Invasive Plant Species of Cloudbridge Reserve

Ana C. Mazzolari

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Introduction

The goal of this research was to determine the presence of invasive plant species in different environments of Cloudbridge Reserve, and to asses the degree of invasion in each environment. Cloudbridge Nature Reserve lies in the Talamanca mountain range in south-eastern Costa Rica. The reserve, adjoining a UNESCO World Heritage national park, was established to preserve and reforest an important gap in the cloud forest on the slopes of Mt Chirripó, the highest mountain in Costa Rica.

While biological invasion is a natural process, the current rate of invasion is clearly a human-cause phenomenon, and is one of the most important effects humans have had on the Earth's ecosystem (Rejmanek 1996).

Invasive taxa (spreading where they are not native) represent a subset of naturalized taxa. This distinction is important because not all naturalized taxa reported in local floras are invasive taxa (Rejmanek 2000). For Richardson *et al*. (2000) naturalized plants are alien plants that reproduce consistently and sustain populations over many life cycles without direct intervention by humans, they often recruit offspring freely, usually close to adult plants, and do not necessarily invade natural, seminatural or human-made ecosystems. On the other hand, invasive plants are naturalized plants that produce reproductive offspring, often in vary large numbers, at considerable distances from parent plants, and thus have the potential to spread over a considerable area.

Vitousek *et al*. (1997) suggest that biological invasions have become so widespread as to represent a significant component of global environmental change. Invasive alien species interact with other elements of global change to cause considerable damage to managed and natural systems and to incur huge costs to society (Money and Hobbs in Zavaleta *et al*. 2001).

In many parts of the world, the invasion of naturalized plants is a serious threat to natural communities. In many protected areas threatened by degrading processes biological invasions may be one or the sole cause, at times limiting the regenerative capacity of the invaded ecosystem (APN 2005).

The results of Timmins and Wlliams (1991) suggest that the threat of invasive species in protected natural areas is increasing with continued urbanization, and intensified agricultural use of the landscape and concomitant fragmentation of the natural landscape. The also assert that the most important influence on the extent of weeds in reserves is tha degree of human impact including proximity to towns, human use, presence of rubbish and distance from road or railway line. Some physical features, such as shape and habitat diversity also influence the number of weeds. For managers of parks and reserves exotic species are an ongoing threat to the persistence of native assemblages because they can consume native species, infect them with diseases to which they have no resistance, outcompete them or alter ecosystem functions, making it difficult and expensive to return to its prior, often more desirable condition. Managers of many reserves estimate they spend an enormous amount of their annual operating budget on control of non-indigenous species (D'Antonio and Meyerson 2002).

Invasive species have a great variety of consequences. Some degrade human health and/or wealth directly; others can change community structure and ecosystem properties, especially when they have very different characteristics from the species in the recipient community (Christian and Wilson 1999, Mack *et al*. 2001, Wedin and Tilman 1990, Scott *et al*. 2001, Luire *et al*. 2003, en Doménech *et al*. 2006). At the same time, they can change the abiotic characteristics of the ecosystem, affecting variables like chemical concentrations, forms and fluxes, and the physical structure of the ecosystem (Strayer *et al.* 2006). Also, they can displace native species and reduce plant diversity (Christian and Wilson en Domenech *et al.* 2006). Invaders that alter ecosystem processes such as primary productivity, decomposition, hydrology, geomorphology, nutrient cycling and/or disturbance regimes do not simply compete with or consume native species; they change the rule of existence for all species (Vitousek *et al.* 1997).

Methodology

The environments used in this study were:

Natural regrowth: previously disturbed area that has been allowed to regrow naturally, no canopy was developed.

Plantation: previously disturbed area that has been planted, no canopy was developed.

Secondary forest: previously disturbed area that has regrown and developed a canopy.

In order to search for the presence of invasive plant species, 27 two meters long transects were made perpendicular to El Jilguero, Gavilan and Sendero Rio trails, and the percentage of cover of each species growing along the transects, excluding trees was recorded.

In El Jilguero/Gavilán trails, five transects were in natural regrowth, seven in secondary forest and five in plantation. In Río trail , three transects were in natural regrowth, six in secondary forest and five in plantation.

The species founded were classified into non invasive and invasive/potentially invasive, based on Chacon and Saborio (http://i3n.iabin.net/documents/Lista_de_Plan_as_introducidas_en_Costa_Rica.doc), Database of Global Invasive Species (www.issg.org) and www.invasoras.acebio.org/filt_especies.asp. Then, the medium percentage of cover of invasive/potentially invasive species was calculated for each environment in each trail.

Results and discussion

The mean percentages of cover of invasive/potentially invasive species in each environment of both trails are shown in Fig. 1.

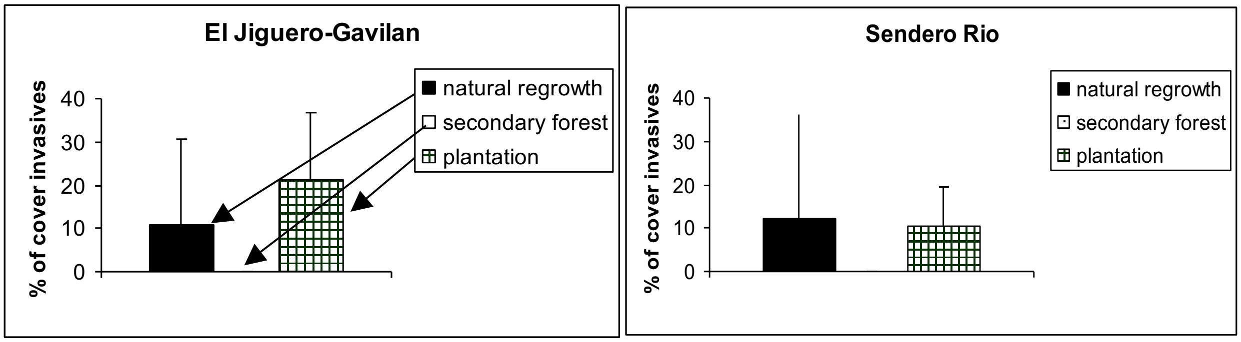

Figure 1. Mean % cover of invasive species in the different environments in El Jilguero/Gavilan and Rio trails.

In secondary forest, no invasive species were founded along the transects in both areas. But in the more disturbed areas, like natural regrowth and plantation the invasive species found were *Rubus niveus* (Fig. 2) and *Solanum quitoense* (Fig. 3); in all cases, the percentage of cover of these species was low (less than 50%).

Landscape-scale factors such as surrounding land uses and amount of regional forest cover are known to be an important determinant of plant communities. Fragmentation and changes in land use can alter ecosystems, providing opportunities for exotic species to invade via increased disturbance and increased movement of seeds (Borgmann and Rodewald 2005).

Fig. 2. *Rubus niveus*

Rubus niveus (Fig. 2) is a shrub native to Asia that may form dense, impenetrable, thorny thickets that can displace native species. It grows in shady areas as well as in sites directly exposed to solar light, being able to grow with other fast growing species, covering small shrubs and tall grasses. It produces sweet, palatable fruit enjoyed by birds, rodents, and humans, and has been cultivated in many regions throughout the world for this reason. Mechanical management of the species is difficult due to its growth form and persistent seedbank, but chemical and biological means of management are being explored. The genus *Rubus* includes around 250 species, 30% of these species are a problem in at least one country of the world. *R. niveus* has been considered an invasive species in Hawaii, Florida, South Africa and Galapagos (Renteria 2007)**.**

Fig. 3. *Solanum quitoense*

Solanum quitoense (Fig. 3) is native to Ecuador, and can grow between 1200 and 2100 metres above sea level, with temperatures between 17 and 20 Celsius degrees. This fast growing plant disperses easily by seeds, giving fruits 10 or 12 months later, the seedbank persists less than one year. It can reach 1,5 or 2 metres of height. Naranjillo has been considered invasive in some islands of Galapagos, such as Isabela, San Cristobal, Santa Cruz and Santiago (Renteria 2007).

Both invasive species founded in this study have limited distribution in Cloudbridge area, so its eradication seems possible before they disperse to other sites. In particular, the eradication of *R. niveus* could require a more long term work, because of its persistent seed bank.

It´s worth noting that in disturbed open areas, ferns and the native blackberry (*Rubus eriocarpus*) showed widespread growth, being predominant among other species. Although these species are native and not considered invasive, they could probably modify the ecosystem becoming a problem for its restoration. This topic could be the initial observation for future research.

This is the first research about invasive species in Cloudbridge, and although it´s an explorative and descriptive study, it could serve as a general overview of the invasive species present in the area, which it´s a necessary first step for making decisions regarding the restoration of the ecosystem.

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