

The implications of the sweet potato's re-appraisal

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The Sweet Potato in Oceania: A Reappraisal (Ballard, et al., 2005) is a book that might not achieve the readership it deserves, even for Rapanuiphiles. Due to its esoteric subject – and due to the fact that, at least at present, it is unavailable in bookstores or via Amazon.com. Acquisition, therefore, requires determination. But the implications contained in this book, especially Chapter 8 (“Sweet Potato Production on Rapa Nui” by Wallin, Stevenson, and Lade-foged) and, to a lesser extent, in Chapter 5 (Green), are potentially staggering. They provide, even in the absence of definitive evidence, a cogent explanation of not only the role of the sweet potato (*Ipomoea batatas*) in Oceania and on Easter Island but the likelihood of subsequent contact or colonization on Easter Island, which is something that I would think, however much it's been bandied about casually, would surprise or entice most Rapanuiphiles and researchers. Not the *idea*, mind you, because that's been around for a while, but the fact that hard evidence to support this conclusion seems to be very nearly in hand. After all, as Stevenson and Haoa (1999) said, “...to date researchers have not been able to muster a large body of evidence that demonstrates repetitive and continuous contact between Rapa Nui and locations to the west”. With *The Sweet Potato in Oceania* perhaps we're on the cusp of doing just that.

To ensure that Rapanuiphiles have a chance to grasp the full meaning of the concept in the event they find it difficult to obtain *The Sweet Potato in Oceania*, I've prepared the following summary based both on the book itself and on other texts, some of which support the book's conclusions, some of which don't, but all of which contribute to what might be the beginning of a revolution in thinking about Rapa Nui history. I realize some of this will be intimately, perhaps even tediously, familiar and I hope that the reader appreciates the attempt to present a more detailed account

of the fascinating discussion in this book, especially to those less initiated into the arcane importance of the sweet potato or who can't lay their hands on this possibly groundbreaking work.

Here's how it plays out...

1) Eastern Polynesians arrive on Easter Island c. 800 CE (give or take a century or two; Skjølsvold 1994).¹

2) The colonizers plant yams (*Dioscorea alata* L.) first — a conclusion drawn from analysis of stratification and oral histories, among other things; e.g., Thomson (1891), Routledge (1919); Métraux (1940), Zizka (1991), Flenley (1993), Stevenson (personal communication, 2007), Wozniak (personal communication, 2007), though some legends mention that the sweet potato came with the initial colonizers (Métraux, 1940; Zizka 1991, in particular referring to Hotu Matu'a but also reports from Roggeveen about the yam). This is why one should always be cautious in relying on legends when forming hypotheses.²

3) Though there is no mention of any general contact with other islands, reciprocal or not, there is at least one legend, according to Métraux (1940), of a man named Koteke “who was the guardian of the plants and seeds” but who had forgotten the sandalwood and was obliged to go back to their homeland to retrieve it. There's no mention of him returning, or how long the voyage took, or what else if anything he returned with if he showed up again, but sandalwood (*Santalum* sp.³) does have a history on Easter Island (Wozniak 2005). There's also another legend that tells how Hotu Matu'a sent men back to their homeland to retrieve a *moai* and they bungled the job by breaking the head off! So the idea of departures *from* Easter Island after initial

¹ Since the jury is still out on new, controversial theories about later colonization, rats and climate having more to do with deforestation than humans, and Europeans being largely responsible for most of the Easter Islanders' ills, I think it's safe to withhold judgment on Hunt and Lipo (2006) and Hunt (2006 and 2007) at least for the time being, although Stevenson, who has expressed his own doubt about the new settlement timeline hypothesis (personal communication, 2007), does make the interesting point that adopting the Hunt and Lipo hypothesis reduces the need for explanations for why the sweet potato appears to have shown up later.

² Thomson (1891) refers to the legend of the origin of the islanders and mentions that he was told they first landed on Motu Nui before heading to 'Anakena. Now, seriously, why would they stop at a tiny islet onto which it is difficult and dangerous to land when within a mile's reach, Easter Island beckons peacefully? The legend doesn't say but it does make one wonder about the plausibility of the story. Another island legend refers to the soul of a man named Hau Maka visiting the island on a scouting expedition of sorts, then returning to Hotu Matu'a to inform him that he had found a good place for his party to go. Yet Thomson says Hotu Matu'a was the discoverer of the islands, while Métraux (1940), ironically citing Thomson, says Hotu Matu'a “arrived two months after the first explorers”. And these first explorers, *sans* Hotu Matu'a, would be, according to another legend [Englert 2002], seven (or six) youths who went to the island to reconnoiter. While it's not clear who was first or what they brought, at the very least there is consistency in the idea that yams were brought by the colonizers and were amongst the first crops planted on the island. And what about Thomson's report that “the native traditions agree in the statement that the discoverers of the island found it destitute of trees and all vegetation except grasses and a creeping vine...”? If nothing else, this reveals how the then-contemporary Easter Islanders had incorporated their current state (the treeless island of the 19th century) with legends of the past. With so many inconsistencies, to rely on oral history at all seems only remotely useful.

³ “But [it was] not found on Rapa Nui during [the] historic period” (Wozniak 2005).

colonization at least appears in oral histories even if we have no other evidence of this.

4) Somewhere between 200 and 400 years later, sweet potatoes show up on Easter Island (Wallin et al. 2005) which we know from both stratigraphy and radiocarbon dating, the latter being the means by which Hather and Kirch (1991) first introduced knowledge of the sweet potato in Polynesia – in Mangaia. All this, of course, indicates that the sweet potato, an undeniably South American plant, made its way into Polynesia – and, with its appearance on Easter Island, this further indicates that the sweet potato spread across the Pacific (and not, as some would believe, by humans from South America directly to Easter Island – a notion lacking evidence).

5) But was it possible the sweet potato was planted on Easter Island from the beginning and simply didn't appear in its agricultural history until much later? When asked about this, Stevenson (personal communication, 2007) said that the evidence presented in Chapter 8 wasn't so much proof that the sweet potato wasn't being cultivated or consumed — only that evidence to explain this simply hadn't been found or that the evidence for it based on dating “tended to be late” in Easter Island history. Wallin et al. (2005) also states that “long-term emphasis on settlement survey and the excavation of *ahu* has resulted in the recovery of few archaeological specimens of sweet potato tubers” and “of the specimens that have been recovered, no dates have been determined directly from charred tubers”. This doesn't tell us about when the sweet potato arrived, only possibly when it was being cultivated. Stevenson goes on to observe that, to his knowledge, no one has looked for sweet potato pollen in this context. This would seem to be substantiated by Haberle and Atkin (2005) who note that, “Despite the dominance of sweet potato ... in many agricultural systems throughout the Pacific, there is no direct evidence for this root crop in the fossil pollen record. This has frustrated attempts to construct detailed chronologies of first appearance and rates of dispersal of sweet potato across the region”. However, recent research by Horrocks and Wozniak (in press) indicates that “Cultivation of sweet potato appears equally extensive” at her study site on Easter Island ... “although its apparent absence from the sample below the macroscopic charcoal horizon ... suggests that it was grown later than yam at that site”. How much later is uncertain (Wozniak, personal communication, 2007). Moreover, Cummings (1996) reported “a few fragments of a large ... pollen grain that, while not identifiable, could possibly be identified as a very deteriorated *Ipomoea batatas* (sweet potato)”. Nevertheless, we're still left with fragments of hypotheses about when the sweet potato was on Easter Island.

Why would this be? There is some mention by Langdon (1995) that the sweet potato “...seems never to have been of much importance for the Polynesians of the Mar-

quesas Islands ... because they preferred their own foods or because conditions did not favor its growth”, so maybe this has something to do with it. On the other hand, Flenley (1993) says there had been time for the sweet potato to be introduced in the Marquesas and then to be discarded and used only as a starvation food. Métraux also refers to it as a “famine” food. But where was it? Was it being cultivated in such small amounts or in such small areas on Easter Island that we haven't found earlier evidence of it yet? It's not like the sweet potato can be stored. Or can it? Bourke (2005) notes that “there is flexibility in the period of tuber harvest [of the sweet potato] in that tubers can be stored on the plant (underground) and harvested as needed”, though the length of time available for this is not stated. And Yen (1974) talks about the longevity of sweet potato *seed* being unknown but tests of 5-year-old seed in a plant-breeding program showed germination. Thomson (1891) mentions that after the initial arrival on Easter Island, “All the plants landed from the canoes were appropriated for seed, and the people immediately began the cultivation of the ground”. Unfortunately, he doesn't say what kind of seed, though he does give us a time-line thereafter: The first Rapanui subsisted for three months on fish, turtle, and the “nuts of a creeping-plant found growing along the ground”. Then, following a “lapse” of a “number of unrecorded years, during which the island had been made to produce an abundance of food, and the people had increased and multiplied in numbers”.

6) If the sweet potato wasn't on Easter Island from the beginning, it had to appear later, but *how*? Green (2005) tells us we can reliably stand by Yen when the latter says “the role of birds in carrying the *kumara* from South America to Polynesia cannot be proposed seriously at this stage”, nor has Yen's position changed on this. Nevertheless, there are only a few options to consider when it comes to how the sweet potato got to Easter Island: a) by humans; b) by birds; or c) by seeds on driftwood.

The human method is the most likely but presents problems, or at least challenges us to re-think the timeline and our understanding of Easter Island prehistory relative to contact with other islands. It's not a question of the sweet potato's origin but how it got to Easter Island. As Ballard (2005) points out, “The hypothesis of an American origin for the sweet potato had been advanced as early as 1886 by de Candolle ... and consensus on the matter had been reached long before [Yen in] 1974 although, as recently as the 1950s, the botanist Elmer Drew Merrill ... was still speculating mischievously on the possibility of an ultimate origin in Africa”. It has been reiterated by Wallin (1999) in examining some earlier conclusions of Hather and Kirch (1991) about finds of prehistoric sweet potatoes in Mangaia *vis-a-vis* the “presence of *Ipomoea batatas* in central east Polynesia around A.D. 1000” as well as “issues of cultural contact between the coast of South America and the Polynesian islands”. So Hather and Kirch, and I dare say probably the rest of us, rightly conclude “the most likely transferors

would have been the seafaring Polynesians, on a voyage of exploration to South America and return". But in the next sequence they add: "This opinion cannot be unequivocally determined on present archaeological evidence".

But, at any rate, the distribution method by birds requires an extraordinary set of circumstances to bring about. The bird would have to eat the sweet potato capsule⁴ or eat an animal that had eaten a sweet potato capsule or the seeds themselves, or would have had to carry the seeds in their feathers or feet (Bulmer 1966). First we have to deal with the problems of birds transporting seeds. Even with Yen's clearly reliable declarations, there has been much discussion about the role of birds in plant dispersal. As Carlquist (1967) observed, Easter Island has or at least had nearly a quarter of its birds arriving with mud on their feet. "This would seem quite unlikely for a low dry island", he says,

...unless one remembers that there is a sizable crater lake with muddy margins on Easter. The large percentage of barbed or hairy seeds likely to have been brought in feathers seems related to the dry conditions — especially grasslands. Easter also has a rather high proportion of drift flora species. This would be expected for a relatively low, remote island. The low proportion of fruits attractive to seed-eating birds betokens the dry ecology of the island. The low number of air-dispersed seeds may be attributed primarily to remoteness, secondarily to dryness.

Going back to Yen, we can't escape what he describes as "the lack of evidence of migration of land birds across the tropical Pacific from South America" and this is relevant because the land birds are more likely than sea birds to consume the sweet potato capsules or seeds or animals that have eaten either. And if the sea birds, which *are* capable of traversing the great distances from, say, Chile to Easter Island, are less likely to consume the sweet potato capsule or seeds or animals that have eaten either, it renders the point moot.

When it comes to the seeds, these transport methods aren't unheard of but their distribution onto Easter Island presents a different set of problems. They are so tough that commercial exploitation of sweet potato seeds requires sulphuric acid (which is why having them pass through the digestive tract of a bird would be more convenient than having the seeds carried in feathers or in muddy feet and dropped onto fields). However, owing again to the seeds' impermeability, it would not be enough for them to simply fall onto the ground and sprout. They would have to be cultivated and there isn't much evidence that ancient Easter Islanders dealt with the sweet potato by way of seeds (Yen 1974).

⁴ According to Bulmer (1966), the sweet potato itself is really a capsule containing one to four seeds. When the seeds are ripe, the capsule is useless as a source of nutriment, so the capsule would have to be swallowed whole for the sake of the seeds they contain or the seeds would have to be picked out or dropped seeds would have to be picked up on the ground. Ripe seeds are black, about 3 mm (0.12 in.) in size, and weigh up to 15 mg (1.5 grains).

The driftwood method is the least likely of all, as it would entail not only the same limitations due to impermeability of the seeds but the arrival of the seeds in coastal areas would put them at a competitive disadvantage relative to other plants that have exploited those regions, to say nothing of the fact that one would expect it to be necessary for a more than a small handful of seeds to arrive for propagation to be possible and how or why a piece of driftwood could pick up seeds like this is hard to explain. The seeds do not float, so drifting on their own is out of the question.

But accepting even for a moment that the seeds reached the island through either birds or adrift on a piece of wood, it might have taken a while for their propagation to become part of the agricultural cycle on the island. Whether it would have taken several hundred years is another question, though owing to the uncooperative nature of sweet potato seeds and the failure to achieve reliable dates, almost anything is possible. Bulmer (1966) notes that the peoples of the Pacific are "observant botanists and gardeners who might quite plausibly be expected to take advantage of a new plant with potentially edible leaves or tubers should it appear in or near their cultivations".

7) If the sweet potato were planted from the beginning and we just haven't been able to prove it, we can at least interpret its late usage as a sign of either a sea change in agricultural practices, the discovery of a new, edible plant (the Easter Island sweet potato is considered by many to be amongst the most delicious varieties), or the sudden need for large amounts of food — due to population demands (hence Métraux's "famine food" reference) or, since the arrival of the sweet potato in the agricultural record also coincides with the height of the *moai*- and *ahu*-building stages on the island (as currently believed; Wallin, et al., 2005), the Easter Islanders found a food that could provide them with the energy to carry out their Herculean stonework. In 1998 Green reported that, "...while the Easter Island sequence does not require the presence of the sweet potato in its crop regime at the time of established settlement, it does seem to require it to be present some centuries after that event, and well before 1200 A.D." And Green (2005) hasn't changed his mind in the intervening seven years, as he notes that the period around 1100 CE is the one that Yen (1974) originally nominated for a necessary appearance of the sweet potato in the Rapa Nui sequence to support the burst of monumental constructions.

Mieth and Bork (2004) add a unique twist when they observe the "coincidence in time itself between the end of woodland clearing, the origin of extremely labor-intensive horticultural stone practices and the final phase of *moai* production at the turn of the 15th to the 16th century", suggesting a "causal relationship between ecosystem, land

management and cultural change or even disruption” (more on that below).

A remaining question is why the islanders wouldn't have cultivated the plant earlier if it were tasty, easy to grow, and highly nutritious – unless it wasn't on the island at that time. Or maybe they didn't know about its advantages, which is hard to believe. The sweet potato has many advantages over the older crops of taro and yam: It can be grown under a wider range of temperature, rainfall, and soil conditions and at altitudes 500 meters (1,640 feet) higher than taro and 800 meters (2,625 feet) higher than yam; yields are higher than for taro even with high soil fertility; and it produces an acceptable yield with intensified land use if the crop period is extended and the fallow period is shortened in response to population increase (which relates well to continuing discussions about over-population and resource-depletion leading to collapse on the island). Also, in comparison to the yam, the sweet potato can be planted at any time of the year (the yam must be planted seasonally) and by way of the vine instead of having to use the yam's tuber (Leach, 2005).

8) So that takes us back to the likely explanation – humans introduced the sweet potato, it took root, and gave rise to or at least augmented the great stone culture for which Easter Island is famous. Why we have had no definitive evidence of any other contact with other islands or why even island legends lack abundant references to reciprocal voyages is difficult to explain. If anything, what we have to work with tends to lead us in the opposite direction: Extreme isolation may have demoralized the islanders (there's a legend reported by Englert [2002] about a belief that islands from the homeland had all sunk). Perhaps deforestation eventually kept them from being able to leave because they couldn't build vessels capable of long sea voyages anymore⁵. But that doesn't mean others didn't visit Easter Island and, along the way, dropped off the sweet potato and said, “give it a try”. This would have happened so much later in the island's time frame that it might simply have escaped mention in any of the oral histories, or at least those that survived the slave raids of the 19th century.

Put as simply as possible, then, if humans brought the sweet potato, and it wasn't planted on the island from the beginning, it means further contact or colonization had to occur. *Period*. The implications for this are staggering in so far as it raises all sorts of questions about the Easter Islanders' ability to travel away from the island; did they just receive visitors (and, if so, who and from where?) or did any Rapanui leave with visitors to Polynesian places elsewhere?

And none of this has even begun to touch on the implications of the role of the sweet potato in Easter Island's whole cultural, political, and religious power structures. As Stevenson and Haoa (1999) noted, if the radiocarbon dating of the sweet potato introduction to the Marquesas, Society

Islands, and Cook Islands area is accurate, it strongly suggests “periodic interaction with external voyagers resulted in the introduction” of the sweet potato and as a result, dry-land farming of tuber crops became the staple commodity of the island population. It was this environmental context that constrained the strategic options for chiefly political control.

Stevenson and Haoa (1999) conclude that this course of events, including the “decline in chiefly rights to land ownership, warfare, and difficulties with resource utilization”, is similar to events on the islands of Mangaia and the Marquesas, where “conditions of high population density in an over-intensified and degraded environment led to a pattern of extreme competition” (Friedman 1982). Why shouldn't we expect this same possibility for Easter Island? And chiefly rights to land ownership, warfare, and difficulties with resource utilization are hardly unfamiliar in the repertoire of Easter Island studies. As Neil Asher Silberman wrote in *Archaeology*, Easter Island's fallen idols are not unique; examples date to the 14th century BCE (and no doubt before); and each case marked the beginning of a process “by which the way was violently cleared for new economic systems, political ideologies, and religious beliefs”. More importantly, if these speculations turn out to be true, we may have a new kind of Easter Island to study and find ourselves one step closer to having more answers rather than questions.

ADDENDUM

Since the completion of this paper, new research has come to light on the subject of distribution of the sweet potato and it seems appropriate to mention it, even though it doesn't necessarily significantly change the scenarios envisioned or discussed above.

The first is a work in press by Horrocks and Wozniak, due out this year in the *Journal of Archaeological Science* – “Plant Microfossil Analysis Reveals Disturbed Forest and a Mixed-crop, Dryland Production System at Te Niu, Easter Island”. Therein the authors evaluate the presence of pollen of yam, sweet potato, and taro, with their main excavation site being Te Niu on the northwest coast of the island). They report that, in 1998, pollen of the sweet potato was identified through analysis by Cummings and that, for the first 500 years of occupation, cultivation was carried out within 0.62 to 1.25 miles (1 to 2 kilometers) of the coast. After 1500, however, much of the remaining forest was replaced by gardens.

Research at Te Niu revealed “larger starch grains, up to 25 μ m in diameter, ovate to sub-triangular, often bell-shaped, with a vacuole (often fissured) at the central hilum, and one domed surface and several flattened pressure facets, present as individual or densely packed (several dozen grains) in ovate cell membranes, consistent with root of the

⁵ We know from the examination of midden sites that fishing practices changed over time from deep sea to more coastal areas, suggesting the Easter Islanders gradually stopped venturing deeper into the ocean, although why is not certain (Flenley and Bahn, 2003; Skjølsvold 1994)

sweet potato." Horrocks and Wozniak acknowledge that lack of pollen of yam, sweet potato, and taro in their samples is not unexpected. "The common yam (*Dioscorea alata*) has small indistinct pollen grains that appear delicate and crumpled, and if preserved could be difficult to identify unequivocally unless present in abundance". By contrast, taro pollen grains are larger, distinctive, and although occasionally identified in sediment cores, this species rarely flowers in Polynesia – and while the sweet potato also has large and distinctive pollen grains, it is rarely found in archaeological deposits, so identifications of this pollen type are uncommon.

Although Horrocks and Wozniak acknowledge that, while the current stage of the extent of differential starch preservation among species is unknown, the very high percentage of yam starch suggests that this was the most intensively cultivated starch crop in the Te Niu area and reinforces the idea that the yam was among the premier cultivations the island.

The second new research is a pre-print by Álvaro Montenegro, *et al.*, to appear also this year in the *Journal of Archaeological Science* – "Modelling the Prehistoric Arrival of the Sweet Potato in Polynesia" – in which the authors discuss the possibility of the sweet potato's arrival via drift journeys. While, as mentioned previously, the seeds of the sweet potato don't float, the capsules are buoyant. Although Purseglove (1965) proposed that the sweet potato may have been introduced into Polynesia by capsules that drifted across the Pacific, the authors of this report also note that Sauer (1993) argued that it is not likely that seed capsules could survive for long in the surf zone along a beach. The seeds could become established in a tidal estuary or could have been collected by islanders, but the authors also acknowledge that they could find no information on how long capsules can remain in salt or fresh water before affecting seed viability and therefore cannot estimate how long they could stay afloat and survive. Unless, of course, the sweet potato seeds, seed pods, or tubers could have rafted to Polynesia on mats of floating debris.

And that's just what Montenegro *et al.* tested in their modeling. In their simulation, sweet potato seed pods that started off along the South American coast were predicted to reasonably hit different island groups, with the best chance of landing on the Marquesas. As co-author Montenegro says, "Among the three most likely targets that get hit, two are within the area where people believe the crop was introduced". But the trip took at least four months and not even coconuts have managed to survive that long adrift in the ocean. More likely, for this scheme to work, say the team of researchers, a loaded vessel was blown out to sea and landed on the islands, which could take as little as 90 days. Montenegro points out that in 2005-2006, a fishing boat from Mexico was swept to the Marshall Islands — just as their model predicts. Although there is reasonable doubt about the possibility of drift introduction, there is the undeniable possibility that pods drifting not by themselves but attached to rafts of floating debris could protect the pods

from the effects of salt water and still contain viable seeds when arriving at the islands. Citing Carlquist (1981), the authors note that transport by rafting of species not adapted to oceanic dispersal is believed to be nevertheless responsible for the introduction of about 8% of Hawaiian flowering plants.

In conclusion, the authors state that, "Even if sweet potato seeds could remain viable after the crossing, there is no guarantee that colonization of the plant would take place. Still, it is intriguing that hits to the Marquesas and Tuamotu, perceived as likely arrival sites for the sweet potato, show, by far, the highest percentages of occurrence among Polynesian targets".

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