



GLOBAL CHALLENGE, LOCAL ACTION:
Ethical Engagement, Partnerships, and Practice

**The Society for Applied Anthropology
69th Annual Meeting
March 17 – 21, 2009
Santa Fe Convention Center**

Terra preta nova.

2009

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GENERAL INFORMATION



How to Use This Program

Sessions are identified with an alphanumeric code that indicates the session number and day of the week. For example, W-80 represents session 80 on Wednesday, and T-15 represents session 15 on Tuesday. Abstracts are in alphabetical order by presenter or session organizer. At the end of each abstract is the alphanumeric code that refers to the session location in the program schedule. The Participant Index lists the page number where each participant may be found in the program schedule.



A Note About Abstracts

Individuals were given a choice to include their e-mail addresses in the program. Those who selected the option to have their e-mail address printed are listed at the end of the abstract. Those who declined the opportunity to print their e-mail address are not printed. For those registrants who did not indicate their preference, their e-mail addresses were not printed.



Registration

Registration is required for attendance at all sessions, as well as the sponsored socials and special events. Registration will start Monday, March 16 at the LaFonda Hotel beginning at 1:00 PM. Registration for the remainder of the week will be held at the Santa Fe Convention at the times indicated below:

Monday, March 16 (LaFonda Hotel)	1:00 PM–7:30 PM
Tuesday, March 17	7:30 AM–7:30 PM
Wednesday, March 18	7:30 AM–7:30 PM
Thursday, March 19	7:30 AM–7:30 PM
Friday, March 20	7:30 AM–4:00 PM
Saturday, March 21	7:30 AM–12:00 PM



Messages and Information

A “Messages and Information” bulletin board will be near the Registration Desk. Please post your messages here for other participants and locate other people registered for the meetings. Program changes will also be posted on this bulletin board, as well as any Topical Interest Group announcements.



Book Exhibit

The Book Exhibit will be held in Sweeney F of the Santa Fe Convention Center. It will be open from 9:00 a.m. to 5:00 p.m. on Thursday and Friday. It will be open at 9:00 a.m. on Saturday and close at 12:00 noon. The book auction (to benefit Student Committee activities) will be held on Saturday at 12:30 p.m. in Sweeney F.



Plenary Sessions

There will be three plenary sessions during the Santa Fe meetings. On Wednesday, March 18, beginning at 6:00 p.m. in Sweeney D, there will be a plenary on “History of Minorities in New Mexico. The featured plenary speaker is New Mexico State Historian Estévan Rael-Gálvez. The Presidential Plenary “The Current World Food Crisis: Anthropological Perspectives” will be on Thursday, March 19, beginning at 8:00 a.m. in the Sweeney B. The plenary will be chaired by Lois Stanford (New Mexico State U). Presenters include Glenn Stone (Washington U), Lois Stanford, Tim Finan (U Arizona), Solomon Katz (U Pennsylvania), Ellen Messer (Tufts U), Barrett Brenton (St. John’s U), John Mazzeo (De Paul U), Thoric Cederstrom (International Relief & Development), and Miriam S. Chaiken (New Mexico State U). At 5:30 Thursday, March 19, in Sweeney D, the School for Advanced Research will sponsor a plenary on “Scholars, Security and Citizenship” chaired by Laura McNamara (Sandia National Laboratories). The plenary speakers are Maren Tomforde (German Armed Forces & Command College-Hamburg), Eyal Ben-Ari, (Hebrew University), Clementine Fujimura (U.S. Naval Academy), David Price (St. Martin’s University), Douglas P. Fry (Åbo Akad University, University Arizona), R. Brian Ferguson (University of Rutgers-Newark), Robert A. Rubinstein (Syracuse University), Anne Irwin (University of Calgary), Laura McNamara, and Danny Hoffman (University of Washington-Seattle).



Social Events

The following social events are planned for registered participants at the 69th Annual Meeting:

- Wednesday, March 18, 5:30-6:30 p.m., Wine and Cheese Reception (Coronado). Sponsored by the School for Advanced Research and Left Coast Press.

TERRA PRETA NOVA

WOODS, William I. and REBELLATO, Lilian (U Kansas), TEIXEIRA, Wenceslau G. (Embrapa Amazônia Ocidental), and FALCÃO, Newton P. S. (INPA/CPCA/Solos e Nutrição de Plantas).

Paper presented at The Society for Applied Anthropology 69th Annual Meeting, 21 March 2009, Santa Fe, NM.

ABSTRACT. Amazonian soils are almost universally thought of as extremely forbidding. However, it is now clear that complex societies with large, sedentary populations were present for over a millennium before European contact. Associated with these are tracts of anomalously fertile, dark soils termed *terra preta*. These soils are presently an important agricultural resource within Amazonia. They provide a model for developing long-term future sustainability of food production simple carbon based soil technologies in tropical environments, particularly among small holders.

1 - *Terra Preta Nova*.

2 - As a result of human occupation, enormous areas of the planet have been modified by a variety of mechanisms leading to the redistribution and alteration of earthen and other surficial materials.

3 - Numerous physical and chemical changes in sediments and soils can result at loci of human occupation. Most importantly, where people live they concentrate nutrients through the deposition of a variety of organic and inorganic debris from materials derived from a hinterland of exploitation.

4 - Major contributions stem from animal and plant products brought to the place of habitation for direct consumption by humans or indirect consumption through domestic animals, or for construction materials and fuel.

5 - In general, when compared to the relevant natural background soils, soils at human habitation sites exhibit anomalously darker coloration, higher pH levels, and increased concentrations of many plant nutrients, which can become extraordinary if the prior

settlement was intense or of long duration. In addition to a suite of macro- and micronutrients, human intervention often enhances other soil properties beneficial to plants, e.g., cation exchange capacity, percent base saturation, moisture retention, conditions of structure, and soil biotic activity.

6 - Within a settlement system proper manipulation of these nutrient streams and their associated transformations, translocations, additions, and losses is a critical variable for long-term success and sustainability.

7 - In Amazonia at least by the advent of the Christian era, successful articulations with and modifications of the environment including true sedentism were present in many settings. The descendents of these cultures formed the complex societies glimpsed so briefly at European contact. Amazonian soils are almost universally thought of as extremely forbidding and with justification one would immediately question the viability of any large agricultural populations within this region. However, Amazonian responses to problems of food production utilized an array of adaptations consisting of a multitude of varieties of cultigens and semi-domesticates, agroforestry, focused manipulation of local ecologies, and large scale modification of soil conditions. Often, associated with the sites of habitation of these prehistoric agriculturalists are tracts of anomalously fertile, dark soils termed *terra preta*. Heightened biotic activity and nutrient retaining capacity brought about by deposition of charcoal, ash, and organic material appear to be principally responsible for these soils' remarkable fertility and persistence long after their cultural manipulation has ceased. These soils are presently an important agricultural resource and provide a model for developing long-term future sustainability of food production in tropical environments.

8 – To understand how these soils developed we need to examine the ethnohistorical and archaeological record on subsistence practices and refuse disposal patterns and consider their effects on the relevant nutrient streams. In order for *terra preta* to develop at some point a threshold must be crossed where net accretion within a habitation zone overcomes losses from erosion, leaching, and volatilization. Within the lowland portion of the Amazon Basin surpassing this threshold at least two millennia ago led to the widespread formation of these soils.

9 – The best archaeological documentation of this process comes from the Hatahara site in the central Amazon. The site occupies a bluff top location overlooking the Rio Solimoes and appears to have been first occupied several hundred years before the present era. Its occupants procured fish, turtles, and aquatic mammals from the turbid Solimoes, harvested crops grown on the rich soils of its floodplain, and hunted and gathered products from the surrounding forest, and through all of these activities concentrated nutrients within the occupied area of the site.

10 - Within a few hundred years of the initial occupation the threshold of net accretion was reached and from then on the rate of accretion accelerated through time. The resultant 20 ha of rich anthrosols were such a valuable resource that they were fought over. It is clear that another cultural group, the Tupi, took over the site during the late preEuropean period and modified the former circular settlement plan to a linear one from which the *terra preta* of Hatahara could have been more readily cropped.

11 - Sometime during the sequence and we do not know when yet, rather than just using the results of centuries of wastes, the idea of **intentionally** changing soil characteristics toward greater fertility was adopted. Through the addition of charcoal and ash and

included nutrients the lands around the core zone of the settlement became improved, resulting in increase productivity for the community. The primary mechanism for this was presumably the application of low temperature combustion of moist floral materials. Such a slash and char, rather than slash and burn, practice greatly increases the production of charcoal and decreases the loss of carbon and other volatiles that increase soil fertility. The resultant soils have been termed *terra mulata*.

12 - While the classic *terra preta* are formed merely as a byproduct of refuse disposal activities, *terra mulata* is a clear case of “landesque capital.” Brookfield (1984) saw this as a type of innovation that “once created persists with the need only of maintenance.” Such improvements increase productivity per unit of land, but may not provide immediate returns on an investment, so a long-term approach to land management is essential. Not explicitly stated, but implicit is intentionality. It takes both an understanding of soil processes and conscious investment in the land to produce soil improvements that qualify as landesque capital and once such investments begin they constitute a profound change in both land management and how land is viewed. And, if the process is continued there is a cumulative affect through time.

13 - *Terras mulatas* have been identified in numerous places in the Amazon since their first recognition on the Belterra Plateau overlooking the Rio Tapajós to the south of the present city of Santarém. Here, huge of expanses of these improved soils are found to the inland of linear *terra preta* sites that extend for kilometers along the bluff edge and in area are an order of magnitude larger.

So, at the time of European contact there were extensive areas of fertile anthropogenic soils throughout lowland Amazonia. The productive capacity of these dark earths was

huge and although the extent to which they were utilized is unknown, the evidence for large nucleated populations suggests that much of this capacity was used.

14 - During the historic period and continuing into the present, such abandoned habitation sites and associated fields with dark earths have been sought out for root stock, cuttings, and medicinals from the ruderal plants. They are routinely selected by smallholders for the establishment of pioneer colonies on the expanding agricultural frontiers. Nearer to urban areas they are put into intensive production of papaya, pineapple, and other high value crops including, amazingly, sod. Near Santarem, Manaus, and other cities they are mined for use in decorative public and private plant displays, family gardens, and even commercial truck gardens.

15 - Even though these soils are estimated to comprise at least 0.2% or 1,260,000 hectares of Greater Amazonia, even with this enormous area, they are not an inexhaustible resource. In spite of reports of cropping without fertilization for decades, the dark earths once exposed are subject to erosion and when cropped they have a nutrient loss with each harvest. In addition, these soils, no matter how valuable for crop production, form a most significant part of the cultural patrimony of the region; they are archaeological sites and hold irreplaceable information on the lost cultures of the Amazon. Consequently, they should be protected and studied, rather than exploited.

16 - The fact remains though that more intensive, less destructive methods of food production utilizing landesque capital need to be established in Amazonia, i.e., the ancient technologies that resulted in the dark earths need to be replicated. A multidisciplinary, international collection of researchers have been working since 2001 toward the goal of generating new dark earths, *Terra Preta Nova*. Based primarily in

Brazil and associated with Embrapa, INPA, the Museu Goeldi, and the universities of São Paulo, Pará, and Amazonas members of this group have been conducting archaeological and ethnographic field investigations, chemical and physical compositional studies of ancient dark earths, and replicative studies through field trials of various forms of organic soil enhancement and crop response. Time does not permit great detail on any of these investigations or on the numerous ethnographic and agronomic observations that have been coming in from investigators in the Tapajós, Trombetas, Negro, Xingu, Solimoes, and Madeira regions. However, some observations can be made.

In general, to be successful the treatments need to:

- (1) increase pH and thus eliminate or at least decrease toxic Al ion activity and make essential nutrients more available for plant growth;
- (2) increase cation exchange capacity and thus both nutrient & water retention;
and,
- (3) increase the percent base saturation and nutrient status of the soil.

Already, it has been demonstrated that applications of organic fertilizers and charcoal increase nutrient stocks in the rooting zone of a variety of crops, reduce nutrient leaching, and improve production on highly weathered and acidic soils for a wide variety of utilized plants. Soil organic matter and nutrients remained resilient through several cropping cycles, suggesting that inputs can decrease through time with similar or greater yields. The process is a cumulative one and with the development of organo-mineral complexes and associated soil microbiota a synergy can develop whereby the process of soil enhancement to a large extent fuels itself.

17 - Numerous articles and three volumes pertaining to this work have been published since 2003 and another volume in Portuguese will be coming out this summer. Please feel free to contact me for the references to any or all of these publications.

18 - With such clearly positive initial results and an expected elaboration on the specifics of the process, what are the problems for implementation? First of all, with the pre-European *terra preta* this process initially happened as an unintended outcome of nucleation, so any associated effort was not recognized; it took centuries for the understanding of the correlation between specific inputs and soil enhancement to develop and be adopted as a common agricultural practice. Now, time is short and the necessary inputs will immediately be recognized. It will take a lot of work and the payback will not always be immediate or continuous. Most plants will respond well to the treatment and this includes the aggressive colonizers; weeds can become a major problem that requires additional labor. In order for this to work a long-term commitment or land ethic needs to be accepted by the small-holders involved. This will require among other things, clear title to land and incentives to start and continue the process through the initial period. Enormous amounts of carbon are sequestered for millennia in the char and replacing slash and burn with slash and char would also greatly diminish carbon emissions. A mechanism through which carbon credits could be transferred to groups of small-holders would be a valued stimulus.

19 – Thank you.