

Invasive alien plants: their nature, management, and links to climate change

The Nature of Invasive Alien Plants

Invasive alien plants (IAPs) are plants that have arrived in a new location, usually as a result of human activities, be they accidental or intentional. In the case of South Africa, most of the invasive alien plant species that have proved most problematic as invaders, in fynbos and other biomes, arrived between 1825 and 1860 along with inward waves of human migration. And yet, most of the world's worst invasive alien plants only arrived at the point at which they can cause major damage within the last 40 years. The reason for invasive alien species' comparatively recent appearance as "the second largest cause of biodiversity loss" is the same as the main reason for their arrival, namely, human activity. One of the major factors in the success of invasive alien plants is the human-driven alterations to ecological patterns. The globalisation of transport structures enabled the transportation of goods and people (and plant species) both within and between continents in a historically unprecedented manner. The concomitant expansion of human habitation and areas under human agricultural management resulted in significant alteration of the natural environment. And finally, the increasing demand for alien plants for use in horticulture greatly expedited the movement of alien plant species to novel areas.

So what then constitutes an 'invasion'? The appearance of a non-native plant in a flower pot in Durban would not seem to constitute an invasion, and yet there is clearly some link between the two. The first stage in the invasion process, as suggested above, involves the introduction of a non-native species into a region in which it was not previously present. As mentioned before, this might be an intentional process such as the introduction of more adaptable variants in commercial agriculture, or accidental, as contaminants in ship's ballast or hay. This stage is the Introduction stage.

It must be born in mind that the introduction of a new species by no means ensures that it will proliferate. As any amateur gardener will tell you, the fact that you put a seed in the ground (whilst a necessary condition) is no guarantee that it will actually grow into anything. The soil might be too alkali. The delicate sprout might be cruelly dispatched by a hard frost or a plague of aphids. And so on. Any new plant species has a host of hurdles to leap before it can be considered established. First and foremost it has to survive in its new environment, and then to reproduce independently (that is to say, without human intervention). When a plant has survived, and overcome the various local barriers to regular reproduction, and achieved a big enough population that it is unlikely to be wiped out by any moderate environmental upsets, then it is said to be Naturalised.

The third stage in the invasion process occurs when a non-native plant species is able to spread to new areas within its immediate locale. This might occur through dispersion by the elements or through the activities of birds and mammals. And bear in mind that this does not occur overnight. An alien plant species can sit quietly and unobtrusively in a small area for any amount of time from a few decades to over a century before suddenly exploding, in terms of both numbers and the ability to spread. A key factor in this sudden population growth is often the impact of human activity on neighbouring ecosystems, which render them suddenly more amenable to the rapid propagation of the plant species. As the plant species colonises neighbouring areas it begins to interact with the local biota, and can alter the local disturbance regime (such as the frequency and intensity of fires), resulting in the eventual displacement of native plants.

Methods of Management

Having grasped the various stages of the invasion process, we can consider the range of methods available for the management of invasive alien plants. There are essentially three different control approaches.

The first of these is prevention. In a nutshell, the idea is that we try and establish a criteria of 'invasion-probability' for a given plant species. We look at a plant species in a specific habitat and ask how likely it is to become invasive in this context. And the key to establishing this quality of 'invasiveness' is often to see if there are any precedents for the plant behaving in an invasive manner

in such environmental circumstances. If the plant species in question has hitherto been invasive in similar environments, then it's a pretty good bet that it will also be invasive in this particular environment. The second approach is removal. If an invasive alien plant is still limited to a small area (i.e. it is still an 'emerging weed'), or if the danger posed or damage caused by the rapid growth of IAS is particularly severe, attempts can be made to eradicate it. The third approach for controlling invasive alien plants is ecological management. Rather than being a particular method or technique, the management approach employs several complementary methods to control alien invasion. These methods can include biological control, improved land management practices (such as modified stocking densities and prescribed burning), the application of herbicides and mechanical methods. Which approach one adopts to deal with invasive alien plants is necessarily context dependent, resting as it does upon the particular ecology of the invasive alien plant species, the particular ecology of the invaded system and the socio-economic peculiarities of the specific situation. For example, in some situations, the spread of the invasive alien plants might be too extensive to be eradicated, or the economic value of a plant species might be deemed to outweigh the risk posed by the plant becoming invasive.

Invasive Alien Plants and Climate Change

In the media and public perception in general, the most significant and pressing environmental issue of the day is generally taken to be that of climate change. Awareness of the dangers posed by invasive alien plants is far less well publicised and would seem to be an environmental problem several orders of magnitude smaller than that posed by climate change. A point that really needs to be appreciated is that the problem of invasive alien plants and that of climate change are inextricably linked. Not only are invasive alien plants drivers of climate change, but climate change can greatly facilitate the spread of these plants and exacerbate the resultant degradation of biodiversity. Specific examples include the rise in atmospheric CO₂ levels and increases in temperature, both of which are likely to hasten the spread of invasive alien plants.

The disturbance of ecosystems as caused by changing global environmental conditions will likely favour the propagation of invasive alien plant species. The reason for this is twofold; firstly, alterations in climate will result in increasing variety in ecosystem conditions, which will increase the probability of invasive alien plants finding habitats suitable for their propagation, and secondly, invasive alien plants tend to demonstrate greater adaptability to disturbance than native species, giving them a marked advantage in competition for resources within an ecosystem. To an extent, changing weather patterns coupled with the spread of invasive plants with a higher fuel load increases the likelihood of hotter and more frequent wild-fires. In addition to damaging biodiversity, the additional release of carbon into the atmosphere can contribute to climate change. Even if one views the effect of invasive alien plants on climate change as relatively negligible, the fact remains that their spread renders ecosystems less likely to adapt to the environmental stresses brought about by climate change. There is little point in attempting to protect staple foods or conserve biodiversity from the effects of climate change if it has already been eroded from within by the activities of invasive alien plants. The local spread of invasive alien plants are a global problem, and the global phenomenon of climate change is a serious local problem.