



## Analysis

# Managing tourism in the Galapagos Islands through price incentives: A choice experiment approach

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## ABSTRACT

This study analyzes nature-based tourism in Ecuador's Galapagos National Park, which faces great risks of invasive species due to visitor contacts. The analysis uses visitors' preference data to evaluate the potential impacts of various pricing strategies on revenues. Data come from choice experiment surveys conducted in 2009, regarding four characteristics of a tour to the Galapagos: length of stay, depth of experience in the islands' ecosystem, level of protective measures taken against invasive species, and price. We found that the typical tourist would be willing to pay 2.5 times more for a tour with high-level of protection against invasive species than for a tour with the current level of protection and otherwise similar characteristics. The mean marginal willingness to pay for a tour with an in-depth natural experience is 1.8 times more than for a similar tour providing only an overview of the Galapagos' ecosystem. Further, we determined that differences in elasticity of demand between long and short tours suggest that a pricing strategy may be used to encourage tourists to take longer tours without affecting total revenue. Such a pricing strategy would decrease the number of unique island visitor contacts per year, thereby reducing the threat to the islands' unique ecosystem.

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## 1. Introduction

Nature-based tourism, once seen as a compromise between conservation and economic development, may in fact be contributing to the loss of biodiversity in fragile ecosystems. Tourism can affect the environment directly, through the development of infrastructure such as restaurants and hotels, but also indirectly, by introducing non-native species into previously isolated or relatively protected areas. The latter can have a substantial effect on the environment. The introduction of non-native species has been blamed for one-half of all documented extinctions in Galapagos since 1600 (Rogg et al., 2005). Island ecosystems are particularly vulnerable to non-native invasions, precisely because they evolved in general isolation (Cook et al., 2006). Hawaii, for example, home to 25,000 endemic species, has more species listed as endangered or threatened than does the entire continental United States (Vitousek, 1988).

The number of visitors to the Galapagos Islands must be limited for three reasons (Plan de Manejo Parque Nacional Galapagos, 2005; Causton et al., 2000). First, each visitor represents a unique contact between the islands and an outsider who carries with him/her the potential to introduce non-native species. Second, the transport of each individual tourist, by plane or ship, constitutes an additional pathway

for non-native species invasion. Through these channels, an increase in individual visitors increases the number of vectors carrying invasive species and, accordingly, the risk of a successful new invasion. Third, the recent shift in Galapagos tourism from long tours to short tours increases the number of unique visitor-island contacts while decreasing the quality of the tourism experience and failing the park's mandate to educate visitors on the importance of its ecosystem. Several strategies exist to balance a growing demand for visits to the islands with the limits imposed by biodiversity conservation goals, but to be effective these strategies must be adapted to tourist preferences.

This study examines one particular tourism management technique: a pricing strategy to manipulate tourist choices. It provides quantitative data about tourist preferences as well as potential impacts of pricing strategies on park revenues and on overall levels and types of Galapagos tourism. We present data from a choice experiment performed in the summer of 2009 by 252 tourists who had just completed a tour of the Galapagos Islands. The experiment presented participants with hypothetical tours of the Galapagos described by four varying characteristics: length of stay, depth of experience in the natural environment of the islands, level of protective measures taken against the risk of invasive species to the islands, and price. Participants were asked which of any of the various tours presented they would select. We used their responses to estimate a choice model and the resulting marginal valuation of each tour characteristic. We found that tourists highly value measures taken on a tour to protect against invasive species. On average, they are willing to pay 2.5 times as much for a high level of protection

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against invasive species compared to a medium level and otherwise similar characteristics. Our estimates also show that demand for a short tour in particular is elastic, whereas demand for taking a tour of some kind is inelastic. This difference in elasticity can be exploited by pricing strategy to achieve three often-competing policy goals simultaneously: reduce the total number of tours to the islands, shift the distribution of remaining tours to long tours rather than short, and maintain total revenues.

Our research extends the literature concerning the valuation of ecosystems by examining declines in biodiversity explicitly linked to individual behavior—namely, the risk of invasive species due to tourism. Previous valuation studies have examined biodiversity itself (Christie et al., 2006) and the degradation of biodiversity through public externalities such as acid rain (Macmillan et al., 1996). Further, we use data from a choice experiment to model the effects of pricing strategies as a mechanism to decrease negative externalities; this contributes to the existing literature on affecting demand for tourism using entrance or access fees (Becker, 2009; Alpízar, 2006; Tobias and Mendelsohn, 1991; Navrud and Mungatana, 1994; Willis, 2003; Chase et al., 1998; McLean and Johnson, 1997). Last, this study differs from previous WTP studies in the Galapagos (Machado, 2001; Oleas, 2008) in its use of a choice experiment methodology rather than an open-ended contingent valuation question.

## 2. Regulating Visits to Sensitive Areas and the Galapagos Islands

The Galapagos Islands are emblematic of the unique flora and fauna that can flourish in isolated ecosystems. Scientists estimate that at least 7000 species live in the Galapagos, making the ecosystem one of the most distinctive on Earth. Of the species found in the islands, 97% of reptiles and mammals, 80% of land birds, 50% of insects and 30% of plants are endemic to the islands (Rogg et al., 2005). Beyond their biological value, the islands are a powerful symbol of the biodiversity that inspired Charles Darwin's theory of evolution (UNESCO, 2014). The isolation that created this local biodiversity also makes it vulnerable to invasive species (Cook et al., 2006). Currently, 60% of the 180 endemic plants are in danger of extinction, according to the standard IUCN Red List of Threatened Species. Of the thirteen documented species extinctions on the islands, eleven were attributed to invasive species (Bensted-Smith et al., 2002; Rogg et al., 2005). In 2007, 1321 non-native species were reported on the islands (Watkins and Cruz, 2007).

The consensus in the literature is that tourism is primarily responsible for the influx of invasive species to the Galapagos Islands (Jones, 2013; McNeill et al., 2011; Trueman et al., 2010; González et al., 2008; Usher, 1988). This belief is echoed by current park managers and experts at conservation organizations on the Galapagos Islands (F. Cruz, personal communication, July, 2009). The invasive species arrive by means of the tourists' physical bodies and accouterment (Chown et al., 2012; McNeill et al., 2011; Pickering and Mount, 2010; Lee and Chown, 2009; Wichmann et al., 2009), airplanes or ships transporting the tourists (Kilpatrick et al., 2006; Bataille et al., 2009), the importation of goods for tourists (González et al., 2008; Causton and Sevilla, 2008), and the emigration of labor from the mainland to support the tourism industry (Trueman et al., 2010). Although tourists are not the only people who could potentially introduce invasive species—scientists and residents returning from travel could too—they create by far the single largest risk. The number of tourists (173,000 in 2008) dwarfs that of scientists visiting the island, approximately 240 per year (author's calculations based on annual scientific permits in 2013), as well as the island's roughly 25,000 permanent residents (Ecuadorian National Census, 2010).

In quantifying the risk of invasive species to an ecosystem, ecologists consider the likelihood that those non-native species will become established, a concept termed "propagule pressure" or "effort of introduction." Three variables determine propagule pressure: the quantity of specimens in each release, the quality of each of these specimens

(hardiness), and the frequency of release (Drake et al., 2005; Lockwood et al., 2005; Lonsdale, 1999; Colautti et al., 2006; Ricciardi et al., 2011). Of these three aspects, the frequency of release is essential for establishment of the non-native species (Lockwood et al., 2005; Ricciardi et al., 2011).

Applying this formula to the issue of invasive species in the Galapagos, each tourist's arrival represents one release event, regardless of that tourist's length of stay, because the majority of non-native species are released in the initial contact between tourist and island (Wichmann et al., 2009; Pickering et al., 2011; Ansong and Pickering, 2013; Ansong and Pickering, 2014). Thus a tourist on a two-day tour has the same impact on invasive species risk as does a tourist on a seven-day tour. Accordingly, when expressing the burden on an ecosystem of non-native releases, ecologists multiply the mean number of seeds that a visitor carries (the measure of quantity) by the number of visitors (the measure of frequency) (Ansong and Pickering, 2013; Chown et al., 2012; Ware et al., 2012; Whittmann et al., 2014). Similarly, economic studies of tourism model the risks of invasive species as the number of unique tourists times the measure of frequency of releases (Warziniack et al., 2013; Perrings et al., 2002; Timar and Phaneuf, 2009).

Given which factors are used to quantify the risk of invasive species, it is clear why that risk has increased alongside the extraordinary growth of the tourism industry and the shift from longer to shorter tours in the Galapagos Islands in recent decades. In the late 1960s a single cruise ship took visitors to the island; by 2006, 80 cruise ships were licensed to do so. The number of tourists has simultaneously grown from 2,000 in the late 1960s to 11,657 ten years later, then to 18,000 by the mid-1980s. The number of visitors rose exponentially in the late 1990s, later reaching 78,000 in 2001 and 173,000 in 2008, an upward trend expected to continue.

Along with an increase in the number of tours, there has been a shift from conservation-focused visitors to more "causal tourists" who are more demanding on the ecosystem (Quiroga, 2009; Watkins and Cruz, 2007). The majority of these visitors (70%) were foreign tourists, predominantly North Americans (Plan de Manejo Parque Nacional Galapagos, 2005).

Current attempts to reduce the risk of invasive species due to tourism are believed to have actually worsened the problem. The National Park of the Galapagos imposed a limit on the number of visitors a cruise ship can carry. Tour operators responded to these capacity limits by reducing the average length of tours given and increasing the number of tours sold (Epler, 2007). The net result was an increase in the number of unique visitor-island contacts (Quiroga, 2009; Grenier, 2007).

Managers are now tasked with counteracting these unintended consequences as well as balancing the policy goal of reducing the risk of invasive species against other concerns. Competing demands for conservation, preservation of "traditional uses of natural resources," promotion of economic growth, and tensions between different lines of business within the tourism industry have rendered any relevant regulation highly contentious (Quiroga, 2009; Heylings and Bravo, 2007). Any policy, therefore, which seeks to reduce the risk of invasive species, must simultaneously maintain revenues while also catering to non-economic goals such as the educational mission of the National Park.

Our study shows that pricing strategies may accomplish just that. Park managers can exploit differences in elasticity in tourist preferences to decrease the total number of tours while shifting remaining demand from short to long tours (Alegre and Pou, 2006). Such a strategy is currently under discussion among many policymakers, scientists and non-governmental organizations (Gardener and Grenier, 2011).

Reducing the total number of tourists would reduce all of the avenues for invasive species introduction that tourism brings with it. While these changes may not reduce the risk of invasive species caused by the demand tourism places on imported goods or by the increased population due to tourism, it does reduce the propagule pressure attributable to tourists' physical bodies, accouterments, and transportation to the islands—the largest contributing factor to the overall risk

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