



## Overview of Vol.6, No.6 – Invasive Animals

### The Problem with Invasive Animal Species

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After habitat destruction, invasive species are one of the greatest threats to biodiversity (Williamson 1999). Until recently, only those species that caused major economic impacts in the form of crop damage received much attention (Parker and Reichard 1998). Now, with the great emphasis in conservation shifting away from single species focus and toward ecosystem management, understanding and addressing invasive species has become paramount (Parker and Reichard 1998).

This understanding does not come easily, however. Those studying invasion biology are struggling to understand what makes a species become invasive. Invasive species tend to displace native ones and alter the invaded ecosystem such that native species no longer thrive there. Is it some characteristic of the species, a trait of the ecosystem, or both working in conjunction that gives a species the ability to displace natives? The answer to this question is little understood, and is confounded by the estimation that only 10% of nonnative species become established and of those, only 10% become pests (Parker and Reichard 1998).

A cursory survey of review papers about invasive species revealed to me that much of the available literature deals with invasive plants. Invasive animals, too, are an interesting subset of invasion biology and sometimes manifest themselves in different ways than plants. Plant pests often are often the result of, or follow agriculture, but this is not as true for animal pests (Williamson 1999). The following paragraphs will discuss a number of different invasive animals, and will, in some small way, try to identify common themes among them.

The species discussed in this section are the common carp (*Cyprinus carpio*), the brown tree snake (*Boiga irregularis*), the Norway rat (*Rattus norvegicus*), the gypsy moth (*Lymantria dispar*), and the white-tailed deer (*Odocoileus virginianus*), which has become invasive in its native habitat. It should be noted that only the Guam population of the brown tree snake and the Langara Island population of the Norway rat will be considered.

In most categories, all these species varied greatly. Methods of introduction for these nonnative species are diverse. The brown tree snake and Norway rat each had accidental introductions to islands when they stowed away on cargo ships and subsequently escaped. Common carp were intentionally introduced in North America in the 19<sup>th</sup> century as game fish, and they were stocked until managers realized that anglers preferred native species. The gypsy moth was intentionally brought to the U.S. to be studied, but was accidentally released from the researcher's home in Massachusetts.

Competitive displacement is the mechanism by which many invasive species become dominant in their new ecosystems (Williamson 1999). Even competitive mechanisms varied greatly among the species reviewed here. For the brown tree snake, competition does not really come into play

because there was only one snake species on the island prior to introduction of the exotic. The native snake, the burrowing blind snake (*Rhamphotyphlops braminus*) does not pose a threat to biodiversity. The Norway rat is larger than the other rat species (*Rattus rattus*) on Langara Island. This smaller species does not pose the same threat to seabirds that the Norway rat does, so in this case, competitive displacement due to size has allowed the Norway rat to become invasive. The common carp has different behaviors than the other species that inhabit lakes, and the changes in the lake that result give the carp a competitive advantage. The gypsy moth is an opportunistic feeder and does not seem to have displaced native species, so competition may not be an issue with this species. Similarly, since white-tailed deer have become overabundant in their native range, competition does not apply here either.

Control methods are another area where there is diversity among these species. For the brown tree snake, there is no tried and true method, but physical, chemical, and biological control are all either in use or in development. Chemical control is the most effective control method for both the Norway rat and the common carp, while biological control is the most promising control option for the gypsy moth. For white-tailed deer, chemical control and physical barriers are each used.

Degree of success also varies among these species. Many think it is unlikely that Guam will ever be completely free of the brown tree snake. Control methods will conceivably improve over time, but even if the species were completely eradicated the extinction of many bird species will still leave the ecosystem forever changed. In the case of Langara Island, with the use of poison, the Norway rat has been completely eliminated, but it remains a problem in other areas. Common carp control efforts have also been met with mixed success. It has been possible to completely remove this species from lakes, but recovered lakes are always subject to reinvasion if the conditions are right. Additionally, the Great Lakes are infested with carp, and the most effective treatment, Rotenone, is inappropriate to use there. Success of gypsy moth control is also mixed. This species will likely never be completely eradicated, so controlling population outbreaks is key. There are a number of control techniques in use, in addition to public education, so minimizing the damage associated with outbreaks should be possible. Minimizing white-tailed deer impacts is also an ongoing process, and it is possible through direct population control. However, depending on the specific location, this is a controversial method.

An interesting common theme that emerged, but that was not discussed explicitly is the effect of invasive species on the aesthetics of an ecosystem. In each case the invasive species has a negative visual impact on its adopted ecosystem, but the havoc that they wreak manifests itself in different ways.

The brown tree snake on Guam has destroyed much of the avian fauna of the island. Aesthetically, the loss of avian fauna means that much of the colorful charismatic species are absent and that the forest has fallen silent. Additionally, many of the displaced species were endemic to Guam, so their loss from that island also marks their extinction. In this way, the brown tree snake has devastated the island by impacting both the aesthetics and ultimately forest succession. Similarly, the Norway rat devastates burrowing shorebird colonies and outcompetes other rodent populations. This loss of biodiversity affects the aesthetics of an area. Carp have potentially more far reaching effects because they have profound impacts on water quality. The

behavior of the common carp severely disrupts a limnological ecosystem, causes unsightly algal blooms, displaces native fish species, and renders a lake unsuitable for waterfowl. From a human perspective, all of these effects decrease the aesthetic value of a lake. The effects of the gypsy moth are probably the most damaging from a human perspective because this species devastates broadleaf forests in eastern North America. Large-scale defoliation has profound implications from both an ecological and emotional standpoint. Severe defoliation turns a beautiful forest into a desolate landscape.

White-tailed deer are the only native invasive species reviewed here, and it is interesting that the implications of deer overabundance are so different from the nonnative invasives. The effects of other invasive species may be more understood by many people because they can either remember a time before the species was present or they have grown up knowing that the species did not belong. White-tailed deer, on the other hand, have become pests in their native range. The deer population has increased greatly due to human development, which leads to an abundance of habitat edges where deer thrive. Also, removal of predators has allowed numbers to soar. White-tailed deer have a tremendous impact on their habitat because of their huge numbers and the amount of food needed to support this population. Large numbers lead to overbrowsing which affects forest succession. However, aesthetic ramifications complicate the "problem" associated with this species. Humans are captivated by megafauna, and many people are unaware that this species has become a problem in some areas. For this reason, management can be difficult when culling the herd is necessary in areas where hunting is not typically allowed. Conversely, deer are an extremely important game species, and their overabundance provides recreational opportunities for a great number of people. In short, the aesthetic effects of this species do not manifest themselves in the same way as the other species.

Review of these characteristics of invasive animal species may not have answered many questions. There is so much diversity in the species that we are struggling to control that this quick examination of various attributes of these invasive species likely only reveals what a difficult task remains before us as restoration ecologists and conservation biologists. Hopefully, as time marches on, our powers of prediction will improve and we can head off some of the problems before they start. In the meantime however, large amounts of funding and people-power are the best solution.

## **References**

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