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ECONOMIC IMPACTS OF INVASIVE SPECIES

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SUMMARY

Invasive species involves interference with complex ecosystems and thus, it is appropriate to adopt the total economic value framework for evaluating their impact on ecosystems. Economic value involves not only often-recognized use and indirect use values, but also non-use vales. In this paper, both costs and benefits of invasive species are identified and discussed with reference to examples. The cost of invasive species involves costs on ecosystems, which have various impacts on human economic systems, as well as of remedial measures.

INTRODUCTION

Change in plant communities is natural. New species could move due to various natural reasons. However, humans have been able to accelerate the movement of plants carrying thousands of species that could not have crossed natural barriers like oceans, mountain ranges and deserts to new areas (Randall 1996).

Invasive species could be considered as the most recently identified threat to biodiversity. Due to their ability to alter the structure and composition of the biotic communities, the impact of invasive species is often considered as irreversible. Species are introduced into new habitats by people for various reasons. Introductions could be accidental or deliberate. Sometimes, there may be escape of species that are imported for a limited purpose. In addition, in maintaining the health of these introduced species, there may be a need of introduction of additional species. For example, human activities, primarily the global movement of organisms associated with ocean vessels and with commercial fishery products, have lead to the redistribution of a vast number of marine organisms over the past centuries (Carlton 1989).

Different stages of the history of humankind are characterized by different scales of human activities, with direct connections with the incidence of invasive species. With the onset of industrial revolution, which has resulted in expansion of communication and transportation systems, rapid increase of invasive plants was eminent. During colonial periods, in many developing countries, large-scale immigration was prominent and increase of introduced species was inevitable due to practices such as high input agriculture, mechanized fisheries and forestry. During postcolonial periods, international interdependence of markets was noticeable. The latter part of this period is characterized by increased applications of biotechnology and appearance of genetically modified organisms and liberalization of trade.

Invasive species could be both aquatic (marine and freshwater) and terrestrial flora and fauna. At present, about 25 invasive species (10 fauna and 15 flora) have been identified in Sri Lanka, with at least one species been reported in each bio-climatic zone of the country.

Economic Impacts

Invasive plants have huge impact on the economy. Although quantitative information is not available in Sri Lanka, estimates for other countries show that plant invasions cause considerable damage to the economy. Alien invasive species have become a threat to Sri Lankan native biodiversity in several ways. Invasive fauna could act as vectors, which transmit diseases to native fauna resulting in heavy direct costs to the national economy. Three fish species have been found to act as active predators of native aquatic fauna. There is sufficient evidence to indicate that two species of indigenous fish have become extinct in waterways where Tilapia (*Sarotherodon mossambicus*) is found in abundance, which involves loss of present use and non-use values.

Although the negative impacts of invasive species of plant and animal species are of a great concern, these species sometimes do carry beneficial effects. For example, water hyacinth (*Eichhornia crassipes*) has a remarkable ability to purify polluted waters. One acre of water hyacinth has been reported to have the potential of producing over 70 tons of dry plant material annually under favourable nutrient conditions. This growth implies removal of nutrients from its surroundings, whether they are toxic or non-toxic, thereby purifying the aquatic medium. Water hyacinth has the potential for removing 1591 kg of nitrogen and over 364 kg of phosphorous

annually from sewage effluent. The species can absorb and metabolize over 68 kg of phenols every 72 hours, from polluted waters. It can also remove over 120 g of trace heavy metal contaminants every 24 hours (Wolverton *et al* 1976; cited in Yapa 1992). Water hyacinth culture removes algae and faecal bacteria, greatly reduces suspended matter and removes odour-causing compounds. As a result, the resultant effluent is clear, odourless and contain little nitrogen and phosphorous. In several experiments carried out in Sri Lanka, water hyacinth has been used to treat effluents from rubber factories. Biological treatment systems with water hyacinth provide an attractive alternative to costly waste-water treatment methods since they do not need much operational and maintenance costs (Yapa 1992).

Several of the alien invasive plants found in Sri Lanka are beneficial, but in large population densities they may have numerous harmful effects. Aquatic weeds can create foul odours, tastes or colours in the waters, irrigation canals may completely get clogged, and aesthetic values and recreational uses (boating, swimming) may be impaired. Water losses due to evapotranspiration from water hyacinth may be eight times as great as the loss from a normal water surface in arid areas. There are other commercial, economic and health effects as well. Aquatic invasives cause large losses in commercial fishery, suppress shellfish beds, hinders navigation, reduce land values, provides mosquito-breeding sites and clogs water intake systems. Economic values could be assigned to the depreciation of property, to the pollution of municipal water supplies, to the loss of navigable streams, and to the failure of irrigation and power systems because of aquatic invasive plants.

Invasives reproduce rapidly and they are able to form stands that exclude all other plants damaging natural areas, altering ecosystem processes, displacing native species, hybridizing with natives and changing their genetic makeup, and supporting other non-native plants, animals and pathogens. Invasive plants could interfere with fundamental ecosystem processes such as the frequency of wildfires, the viability of water or nutrients and the rate of soil erosion.

In Florida, for example, *Casuarina equisetifolia* have colonized mangrove habitat, rocky shorelines and sandy beach dunes and formed a dense mono-specific stand, crowding out native vegetation and eliminating the food sources of wildlife. On dunes, its shallow roots have inhibited nest building by sea turtles and American crocodiles, which indicate impaired direct use,

indirect use and non-use values. Large amounts of pollens produced have caused human respiratory problems, which has a direct impact on the economy.

In controlling invasive species, it is necessary to balance the damage that weeds do to the habitats against the damage that the habitat will suffer because of the control methods. For a habitat that is dominated by an invasive species harsh tactics could be used, but if there are just few invaders in an otherwise pristine environment, a more delicate approach may be required. For example, herbicides may reduce aquatic weeds but may also kill fish or make water undrinkable.

In Australia, European settlement has brought in rabbit (*Oryctolagus cuniculatus*) and the fox (*Vulpus vulpus*). Rabbits have grown in large numbers soon and led to destruction of the vegetation. Foxes were also able to reach high numbers preying on the rabbit population and as a result had a considerable impact on other prey items such as native mammals, reptiles, frogs, scorpions, and large insect species. Once rabbits reached plague proportions, programmes to poison, fumigate and destroy the animals were introduced, killing rabbits and other native fauna. The introduction of myxomatosis in the 1950's reduced rabbit numbers but also forced foxes to turn more to the remaining native species for food. This example illustrates how the introduction of species and later attempts to control them could have a variety of effects on native species.

DISCUSSION

Underlying reasons for the introduction of invasive species could be identified as government or market failures. Market failure refers to the inability if markets to capture costs and benefits of invasive species. Government or policy failure refers to the inability to recognize costs of invasive species in formulating policies in other sectors.

Although there have been a number of international conventions to control the movement of exotic marine organisms, adequate control still occurs largely at the regional and local levels (Carlton 1989). Despite their many negative effects, some species have considerable value. As a result, there are conflicts of interest. These conflicts have to be dealt in a sensitive manner if progress is to be made in reducing the significant negative impacts of alien invasive plants. Biocontrol methods could be used to reduce the invasive

potential of otherwise useful species without killing them (for example, by reducing the number of seeds they produce). In addition, potential invaders could be recognized early and precautionary measures could be taken. Establishing a system to monitor the flora, especially threatened species, studies on natural communities, developing detailed vegetation maps, instituting ecological and distribution studies of the most aggressive alien plants are other important measures. In planning future agricultural development, it is important to anticipate and prevent undesirable plant invasions.

Valuation of economic impacts of invasive plants would be and urgent need, which would be essential in demonstrating the economic costs of invasive species and urging immediate policy measures.

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