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A comprehensive study on invasive plant species: Impacts and management

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Abstract
An invasive plant is those that is not native to the location where it has been planted and whose spreading creates problems for the local vegetation. Not all non-native plants are invasive, but those that spread uncontrolled will out-compete native plants and dominate an area, particularly in unmanaged environments. The spread of alien plants in India has been both ecologically and human mediated. There are a few reasons that invasive plants may spread from one yard to other yards and wild spaces. Those plants with the highest potential are abundant seeders whose seeds are disseminates with the help of wind and wildlife. They will be fast growers, growing earlier and more quickly than native plants. Hardy varieties grow dense, taking up lots of space and casting shade, able to grow in many conditions including on both fertile and barren land. The invasive, non-native plants don't align with the energy of a foreign space, growing faster than native species and causing a host of resulting problems for local ecosystems. Invasive plants cause important issues because they despite growing knowledge about the harmful impacts of certain invasive plants on native species and ecosystems, their deliberate spread has continued, even till quite recently. Understanding the role of alien species in forest communities, and how native and alien species interact to shape the composition and structure of contemporary forests, is of critical importance to invasion ecology and natural resource management And, despite the successful implementation of management initiatives in some protected areas, these efforts have not expanded toother areas. Invasive alien species are one of the biggest drivers of biodiversity loss and species extinctions.

Keywords: Fast growers, human mediated, degraded land, highest potential, native plants, wildlife

Introduction

Worldwide there is a growing catalogue of the potential impacts of invasive species on native species, wildlife habitats, disturbance regimes, and ecosystem services (e.g. Pye ek *et al*. 2011; Foxcroft *et al*. 2014; Simberloff *et al*., 2013) [15, 40]. There have been several recent reviews of hypotheses pertaining to species traits that make them invasive, or community characteristics that make them invasible (Catford *et al*. 2009; Gurevitch *et al*. 2011; Jeschke *et al*. 2012) [5, 19, 21].

Invasive species', also known as 'alien invasive species', are species whose introduction, establishment and spread into new areas threaten ecosystems, habitats or other species and cause social, economic or environmental harm, or harm to human health (FAO, 2007:82) [14]. Invasive plants are unfamiliar species that tend to spread out of control in their unnatural habitats. The term "*invasive*" is generally a term reserved for plants that have been introduced from other regions and tend to flourish rapidly in their new habitats. Invasive species encroach large areas of land, replacing existing natural vegetation and reducing native tree regeneration (David, 2019) [10]. Invasive plant species are characterized by their *fast growth rates, short life-cycles, higher reproductive potential, highly competitive abilities and allelopathy* that make them successful invaders of native habitats. The main key characteristic of an invasive plant is that it is not indigenous to the area, and it tends to spread rapidly and overpower the local indigenous plant

Invasive plants were introduced in the middle of the seventeenth century for a range of purposes that included *timber, tannins, oils, firewood, ornamentals, stabilizing sand dunes, windbreak barriers, hedges, soil conservation and shade* (Troup, 1932) [41]. Invasive alien plant species have threatened the integrity of ecosystems throughout the world. They affect not only the species diversity of native ecosystems but also threaten their biological integrity. For instance, in India, there are numerous invasive species like *Parthenium hysterophorus* and *Lantana camara* which are very troublesome and have caused adverse ecological, economic and social impact (Early et. al. 2016) [11]. Globally, exotic species invasion has altered ecosystem structure and function (Crooks, 2002) [9]. Lantana also competes with agricultural crops and has an allelopathic effect-inhibiting the growth of other plants crops and has an allelopathic effect-inhibiting the growth of other plants. Non-native species ecosystems impacted through competition on native species and by altering habitats, nutrient cycles, and energy level.

Another explanation is that invasive species are able to take more rapid advantage of available resources and at the same time use nutrients more efficiently in low resource environments, when compared with native species (Funk and Vitousek, 2007) [17]. *Lantana* camara has been shown to be efficient at nutrient uptake and use (Bhatt *et al*. 1994) [2], which would potentially give it a competitive advantage over other species, especially on nutrient poor soils. It has also been suggested that invasive species typically produce large number of fruits that are widely dispersed, as do pioneer species, thus enabling them to exert propagule pressure (Lockwood *et al*., 2005) [23]. Increased abundance of unpalatable *L. camara* has been correlated with reduced abundances of native species. This means increased susceptibility of native vegetation to browsing, forage scarcity for herbivores, and, in turn, implications for predators like the tiger (Prasad 2010) [30]. *Lantana camara*'s prolific fruiting attracts large numbers of frugivores, especially birds, potentially disrupting native plant-frugivore interactions and altering bird community composition, especially the abundance of certain feeding

guilds (Aravind *et al*. 2010) [1]. *Prosopis juliflora* was also introduced to several PAs as a way to alleviate pressure for fuel wood from local forest-dependent communities (Robbins, 2001) [36], from where it has spread rapidly.

Prosopis juliflora has also been shown to be tolerant of drought and salinity (Pasiecznik *et al*., 2001) [27]. These characteristics, in combination with its low palatability, probably give it an advantage over native species. Its seed characteristics enable it to establish and grow faster than the native species. The invasion of alien species of plants into a natural ecosystem or habitat is a complex problem. Invasive species can affect the soil and its microorganisms, and thus native species of plants as well, often leading to their displacement (Lazzaro *et al*, 2000) [22]. IAS can pose a threat to both natural ecosystems and crops, human health, and some branches of industry, such as tourism (EPPA,2009).

Spread of the IAPS at global scale, particularly in disturbed areas such as landfills/dumps (which may form invasive plant epi-centres), can profoundly affect human health through their pollen and toxins (Plaza *et al*., 2018) [29]. Therefore, unravelling the mechanisms, that make the replacement of indigenous climax communities originating through natural succession by IAPS-dominated communities (Blumenthal, 2006) [3]. Species specific mechanisms for elucidating the spread of alien plants is necessary as they show differential invasive potential in tune with their ecosystem attributes (Ehrenfeld, 2008) [12]. Generally, aliens were better competitors compared with natives, and natives were more stress-tolerant than aliens.

IAPS become more successful in the novel habitats when they are away from natural enemies like pathogens and herbivores found in their native habitats (Blumenthal, 2006 & Rai, 2015) [3, 32]. For example, the seeds of Impatiens glandulifera, in newly invaded regions are free from fungal pathogens (Najberek *et al*., 2018) [26].

Invasive plants affect the habitats adversely, reduce diversity and ecosystem attributes, which is further compounded by the climate change occurring in the pristine ice-free Islands (Frenot *et al*., 2005) [16]. Several environmental (e.g. solar radiation, soil variables/physico-chemical characteristics) and geographical attributes may act in concert, determining the invasion success, as demonstrated in the temperate forests of Korean Peninsula (Cerny *et al*., 2013). IAPS are also known to affect quantity of surface and ground water (Shackleton *et al*., 2019) [39]. Some IAPS exploit an enormous amount of water, which can compound the impact of water scarcity and bring a paradigm shift in socio-ecological regimes (Gaertner *et al*., 2014, Shackleton *et al*., 2019.) [18, 39].

IAPS are also reported to alter the soil stability resulting in soil erosion (Pejchar and Mooney, 2009) [28]. The cultivation of multi-purpose trees and shrubs is encouraged widely in order to boost bioenergy and industrial sectors (Rai *et al*., 2018) [33]. Although, multi-purpose plants provide several benefits to humans, the introduction of IAPS as a multipurpose species [e.g. introduction of *Prosopis sp*. (mesquite) in South Africa] can profoundly affect the ecosystem services (Rejmánek and Richardson, 2013, Shackleton *et al*., 2015, Shiferaw *et al*., 2019) [35, 37, 38]. Several ornamental IAPS also pose health issues as they emit toxins in the environment (Celesti-Grapow *et al*., 2010, Mazza *et al*., 2014) [6, 25]. *Opuntia stricta* contains glochids in the fruit, which cause the eye irritations (Shackleton *et al*., 2017). The very basis of the pollen allergy from Ambrosia artemisiifolia (ragweed) is due to its 11 allergens reactivity towards IgE; and Amb a 1 and Amb a 11 are recognised as the major allergens (Chen *et al*., 2018) [8]. *Parthenium* is also considered as an allergy inducing IAPS, which is known to cause respiratory asthma and eczematous dermatitis (Reaser *et al*., 2007, Mazza *et al*., 2014) [25, 34], *Cenchrus ciliaris*, an invasive grass, is promoted by the farmers for grazing purposes (Marshall *et al*., 2011, Shackleton *et al*., 2019) [24, 39]. Interestingly, (Cai *et al*., 2016) [4] observed that phytoplasmas infecting vegetables belong to the same genetic lineage as Parthenium. Fighting the spread of IAS often requires considerable financial resources (Hoffmann & Broadhurs, 2016) [20].

Discussion

Invasive alien plant species are the alien species of plants having efficient reproductive and vegetative strategies enabling them to sustain self-replacing populations, capable to produce offspring, even in the remote areas and harsh conditions. A naturalized species is defined as an alien (introduced) species that can consistently reproduce and sustain populations over many generations. After successful local establishment, Invasive plants can significantly affect the native plants of the invaded region, which are those species which have evolved in a particular area without the human intervention and thriving by natural means. They introduced for human welfare are known to create environmental and economic havoc. Anthropogenic disturbances are the prime factors responsible for biotic invasions. If such human mediated disturbances will be continued in the long term, there may be emergence of new invasive plants species hazardous to environmental/human health. However, with the explicit understanding of various mechanisms involved in arrival, spread and establishment of invasive plants, we can sustainably manage the invasiveness. In invasion ecology, more emphasis should be given on chemical ecology of native-Invasive plant interactions to elucidate the mechanisms of biodiversity loss. Emerging global issues, like biodiversity loss, climate change, un-sustainable agriculture and environmental disturbances should be studied in depth to understand their complex interacting impacts on human health. Therefore, future researches should use multiple environmental stressors to address their impacts on environment/ecosystem services, socio-economic (livelihood), and human health. Also, the future course of invasive plant management must address the economic considerations and societal acceptability. Management of the invasive plants through their eradication involves a huge cost. Since, invasive plant impact on ecosystems is highly variable in respect of their socio-ecological conditions, cost-benefit analysis is essential in future studies to safeguard the livelihood benefits.

Conclusion

The more time a plant has to spread, the faster and more extensive its reach will be, which is why it's important to act quickly when an invasive species is identified. Early action is both easier and cheaper than waiting until it's a widespread problem. It competes with local vegetation for limited resources like nutrients, moisture, light, reducing plant diversity in an area by suppressing native growth, encourage soil erosion and reduce flood control when native root systems are disturbed or removed. Also affect food resources for native wildlife by suppressing the growth of

leaves, berries, nuts, and other foods that native animals like insects (including important pollinators), rabbits, deer, and birds depends on. Whole food webs in turn affected by impacting food sources for both herbivores and carnivores. Invasive plant species are non-native plants that are introduced to a new area and have negative effects on the environment, economy, or human health. They can displace native species, alter ecosystems, and threaten livelihoods. They remove habitats for native birds, insects, and mammals by preventing the growth of trees, bushes, and other protected spaces where they live. Farmers and landowners can control what is planted on their lands, but sometimes an invasive species finds its way onto a cultivated or barren land by wind or animals. Invasive plants should be managed by any ways depending on their stage of establishment. Prevention is the most effective approach to mitigating the impacts of invasive alien species. The national coordinated effort for invasive species monitoring, research, and management should be implemented. Awareness should spread what to look for and which species is to avoid planting, keeping an eye out for random volunteer monitoring to growth of invasiveness and taking right action to remove invasive plants when they are noticed. Those species known as "sleeper species" need to be identified and eradicate for control before they spread and become invasive. Invasive alien plant species, are a major ecological threat around th world. Invasive alien plant species, are a major ecological threat around the world. These are plants introduced outside their natural range, either intentionally or accidentally, that aggressively spread and disrupt the delicate balance of their new environment.

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