



**Easter Island (Rapa Nui) Culture
FIELD REPORT 2010**

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Country: Chile

Research site / region: Easter Island

Date field report completed: 3 January 2011

Period covered: 6 June 2009 to April 2010

Report completed by: Christopher M. Stevenson

Dear Earthwatch Volunteers and Friends of Rapa Nui,

I am finally getting around to the field report from the 2010 field season after a very busy year at home and again on Rapa Nui. As you may have gleaned from the media, the political situation on the island is very tense as the Rapanui insist on the return of their lands from State management. This, however, has interrupted neither our continued archaeological investigations nor the initiation of new Earthwatch projects on the island.

The focus of our last two field seasons was the sampling of remote sites in upland Vaitea, the installation of six weather stations around the island, and the testing of in-garden and non-garden soils. The artifacts from the testing are in the process of being dated. The weather stations continue to function well although there have been several set backs as the more remote ones are subject to periodic vandalism. This has required one emergency trip to the island and another one coming up to replace damaged components. This year, we plan to enlist the services of the local youth to guard against future damage. The results of the soils analysis are completed and clear evidence for nutrient enrichment within gardens is evident from the elevated phosphorus levels within the soil.

All of these results were made possible by your strong efforts in the field. Collecting information in a systematic and informed manner is the cornerstone to a good scientific project and Sonia and I really thank you for all that you have done. Over the many years we have consistently relied upon volunteers and have rarely been disappointed.

Best regards to all.

Iorana,
Chris and Sonia
Lead Earthwatch Scientists

Top highlight from the past field season

The most challenging aspect of the last season was assembling the six HOBO weather stations in the living room of the crew house. Luckily, the ceilings were 14 feet high and could accommodate the towers which were 12 feet high. There was not much room to spare. Each station came in parts and "some assembly" was required. This took an entire 10 days, but by the end of the team, the units were installed in the field and working.

Non-technical overview of results

This project seeks to test the overall hypothesis that Rapa Nui suffered a dramatic and sudden social and political collapse in the 17th century that was brought on by human degradation of the environment. This drastic situation would have been accompanied by both a population decline and a restructuring of political hierarchy and how the economy was managed. Caught in an unsustainable life style, there was a readjustment that took place which changed traditional forms of government and how people made a living.

However, is this popular scenario really true? Is there empirical evidence available to support this story? A review of the existing archaeological literature reveals significant short comings in the data and assumptions about the timing of events. The most serious aspect of this discussion is finding well-dated evidence that places key events within a well verified time frame. Currently, the collapse is assigned to the late 17th century based upon oral traditions of a battle between two rival clans, but is this an analogy for an island wide civil war that resulted in a severe loss of life, lack of food, and the break down of hierarchy? Oral traditions are suggestive of changes in the past since the story is considered important enough by a population to be preserved over time. However, a more empirical foundation is required. In this project we are looking for archaeological evidence for past events and processes that include environmental degradation, population decline, and social restructuring. For this reason we are focusing on reconstructing landscape use-history since the archaeological record contains the evidence to evaluate whether one, or all, of the events occurred.

We briefly look at how our work assesses each one:

a) *Landscape alteration*: There is no doubt that Rapa Nui was deforested by Polynesian settlers as the need for agricultural land grew in response to a growing population. But as land was brought into production through farming, was it simply used to the point of exhaustion and allowed to erode? Our surface survey offers indications to the contrary and suggests that the landscape was actively managed in order to maintain and even increase productivity. As the land was cleared, the rock garden was invented to help retain moisture on this dry island. Rocks covered the ground surface to form an effective moisture barrier and boulders from neighboring outcrops were stacked as wind breaks. Gardens were also placed in protected areas at the base of hills and ridges. Our soil nutrient studies show the gardens were actively fertilized and not allowed to degrade over time. Evidence such as this does not point to an environmental crisis.

b) *Population decline*: So when did population decline on Rapa Nui? We know it dropped from many thousands to several hundred people, but when did it happen? It may have fallen sharply in the 18th century after European contact and the introduction of diseases or it may have happened earlier. To determine this, we are conducting large scale obsidian hydration dating and radiocarbon dating of the landscape features such as houses and gardens. By dating a large number of contexts across the island we should come close to dating the beginning and end points of Rapa Nui occupation. Current results from La Perouse (Hanga Ho'onu) show a large number of dates occurring in the 19th century and suggest that a substantial population was still present past European contact. The obsidian dates point to use of the island

beginning in the 13th century--a little later than expected. As our sample of dates accumulates we should be able to resolve the temporal issues of population growth and decline.

c) *Organizational change*: The same data set used to monitor population can also inform us about organizational change in the economy. The island was not used in all places at all times and the use and abandonment of the uplands may signal a change in how the economy was managed. Our data shows that the uplands were abandoned and the field systems were no longer productive. If the soil nutrient data shows that the terrain was still productive, then why were the fields abandoned? It may reflect a shift to a less intensive farming economy if it occurs prior to the 17th century, or again, the impact of disease if it occurs later. Currently, the collapse scenario is not looking like the best explanation in the face of the new data we are collecting and analyzing. But much remains to be pieced together before we can provide a more fully validated explanation.

REPORTING AGAINST RESEARCH OBJECTIVES

Objective 1:

Archaeological Survey and Test Excavations

Progress toward/against Objective 1:

The survey goal for this project is to complete an inventory of seven survey blocks (500 x 500m each) and to sample the prehistoric sites they contain for obsidian and datable organic remains. Four and a half units have been completed. During the last field season we resurveyed and tested the Vaitea survey area and half of the Anamarama sector. GIS/GPS methods were used to map the individual archaeological features, the ancient rock gardens, and the location of our test units.

Objective 2:

Environmental Monitoring: Soil Moisture, Soil Temperature, and Wind Velocity

Progress toward/against Objective 2:

One of the major efforts of the last field season was to install six HOBO weather stations around the island to record environmental differences that could have impacted ancient agricultural practices. Two stations were placed at elevated locations on the major central volcano and four stations were placed at near coastal locations (western, southern, and northern coasts). Each station was equipped with sensors to record rainfall, wind speed and direction, barometric pressure, air temperature and relative humidity, soil moisture, and soil temperature.

Objective 3:

Soils Evaluation: Soil Nutrients

Progress toward/against Objective 3:

During the last field season over 150 soil samples were selected from two contexts. First, shovel testing was conducted in the upland Vaitea region to look at the nutrient status of soils within and outside of gardens. Paired samples (in-garden, non-garden) were obtained from each garden identified during survey. Using these data we wish to determine if organic mulching was used at these higher elevations. Second, a transect of soil tests was made between two basalt outcrops to determine if the nutrient levels of soils were greater at the base of outcrops. This was conducted to test the hypothesis that weathering of the outcrop over

thousands of years had increased nutrients in the soil from decomposing minerals. Enrichment in phosphorus at the base of outcrops could account for garden placement at these locations. The soils have been analyzed at ALS Laboratories and the data is under analysis at present.

Objective 4:

Rock Garden Chronology and Function

Progress toward/against Objective 4:

This year satellite imagery of Rapa Nui was used to map the island-wide distribution of prehistoric rock gardens. A Master's thesis on the topic has been recently completed and is under review. Using a combination of infrared images and ground survey data, spectral signatures were developed for rock gardens in different parts of the island. Rock garden boundaries were established at high levels of confidence and their distribution was mapped. It was determined from the maps that gardens extend from the coast until the 350m elevation where they cease to exist. It is hypothesized that soils at this elevation are nutrient poor as a result of leaching since their formation many thousands of years ago. Also at this elevation, the effectiveness of the rock garden against high winds may be marginal. It was also noted that some island territories had a vastly greater number of rock gardens within their boundaries. The implications of this are not completely clear at present, but some chiefdom segments may have been able to produce greater amounts of food compared to other farmers. This may have given some parts of society a material and economic advantage over others.

Objective 5:

Landscape Settlement and Landscape Settlement Chronology

Progress toward/against Objective 5:

Efforts have been made to critically evaluate the quality of the obsidian hydration calibrations to produce accurate age estimates. A total of 70 obsidian dates were completed and compared with radiocarbon dates from the same excavation level in over a dozen excavation units. The correspondence between the two dating methods was good, especially for contexts belonging to the 14th and 15th centuries. There was a non-convergence for the 18th and 19th centuries likely due to the fact that obsidian dates from this period were poorly represented. We are not sure why the obsidian dating method is not picking up late period activity and will continue to investigate this problem.

Objective 6:

X-ray Fluorescence Analysis of Obsidian

Progress toward/against Objective 6:

X-ray fluorescence (XRF) trace element analysis has been completed on over 100 samples from the prehistoric obsidian quarries of Mt. Orito, Rano Kau I, Rano Kau II, and the off-shore source of Motu iti. A set of 12 elements were analyzed to determine if the elemental proportions of each source were unique. If so, then artifacts from prehistoric sites removed from the quarries could be physically linked to their point of origin. We have found that a small number of elements (Strontium, Rubidium, Iron, Zirconium) have unique concentration levels for four of the five sources. Unfortunately the Orito quarry cannot be chemically distinguished from the Rano Kau I source.

A total of 60 samples from prehistoric habitation sites were analyzed by XRF from the region known as Te Niu on the western flank of Rapa Nui. The vast majority of the artifacts originated from the Rano Kao I/Orito source while a small percent came from the islet of Motu iti. No materials were identified from the Rano Kao II source and it appears likely that the material was not used prehistorically. This is probably due to the generally poor quality of this obsidian. Future analysis on this subject will include two additional research efforts. We are currently waiting for a set of 40 additional samples from the Motu iti source to arrive in order to increase the number of analyzed source samples. We will also analyze an additional 100 samples from the interior regions of the island to look at obsidian source variation.

PARTNERSHIPS

1) National Science Foundation: A three year project funded to evaluate the hypothesis that Rapa Nui society "collapsed" during the late 17th century. The grant provides resources to obtain specialized analyses such as radiocarbon dating, soil nutrient testing, obsidian hydration dating, and collaborator support.

2) Fundación Isla de Pascua: The foundation conducts archaeological surveys of the island on a long term basis. We work with the foundation to further that goal. The director of the foundation, Sonia Haoa, is an Earthwatch scientist on this project.

CONTRIBUTIONS TO CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

Local

A copy of all of the field results is given to the Fundación Isla de Pascua for their use without restriction.

DISSEMINATION

2009:

Mulrooney, M.A., Ladefoged, T., Stevenson, C.M., Haoa, S. The Myth of A.D. 1680: New Evidence from Hanga Ho'onu, Rapa Nui (Easter Island). *Rapa Nui Journal* 23(2):94-105

2010:

Mulrooney, M., Ladefoged, T.N., Stevenson, C. and S. Haoa. Empirical assessment of a pre-European societal collapse on Rapa Nui (Easter Island). *Proceedings of the VIIth International Conference on Rapa Nui and the Pacific*. Los Osos, Easter Island Foundation.

2011:

Flaws, Andrew L. The Identification and Analysis of Rapa Nui (Easter Island) Rock Gardens by Satellite Remote Sensing. Master's Thesis, Department of Anthropology, University of Auckland.

DEVELOPING ENVIRONMENTAL LEADERS

- 1) Student lecture on Rapa Nui: St. Mary's College of Maryland, St. Mary's City, MD., November 2010. (15 persons)
- 2) Public lecture: Archaeological Society of Virginia, Richmond, VA., June 2010. (18 persons)

LONG TERM IMPACT OF PROJECT

Cultural heritage enhanced, restored or maintained

The project contributes to developing a tangible record of the archaeological landscape as it existed in prehistory. The expansion of agriculture and housing on Rapa Nui has started in earnest and this record is one of the few remaining documents of what once existed.