



The Arizona
Native Plant
Society

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A collage of Arizona's Most Unwanted. From top right, invasions of tamarisk (photo courtesy Diane Drobka), stinknet, buffelgrass, and fountain grass (photos courtesy John Scheuring).

Invasive Plants

This year's Arizona Botany Symposium celebrated our amazing native plant life and the precious habitats that plants provide for the critters and creatures of Arizona. But our native plants are under increasing pressure from invasive plant species that are quickly spreading along our roadways, seeping into our urban areas, and working their way into our "untouched" riparian waterways, bajadas, and mountainsides. This issue of *The Plant Press* is dedicated entirely to the understanding of the invasiveness of plant species. The authors take us beyond the simplistic distinction between weeds vs. natives or exotics vs. natives. You will learn that even native plants can be weedy or toxic but never invasive. You will be introduced to the concept of noxious weeds and our regulated Arizona Noxious Weed List. You will read the stories of two Arizona noxious weed introductions and their paths to destructive invasiveness. Finally, you will learn about some key exotic plants and their invasiveness in Sonora, our neighbor to the south. We hope these articles expand your understanding of invasive plants and that they will inform your decision-making regarding them in your own neighborhoods and throughout Arizona. Grow native!

Weeds: Invasives vs. Noxious vs. Weedy Natives

by John H. Brock¹

Introduction

The introduction of exotic plant species to the floras of the lands within the United States has been going on for more than 200 years. Many of these introductions were intentional and others were unintentional. Many of these exotic plant species turned out to become weeds in native plant ecosystems, in agronomic lands, and in urbanized areas. Terminology of these weedy plants includes the use of both *exotic* and/or *alien* to describe species. In Arizona, Tellman (2002) listed about 240 exotic naturalized plant species in the Sonoran Desert region. Most of these species were not spreading beyond localized areas. Many of these introduced plants adhere to the “Rule of 10” concerning plant introductions (Jeschke and Pysek 2018). Basically this “rule” states that one out of 10 imported species appear in the wild, and of those, one out of 10 becomes established in the environment. While this plant invasion “rule” is helpful, Jeschke and Pysek (2018) state that it has limitations. However, I find it helpful in understanding the degree of success in plant invasions. Plant invasions occur in four stages: (1) Introduction, (2) Establishment, (3) Spread, and (4) Invasive plant transformation of ecosystems, like downy brome (*Bromus tectorum*) in the Great Basin of the western United States.

Before humans began migrating from their origin(s), they probably dealt with plants they considered undesirable. When humans migrated from those sources, they may well have brought with them propagules of plants they deemed desirable and planted them in their new locations. Chambers and Hawkins (2020) stated “A weed is an unwanted plant, and people have lived with and combated unwanted plants since the dawn of agriculture and perhaps even earlier.” With the advent of sedentary agriculture, some plant species clearly became problems in land where desirable plants were being cultivated, including some of those brought by human migrants. With the colonization of North America, European peoples brought with them plant species that were exotic to the local floras and some of those became invasive. Early examples of these plants are found as seed and plant parts in adobe used in building by Spanish colonizers in Mexico and southern California. Other Europeans brought crops and

plant materials (as in bedding and forages) to the eastern parts of North America. Some of the plants were intentional introductions and others were “hitchhikers” or “stowaways” within the desirable seeds, and some became weeds to the new land managers.

Definitions

Weed: A plant out of place (Popular usage). A plant that interferes with management objectives for a given land area at a given point in time (Torell 2002). An alien species whose introduction does or is likely to cause economic or environmental harm and harm to human health (Executive Order 13112. 1999).

Executive Order 13112 was signed by President Bill Clinton in 1999. Among other things, Order 13112 established the Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW). Pre-dating the 1999 Executive Order dealing with exotic plants was Executive Order 11987 signed by President Jimmy Carter on May 24, 1977. It requires Federal agencies, to the extent permitted by law, to restrict the introduction of exotic species into the natural ecosystems on lands and waters owned or leased by the United States, states, local governments, and private citizens. These executive orders helped focus land managers to recognize the role of harmful plant introductions.

Noxious: A noxious weed is a plant considered to be harmful to the environment or animals, especially if it is one which may be the subject of regulations governing attempts to control it.

In the United States, noxious weeds are listed per the Federal Noxious Weeds Act of 1970 and they are also defined and listed by state governments. The Arizona noxious weed list was recently updated and is maintained by the Arizona Department of Agriculture. The website for Arizona noxious weeds is found at: <https://agriculture.az.gov/pestspest-control/agriculture-pests/noxious-weeds>. Noxious weeds on federal and state lists are placed there for regulatory reasons. In most cases, weeds of this category, like field bindweed (*Convolvulus arvensis*), are often associated with agronomic lands and are to be removed from the landscape. Unwanted plants and weeds not on the list may be recommended for control by persons doing habitat management. Good examples of these are those that could contribute fuel for wildfires, such as red brome grass (*Bromus rubens*) and a

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somewhat recent invader, stinknet (*Oncosiphon piluliferum*). Both of these species contributed to wildfires in June 2020 in the northern part of Phoenix.

Invasion of Exotic Species

Paraphrasing from Brock (2013), biological invasion is considered to be one of the symptoms of global environmental change. Invasive species can displace native species when introduced to habitats where they did not evolve as a part of the functioning plant community. Their success is often linked to the lack of natural enemies from their original ecosystem(s) — not present in the new locations — to keep them in check. There is mounting evidence that increased CO₂ and nitrogen in the atmosphere, warming temperatures, and nitrogen as a water pollutant enable some of the alien invasive species. The ecological traits of invasive plants that make them competitive are largely physiological and reproductive rather than morphological. For example, some invasive species, such as annual brome grasses, capture nitrogen from the soil nutrient pool earlier in the season than do native plants, giving them a competitive advantage. In some cases, aggressive invasive species literally transform the invaded habitat, changing its ecological structure and function. These plants are called **transformer** species since they alter the plant community by changing productivity, forage composition for wildlife species, and watershed and soil erosion processes.

In warm deserts, red brome grass and buffelgrass (*Cenchrus ciliaris*) provide fine fire fuel, where such fuel is rare in the native flora. After a fire in invaded sites, these exotic grasses play a role in transforming the Sonoran Desert from a community dominated by shrubs and cacti to one largely devoid of those growth forms.

Lag times

Lag times can hinder or alter the prioritization of managing invasive species because an invasive that was not originally being managed can suddenly become a high priority for management and control within a particular area. It is very hard to identify a potential invasive species as being in its lag period and it is often not until after its population becomes established and spreads that the lag time is detected.

Recalling the Rule of 10, introduced species most commonly do not immediately become invasive. Introduced alien species that become naturalized, i.e., growing without the continued support of humans, may escape almost immediately or may not display their invasive nature for some time. These species display a “lag time” during which they are adapting to their new home. Some species become invasive almost immediately, and two invasive riparian trees in southwestern North America fit this scenario. Those species are salt cedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*). Buffelgrass and stinknet both seem to fit a short lag time condition as well. Lag times for many woody and perennial herbaceous invaders may consist of periods up to 50 years. During this time, the species may be adapting to local conditions or their seeds may lie dormant, especially in plants that produce hard seeds. An example of such an invasive plant with a long lag time is sweet resin bush (*Pentzia incana*), an alien perennial plant native to South Africa. In the mid 1930s, it was introduced to at least three Arizona sites as part of plantings to evaluate non-native plants for erosion control. In the early 1990s, it was observed to be spreading from one of its planting sites near Mount Graham on the Coronado National Forest, which was about 50 years from its

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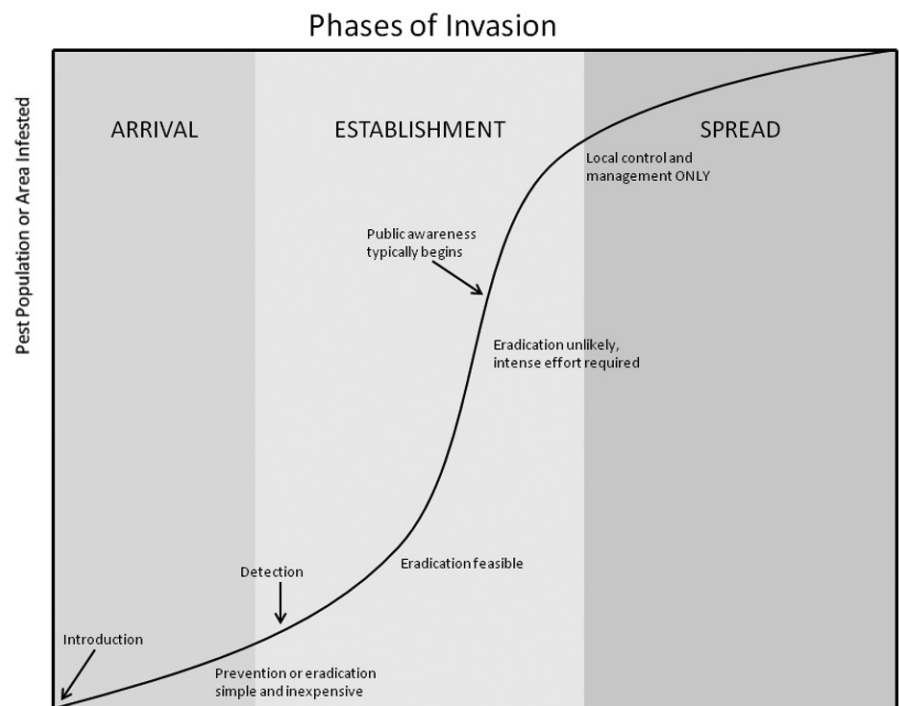


Figure 1. Sigmoidal curve of invasive species (plants) dynamics, as related to spread and effort for management (Alvarez 2016).

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introduction. It was also planted near the town of Miami on the Tonto National Forest and on the Prescott National Forest. Thus, it had a lag time of at least 50 years before its invasive nature was exhibited. Two alien perennial grasses have also displayed a lag time since introduction. These grasses are yellow bluestem (*Bothriochloa ischaemum*) and Lehmann's lovegrass (*Eragrostis lehmannia*). Both species were introduced to the southwestern United States after the 1940s for erosion control and forage. Yellow bluestem (Hickman et al. 2018) and Lehmann lovegrass (Texas Invasives Plant Data Base, 2020) stayed in place after initial planting, and in the case of Lehmann lovegrass, disappeared from many planting sites, except those with calcareous soils. The lag time for these species to become considered invasive was about 40 years. In both cases, these grasses are very competitive to native vegetation and can contribute to a fine fuel load (Figure 1).

Native Weedy Plants

There are several Arizona native plants considered to be weedy to land managers. These species historically were few in number on southwestern landscapes before European colonization. The introduction of domestic livestock, the practice of putting out wildfires, and a major drought, led to native plant expansion on landscapes (Wildeman and Brock 2000). Livestock grazing before 1900 was largely uncontrolled, wildfires were suppressed, and in the late 1880s, southwestern North America experienced a major drought. As a result, many bare areas developed on the landscape and several native plant species took advantage of these areas to colonize the bare soils. Those species included: several junipers (*Juniperus monosperma*, *J. utahensis* and *J. depenna*), woody legumes such as velvet mesquite (*Prosopis velutina*) and catclaw acacia (*Acacia greggii*), and several species of prickly pear or cholla cactus. In the warmer deserts, plants like creosote bush (*Larrea tridentata*) took advantage of the openings in the community. In addition to the woody species, long-lived perennial herbaceous plants, such as broom snakeweed (*Gutierrezia sarothrae*) and other members of the Asteraceae became more common in the flora. With the advent of rangeland improvement practices over the past 70 years or so, many of these plants have been targeted as “native weeds.” However, in Arizona we have never seen weedy native species encroach on or displace other natives outside of disturbed areas.

Conclusion

Hundreds of exotic plant species have already become commonplace in Arizona wildlands, roadsides, and urban areas. Additional new exotic species are constantly being

introduced via roadways from adjacent states and Mexico and via the commercial landscape trade. With the extreme weather events brought with climate change, we anticipate an increasing number of introduced exotic species to threaten and displace native flora as noxious weeds. We need to track the occurrence and prevalence of exotic species and identify those species that need to be controlled before they get out of hand. Timely updates of the Arizona Noxious Plant List and the full support of the Arizona Department of Agriculture are vital. Effective control of emergent noxious weed threats will increasingly necessitate the full cooperation between federal, state, municipal and private land managers.



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Note on Scientific Nomenclature for Buffelgrass

The scientific nomenclature for Buffelgrass is a little complicated. Some sources refer to it as *Pennisetum cilare* while others identify it as *Cenchrus ciliaris*. Both scientific names are used in this issue.