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ARTICLE

Domestication and Dispersal of Native Crops in Amazonia

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Abstract

Recent decades have witnessed the rapid expansion of interest in and research on the domestication of crop plants worldwide. These species are the basis of the rise to dominance of *Homo sapiens* over the last 10,000 years. New techniques in archaeology and the expansion of molecular genetics are uncovering abundant evidence to support or refute old hypotheses about human domestication of crops and creation of food production systems that fueled population expansions and linguistic diasporas, and to raise new hypotheses. In Amazonia and elsewhere in lowland South America, archaeologists are starting to examine these hypotheses in earnest, and geneticists are starting to generate data to identify crop origins and dispersals. Archaeologists now generally agree that Amazonia was inhabited by numerous advanced societies before European conquest, especially along the major white water rivers and in other favorable locations for food production, and that these societies had domesticated significant areas of numerous landscapes. This special section of *Tipití* summarizes a set of presentations given during the recent 2nd International Meeting on Amazonian Archaeology, held in Manaus, Amazonas, in September 2010. An overview of plant domestication opens the sequence, followed by new archaeobotanical evidence from the southeastern Colombian and central Brazilian Amazonia and from the southern savannas of Brazil, and new molecular genetic evidence about the origins of peach palm (*Bactris gasipaes*) and the dispersal of manioc (*Manihot esculenta*), maize (*Zea mays*), and peach palm in lowland South America.

Keywords: archaeobotany, genetics, *Zea mays*, *Manihot esculenta*, *Bactris gasipaes*

Introduction

The rise to dominance of modern humans over the last 70 millennia has radically changed the face of our planet, so much so that we have now created our own geological era, the Anthropocene (Crutzen 2002, Zalasiewicz et al. 2010). Humans have attained this dominance by domesticating both landscapes and populations of plants and animals (Clement et al. 2009), resulting in the domestication of the planet (Kareiva et al. 2007). Needless to say, this rise to dominance has fascinated scholars and over the last few decades it has been analyzed intensively by archaeologists and other social scientists, and by plant and animal geneticists, the latter studying the domestication of populations of plants and animals and the former studying both types of domestication (Zeder et al. 2006, Piperno 2011).

In this endeavor, there is a remarkable contrast between the relatively small amount of scientific information, and the diversity and size of Amazonia. Ellis' (2011) global analysis of human impact through time suggested the existence of semi-natural landscapes across the region between 3000 and 500 BP, with no densely settled areas.

Until a few decades ago, one school of thought considered Amazonia to be a huge nearly pristine forest, little modified by humans, and which did not allow the establishment of large human communities (Meggers 1996). In recent decades, this story has changed radically, with the realization that Amazonia is a complex mosaic of areas, many of them intensely managed and with large human settlements by the time of European conquest (Denevan 2011, Heckenberger and Neves 2009, Moraes and Neves 2012). As research intensifies, there is a growing realization that humans have modified many if not most local landscapes, modifying or eliminating forests and other vegetation, managing, selecting and domesticating native plants into crops, and introducing crops from other Neotropical biomes.

The set of studies in this special section of *Tipití* is part of this expanding research effort and were first presented in a symposium at the 2nd International Meeting on Amazonian Archaeology, held in Manaus, Amazonas, in September 2010. These studies use different approaches (archaeology and genetics) and have different objects of study (macro and micro plant remains, anthropogenic soils, and cultivated plant diversity), all seeking to better understand the human history of Amazonia and to better understand what occurred in that region, since humans stepped into it for the first time, completely changing the story of mankind and the Amazon. The authors seek to contribute to answering several questions: How have humans subsisted in Amazonia? What were their technologies and subsistence resources? What was the contribution of food production in Amazonia? What are the patterns of diffusion of these technologies and crop plants?

The presentation by Barbara Pickersgill, offers an overview of plant domestication. The author poses and answers a series of questions; many of these answers are changing as new research appears. What is domestication? How did domestication occur? When and how fast did domestication occur? Was the same crop domesticated more than once? Where was a given crop domesticated? The answers call upon new archaeological and genetic research from the Middle East, Asia, Mesoamerica and Amazonia, seeking to contrast domestication in Amazonia with that elsewhere, which is still a difficult task given the small Amazonian dataset to date.

Three studies delve into the archaeological record, with special attention to archaeobotany. Morcote-Rios et al. and Caromano et al. report on research in archaeological sites with terra preta de índio in Colombian and Brazilian Amazonia, respectively. Terra preta de índio or Amazonia dark earths are anthropogenic soils created by intentional and non-intentional human management during centuries or millennia. In these soils, traces of human presence are observed both by macro (charcoal) and micro remains (phytoliths and starch). The identification of these plant species allows reconstruction of the use of these species in the past, both the domesticated species, and those that were collected or managed. Some of the phytoliths and the starch allow reconstruction of parts of the diets of the populations that once lived at these sites and, in the case of identification of alien species, such as maize, to contribute to identifying dispersal routes.

Shock et al. studied macro-remains in Central Brazil, in the transition between the Cerrado and Caatinga biomes and the remains are of plants that originated in Amazonia or were dispersed through Amazonia to get to the sites studied. Species such as maize and beans, for example, passed through the Amazon region and, in this way, information about these species beyond Amazonia also allows inferences about what occurred within the forest. The authors found that the cultivated species were distributed gradually and not in a single package, suggesting how they reflect cultural changes, the incorporation of technologies, knowledge and crops from different cultures, giving clues of the interaction among them.

Three studies use genetics to examine origins and dispersals. The study by Freitas and Bustamante, follows a line of reasoning similar to that of Shock et al. about dispersal of cultivated plants. The authors report on a genetic study of maize, using both archaeological DNA of samples found in Central Brazil, as well as a number of other indigenous samples from different parts of Central America and South America, including Amazonia. They found that maize was dispersed along at least two distinct routes from its center of domestication in Mexico, with one route through the Andes and then into the lowlands of Central Brazil, and the other through the South American lowlands. They also identify the northern rim of Amazonia as the region with greatest maize genetic diversity, suggesting its importance to the people that lived there and managed it.

The other studies explore the question of the origin of domestication and dispersal of two Amazonian species: manioc and peach palm. Mühlen et al. studied manioc, which was and continues to be a major crop in the world tropics. They examined an important feature of manioc, which is the cyanogenic glucoside content that differs between the two groups of varieties: sweet and bitter. The authors used genetic markers and found that different patterns of dispersal could be identified for each group of varieties. Cristo-Araújo et al. studied the peach palm, the only palm domesticated in the Neotropics. They used genetic markers and sequences of the chloroplast genome to try to determine which of the three hypotheses about the origin of this palm is correct. Based on chloroplast sequences – with maternal inheritance – they determined that the most likely region of domestication was southwest Amazonia, from where the peach palm was dispersed to the northeast and northwest along two distinct routes.

These studies show how new tools, approaches, and interdisciplinary work in archaeology and genetics are contributing to the elucidation of human history and domesticated plants in Amazonia. It is also clear that these studies are only the beginning of a research effort to understand the domestication of Amazonia before European conquest.

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