



REVISITING DARWIN'S VOYAGE

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The kauri (*Agathis australis*) in the Bay of Islands, New Zealand, is a tree of great antiquity whose ancestors arose around 135 million years ago (all photographs in this chapter are by the author).

Charles Darwin's voyage around the world from 1831 to 1836 on HMS *Beagle* is one of the greatest journeys of all time and arguably the most important scientific expedition ever, given how it changed our fundamental view of nature. My interest in revisiting the landfalls of this voyage was sparked by a conversation some years ago.

A professor of English literature was boasting how students in the arts are directly exposed to the words of the great genius, be it Shakespeare or Dante, whereas science students rarely read great scientists directly. Who, after all, reads Newton's impenetrable Latin tomes? I disagreed: Several notable scientists have left readable accounts of their work, and none more so than Darwin.

Reminded of the many passages in the *Voyage of the Beagle* where Darwin paints eloquent pictures of the scenes he encountered, I started to wonder how much of Darwin's world remains, almost 200 years later. What happened to the descendants of the various indigenous people that Darwin encountered? What are the changes in landscapes and biota? Despite the vast literature on Darwin, you will have difficulty finding answers to the above questions. To know for sure what has happened requires revisiting Darwin's field locations – a considerable undertaking, even today.¹

To place Darwin's voyage in context, we must start with some background. After dropping out of medicine at the University of Edinburgh, Darwin took up theology at the University of Cambridge. Nature and geology were his hobbies, and perhaps Darwin might have become another Gilbert White had it not been for a chance event in 1831.

John Henslow, a tutor at Cambridge, recommended Darwin to his colleague George Peacock as a candidate for the well-educated and scientific person that was being sought by Captain Robert FitzRoy for his upcoming voyage of HMS *Beagle*. The *Beagle* previously

surveyed South America from 1826-1830. In 1828, in the desolate Magellan Straits, the *Beagle's* dejected captain, Pringle Stokes, committed suicide and Fitzroy was promoted to command the ship. Later, FitzRoy wrote:

There may be metal in many of the Fuegian mountains, and I much regret that no person in the vessel was skilled in mineralogy, or at all acquainted with geology. I could not avoid... inwardly resolving that if I ever left England again on a similar expedition, I would endeavour to carry out a person qualified to examine the land.²

In the end, Darwin was FitzRoy's man.

In this short essay, I discuss a few themes evident at each of Darwin's landfalls: changes in peoples, alterations in flora and fauna, and relative stasis (but greater understanding) in some locales of Darwin's geology.

Peoples Along Darwin's Voyage

Darwin wrote, 'Wherever the European has trod, death seems to pursue the aboriginal'.³ By the 1830s, European colonization had reached varying extents. The Portuguese had already been in Brazil for three hundred years, whereas European settlers were comparative newcomers in the western Pacific. Meanwhile, Tierra del Fuego was still inhabited only by indigenous people, while farther north, settlers were actively exterminating Indians.

In 1833, Darwin was lucky to avoid confrontation during a 600-mile inland journey from Patagones to Buenos Aires. Like the American "wild west", Indians were fighting against settlers who were taking their land. At the time, Indians were dispersed and homeless, and Argentine forces led by General Rosas were rounding them up for extermination. Shocked, Darwin argued that at least that the women should be spared but was told, 'Why what can be done? They breed so'.⁴ Today, the flat pampas of Buenos Aires province consists of pasture or crops and small copses that repeat as far as the eye can see. Rosas' legacy is a pampas devoid of indigenous people and populated by European descendents; it is only in the less fertile land south of Rio Colorado that you will encounter indigenous faces.

Farther south still, several different tribes occupied Tierra del Fuego when Darwin visited. FitzRoy wanted to "civilize" the natives with an Anglican mission containing three Fuegians that he had picked up in the previous voyage of the *Beagle*: a young woman, Fuegia Basket, and two men, York Minster and Jemmy Button. Back in England, these three had been taught English, Christian ways. FitzRoy landed the three Fuegians at Wulaia on Navarin Island together with a missionary, Richard Matthews. But natives stole Matthews' property and made him fear for his life. An almost hysterical Matthews was taken back on board the *Beagle*, while FitzRoy's three Fuegians later returned to their native ways.



The suicide of Capt Pringle Stokes resulted in Robert Fitzroy taking command of the *Beagle* on its first voyage and the sequence of events that ultimately led to the *Beagle's* voyage with Charles Darwin. Stokes' grave, shown here, lies south of Puerto Hambre on the Straits of Magellan, Chile. The cross is a replica; the original cross is now in the Salesian Museum in Punta Arenas,

The original inhabitants of Tierra del Fuego consisted of four main groups: coastal people, the Yahgan (or Yámana) and Alakaluf, and inland-dwellers, the Selk'nam (or Onas) and Hausch. The pre-Magellan population of all the tribes was probably around ten thousand.⁵ York Minster and Fuegia Basket were Alakaluf, while Jemmy Button was Yahgan. Wulaia was Yahgan territory and today is deserted. Grassy mounds of mussel shells – middens – are all that remain of the Yaghans. It is strangely eerie to stand on the middens amongst the gnarled southern beech trees and witness a serene scene of windswept emptiness, knowing that this was once bustling with Yahgan canoes, the shouts of women, and laughter of children. The Yaghans had been in Tierra del Fuego for at least 6,000 years when Europeans brought an epidemic in 1863 that reduced their numbers from 3,000 to 2,000, killing Jemmy Button in 1864.⁶ Later epidemics, including measles, virtually exterminated the Yaghans while commercial fishing depleted their hunting grounds of seals and whales. By the beginning of the twenty-first century, just one full-blood Yahgan remained, an elderly woman living near Puerto Williams, Chile. Meanwhile, the Alakaluf had dwindled to about a dozen. Darwin's Fuegians are no more.

Brazilian Indians had essentially vanished from the coastal areas by the time Darwin arrived. Over the preceding centuries, they had either fled inland or were decimated by European disease, slavery and subjugation. Without indigenous labour, African slaves had been imported for Brazil's sugar, coffee and cotton industries in numbers that exceeded those shipped to North America.⁷ Consequently, Darwin's account of Brazil is peppered with his horror of slavery. Darwin heard the screams of tortured slaves in Pernambuco and later, in Rio, a young mullato (mixed African and European) where he was staying 'was reviled, beaten and persecuted', while the old woman opposite crushed the fingers of her slaves with screws.⁸

Today, the legacy of slavery exists in massively unequal cities such as Rio de Janeiro. On the hills above luxury beachfront apartments and hotels, sit *favelas* or slums that were founded in the late nineteenth century by ex-slaves. The people down in the wealthy neighbourhoods tend to be more European than the favela inhabitants and surveys show little upward mobility even over four generations.⁹ Darwin, at least, was hopeful that injustices for black Brazilians would eventually be undone: 'I hope the day will come when they will assert their own rights & forget to avenge their wrongs.'¹⁰

Darwin's comparisons of indigenous peoples are often jarring for the modern reader. In his age, white men were raised to believe in their cultural superiority to "savages". This is the context when Darwin writes of Tahitians as superior to Maoris, who, in turn, are more advanced than Fuegians. But Darwin firmly opposed a common view at the time that different human races were different species. In *The Descent of Man*, Darwin stressed the resemblance between 'all races in tastes, dispositions and habits'.¹¹

Wulaia, Navarin Island, where Fitzroy landed his three Fuegians.



Ultimately, Darwin's more radical step was to consider humans as just another species within the animal kingdom. On this point, it is interesting to wonder about the views of Augustus Earle, the *Beagle's* artist from 1831-1832. Earle had already been around the world, and wrote in his 1832 book (bigotedly) of Australian Aborigines as 'the last link in the great chain of existence which unites man with the monkey'.¹² Did Earle ever discuss the relationship of man to apes with Darwin? At the very least, we know that Darwin had read Earle's travelogue.¹³

Changes in Flora and Fauna at Darwin's Landfalls

Aside from the change in people, biodiversity along Darwin's voyage has much altered in response to deforestation and invasive species.

Perhaps the most extreme case is the Atlantic forest on the eastern coast of Brazil. Darwin visited a farm here, northeast of Rio de Janeiro, which was 'cut out of the almost boundless forest'.¹⁴ Excursions into the forest were Darwin's most rewarding moments where 'wonder, astonishment and sublime devotion fill and elevate the mind'.¹⁵

Now, apart from ever-smaller remnants, Brazil's Atlantic forest has largely vanished.¹⁶ What remains is home to most of Brazil's endangered species. The forest once stretched an incredible 4,000 km from the tropics to subtropics, covering an area bigger than Egypt. Today, only 7 percent remains and many forest species are like "living dead" because of the time delay between past habitat loss and extinction.¹⁷

New Zealand has also experienced massive deforestation, which Darwin believed had occurred even prior to his visit. In the Bay of Islands, in 1835, Darwin walked through plains of thick fern. He noted that:

Some of the residents think that all this extensive open country originally was covered with forests... by digging in the barest spots, lumps of the kind of resin which flows from the kauri pine are frequently found.¹⁸

In the late nineteenth century, colonialist trade accelerated deforestation of inland areas. Giant kauri conifers, which Darwin found 'remarkable for their smooth cylindrical boles, which run up to a height of sixty, and even ninety feet, with a nearly equal diameter' were soon exploited.¹⁹ Kauri helped build Sydney, where kauri floors are still found in nineteenth century houses, and San Francisco, which still has kauri beams in some waterfront warehouses. But by the end of the nineteenth century, kauri had almost vanished.

In Mauritius, Darwin's virgin forest was again largely wiped out. In the 1970s, thousands of hectares of native forest were cleared and replaced with Florida pine. Unsurprisingly, native forest was precisely the habitat favoured by endemic birds. In the 1980s, the echo parakeet almost became extinct and was only saved by captive breeding. In 1991, the pink pigeon population collapsed down to ten individuals and again was only rescued from extinction by conservationists.

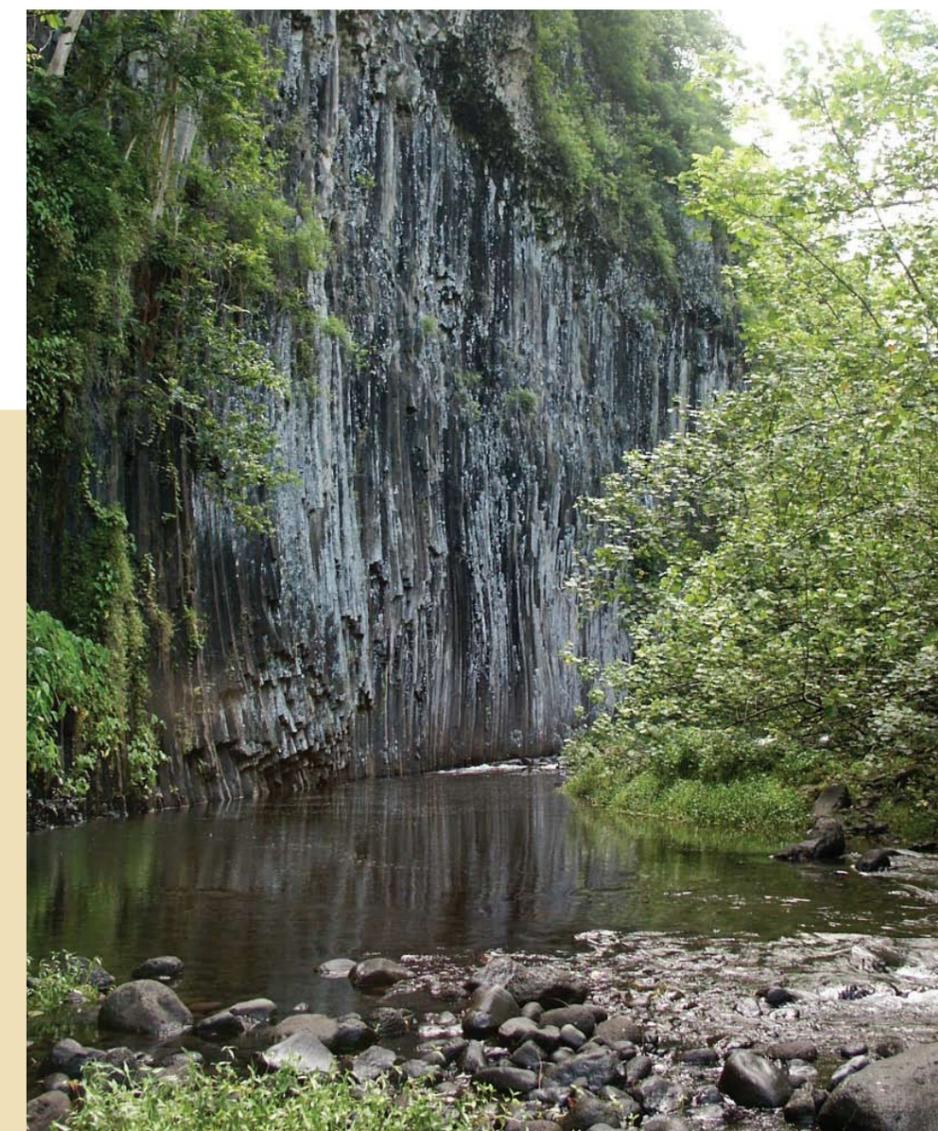


An echo parakeet (*Psittacula eques*) within the captive breeding programme of the Mauritius Wildlife Foundation. The bird was common in Darwin's time but declined to a population of about 10 known birds the 1980s. This is a female, distinguished by her grey beak, which in the males is pink.

Darwin took lunch at this location on the Tuauru river in Tahiti, on November 18, 1835. 'Shaded by a ledge of rock beneath a façade of columnar lava, we ate our dinner', Darwin wrote (in R D Keynes' *Charles Darwin's Beagle Diary*, p 370). The basaltic columns remain unchanged, but the river bank is now invaded by miconia trees.

Deforestation is not the only detrimental factor: on Darwin's islands, in particular, habitat loss has been exacerbated by invasive species. In Tahiti, along Darwin's Tuauru river, *Miconia calvescens* is currently abundant. Miconia's large leaves block sunlight and suppress the growth of surrounding plants. A native of Central and South America, miconia was unknown in Darwin's time. Now it chokes seventy percent of Tahiti's forests and at the end of the twentieth century threatened forty to fifty plant species. Fortunately, science uncovered a natural fungal enemy for miconia and, in 2000, the fungus was sprayed into the Tahitian wilderness in the hope that disease might kill the invader.

Tahiti also hosts another unusual invader: a snail. French colonists introduced a giant African snail as "escargot" in 1967. Somehow this snail made a fast getaway and began



to breed and devour crops. To chase it down, authorities introduced a carnivorous predator snail from Florida. Although it ate African snails, the predator also gorged on partulids, which are endemic tree snails. On Tahiti's neighbouring island of Moorea, at least five partulid species are now extinct, while on Tahiti itself, partulid populations are threatened.²⁰ The Partula are to French Polynesia what Darwin's finches are to the Galapagos: unique examples of speciation on nearby islands. So partulid extinction is a tragic scientific loss: partulid genomes could potentially tell us how species diverge.

Darwin's other islands all tell tales of floral and faunal invaders. Monostands of invasive Chinese guava and privet choke native plants in Mauritius, while three centuries after the Dodo went extinct, invasive animals continue to threaten Mauritian endemic fauna. Introduced rats, cats, mongooses and monkeys eat the eggs or chicks of endemic birds.

In 1837, two years after Darwin's visit, the Australian possum was introduced to New Zealand. Today, 70 million possums strip the foliage off a wide range of native plants like hooligans, competing with native animals. Meanwhile, stoats and feral cats eat birds and chicks, and unleashed dogs destroy kiwi.

We might think that the isolated Galapagos Islands would surely be in better shape, but problems from invasive species persist even there and have a long history. Fossil bones inside caves, mainly from the meals of owls, record extinctions that happened after the 1535 arrival of humans, including geckoes, land iguanas, rice rats and giant rats. People introduced pigs, goats, dogs, cats, black and Norwegian rats, and numerous plants. Land iguanas were lost from Baltra and James islands probably because of habitat loss and predation related to invasive animals. In the late 1980s, a burgeoning goat population in the Galapagos wreaked havoc by competing with tortoises and land iguanas for food. Fortunately, by 2006, goats were finally eliminated from Isabela, Santiago and Pinta islands.

Geology Revisited

While the people and biogeography have changed dramatically, one aspect of Darwin's voyage that usually remains faithful to his descriptions is the field geology. In fact, Darwin cannot be understood without recognizing that his main scientific interest during the voyage was geology.²¹ The areas of geology where Darwin's ideas have had the most lasting impact concern coral reefs and palaeontology.

Darwin's theory of coral islands 'was thought out on the west coast of South America', influenced by his deductions of sea-level change.²² But the ideas were honed from observations in the volcanic islands of Cape Verde, Galapagos and Tahiti, and finally, in 1836, the Cocos (Keeling) atoll in the eastern Indian Ocean.

Darwin's theory has three stages. First, a "fringing reef" forms around a volcanic island. Then, as the volcanic cone subsides, the deposition of coral keeps up to form a "barrier reef", separated from shore by an increasing expanse of water. Finally, once the central volcanic summit is completely submerged, only an atoll remains. Darwin published his theory on coral reefs in 1842, but it took the advent of the hydrogen bomb to prove him right.²³ In 1951, a year before a test of an American hydrogen bomb, two holes were drilled in the Enewetak Atoll test site in the Pacific. The bore went through old corals and then reached volcanic rock at depths below a kilometre. The upper limestones were of shallow water origin demonstrating the subsidence of the volcanic rock and upward growth of coral.

Darwin's Cocos atoll is a classic tropical island with white sandy beaches, leaning coconut palms with feathery fronds shaking in the breeze, and a lagoon of brilliant blue water. Alexander Hare first settled there in 1826 with an entourage of predominantly Malay workers. In 1831, Hare left, and his one-time associate, John Clunies-Ross, assumed control. Remarkably, Clunies-Ross's descendents commanded the island until it was purchased by Australia in 1978. Earlier, an Australian government memo had concluded

The interior lagoon of Cocos, the atoll that Darwin discusses at length in his theory of coral reefs.





The author (foreground) searches for fossils in the Monte Hermoso cliffs with palaeontologist Teresa Manera (background) of the University of Bahía Blanca.

that the Cocos “government” was ‘entirely in the hands of an expatriate English businessman’ and the 1970s saw a flurry of media reports about an island that time had forgotten.²⁴ Darwin had commented on the plight of the Malays in 1836, but his scientific interest was in the *Beagle*’s depth survey of the reef. Far from the outer reef, ‘the submarine slope of this coral formation is steeper than that of any volcanic cone’, Darwin remarked, showing that corals were not merely like icing on a volcanic cake (Charles Lyell’s view) but went deeper, as Darwin theorized.²⁵

The other key geological subject that profoundly influenced Darwin was palaeontology. After arguing for natural selection, Darwin’s *On the Origin of Species* makes the case for evolution starting with the fossil record, which Darwin experienced firsthand.

In 1832, at Punta Alta, Argentina, Darwin found a coastal cliff packed with fossilized bones. Darwin realized that these came from extinct creatures, including several types of giant ground sloth, which he compared with the anatomy of a living sloth. Then there was an extinct horse; a *Macrauchenia*, a sort of guanaco-like animal as big as a camel; and a *Toxodon*, an animal like a hippo. Today, we know that the fossils range in age from about 12 to 16 thousand years. East of Punta Alta, Darwin also visited bluffs at Monte Hermoso where siltstone, deposited from a slow-moving river 4-6 million years ago, sits below younger sandy sediments. Here, Darwin found fossil teeth of a capybara-like rodent.

Darwin’s cliffs at Punta Alta were destroyed to construct a naval base, Puerto Belgrano, but a local “Carlos Darwin” Museum of Natural Sciences highlights Darwin’s discoveries. In contrast, Darwin’s Monte Hermoso cliffs still exist but lie within military grounds (and should not be confused with Monte Hermoso town). Collectors have stripped the cliffs of fossils but when I visited, I ran across the jaw of a *Glyptodont*, an extinct giant armadillo. Farther east, Puehuen-Co’s beach contains tidally-eroded outcrops that Darwin missed. Here, in 1986, Argentine palaeontologist Teresa Manera discovered fossil footprints, including 90 cm long footprints of the *Megatherium*.

Concluding Remarks

By following the voyage of the *Beagle*, we see how Darwin was shaped by the adventures of youth, providing a useful counterpoint to the trademark image of Darwin as an old bearded man. Within the voyage, we see Darwin’s scientific process, as well as the seeds of his concept of evolution.

Revisiting Darwin’s voyage informs not just the science but contemporary concerns and where they originate. Darwin carefully recorded the culture of each country during the great nineteenth century transition when Europe increasingly drew its food and resources from colonies in the Americas or Pacific. By revisiting the peoples along his voyage, we can see how the structure of modern societies retains an indelible imprint of past history. Now, globalisation has supplanted colonialism. For example, China is currently powered by the mineral wealth of South America and Australia in exchange for supplying many of the world’s consumer goods; we see its demand for food reaching out and beginning to deforest the Amazon to produce soy. The Atlantic forest provides the parable that shows the result of trends that started in Darwin’s time, albeit with different mechanisms, which now threaten what remains of the natural world that Darwin so eloquently explained.

- 3 Scientists who have argued this include Simon Conway Morris in *Life's Solution* (Cambridge University Press, 2003) and Paul Davies in *The Mind of God* (Simon and Schuster, 1992).
- 4 Darwin, Charles (1985) *The Origin of Species* Penguin: Harmondsworth p 459.
- 5 Ruse, Michael (2001) *Can a Darwinian be a Christian?* Cambridge University Press: Cambridge.
- 6 Probably the best account of this topic was given by the English philosopher F R Tennant in *Philosophical Theology* (Cambridge University Press, 1930).
- 7 Weinberg, Steven (1993) *Dreams of a Final Theory* Vintage: London.
- 8 Darwin, Francis (ed) (1887) *The Life and Letters of Charles Darwin including an Autobiographical Chapter Vol III* John Murray: London p 196.
- 9 Darwin, Francis (ed) (1887) *The Life and Letters of Charles Darwin including an Autobiographical Chapter Vol I* John Murray: London p 308.
- 10 Aveling, E B (1883) *The Religious Views of Charles Darwin* Freethought Publishing Company: London p 5.

Dayton, 1925: Dover, 2005

- 1 All quotes from the trial transcript taken from the University of Missouri-Kansas City School of Law website: www.law.umkc.edu/faculty/projects/ftrials/scopes/scopes.htm
- 2 In the 1926 edition of *Civic Biology*, nearly all the references to Darwin had been removed. Today the controversy surrounding Hunter's book is that it uses evolution to justify white supremacist opinions and the implementation of a eugenics programme to prevent degeneracy. Indeed, Butler, in many ways a progressive, is thought to have objected to the teaching of evolution because of its unsavoury association with forms of Social Darwinism.
- 3 Mencken's trial account is available on the University of Missouri-Kansas City School of Law website: www.law.umkc.edu/faculty/projects/ftrials/scopes/menck.htm. Rappalaye's plan of gaining publicity for Dayton backfired as much of the coverage in the press was unflattering.
- 4 Scopes' reflections are available on the University of Missouri-Kansas City School of Law website: www.law.umkc.edu/faculty/projects/ftrials/scopes/scopesreflections.html
- 5 The trial is also similar to that of McLean vs Arkansas, 1981, when ACLU filed suit after Arkansas passed Act 590, which stated 'Public schools within this State shall give balanced treatment to creation-science and to evolution-science'. The court found in favour of McLean.
- 6 Robertson's reactions to the election are reported in Edward Humes' detailed account of the Kitzmiller v Dover trial published in 2007, *Monkey Girl: evolution, education, religion, and the battle for America's soul* HarperCollins Publishers: New York.
- 7 Ibid. pp 332-334.

Revisiting Darwin's Voyage

- 1 See Armstrong, P H (1992) *Darwin's Desolate Islands: naturalist in the Falklands, 1833-34* Picton Pub: Chippenham, England; Armstrong, P H (2004) *Darwin's Other Islands* Continuum International Publishing: London; Green, T (1999) *Saddled with Darwin: a journey through South America*, Weidenfeld & Nicolson: London; Estes, G, Grant, K T & Grant, P R (2000) 'Darwin in Galapagos: his footsteps through the archipelago' *Notes and Records of the Royal Society of London* 54, pp 343-368.

- 2 King, P P (1839) *Narrative of the surveying voyages of His Majesty's Ships Adventure and Beagle between the years 1826 and 1836, describing their examination of the southern shores of South America, and the Beagle's circumnavigation of the globe. Proceedings of the first expedition, 1826-30, under the command of Captain P Parker King, RN, FRS* Henry Colburn: London p 385.
- 3 Darwin, C R (1839) *Narrative of the surveying voyages of His Majesty's Ships Adventure and Beagle between the years 1826 and 1836, describing their examination of the southern shores of South America, and the Beagle's circumnavigation of the globe. Journal and remarks. 1832-1836.* Henry Colburn: London p 520.
- 4 Ibid. p 120.
- 5 Chapman, A (2006) *Darwin in Tierra Del Fuego* Imago Mundi: Buenos Aires.
- 6 Bridges, E L (1948) *Uttermost Part of the Earth* Hodder & Stoughton: London.
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- 9 See Soares, F & Soares, Y (2005) 'The socio-economic impact of favela-bairro: What do the data say?' in *Working Paper OVE/WP-08* Inter-American Development Bank: Washington, D C; Perlman, J E (2006) 'The metamorphosis of marginality: four generations in the favelas of Rio de Janeiro' *Annals of the American Academy of Political and Social Science* 606, pp 154-177.
- 10 Keynes, R D (ed) (2001) *Charles Darwin's Beagle Diary* Cambridge University Press: Cambridge p 80.
- 11 Darwin, C R (1871) *The Descent of Man, and Selection in Relation to Sex Vol I* John Murray: London p 232.
- 12 Earle, A (1832) *A Narrative of a Nine months' Residence in New Zealand in 1827; together with a journal of a residence in Tristan D'Acunha, an island situated between South America and the Cape of Good Hope* Longman: London.
- 13 Letter from Darwin, C R to Darwin, C S, 27 Dec 1835. See Barlow, N (1945) *Charles Darwin and the Voyage of the Beagle*. Pilot Press: London p 130.
- 14 Keynes op. cit, p 56.
- 15 Ibid. p 59.
- 16 Dean, W (1995) *With Broadax and Firebrand: the destruction of the Brazilian Atlantic Forest* University of California Press: Berkeley, CA.
- 17 Brooks, T & Balmford, A (1996) 'Atlantic forest extinctions' *Nature* 380, p 115.
- 18 Darwin (1839) op. cit. p 506.
- 19 Darwin (1845) op. cit. p 427.
- 20 Coote, T, Loeve, E, Meyer, J-Y & Clarke, D (1999) 'Extant populations of endemic partulids on Tahiti, French Polynesia' *Oryx* 33, pp 215-222.
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Visit the extensive website entitled The Complete Works of Charles Darwin Online (darwin-online.org.uk/) for a more detailed bibliography. Darwin material is also available on the website of the Darwin Correspondence Project (www.darwinproject.ac.uk/).