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Research Probe

Island, Islandness, Vulnerability and Resilience

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Island studies have long been fashionable in tourism. To the cynical this may be because many islands are attractive places to visit and conduct fieldwork. However, more likely is that islands, whether tropical or not, are integral to the tourism imaginary of the developed world (Harrison 2004; Hall 2009a; Sæþórsdóttir et al. 2011). Indeed, as has been suggested by Hay (2006) the concept of an island - and therefore 'islandness', the qualities of being an island or like an island - is a metaphor central to Western thought. This of itself makes Island Studies a worthy research area. Yet, as both the lead article and other responses suggest, the field of island research is often clouded by fuzzy conceptualization. Indeed, this should not be surprising as only a thorough meta-analysis of the various publications on islands that identifies their foci and the variables examined would help provide greater clarity of what are the key dimensions of islands that warrant study and their relative importance. Without such an approach we often cannot identify whether islandness is a key or incidental variable in research and, in many cases, when trying to put island research in some sort of comparative context we may actually be comparing apples and oranges.

The Study of Islands as a Natural Laboratory

The study of tourism in islands is important for both applied and more theoretical and philosophical reasons. At an applied level, the reality that so many people live and visit islands makes them a significant research location. Studies of the impacts of tourist visitation on the island destinations of the Pacific, the Caribbean and the Mediterranean have helped provide long-term assessments of the changes that tourism may bring to destinations as well as how they can be addressed (e.g., Conlin and Baum 1995; Briguglio et al. 1996; Lockhart and Drakakis-Smith 1996; Apostoulopoulos and Gayle 2002; Baldacchino 2006a, 2006b; Bacchilega 2007; Carlsen and Butler 2011). Such research is especially significant for examining the central paradox of tourism development that while the environmental and socio-cultural dimensions and representations of an island destination may serve to attract tourists, those visitors and the industry that supports their mobility also change the nature of the destination and the varied resources on which tourism is based (Gössling 2003; Hall 2010a).

Since the late 1990s islands have also become a significant focal point for research on environmental change, and especially climate change. The threats posed by climate change to tourist destinations such as the Bahamas and the Maldives have received a great deal of prominence in recent years (Gössling et al. 2009; Scott et al. 2012). As the Alliance of Small Island States (AOSIS)'s (2009:1) *Declaration on Climate Change* stated, 'climate change poses the most serious threat to our survival and viability, and, it undermines our efforts to achieve sustainable development goals and threatens our very existence'.

Islands also provide a considerable opportunity to contribute to the development of theory. Islands are often popular tourism destinations attracting tourist numbers often far exceeding their permanent population. Their distinctive characteristics of being relatively confined terrestrial systems, because they are bounded by sea, present a considerable opportunity to develop a more advanced understanding of tourism systems (Hall 2008), and the effects of inputs, outputs and socio-economic evolutionary processes within the destination. Hall (2010a: 246) has gone so far as to argue that the bounded nature of islands and their tourism systems serve to delineate 'a "natural laboratory" for the observation and study of tourism's impacts and the effects of mobile, often seasonal, human populations on permanent settlements, culture and the natural environment'.

Island Resilience and Vulnerability

For the biological sciences, and ecology and biogeography in particular, islands have provided confined natural systems within which to study system dynamics and the impacts of human activities (Hall 2010b). In the same way, the social sciences are also increasingly recognizing the opportunities provided by islands to gain a better

understanding of island communities and the insights that island studies may bring (McCall 1994, 1996; Biagini and Hoyle 1999; King and Connell 1999; Baldacchino 2004, 2006a; Baldacchino and Milne 2000; The Shima Editorial Board 2007). Nevertheless, it is remarkable that the key role of islands in the development of ecological thinking, most clearly recognized in the theory of island biogeography (MacArthur and Wilson 1967), has not been replicated in development of a human ecological approach to island studies. This is even more surprising given the awareness of issues of resilience and vulnerability. For example, while there is recognition of the competition between society, including tourism, and wildlife for natural capital (Figure 1) (Czech 2004), this is usually identified more in an abstract, unbounded form. However, islands provide an opportunity to set a boundary to study competition for human and natural capital. With such competition, of course, being one of the major reasons why many island ecosystems have suffered such a high degree of loss of endemic biodiversity.

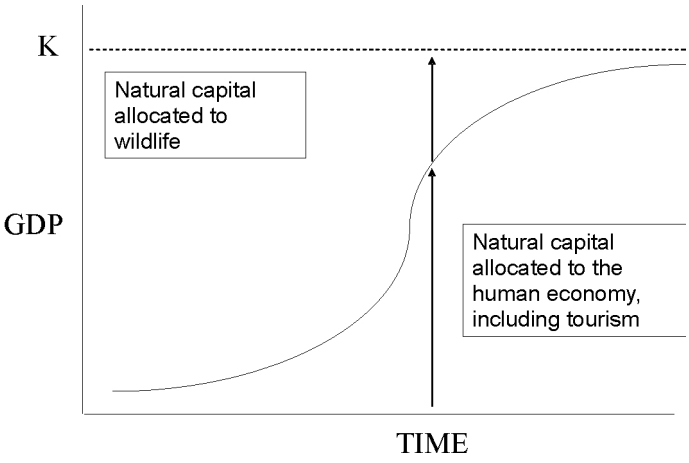


Figure 1. Competition for natural capital between people and wildlife

The concept of island biogeography examines the relationships between species and a given area (Preston 1962; MacArthur and Wilson 1963, 1967). The conventional expression of the species-area relationship is S = CAz where S and A are species count and area, respectively, and C and z are fitted species specific constants. However, significantly for the wider applicability of the species–area relationship, an 'island' can be regarded as any area of suitable habitat that is surrounded by unsuitable habitat. This therefore includes not only terrestrial islands covered by sea but could, for argument's sake, include a relatively natural national park area surrounded by agriculture.

The number of species that are found on an island depends on a number of factors, including its area and topography, diversity of habitats, shape, spatial and temporal isolation, climate, previous connection to landmasses, accessibility to its source of colonists (i.e., not just distance to nearest source region but location relative to ocean currents as well as wind currents), and the equilibrium rate of colonization by new species and the rate of extinction of existing species (Cox et al. 1973). The equilibrium model of the biota of a single island proposes that the equilibrial species number is reached at the intersection between the curve of the rate of new species immigration, not already on the island, and the curve of extinction of species on the island (Figure 2). The model, therefore, suggests that although fluctuations will occur over time, there is a finite limit on the species biodiversity of a given area. This is highly significant in biodiversity conservation terms as, because every species runs the risk of extinction, 'the more that have arrived the more species there are at risk. In addition, as more species arrive, the average population size of each will diminish as competition increases' (Cox et al. 1973: 98).

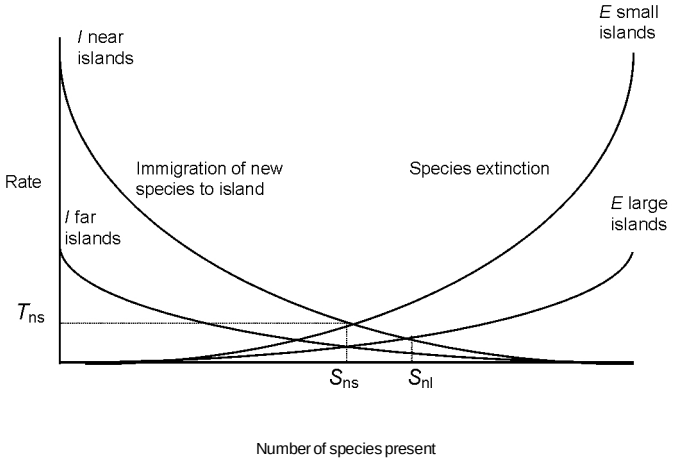
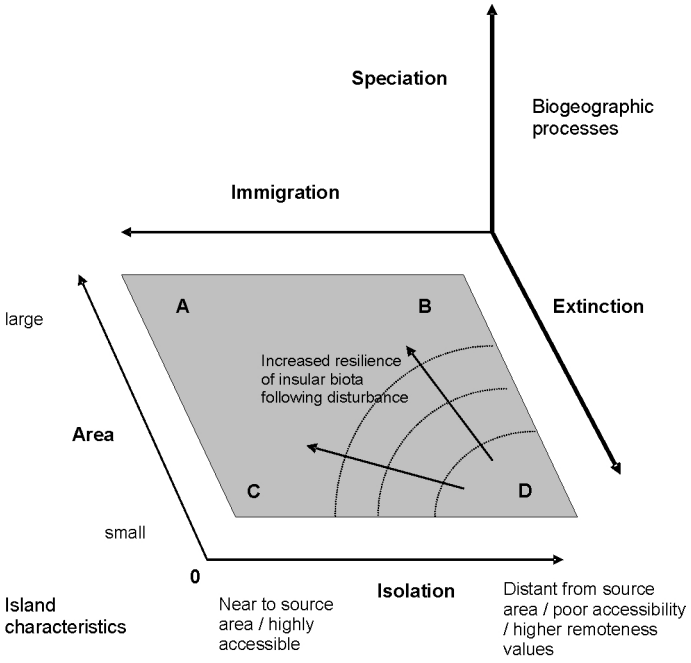


Figure 2. Equilibrium model of the single island biota

The equilibrial species number is reached at the intersection between the curves of the rate of immigration of new species, not already on the island, and the curve of extinction of species on the island. Immigration rates are postulated to vary as a function of distance, and extinction rate as a function of island area (increased competition for finite natural resources). The model predicts different values for S (number of species), which can be read off the ordinate and for turnover rate (T) (the number of species that become extinct and are replaced by immigrants and speciation over unit time). Each combination of island area and isolation should produce a different and unique combination of S and T. For reasons of uncluttered illustration only limited values are shown. The equilibrium point at which I equals E is never completely constant as it will shift over time in relation to a range in external and internal factors however the key point is that there is a 'capacity' to how many species can successfully inhabit a finite area over time (Whittaker & Fernández-Palacios 2007; Hall 2010b).

MacArthur and Wilson (1967) favoured logarithmic transformations of both axes thereby enabling the constants c and z to be determined by least squares (linear) regression (Whittaker and Fernández-Palacios 2007). MacArthur and Wilson (1967) found that in most cases z falls between 0.20 and 0.35 for islands. The model is highly significant in that, even though it has heuristic value without it, the contribution of the theory to biogeography and environmental conservation provides a high degree of rigor with respect to dynamic modelling of ecological and biological population processes (Hall 2010b). One of the more interesting variants of the theory of island biogeography is that of Lomolino (2000) who argued for a tripartite model of island biography that illustrates the three fundamental biogeographic processes of immigration, extinction and evolution as a function of island characteristics of area and isolation (Figure 3).



Community characteristics of labeled regions are as follows:
A: Moderate to high species richness, low endemicity and low turnover;
B: Moderate to high species richness, high endemicity and low turnover;
C: Moderate to low species richness, low endemicity and high turnover;
D: Low species richness, low endemicity and high turnover – a depauperate island.
Species richness is the number of different species represented in a set or collection of individuals it does not take into account the abundances of the species or their relative abundance distributions.
Endemism is the ecological state of being unique to a defined geographic location. Species that are indigenous to an island are not endemic if they are also found elsewhere (After Lomolino 2000, Hall 2010b).

Figure 3. Relationships between biogeographical processes and island characteristics

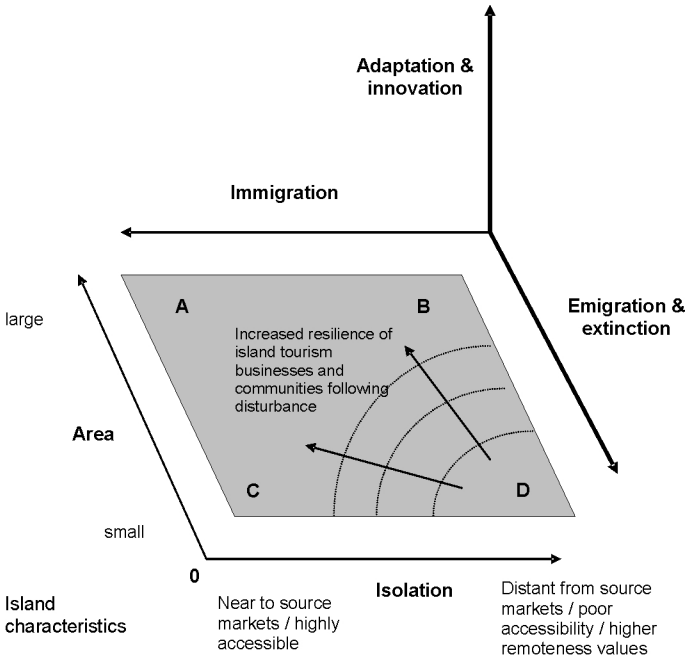
Under such Lomolino's approach, immigration rates should increase with proximity to a source region and the ability of species to travel or be transported across immigration barriers and filters. Extinction rates should decrease as island area increases, or increase with growing resource requirements of the focal species. Finally, speciation should be most important where extinction and immigration are lowest and therefore it increases in relation to increase in island area and isolation and decreases with respect to resource requirements and the capacity of species to move or disperse within their environments (Lomolino 2000). However, just as significantly, the interrelationships between island characteristics and biogeographical processes provide for the relative resilience of islands to disturbance, whether from storms or drought, or from anthropogenic pressures such as tourism, as well as providing significant insights into the design of nature reserves and the requirements for biodiversity conservation (Hall 2010b).

Are there broader lessons to be learned from island biogeographical theory? The answer is yes, in at least two ways. First, linkage between island biogeography and studies of the impacts of tourism on islands provide clear illustrations of the environmental pressures that tourism places on island resources, which can only be satisfied by importing resources from elsewhere unless such resources are either going to be depleted and / or limits are placed on the number of resource users, i.e., locals and visitors. This is evidenced, for example, in the import of food and water to many island destinations to supplement what cannot be provided locally in order to meet a given level of real population demand (real population is the permanent population plus the temporary tourist population at any given time) (Gössling et al. 2012). From this perspective, the impacts of tourism on islands viewed via the lines of island biogeographic theory that provides a clear indication of the need for the development of a steady state approach to tourism that recognizes the large ecological footprints of much tourism consumption. Hall (2009b, 2010c) argues that sustainable tourism needs to be understood from a steady-state economic perspective that explicitly recognizes the extent to which economic development is dependent on the stock of natural capital. According to Hall (2009b, 2010c) steady state tourism is a tourism system that encourages qualitative development but not aggregate quantitative growth to the detriment of natural capital. A steady-state economy, including at the destination level, can therefore be defined in terms of 'a constant flow of throughput at a sustainable (low) level, with population and capital stock free to adjust to whatever size can be maintained by the constant throughput beginning with depletion and ending with pollution' (Daly 2008: 3).

Secondly, the application of the island biogeography approach to islands can provide a clear analogue to the

human and business ecology of islands. The use of analogue theory – a formal theory of model building which provides for the selective abstraction of elements from an empirical domain and their translation into a simplified and structured representation of a particular system – is now so widespread in tourism and the social sciences that its implications are often little considered (Livingstone and Harrison 1981), with the wave analogue model of the tourism area life cycle arguably being one of the most recognized in tourism (Hall 2006).

Figure 4 presents a model of the application of island biogeographical theory to the understanding of adaptation, resilience, and vulnerability in island tourism businesses but it could also be adapted to other aspects of island human ecology. From this approach, the equilibrial or steady-state number of businesses is reached at the intersection of the rate of immigration of new businesses, not already on the island, and the emigration or closure (extinction) of businesses on the island, along with the capacity of businesses to innovate and adapt (which is analagous to species evolution over time and the occupation of new ecological niches). Immigration rates are postulated to vary as a function of distance, and closure rate as a function of island area and resources that determine the competition for finite natural and human capital. Although heuristic, the model can potentially predict different values for S (number of businesses) (in substituting values for Figure 2), and for turnover rate (T) (the number of businesses that become close and are replaced by immigrants and innovation over unit time). Each combination of island area and isolation should produce a different and unique combination of S and T. The equilibrium point at which I equals E is, of course, never completely constant as it will shift over time in relation to a range in external and internal factors. However, the key point is that there is a 'capacity' to how many businesses - or people, including visitors - can successfully inhabit a finite area over time without there being loss of natural capital (Hall 2010b).



Community characteristics of labeled regions are as follows:
A: Moderate to high business richness, low endemicity and low turnover;
B: Moderate to high business richness, high endemicity and low turnover;
C: Moderate to low business richness, low endemicity and high turnover;
D: Low business richness, low endemicity and high turnover – a depauperate island economy
Business richness is the number of different businesses
Endemicity is the number of businesses unique to the island/location. It does not include international chains.
(After Lomolino 2000; Hall 2010b).

Figure 4. Island biogeographical perspectives on island adaptation, resilience, and vulnerabilty

Conclusions

This response has sought to emphasize that islands and islandness, whether as metaphors or reality, are important areas of research. But it has also argued that notions of resilience and vulnerability are not just metaphors but are realities faced in the consumption of resources from a finite space. This could be an island surrounded by water– or it may just as well be our island Earth in the sea of space. Either way, it is time that notions of tourism's contribution to the loss of natural capital as well as steady-state tourism economies need to be taken seriously. More than many other destinations, islands have the potential to being a natural laboratory for tourism because of the way they can illustrate the dynamics of a tourism system. However, to understand such processes will require more than just metaphor and will instead demand an appreciation of island studies that crosses disciplinary borders.

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