

“Amazonian Dark Earths: Foundation Investigations” to be Presented at the Meeting of the 3rd International Biochar Conference

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Introduction

Against a backdrop of highly weathered, infertile soils, patches of very productive soils are found throughout lowland Amazonia. Although the anthropogenic origins of these soils, termed Amazonian Dark Earths (ADE), were recognized in the mid-19th century, debate continued over this scenario well into the 20th century. Until recently, not much scientific attention was given to their significance for our understanding of the past, their present use, or future applications. The early years of ADE research and reports are discussed in this paper.

Results and Discussions

Amazonian Dark Earths (ADE) are anthropogenic soils called *terra preta do índio* and *terra mulata*, respectively, in Brazil. They were created by indigenous people hundreds, even thousands of years ago. *Terra preta* proper is a black soil, associated with long-enduring Indian village sites and is filled with ceramics, animal and fish bones, and other cultural debris. Brownish colored *terra mulata*, on the other hand, is much more extensive, generally surrounds the black midden soils, contains few artifacts, and apparently is the result of semi-intensive cultivation over long periods. Both forms are much more fertile than the surrounding highly weathered soils and they have generally sustained this fertility to the present. This fertility probably is because of high carbon content, which retains nutrients, and an associated high and persistent microbial activity.

It has only been since about 1980 that these soils have received intensive scholarly attention. Recent research has been multidisciplinary and international, especially by soil scientists, archaeologists, and geographers from the Brazil, Germany, the United States, and Colombia. The topic is now of major scientific interest, of relevance both to prehistory and to agricultural development and

global climate change today; hence the value of this historical survey.

Other than a 17th century Jesuit priest's observations all known entries are dated since 1874. Hartt, Smith, Brown and Lidstone, Orton, Derby, and Steere in the 1870s all noticed the *terra preta* and referred to its distinctive properties and association with prior settlements. Friedrich Katzer in the late 19th century conducted pioneering analytical work on these soils and suggested that because of their fertility the dark earths were cultivated in ancient times when the region was more or less densely populated. In the early 1920s Curt Nimuendajú directed excavations and surveys of dark earth sites within the lower Tapajós region and adjacent Amazon bluffs. Like Katzer, Nimuendajú believed that the dark earths had developed from Indian habitation activities associated with permanent settlements and that the resultant fertile soils were then used for crop production. In the 1940s and 1950s various observers reported and described dark earth soils. However, rather than analytical research, attention was more focused on possible natural origins of the soil, in contrast to the earlier belief that the soil was of human origin.

In 1966 Dutch soil scientist Wim Sombroek based on his earlier dissertation published his classic *Amazon Soils*, which includes descriptions and lab analyses of dark earths on the Belterra Plateau. He made a distinction between black *terra preta* proper derived from village middens and brownish *terra mulata*, a term he introduced to the literature, which he believed "obtained its specific properties from long-lasting cultivation." He was the first to suggest this as far as we know. And he mapped the distribution of dark earths along the bluffs of the lower Rio Tapajós. In 1966 he questioned whether it was "economically justifiable," in his words, to create and cultivate such soil today. However more recently he promoted the idea of developing new dark earth as carbon stores and sinks for intensive cultivation, what he called "*Terra Preta Nova*". Sombroek, "The

Godfather of Amazonian Dark Earths”, ushered in the modern period of investigations of these distinctive soils and all four of the recent *Amazonian Dark Earths* books are dedicated to Sombroek, who tragically passed away in 2003 [1-4].

Conclusions

The early period of publications about Amazonian Dark Earths, involving discovery and initial descriptions, included perceptive reporting by observers such as Hartt, Herbert Smith, Katzer, Nimuendajú, and a few others. In many respects their observations about the anthropogenic origins and importance of these soils were ignored or misinterpreted until they were resurrected by Sombroek in the 1960s. It has now been archaeologically demonstrated that large, planned, and persistent pre-European settlements associated with anthropogenic dark earths were present throughout Amazonia. The topic of Amazonian Dark Earths is finally receiving the focused interdisciplinary, international scientific attention it deserves. In just a relatively short period the results have been stupendous and have taken us on avenues unseen before. We see no reason that this trend should or will abate.

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¹ Teixeira, W. G.; Kern, D. C.; Madari, B. E. Lima, H. N.; Woods, W. I. (Eds.). 2009. *As Terras Pretas de Índio da Amazônia: Sua Caracterização e Uso deste Conhecimento na Criação de Novas Áreas*. Embrapa Amazônia Ocidental, Manaus. 421 p.

² Woods, W. I.; Teixeira, W. G.; Lehmann, J.; Steiner, C.; WinklerPrins, A.; Rebellato, L. (Eds.). 2009. *Amazonian Dark Earths: Wim Sombroek's Vision*. Springer, Berlin. 502 p.

³ Glaser, B.; Woods, W. I. (Eds.). 2004. *Amazonian Dark Earths: Explorations in Space and Time*. Springer-Verlag, Berlin. 216 p.

⁴ Lehmann, J.; Kern, D. C.; Glaser, B.; Woods, W. I. (Eds.). 2003. *Amazonian Dark Earths: Origin, Properties and Management*. Kluwer Academic Publishers, Dordrecht. 505 p.