



# All Plants are “Exotic Invasives”

Daniel E. Moerman

## Editorial

I am not a botanist, but an anthropologist caught up with the former since I became editor of *Economic Botany* in 2004. So, I catch a lot of botanist “stuff.” One that I catch (and am, to a degree, subject myself) is the odd notion of “exotic invasive species.” As a volunteer member of a land conservancy group, I hear serious rhetoric about the evils of exotic invasive species. I know that an easy way to gin up a crowd of volunteers is to advertise an effort to eradicate exotic invasive species: “Come pull the horrible garlic mustard!” This talk has troubled me.

After a visit to Hawai‘i a year ago, I came to the idea that “all plants are exotic invasive species.” A recent book by Jonathan Silvertown (2005) *Demons in Eden*, generally begins with that idea, that plants are what he calls “demons,” or “demonic,” with a propensity to expand as far and fast as they might, until stopped. He then asks why there isn’t just one utterly dominant species that according to the primary Darwinian notion – “species have the ability to reproduce at geometric rates” – has overwhelmed all the rest. But, as we all know, there are hundreds of thousands of species; the question is “Why?” Silvertown finds a series of evolutionary and ecological explanations (niche adaptation being the most interesting) to explain the paradox of diversity. But in my view, Silvertown has a much harder time explaining diversity than he does explaining abundance. In any event, the interaction of the demonic and the competitive results in biodiversity, which is the consequence of this process.

So, consider: “All species are exotic invasives.” Most don’t succeed in destroying all their competitors, but not for lack of trying.

In Hawai‘i, and on other island groups, recently introduced species have often taken over vast tracts of land at the expense of native species. Many of these native species are endemic to the Hawaiian Islands, and have become highly endangered. At least that’s the way it is ordinarily phrased. My preference is to collapse these distinctions, and recognize that all species are exotic and invasive.

Why? First, the Hawaiian islands are the remains of massive volcanoes which arose atop a hot spot in the Pacific plate. They were formed of sterile molten rock. My understanding is that the endemic higher plant flora of Hawai‘i, preceding human occupation, is descended from approximately 40 original plants, seeds, roots, or whatever, deposited after storms, or from lost birds, or the like. The first of those 40 landed on one of the islands which existed at the time (they come and go in what is apparently something like a 15 million year cycle) and somehow “took root,” so to speak. An omniscient observer would have to consider this first plant on a totally sterile island as mighty exotic, and surely invasive. This first species spread as far as it could, and, as did the following 39, diversified into different niches (or something like that). Each species moved forward, and probably backward, with newly evolved species probably invading the landscapes of their ancestors (one count shows some 1500 species evolved from the 40 originals). Some of them managed somehow to float or be carried to other islands. While there are “island endemics,” others seem to have moved throughout the island chain. The youngest islands are to the east, the oldest to the west (a number of them totally submerged by now). But the point here is that each and every one of those species moved somewhere from somewhere else. A particular individual new species of the adaptive radiation may have emerged in one of those

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pie shaped valleys on one island, and then moved to other valleys, invading each -- exotic each time -- and may have made it to other valleys on other islands, again exotic and invasive each time.

Then, about 800 years ago, a canoe or two arrived with plants (a number of them sterile -- taro in particular -- and hence not very invasive unless carried about by another exotic invasive, *Homo sapiens*, who, of course, filled up the whole archipelago pretty quickly, with taro along all the time). Some plants are distributed by storms, some by wind and waves, some by birds, some by people. An aside: these, to many contemporary Hawaiians, are the "good" exotic invasives which they call "canoe plants." (Also among them were other creatures including rats, dogs, pigs, lice, maybe earthworms, flies and mosquitoes, and probably a number of other exotic invaders as well.)

Then about 400 years ago, Cook and his followers arrived, bringing a whole new array of outsiders, many of which, like the first wave of exotics from millennia earlier, took off on their own invasions, pushing aside their predecessors much as the original ones pushed aside their own Hawaiian ancestors. This process, of course, continues today as people deliberately or not bring new species to the Islands in pots or pants cuffs (there are about 1300 naturalized "non-native" species in Hawaii (USDA 2008).)

I believe that islands provide us with a sort of microscopic view of processes which occur in a much larger scale, in continental areas. Consider the extraordinary consequences of the C/T extinctions, as recently described in James Powell's (1998) wonderful book *Night Comes to the Cretaceous*. Powell deals primarily with animals, but the plant world experienced much the same cataclysmic shock, and most plants, and most plant species, were destroyed. But the remainder, like those few first arrivals in Hawai'i, expanded madly (demonically?) until their descendants, in massive adaptive radiations, expanded back on their ancestors, and extinguished them yielding the recent reality of species having an average life span of about 10 million years. A few mammals (and particularly primates) survived that catastrophe. They had been insignificant and marginal in the dinosaurs' world for 70 or 90 million years, and then exploded in a radiation of their own.

Note that the same sort of thing can also happen at an even smaller scale than the Hawaiian one. I live in Michigan, a

land of rolling hills, eskers, and moraines. When I look out my study window, and see a state with 2800 or so species of plants (about 1400 in the county I live in), I am looking at a landscape that as recently as 12,000 or so years ago was covered with 100 feet (more?) of ice. By about 9000 years ago, in a massive global warming, the ice was melting fast, forming the Great Lakes; soon, the first plants arrived, presumably from the south, invading the previously ice-sterile lands of what is now my back yard. Exotic invaders. My wife and I took a trip to Antarctica this past winter; Antarctica has two plant species (the Antarctic hair grass, *Deschampsia antarctica* E. Desv., and the Antarctic pearlwort, *Colobanthus quitensis* (Kunth) Bartl.), (see Fig. 1) and we saw them both (Imagine, mastering the entire flora of a continent in 10 days!!!). I think of them when I think of those first tough, but surely exotic invaders as the ice retreated north through Michigan.

Today, those first post glacial invaders are probably long gone, north or extinct; I don't know. What we have now is a mix of about 75% or so of plants that have been here for, say, a 1000 years or more, and 25% or so of plants that are newer migrants (buckthorn, autumn olive, honeysuckle, purple looestrife, etc.) which we revile as "exotic invaders" but which are, to me, no more or less invaders



**Figure 1.** *Colobanthus quitensis* (Kunth) Bartl. (Caryophyllaceae), the Antarctic pearlwort, grows about 2 inches tall; it is found along the continental edge and along the western coast of the Antarctic peninsula (it is widely distributed from Mexico to the Antarctic). The other plant, *Deschampsia antarctica* E. Desv. (Poaceae), the Antarctic hairgrass, has a prostrate growth pattern, probably due to the constant wind (it is also found in Chile, Argentina and the Falkland Islands). There is some evidence that, as Antarctica warms, these plants are extending their range (that is, they are invading further south where they are certainly exotic). Antarctica has several hundred species of lichens, some of which can be seen on the rocks in this photograph.

than all the oaks, hickories, deer, rabbits, woodchucks, and, of course, *H. sapiens*, who populate these hills and dales today.

And at a really smaller scale yet, consider another invader. *Chelone antiqua*, the red turtlehead (see Fig. 2), which is an endangered species in Michigan. A native species of the eastern United States, it is reported to exist in only one county in the state, in the Huron River valley west of Ann Arbor, on wet sandy banks below a small dam on the river (Voss 1996). That is about 15 miles from where I live, on the other side of a city of 125,000 people. This beautiful plant colonized my wife’s flower garden in about 2002. The opposite of a naturalized species, this is a culturalized one. Since then, it has expanded into a gorgeous clump of pink-red flowers along with the rudbeckias, echinaceas, yarrows, thalictrums, daisies and roses that dominate the summer garden. It is a beautiful, if exotic and invasive, plant that we enjoy deeply.

Finally, let me note that a summer flight across the United States in a jetliner offers a magnificent view of tens of thousands of square miles of corn (invaded from Mexico), and wheat (invaded from the middle East); Idaho is home to billions of invading potatoes from Peru; the American

south is covered east to west with thousands of acres of southeast Asian rice; and California has as many acres of (Mexican? Indian?) cotton. Although harder to see from the air, a report in 2006 stated that the most valuable American crop was (Chinese) marijuana: \$36 b vs. \$23 b for wheat and \$17 b for (Chinese) soybeans. There are obviously many other examples of this category of humanly assisted exotic invasives.

So, to be careful, I’d say that “Unless a compelling argument can be made to the contrary for a particular species, all plant species are (or originally were) exotic invasives.”

Why do I care about this? I argue that the fact that a plant is new – exotic and invasive – in a particular environment at a particular scale does not mean the plant is a “bad” one. What I have been trying to gain is some leverage over the moral outrage regarding “invasives,” the “good plants”/“bad plants” distinction. I don’t doubt that some plants are more desirable than others, and that some recent immigrants are poorly behaved (loosestrife, garlic mustard, kudzu) by the standards of more established residents. But some of the old timers can be pretty unpleasant, too (poison ivy, crabgrass, dodder). Once it is apparent that, in a very broad sense, all plants are exotic

invasives (as are we human beings, everywhere but, perhaps, in the Rift Valley), then one must find a way to be more discriminating in talking about desirable and undesirable plants, and the contexts in which those judgements are made.

## Literature Cited

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**Figure 2.** *Chelone obliqua* L. (Scrophulariaceae), red turtlehead, is shown here with a native bee, in my wife’s flower garden, where it established itself (or culturalized itself, by invading the garden). *Χελωνη* or *Khelônê* was a Greek nymph who, for reasons of her own, refused to go to the wedding of Zeus and Hera. Zeus took serious offense and threw the nymph, and her house, into a river where she became a turtle, carrying her house on her back for the rest of time. The flower’s resemblance to a turtle is a probable explanation for the name. In addition to this garden, I have also seen a clump of red turtlehead growing in an extension lawn, between sidewalk and street, near the Farmers Market in downtown Ann Arbor.

