

## A NATURAL SELECTION

Review of:

Thomas Belt 1874. *The Naturalist in Nicaragua*. London: John Murray 403 pp.  
Second edition reprinted 1985 by the Univ. of Chicago Press. Available online  
from Project Gutenberg or at

<http://www.biodiversity.org/bibliography/1390#/summary> .

[Thirty-fourth in a series on "naturalist-in" books.]

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The English mining engineer Thomas Belt (1832-1878) traveled extensively for work, ending his short life in Colorado. In 1868 he went to Nicaragua to supervise operations of the Chontales Gold-Mining Company and stayed for four years. The mines in that period were just at the point between profit and loss, so that superintending them was a worrisome business.

Belt had a thorough grounding as an amateur naturalist, which he put to good use in the course of traveling about Nicaragua -- mostly on mules and boats -- on mining business. Approximately the second half of the book is taken up with two long overland journeys, one to the northern border area and the other to the Atlantic-coast area. He collected many birds, butterflies and beetles, especially long-horned beetles (Cerambycidae). The specimens went to specialists in Europe, who used them to significantly advance knowledge of the Nicaraguan fauna.

The 21 chapters are supplemented with 28 illustrations, including a map of Nicaragua. The chronological narrative serves as a framework for his observations, in the emerging pattern of naturalist-in books. It starts with his arrival at the port of Greytown on the Atlantic side. Greytown was established as a British trading post and had formerly been an important port, but shifting currents in the delta in recent years had caused the harbour to silt up a great deal, and Belt thought it would probably slip into insignificance. He was right, probably more than he imagined, as it is today an overgrown ghost town, its last residents relocated in 1984.

The party took several days to travel upriver to Lake Nicaragua, at 8264 km<sup>2</sup> the largest lake in Central America, yet remarkably shallow. It is home to bull sharks, *Carcharhinus leucas*, individuals of which move between the lake and the Caribbean Sea along the river. There is also much attention to "alligators" (possibly a conflation of the spectacled caiman and American crocodile) in the river and lake. From there, they rode inland to Santo Domingo, headquarters of the mining company.

Belt published several research papers in geology, but as far as I know *The Naturalist in Nicaragua* comprises all of his published original biological observations. In his introduction to 1985 reprint, Daniel H. Janzen refers to Belt's "disciplined and eager inquisitiveness" and says of his book that "On nearly every page ..., Belt gives us a superbly drawn description of an animal or plant, and what it is doing, and then he tells us that all this suggests to him and why." Stated another way, he combined the key components of an outstanding naturalist: extensive knowledge, an attention to detail, and a coherent

theoretical outlook. The book's subtitle indicates that his observations were "in reference to the theory of evolution". To today's naturalists it is second nature to interpret in the light of natural selection, but in Belt's time it was still a rarified attitude.

We can illustrate his virtuosity by reference to three social insects.

Belt kept a garden with fruit trees and other crops. The greatest pest, he found, was the leafcutter ant (bachac) *Atta* prob. *colombica*. Members of this genus are a prominent feature of lowland neotropics, where they strip vegetation from many kinds of plants, sometimes destroying entire citrus plantations in short order. Belt "had to wage a continual warfare against them." He tried with little success to destroy their colonies by various means, including brute-force excavation. This led to a description of the nest mound, the many tunnels into it, and the many round chambers connected by tunnels, maintained by constant digging, an enterprise must have impressed a mining engineer.

The magnitude of their leaf cutting and transportation was also striking. "The ceaseless, toiling hosts impress one with their power, and one asks -- What forests can stand before such invaders? How is it that vegetation is not eaten off the face of the earth?" he asked. The answer, he supposed lay in the chemical defenses and immense recuperative power of tropical vegetation.

Although *Atta* had already attracted much comment at that time, it was not plain what could be the use(s) of the leaf fragments. Some naturalists supposed that they served directly as food and/or to thatch the ceilings of the nest chambers, while Belt proposed that they were compost "on which grows a ... fungus, on which they feed." The ants, then, are mushroom gardeners.

He recognized that an extraordinary hypothesis requires extraordinary evidence. Despite a constant flow of leaf fragments into the nest, he never found any substantial quantity of them inside and concluded that they must be used up on arrival. The chambers were about 3/4 full of a loose, spongy, light-brown mass, which on closer examination were seen to be minute pieces of leaves, withered and brown and overgrown with a minute white fungus. There were larvae and pupae among these masses, and he found chambers with exhausted leaf refuse without workers or brood. During that same year, Fritz Müller independently arrived at the same conclusion in Brazil.

Raids of *Eciton* spp. were similarly impressive. Belt describes how these army ants climb plants and push everything that cannot fly off to nestmates below. Some spiders escape by hanging down on draglines. The raiding columns are accompanied by ant thrushes, which feed on bugs flushed by the ants.

Army ants and some others make no use of vision and much use of scent in holding the colony together and coördinating its activities. Belt performed the same simple field experiment that many have done before and after with column-foraging ants. He scraped away part of ground along the route of a column, leading to agitated confusion at the site of the breach.

Belt showed his speculative tendency in regarding *Eciton* as the most intelligent of Central-American ants and ahead of social wasps and social bees. He cited examples of army-ant behaviour that seemed hard to explain as innate and became just a bit rhapsodic about their social intelligence. One could cite

numerous other examples of his bold curiosity, such as thoughts on why forest trees are so much more diverse in the tropics than in English forests and on the relative range sizes of land versus freshwater species of the same taxon.

The bull's-horn acacia, *Acacia cornigera*, has conspicuously swollen hollow thorns what are inhabited by *Pseudomyrmex ferruginea*. This pugnacious ant responds vigorously to any intrusion on its plants and so safeguards them from both large herbivores and leafcutter ants. At the leaf bases are extrafloral nectaries and little yellow fruit-like bodies. Belt noted that when the latter ripen, ants carry them into the nest, presumably as food.

There is much comment on "honey-secreting glands" in these and other plants" -- which he noted were especially found on young leaves and sepals -- and the protection furnished by ants attracted to the nectar. His conclusion -- that these plant devices serve to attract and keep pugnacious ants, which defend the acacia -- makes very good sense in the light of natural selection and was experimentally corroborated almost a century later.

He also makes a case that some other plants, including *Cecropia* and *Melastoma*, gain a similar advantage by providing ants with dwelling places and that yet others, including *Passiflora* spp., provide only extra-floral nectaries.

Belt's ingenuity is shown by a further twist in this topic. He noted that the extra-floral nectaries of *Passiflora* were sometimes neglected by the ants. Finding honeydew-producing scale insects on the stems, he watched ants stroking them and drinking the exuded droplets and deduced that the ants' attention had been largely transferred to the insects. The plants and scale insects, he concluded, were in competition for the ants' protective services.

There was ample opportunity to observe the 13 species of hummingbirds found around Santo Domingo. In one interlude, he watched two male white-necked jacobin, *Florisuga mellivora*, competing for a female. They displayed ostentatiously, ending in a physical fight, and Belt asked whether the issue was settled by the female accepting the better displayer or the better fighter. Without saying so explicitly, he was referring to Darwin's (1871) very recent distinction between the two basic forms of sexual selection.

Travel in Central America at that time was not nearly the rough business experienced by Bates in the Amazon or Wallace in Southeast Asia, but it had its hardships. Perhaps the worst of these -- the one that comes up over and over -- was mosquitoes. One mosquito-infested night, a Jamaican companion addressed a philosophical question to him:

"Mr. Belt, sir, can you tell me what is the use of mosquitoes?"

'To enjoy themselves and be happy, Jacob.'

'Ah, sir! If I were only a mosquito!' said Jacob, as he can down with another fruitless whack."

There was very little commercial accommodation in Nicaragua, but travelers could count on customary local accommodation at ordinary households. Local hospitality was so much the custom of the peasantry that on long overland journeys Belt's party could start out each day with no certain knowledge of where they would be at nightfall, much less advance arrangements.

Belt was markedly sympathetic to the mostly Amerindian peasantry, but with

little admiration. He draws a strong contrast between what was known of them before the Spanish conquest and their present condition, which he regarded as much degraded. "In destroying the ancient monarchies of Mexico and Central America, the Spaniards inflicted an irreparable injury on the Indian race."

Assuring us that "I shall not harrow the feelings of my readers with the mass of treachery, avarice, blasphemy, and horrible cruelties with which the conquerors rewarded the noble people who entertained them so courteously", he characterized the conquest as "one of the darkest pages in modern history".

He likewise deplored the condition of peasant women as hard labourers and suggested that there had been much greater equality of the sexes before the conquest.

The problem with both Amerindians and the descendants of Spanish settlers, he thought, was a lack of ambition due to the ease of gaining a subsistence living, so that "the bands of indolence have wound round them generation after generation, and now they are so bound up in the drowsy folds of slothfulness that they cannot break their silken fetters." His flabbergasting upshot was that no progress could be expected until Mexico joined the USA, followed by rest of South America, giving rise to a flood of vigorous new immigrants from the north, who would transform the region ... well, I think you get the point. It illustrates how smart people of good from one age can reach conclusions that in another age seem quite incredible.

Travel about Nicaragua was quite safe except during occasional periods of insurrection. One such outbreak kept Nicaragua occupied for four months during Belt's stay. Most of the able-bodied men were pressed into one army or another, giving rise to a great deal of activity, but very little actual battle. One town with which Belt was familiar changed hands a number of times with hardly any casualties. So, how were issues settled? "The usual course was for the two armies to manoeuvre about until one thought it was weaker than the other, when it immediately took to flight." Although he makes no comment on the ritualized intraspecific combats of animals, the parallel is clear.

And what does the winning faction gain? Rule over the country. In Belt's view, elections in Central-American republics were always fraudulent, so that an unpopular government could not be recalled except through force of arms. It would have been undiplomatic for an Englishman to cite the American *Declaration of Independence* in this respect, but I expect he had read it and approved.

#### Reference

Darwin, C. 1871. *The Descent of Man and Selection in Relation to Sex*. Vol. 1-2. London: John Murray.

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