Supporting Information

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SI Text

***Cocos nucifera*: History and Current Status at Palmyra.** *Cocos nucifera* likely originated in Southeast Asia; it is now found in high abundance in the tropics and subtropics worldwide. Its radiation occurred both via natural water dispersal within the region and via anthropogenic dispersal to more disparate parts of the globe (1). The utility of *C. nucifera* for humans as a source of food and materials made it a key component in the horticultural repertoire of many cultures, particularly in the Pacific, and humans carried nuts of *C. nucifera* with them as they dispersed across the Pacific (2). More recently, humans have actively established and encouraged the expansion of *C. nucifera* plantations for subsistence and commercial enterprise (3). The result is that near monodominant stands of *C. nucifera* now are commonplace in many tropical islands and coastal forests. The large amount of time that has elapsed from human dispersal of this plant makes it difficult to determine the means and precise date of arrival of *C. nucifera* at any individual site. However, genetic, morphological, and palynological analyses suggest that the palm is likely not native in many parts of the Pacific, including the Americas (1, 2, 4).

It is not known definitively how and when *C. nucifera* was first introduced in the Line Islands archipelago where Palmyra is situated, as there are no pollen cores for the region that have sampled sediments that predate Polynesian arrival (1). The closest known palynological evidence dating before Polynesian settlement, from cores in Hawaii, suggest an anthropogenic origin of *C. nucifera* (5, 6). Regardless of original means of arrival, historical vegetation surveys, and photo documentation at Palmyra demonstrate that the coconut palm has significantly increased in abundance and expanded its range on this atoll in the last 150 years, particularly after military occupation (7–9). Modern expansion of the coconut palm has been greatly aided in the Line Islands in colonial and postcolonial eras by the regionally active commercial coconut plantation operations. Palmyra was operated principally as a commercial coconut plantation for multiple years in the late 1970s. The source of current variation in *C. nucifera* abundance is unclear, but is likely to be the result of a combination of chance, original location of *C. nucifera* establishment and subsequent plantings, and incomplete spread of the palm, as preliminary data suggest the palm is likely still encroaching on native forests.

Guano Inputs at Palmyra. We estimated rates of guano production per bird by multiplying the frequency of defecation (from 19 h of direct observation) by the average dry weight of defecation samples collected on plastic sheets placed underneath nests or roosting birds ($n = 120$) (10). All samples were collected from beneath red-footed booby colonies, as these constituted the majority of avian biomass on the atoll. For calculating defecation quantities for other species, we assume guano produced scaled allometrically with body size of species (10, 11). We then used average bird density (biomass birds per square meter) per forest type (Fig. 1*B*) to calculate total inputs. To estimate nutrient content, guano samples collected from these sheets were Kjeldahl-digested and then analyzed for %N and %P on a continuous flow autoanalyzer (Alpkem Flow Solution IV).

We found birds defecated approximately every 36 min, each dropping weighing 0.66 g (mean dry weight; SE = 0.04, $n = 67$). The average rate of guano deposition can thus be estimated to be between 127 and 190 kg ha^{-1} y^{-1} (dry weight) in *Cocos* forests and between 1,454 and 3,630 kg ha^{-1} y^{-1} in PT forests. Fresh guano had an average of 18.1% N content (SE = 0.4%, $n = 16$), and 2.9% P content (SE = 0.1%, $n = 16$). Based on these calculations, we estimate that *Cocos* forests receive between 23 and 34 kg of N ha^{-1} y^{-1} and 4 to 6 kg of P ha^{-1} y^{-1}, while PT forests receive between 261 and 653 kg of N ha^{-1} y^{-1} and 42 to 105 kg of P ha^{-1} y^{-1} from guano. Inputs of bird/chick carcasses, feathers, and regurgitate are no doubt also reduced in *Cocos* forests.

Without historical records of bird abundance, it is impossible to know if *Cocos* proliferation is causing a net loss of birds and their nutrients to the atoll, or concentrating the birds in remaining native forests, accentuating nutrient differences by actually elevating subsidies in PT forests.

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