Social and Ecological Interactions in the Galapagos Islands

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Land Cover and Land Use Change on Islands

Social & Ecological Threats to Sustainability

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Prologue: Geographies of Hope and Despair: Land Cover and Land Use on Islands

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Introduction: The Age of Islands

Islands have long fascinated scholars, but perhaps never more so than in the current epoch of the early twenty first century, gripped as it is by the contradictory dynamics of scientific and technological progress on one hand and a viral pandemic and environmental catastrophe on the other (Bonnett, 2020). Artificial islands are built as enticing, exclusive sites of pricey real estate (Jackson & Della Dora, 2009); while other islands, and their communities, succumb to the slow yet steady threat of saltwater intrusion or sea level rise (Farbotko, 2010a). Enclave/island spaces are the new frontline spaces of development, and the emblematic sites of the Anthropocene (Pugh, 2018; Sidaway, 2007).

If islands did not exist, we would simply have to invent them. They entice outsiders: as synecdoches (whereby a part is made to represent the whole): as "prototypical ethnoscapes" (Baldacchino, 2007a, p. 9); and as handy, manageable and scaled-down reproductions of (larger and messier) continents (Kirch, 1997). The smaller islands get, the simpler and the greater the imputed convenience of this 'island-mainland' correlation. No wonder, therefore, that scientists—often outsiders—descend Gulliver-like upon (smaller) islands to identify, witness, observe and then depart, while inferring and deducing cause-effect relationships, which they acknowledge as writ large in larger (read mainland) contexts (Baldacchino, 2008, p. 42). It is as if islands have been ordained and disposed to act as "outposts of globalisation" (Ratter, 2018); and as advance indicators or extreme reproductions of what is present or future elsewhere (Baldacchino, 2007b). No discipline has been spared from this exercise; but zoologists (think Charles Darwin, Rosemary Grant),

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bio-geographers (Jared Diamond, Rosemarie Gillespie) and anthropologists (Bronislaw Malinowski, Margaret Mead) probably lead the pack with their proclivity and enthusiasm for such island fieldwork and *in situ* observation (Baldacchino, 2006).

Illusionary Beacons of Stability

The self-evident physicality of an island offers a beguiling expression of stability: a piece of land surrounded by water, crafted by God and/or Nature. And yet, this staid condition of islandness is illusory; the picture-perfect image is transient (Kelman, 2018). First, this is because of the natural cycles of geological and environmental change, which sculpted the island in the first place: from volcanic eruptions, coral growth, or the erosion of erstwhile connected peninsulae and promontories. Cycles of vegetation, and their accompanying fauna, are replaced in succession. The same forces can and do eventually lead to the wholesale disappearances of such islands, though not necessarily in our lifetime (Whittaker, Fernández-Palacios, Matthews, Borregaard, & Triantis, 2017).

A second cause is the impact of the human species on its natural environment, readily visible in island features. Land is reclaimed to extend surface area; sand, stone and gravel are shifted to design or better protect harbours and coastlines; bridges are built to connect islands, and to connect islands to mainlands; in which case, some might say that they are no longer islands (Royle, 2002). Swamps drained, mines quarried, hills levelled, forests felled, river courses dammed and altered … with modernity, history has transitioned into one continuous and open-ended struggle to force landscape and geography to succumb to human intent. (Some would add greed.) As with French writer Albert Camus when he visited the island of Manhattan, it would be easy to forget that this "desert of iron and cement" is actually an island (Camus, 1989, p. 51). In this mission of "culture as development," humans play a significant part in transposing or abetting the movement of species from one ecosystem (where they may have evolved naturally) to another (where they may find themselves in different predicaments, ranging from being hugely disadvantaged to finding themselves in dominant positions and with fewer or no natural predators) (Quammen, 2012).

A human-mediated spread of invasive, non-native species drives biodiversity loss and habitat degradation all over the planet, but these consequences are nowhere as stark as on small islands, with their fragile ecosystems (with native and endemic species having evolved in splendid isolation from predators, diseases and competitors) as well as with strained and limited human resource skill and expertise pools. Already in the heydays of colonialism, islands were savagely transformed into platforms for monocrop economies (think tobacco, sugarcane, banana, pineapple), or sites for the planned transfer of invasive species, driven by the whim to reproduce, say, the idyllic English countryside (Grove, 1995; Royle, 2007). Such small islands may be hotbeds of biodiversity; but, barring extreme measures of access limitation

or prevention—not easy to impose, as the recent history of the Galápagos archipelago reminds us—they are *not* likely to withstand or escape the impact of humanity over time. References to a 'balance' between conservation and development are often euphemisms disguising serious issues of ecological degradation (Mathis & Rose, 2016). Whatever traces of 'nature' can be found in such disturbed enisled spaces, the best we can hope for are "human gardens": seemingly natural, but actually constructed scapes (Picard, 2011). On most small islands, we need to acknowledge that we live in a "post wild world" (Marris, 2013).

Size and scale conspire to make such changes appear even more dramatic (Fordham & Brook, 2010; Hay, Forbes, & Mimura, 2013; Kerr, 2005; Kier et al., 2009; Kueffer et al., 2010; Pelling & Uitto, 2001; Spatz et al., 2014), a dynamic also described as "articulation by compression" (Brinklow, 2013). For the first time ever, cityscapes now represent the homes of the majority of humanity (Berry, 2015); but, on small islands, such urbanisation has led to exceptionally heavy population densities, and therefore a greater propensity to sprawl and physically connect island urban zones with contiguous islands or mainlands (Grydehøj, 2014, 2015). Many of the world's capital cities, built originally on islands to afford better protection from attack, have outgrown their protective defensive walls and possibly eliminated the aquatic border, now an irritating barrier to expansion, that separated them from nearby land (Baldacchino, 2014).

Islands and Density

Islands that are political units are also geographical enclaves that tend to have higher population densities than mainlands, also because offloading people across the sea remains a more problematic, and definitely more dangerous venture than distributing them across land borders onto a neighbouring land mass. Moreover, around half of humankind dwells on or near coastal regions, because continental interiors are disadvantaged locations for settlement. Amongst island states and territories, subnational island jurisdictions (SNIJs) tend to be even more attractive spaces for in-migration than sovereign island states, even though they tend to have a much smaller land area (Armstrong & Read, 2003; McElroy & Pearce, 2006).

At the risk of serving as a paean to positivism, the much higher mean population density for islands than for continents is supported by the statistical evidence. Excluding the large (but practically empty) land mass of Greenland—for all its land area of 2 million km^2, its resident population is around 55,000—the world's island units have a mean population density of 144 persons per km^2: this is *three times* the mean value of 48 persons per km^2 that works out for Eurasia, America, Africa and Australia combined; and excluding Australia would only make a marginal difference (see Table 1).

Islands occupy just 1.86% of the Earth's surface area; and this percentage drops down to just 1.47% if one again excludes Greenland. However, they are the

Table 1 Population density on islands and continents compared (2010 data)

Land Mass	Population (A)	Land Area (km^2) (B)	Population Density (A/B)
1. Four continents	6,550,400,000	136,071,330	48
2. As (1) above, less Australia	6,530,000,000	128,453,330	51
3. All island states and territories	588,800,000	6,263,612	94
4. As (3) above, less Greenland	588,700,000	4,088,000	144

Source: Baldacchino (2011, p. 168)

Table 2 The 13 states and *territories* (in italics) with the highest population density (of more than 2,000 persons per square mile) for base year 2010 (*rounded figures*)

Rank	Jurisdiction	Of which, islands	Resident Population	Area(mi^2)	Density(/ mi^2)
	World (land area only)		7,100,000,000	57,510,000	123
1	*Macau (People's republic of China)*	Partly	546,200	11.3	48,450
2	Monaco		33,000	0.75	44,000
3	Singapore	Fully	5,077,000	274.2	18,510
4	*Hong Kong (People's republic of China)*	Partly	7,008,900	428	16,380
5	*Gibraltar (UK)*		31,000	2.6	13,260
6	Vatican City /Holy See		1000	0.17	5880
7	Malta	Fully	410,000	122	3360
8	*Bermuda (UK)*	Fully	65,000	20	3250
9	Bangladesh		164,425,000	55,598	2960
10	Bahrain	Fully	807,000	280	2880
11	Maldives	Fully	314,000	115	2730
12	*Guernsey (British Isles)*	Fully	65,700	30	2180
13	*Jersey (British Isles)*	Fully	91,500	45	2040

Source: Baldacchino (2011). Jurisdictions *in italics* above are self-governing units and not independent states

collective home to some 10% of the world's population: almost 600 million people (Baldacchino, 2006, p. 3).

Gross mean figures of population density—calculated as the mid-year resident population per unit of land area—can be misleading, since various regions in the world are inhospitable to human life and populations tend anyway to cluster and aggregate around coastal regions, riverbanks, ports and sources of fresh water. Still, several of the most densely populated territories in the world are city-states and small jurisdictions (see Table 2). Their residents share a relatively small land area, high levels of urbanisation, relatively high levels of economic prosperity but accompanied by relatively high levels of environmental degradation. Many tend to be peninsular or island units, preventing a natural spillover of population across contiguous

Table 3 Discrete (unbridged) islands with very high population densities (over 2000 persons per square mile)

Population Density (per square km)	Island Unit
820	Oreor (Palau)
830	Losap (Federated States of Micronesia)
840	Kili (Marshall Islands)
840	New Providence (Bahamas)
900	Moen (Federated States of Micronesia)
920	Java (Indonesia)
1000	Tarawa (Kiribati)
1000	Funafuti (Tuvalu)
1130	San Andrés (Colombia)
1260	Malta (main island of Maltese islands)
2460	Majuro (Marshall Islands)
5180	Malé (Maldives)

Source: Baldacchino (2011)

borders. The glaring exception is Bangladesh, the only country in the world with a large (and relatively poor) population and a high population density: at least 100 million people there are at risk from the effects of (even moderate) sea level rise (Islam & Van Amstel, 2018).

Some of these jurisdictions, like Jersey, are single island entities. Others boast a number of island units, in which case a mean national population density often conceals more extreme statistics at the sub-state level. This is most evident in the cases of Malé, capital island of the Maldives, and home to some two-thirds of that country's population. Others include New Providence (capital island of the Bahamas, and location of Nassau), Moen (capital island within Chuuk, one of the four Federated States of Micronesia), Majuro (capital island atoll of the Marshall Islands), South Tarawa (main atoll settlement within sprawling Kiribati), Malta (main island within the Maltese islands) and San Andrés (a sub-national island jurisdiction of Colombia). In each of these cases, population densities are much higher than their respective national mean figures. Many of the world's most densely populated islands are to be found amongst South Pacific archipelagic states (see Table 3). All of these, except Java, Indonesia, are small island units.

Empty Islands

If one is looking for extreme cases of population density, islands offer ample examples from *both ends* of the density continuum. Indeed: island jurisdictions do not just provide scenarios of very high population density, with places like Bermuda, Malta and Singapore topping the list. They also throw up examples of delineated land areas with very low or zero population density: islands - including the island

continent of Antarctica - offer the *only* examples of completely de/unpopulated, geographically discrete and self-identifiable areas on the globe: every other type of landform—montane, steppe, desert, valley, forest, river delta, taiga, tundra …—is at some point physically connected to another. Not islands: "'uninhabited' is a word attached only to islands" (Birkett, 1997, p. 14). In their 'emptiness', such island locales are attractive, and in sometimes very contrasting ways. One enticement could be the exploitation of their (often unique) natural qualities and apparent 'underdevelopment' or 'pristine' state for the purpose of identifying, and then protecting, nature reserves, possibly harbouring rare, threatened and/or endemic species. After all, nature reserves are "habitat islands" in any case (Pickett & Thompson, 1978). Such island spaces are easier to protect from the curious or adventurous. Another, contrasting attraction could be the use of such islands, especially depopulated ones, as locales for offshoring undesirable "waste" (human or material) and dangerous experiments: an "enforcement archipelago" that includes detention centres for refugee claimants, high security prisons, quarantine stations, nuclear waste dump sites and high-risk scientific test facilities (Mountz, 2011).

Islands as Tourism Destinations

Pressure on land is greatly exaggerated on islands, also because many of them have transitioned organically into tourism destinations (Carlsen & Butler, 2011). Many islands come with unique cultural or natural specificities; and so these locales become attractive places to visit (Harrison & Hitchcock, 2005). The obligatory crossing over water (by air or by ship/boat) becomes part of the catharsis associated with the spiritually or mentally cleansing journey over water to an island 'paradise' (Patton, 2007). It is no wonder, therefore, that almost a sixth of UNESCO's World Heritage Sites—115, at the latest count—are found on islands, or are islands *in toto* (World Heritage Sites, 2019). And yet, the pressure of visitor numbers threatens the sustainability of the tourism industry, especially on small islands (Apostolopoulos & Gayle, 2002; Lim & Cooper, 2009). Tourism aggravates the crowding and pressure on basic resources (transport, water, energy, foreshores …) and introduces an additional and different set of land use and sea/landscape stakeholders into the bargain. Overwhelmed by their own galloping success in attracting visitors, and miffed by the failed promises of mega-projects gone horribly wrong (Lippert & McCarty, 2016), small islands scramble to manage tourism numbers as best they can: encouraging small scale eco-operations; closing tourist sites for 'maintenance' (Dickinson, 2019); and mounting hostile displays against tourists, while claiming the right to 'take back' their island (Dodds & Butler, 2019). In pursuing the mantra of ecotourism, small islands may also invest in inefficient or ineffective renewable energy and sustainability initiatives so as to hold on to an illusory eco-island status, thereby ensnaring themselves in an eco-label (Grydehøj & Kelman, 2017).

There are many initiatives underway in the name of small island sustainability; but progress is slow and may shift scarce resources and policy attention from other, more pressing concerns (Baldacchino & Kelman, 2014). Working towards sustainable development can be elusive in small islands (as well as in small island and archipelagic states) because this is fraught with multi-scalar challenges. These include limited biodiversity, extensive in and/or out-migration, pressure of tourism visitations, external interventions and protocols, scarce human resources, weak management systems, inadequate data (and problems of interpretation), social divisions and tensions (often invisible to outsiders) and simultaneous quests for modernity and conservation (Connell, 2018). Moreover, small islands by definition thrive and survive by inputs (including in-migrating species) derived from beyond their shores: it comes as no surprise that Cuba, long subjected to a trade embargo, was feted by the World Wildlife Fund in 2006 as the only country on the planet anywhere close to sustainability (Guevara-Stone, 2008).

Prospects

Nearly a quarter of all sovereign states are islands, and islands have taken the lead in the development of innovative forms of governance (Felt, 2003; Stratford, 2006), environmental management, and in the development of alternative energy technologies (Hay, 2006, p. 20). Meanwhile, from Tuvalu to the Venice Lagoon, islands have become the nostalgic targets of a sadistic streak of 'dark' tourism, invaded by visitors attracted to such places while they remain accessible, and indirectly contributing to and hastening their demise with their carbon footprint (Farbotko, 2010b; Hindley & Font, 2017).

If any traces of optimism are to be found in the pages of this book, then it may be the sophisticated capture of data that steals the show. From the Hawaiian islands and the Galápagos, to Montserrat and Sulawesi, more powerful and yet more affordable technology has provided important datasets that capture the state of environmental degradation, ecosystem service disruption, loss of forest cover, increase of land dedicated to agriculture, and the penetration of non-native invasive species. One can also better overlay and integrate different classes of data to approximate the multifaceted and integrative nature of environmental change, and at various spatial scales. It is already possible to compare the state of today's islands with their condition in the distant, or not so distant, past: again, small islands can demonstrate radical landscape changes over relatively short periods of time. The expectation is that, armed with the science and the data, and the visual 'before and after' imagery that they permit, policy makers are better convinced and equipped to make the case and to implement measures that brake, or perhaps even revert, the consequences of rampant globalisation and consumerism. Islands may yet present themselves as geographies of hope, rather than of despair.

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