxious weed law[1] that requires landowners to control and/or eradicate certain plants because they are classified as undesirable invasive species. Landowners can be fined for failing to eradicate a plant and plots of land can even be quarantined[2] if they are infested badly enough. So why are invasive species considered a problem worth legislating against, and why does the noxious weeds list[3] contain some apparently harmless and attractive plants?

In some cases the damage caused by an invasive species is very obvious. I will describe some obviously undesirable types of species, before explaining the more subtle problems caused by plants that at first seem perfectly harmless.

Perhaps the most obvious risk with invasive species is the introduction of a predator that is more effective than any native counterpart. In New Zealand, for example, many species of flightless bird evolved in the absence of predators that raided their nests. Without any reason to escape the forest floor flying was a waste of energy for species like the kiwi and weka, which lost the ability to fly and even build their nests on the ground. When European settlers introduced ferrets, stoats and weasels in an attempt to start a fur trade, some inevitably escaped their farms and found the native birds very easy prey. Stoats in particular were able to become very numerous in the absence of the larger predators that would eat them in their native Europe. New Zealand's Department of Conservation claims that stoats alone kill 60% of kiwi chicks[4], and other introduced predators claim most of the rest, putting enormous pressure on the population of this much-loved bird.

Another highly visible impact of invasive species is overgrazing, a particularly severe instance of which is the story of Australia's feral rabbits[5]. European colonists brought rabbits with them, perhaps as pets or as game to hunt, and once in the wild they bred like, well, rabbits. In the worst-affected places their overgrazing stripped land of almost all vegetation, as shown in these photos:

Phillip Island, Victoria during rabbit infestation (left) and after rabbit eradication (right). Photo credit: Australian Government Department of the Environment and Heritage.

The damage caused by rabbits is clear enough, but *why* they are so destructive is not quite so obvious. New Zealand's ground-dwelling birds had no natural predators, but Australia has plenty of native herbivores and there's no obvious property of European grass that makes it rabbit-resistant, so how did the same rabbits that form a stable population in Britain manage to run rampant in Australia and strip large areas of vegetation?

The problem turns out to be local conditions and the speed of change. In an ecosystem that has time to evolve, stability normally develops as one species balances out another. Over the long term animals that exhaust their food supply will starve and die off, so species that only eat at a sustainable rate end up dominating the population. In the case of rabbits, Britain provided them with a dependable supply of food and native predators that kept their population in check.

In Australia, conditions were quite different. Rabbits were artificially introduced without being accompanied by the whole complement of predators that normally eat them, so their population was able to grow much faster. To make things worse, while Britain has relatively constant weather Australia experiences dramatic cycles of drought and rain[6]. During a rainy cycle (which may last for one season or several years) the rabbit population increases dramatically in the presence of plentiful food and absence of predators. Then when a drought hits there is an excess of rabbits, which eat all available food before starting to die off, causing scenes like that on Phillip Island (pictured above).

Apart from the occasional toxic species—such as giant hogweed, which poses a clear public health danger[7]—the damage caused by invasive plants tends to be less apparent. After all, we are taught to value greenery and many invasive plants are pleasant things that were introduced because someone fancied some for their garden. Scotch broom, loosestrife and reeds are all attractive to look at, and wild blackberries provide tasty snacks, so why are they all unwelcome here in King County[8]?

In the same way as stoats and rabbits are harmless in their native ranges and massively destructive where they have been introduced by humans, the key to the effect of plants is how they interact with local conditions. I will describe one plant—*Spartina alterniflora* a.k.a. Smooth Cordgrass[9]—that is problematic in coastal Washington, because it illustrates several related issues.

Spartina is a large, salt-tolerant grass that grows along shorelines and is native to the East coast of North America. In its native environment it is highly valued, because it is tolerant to a wide range of conditions and has a tendency to trap silt, so it protects shorelines like Florida's flat land and Louisiana's bayou from being eroded away. The stabilised shoreline behind a stand of *Spartina* is then able to support a range of other plants and wildlife.

In Washington, however, this plant is too successful. *Spartina* tends to form large, dense stands in which it crowds and shades out the native plants, which haven't had time to evolve a response to the competition as they would if it were spreading at a natural rate. Like the rabbits in Australia, it is not eaten fast enough by the local wildlife to keep its population under control so it is able to dominate local ecosystems, which it has managed to do particularly dramatically in Willapa Bay[10].

Having come to dominate an ecosystem in such a short time, *Spartina* causes damage in several ways. Because it crowds out native plants, it not only puts the populations of those plants under pressure but also has a knock-on effect on the many native animals that feed on other salt-marsh plants but are not able to eat *Spartina*. This can either cause the native animals to die out or amplify the effect on native plants as animals displaced by the invading Spartina attack the smaller numbers of remaining plants. Worse than any of these effects, though, is the very silt-trapping that makes this such a useful plant elsewhere in the world. The natural state of Washington's estuaries includes an extensive wet mudflat with a very gradual transition from dry land to river channels, but *Spartina* 'fixes' the shoreline by trapping silt, creating a much more abrupt transition from dry land on one side of the infestation to a steep-sided river channel on the other. In just a few years extensive mudflats can be transformed by the introduction of this one plant.

These effects are not merely æsthetic. The loss of mudflats takes away suitable habitat for several commercially useful species: oysters, which live in the intertidal zone, sole, which live in the muddy estuary bed, and chum salmon, the young of which eat insects and shelter from predators in the mudflats[11]. Ironically, it seems to have been the oyster industry that first introduced *Spartina*, by accident.

Spartina, rabbits and stoats are all problems in different places for different reasons, and there are many other unwelcome invasive species around the world, but they have several important things in common. None of them are harmful species in their native environments, but each has for some reason managed to establish itself more successfully in a place where it does not belong, in the absence of the competitors and/or predators that would normally keep their numbers in check. Each causes significant changes to the ecosystems to which they are introduced, whether by direct actions like grazing or indirect means such as out-competing native species. In every case, the problem is not that any one individual makes much difference, but that once released into the wild they change natural systems *at a much faster rate than the local species can respond to*.

The bottom line is the same as for so many other human impacts on our environment: it is the *speed of change* that makes invasive species matter.

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[1] http://dnr.metrokc.gov/wlr/lands/weeds/nox_obnox.htm

[2] http://apps.leg.wa.gov/RCW/default.aspx?cite=17.10.210

[3] http://dnr.metrokc.gov/wlr/lands/weeds/weedlist.cfm

[4] http://www.doc.govt.nz/templates/summary.aspx?id=33447

[5] http://www.environment.gov.au/biodiversity/invasive/publications/rabbit/index.html

[6] Jared Diamond: *Collapse: How Societies Choose to Fail or Succeed*

[7] http://dnr.metrokc.gov/wlr/lands/weeds/hogweedburns.htm

[8] http://dnr.metrokc.gov/wlr/lands/weeds/weedlist.cfm

[9] http://www.wapms.org/plants/spartina.html

[10] http://www.ecy.wa.gov/programs/sea/coast/plants/spartina.html

[11] http://www.wapms.org/plants/spartina.html