

Chapter 2

Terra Preta de Índio and Amazonian History

Introduction

Throughout time different people have represented the Amazon rainforest in different ways. How the forest was seen by these people helped to delineate the policies for the region. Not only the forest itself, but also the soils of the Amazon were represented in different ways throughout its history. In this chapter I analyse the *terra preta de índio*, elaborating on its pedological characteristics and the implications of its discovery. The chapter is divided into five sections. The first section is dedicated to *terra preta de índio* itself, what it is, why it is different, and what kinds of discussions include this soil. The second section goes through the history of the research done on this topic. The aim of this section is to identify key moments in the research history. The third section analyses three different views of the Amazonian soils. The first view sees the soils of the South American rainforest as fertile due to the luxurious quality of its vegetation. The second view goes against the first, finding the soils of the Amazon infertile and the third view opens space for a more pluralistic view of the forest and its soils. The fourth section focuses on the pristine myth that was cast on the Amazon rainforest. The fifth section addresses the importance of TPI in the current scenario.

Terra Preta do Índio

The Amazon rainforest is impressive. With a territory that encompasses eight countries and the French Guiana, it is the home of the longest flowing river in the world and the forest still holds many mysteries. The Amazon covers 40 % of the Brazilian territory and it expands seven million square kilometres in South America (Neves [2006](#)), an extension almost the size of the European continent.

The Amazon, one of the last resource frontiers of the world, presented a contradiction. The region was known for having poor soils and yet had a large fauna and flora diversity. The richness was found above ground. The low fertility of the soils of the Amazon would have been the result of natural characteristics of the region, as the forest is exposed to tropical climate variation. Extreme conditions such as torrential rain and strong sun acidify the soils, making them incapable of holding nutrients.¹ This conception of the forest as a green hell, an inhospitable place for not allowing agriculture, and therefore human life, is no longer dominant among scholars.

Terra preta de índio is in the centre of the debate that is changing this conception. The soil itself is an archaeological artefact and it represents a cultural complexity that deserves to be highlighted. Most of the TPI sites cover an area of two to five hectares, but the size of these sites in upland areas can vary from less than one and up to 500 ha (Smith 1980; Kern et al. 2009). *Terra preta de índio* is a soil horizon that draws attention² because its depth can vary from 10 to 200 cm. On average TPI sites are soil horizons of 30–60 cm deep (Kern et al. 2009). They are the evidence of centuries of communities that lived in the region, changing the soils and each producing a variety of unique chemical and physical traits (Woods 1995). This soil is found throughout the Amazon (Petersen et al. 2001). The soil is not just found in the Brazilian Amazon, it is found in other countries as well, such as Colombia, Bolivia, Peru, Venezuela and the Guianas (Eden et al. 1984; Andrade 1986; Junqueira et al. 2010). There are, however, differences between the *terra preta de índio* found by rivers and the one found away from it.³ The patches of soil found near rivers are considerably bigger and more concentrated. This difference is connected to the period and intensity of human occupation of the place. See the picture of TPI below and notice the ferralsols underneath *terra preta de índio* (Photo 2.1).

Terra preta de índio has different characteristics than the other soils in the forest. The colour of *terra preta* and *terra mulata* varies from black to brown⁴ (Woods and McCann 1999) and they contain large quantities of nutrients, such as phosphorus, calcium and magnesium (Glaser and Haumaier 2001; Sombroek 1966; Woods and McCain 1999; Lehmann et al. 2003). Potassium and zinc are also found at higher levels than in the surrounding soils. Being of lighter colour, *terra mulata* does not have as many archaeological artefacts as *terra preta*, and it also has less phosphorus (Sombroek et al. 2002). *Terra preta de índio* also has high cation exchange capacity.⁵

¹The nutrients are washed away.

²*Terra preta de índio* is a soil horizon; it is the superficial horizon on top of various soils. A soil horizon is the vertical section that, cutting from the surface, goes down until weathering, showing in most cases several horizontal layers parallel to the surface. Each horizon has different characteristics.

³TPI sites along rivers are normally larger and more linear than interfluvial areas (Smith 1980).

⁴*Terra mulata* is a term coined by Sombroek in 1966.

⁵High cation exchange capacity is good because when chemical elements, such as calcium for example, goes into the soil solution, it is held by the soil and it does not go away. It works as a changeable storage place.

Photo 2.1 *Terra Preta do Índio* – Laguinho Amazonas.
 Source TPI in Laguinho, Amazonas. Taken by the author



In addition and in general, *terra preta* presents high microbiological diversity (Costa et al. 2009).⁶ Residues of incomplete combustion, in other words charcoal, are found in the soil. This component, together with the aromatic humic substances, would be responsible for the persistency of the organic material in the soils.

The activities of the people who lived in the forest before and after the arrival of the Europeans has led to an accumulation of residues from plants, animals, large amounts of charcoal and several chemical elements such as phosphorus, magnesium, zinc, calcium and manganese. These stocks may play a key role in the formation of the soil, as well as of a higher pH⁷ (Novotny et al. 2009). One important factor regarding TPI is its resilience; the soil remains fertile for centuries.

Some elements in the soil give away its history. Phosphorus, for example, is one of them. Initial studies on this element were restricted to the North of Europe (Woods 2009), but later that changed. This element is an indicator of past anthropic activities. Cultural deposits, which involve urine, plants, animal tissue and bones contain large amounts of phosphate.⁸

The fertility of *terra preta de índio* contrasts sharply with the infertility of other Amazonian soils. The origin of this fertility is likely due to the high concentration of carbon in the soil (Woods and Denevan 2009), which retains nutrients and humidity. These are twice as productive as other nearby soils (Marris 2006).

⁶Biochar can affect the soil biological community. In the case of *terra preta de índio*, it has been demonstrated that it increases soil microbial biomass (Lehmann et al. 2011; Tsai et al. 2008).

⁷Higher than adjacent soils which are acidic. In the example given, the control soil (non-TPI) had a pH of 4.4 where the TPI had 5.4.

⁸Colour, pH, carbon, nitrogen, calcium (which can come from human and animal faeces, bones and other organic and inorganic residues), potassium, magnesium (the last two indicate vegetal ash), copper and zinc (mainly in urine and faeces, respectively, which indicate intense occupation or occupation for a long period).

Photo 2.2 *Terra Preta de Índio* Pottersheds. Source Laguinho, Amazonas. Picture taken by the author



Research conducted by Bruno Glaser in the University of Bayreuth, Germany, revealed that one hectare of *terra preta* one meter deep contains 250 tonnes of carbon, a number that contrasts with the quantity of carbon in other soils of the region (100 tonnes). The carbon of *terra preta* is not only in the charcoal, but also in the organic carbon and the bacteria biomass. The quantity of carbon present in the soil has great implications for climate change. The capture of carbon in the atmosphere is a crucial subject nowadays, as is food production. Both subjects are related to *terra preta*. See the picture below of the black *terra preta de índio* and the high content of ceramic pottersheds (Photo 2.2).

Research carried out in the Amazon has shown that the formation of most of the *terra preta de índio* in the sites studied occurred between 500 and 2500 years ago (Neves et al. 2003). Soil Organic Matter (SOM) is a key factor in the fertility of a soil and deserves further attention. In tropical soils, the SOM is usually low as the soils are highly weathered. In the tropics, SOM plays a key role, as it is a major pool of nutrients such as nitrogen, phosphorus and sulphur (Steiner et al. 2004). SOM also influences the pH, the cation exchange capacity, the anion exchange capacity and the structure of the soil.

The existence of *terra preta de índio* raises an important issue regarding its formation. Human activities transform the fertility of the soil, and since the beginning of agriculture organic fertilisers have been added to enrich them. Although the origin of TPI was still an issue open to debate in the twentieth century, the anthropic origin of the soil is now unquestionable (German 2003). The chemical and biological processes that culminated with the *terra preta de índio* are the result

of cultural activities, such as deposits and funerals.⁹ Based on carbon dating of the soil, these activities took place in the Amazon before the arrival of the Europeans.

The debate about the intentionality of the creation of *terra preta* has not yet reached an end (Fraser and Clement 2008). The soil can also be the involuntary product of years of deposit patterns of indigenous populations, as defended by Kern and Kampf. How it was ‘created’, whether intentionally or not, and which acts led to its formation are still being discussed. Macedo (2009) conducted research in the floodplains of the Solimões River and concluded that *terra preta de índio* was not intentionally created for agricultural purposes. As the floodplains are already fertile, there is no point in creating fertile soil horizons there. This demonstrates that the discussion is in fact very much open to debate. It is important to stress that ceramic archaeological artefacts are generally found in this soil, indicating the cultural value of the history of the soil.

Terra preta de índio also has a great historical-anthropological importance. For centuries the Amazon rainforest was seen as virgin (Clearly 2001). The soil had a central role in the defence of the argument against the existence of complex civilisations in the forest. The backwardness of the people found in the Amazon was part of the European discourse when they first arrived. For a long time the Amazon was represented as a space of nature, rather than a space of society (Raffles and WinklerPrinks 2003). This representation, and the fact that studies on natural science receive more attention, could be a consequence of the understanding that the people of the forest were backward. However, recent studies in the region have demonstrated that the Amazonian environment has a natural and cultural history. Amazonian indigenous cultures have been influencing and changing the diversity of the forest landscape for long periods of time (Balée 2010).

It is important to stress that the discussion on human occupation is still very much alive. Some scientists argue that there were large human settlements in the Amazon. Others that specific interests of actors involved, together with a lack of interaction between scientists, have led to conflicting interpretations. Meggers (2003) argues, for example, that large habitation sites are the result of multiple re-occupations within a millennium of villages similar to those that exist today.

Terra preta de índio has been known for over a century, but its existence was obfuscated for many decades. One way to try to explain that is the issue of scale (Moran 1996). Right up until the 1970s, most of the Amazon was categorised as ‘high forest’. The soil in question is not the most abundant in the forest. If at the time when the region was less explored its extension seemed not so relevant, this belief is different today. Another explanation would be the lack of economic importance associated to the soil, which is present in the forest in individual patches and therefore seen as without economic value (Woods 1995).

⁹It is important to stress the research of Balée and Clement in the topic of cultural history and knowledge on anthropic soils. They have been conducting research on these issues for decades and have made sound contributions to the study of not only TPI, but also of the Amazon.

The rise of *terra preta* in academic and research centres, not only in Brazil but also in international scenarios, has had important repercussions. Studies on the soil, involving its nutrients, ceramic and carbon, has had great impact on the recuperation of the history of not only the region, but also the country. The fertility of TPI is a concrete evidence of the existence of the people of the Amazon in the past, and this fact has historical and cultural repercussions. The rise of climate change in both national and international political agenda has also triggered changes in how *terra preta*'s carbon has been studied. In the 1980s and 1990s, the interest of *terra preta de índio* regarded its capacity to retain nutrients and the type of human actions that would have led to the development of TPI (Andrade 1986). In the 1990s climate change began to make an impact on the research. In many places around the world the research focuses on big enterprises, on a big scale. This kind of research excludes the small farmer yet again. Some trials, such as those carried out by Brazilian institutes, concentrate on small farmers (Woods et al. 2006). That is not, however, the dominant scenario.

History of the *Terra Preta* Research

The existence *terra preta de índio* has been known since the nineteenth century. In 1865–1866 an expedition organised by Swiss geologist Louis Agassiz took the Canadian geologist Charles Hartt to the Amazon. The objective of the expedition was to prove the immutability of species, consequently contesting Darwin's theory of evolution (Barreto and Machado 2001). Although the expedition did not succeed in that sense, Hartt's discoveries marked the history of archaeology in Amazonia. He made four trips to the forest between the years of 1865 and 1877 and was the first to work with scientific methods in archaeological research. The first accounts of *terra preta de índio* are from the nineteenth century, but how can we explain the absence of TPI in the many trips made by naturalists from the sixteenth to the eighteenth century? The purpose of these trips and the incursions within the Amazon was to find resources that would be of interest in Europe, such as metals, *pau-brasil*, and exotic plants for medicinal purposes, the drugs of the hinterland. It is important to remember that at this time the soil was viewed as fertile, so naturally researchers wanted to study how the natives lived.¹⁰

The first written accounts on *terra preta* were made by Charles Hartt and Joseph Beal Steere in 1870 and 1871, respectively (Kern et al. 2009). Other scientists, including James Orton, identified *terra preta* in the nineteenth century.¹¹ During this period *terra preta de índio* was also accounted for in other parts of the Amazon. Barrington Brown made observations on *terra preta* from Guiana in 1876. One of

¹⁰The geographer Morse, for example, said that the soils were "extremely fertile" in 1809 (Kern et al. 2009).

¹¹Ortom, J. *The Andes and the Amazon* 1875.

Charles Hartt's students, Herbert Smith, wrote extensively on terra preta in 1879¹² (Petersen et al. 2001). Smith wrote about the soil that he called "the best of the Amazon" near the Tapajós River and Santarém.

In the beginning of the twentieth century, the archaeologist William Farabee identified deposits of *terra preta* near Santarém. Curt Nimuendaju made the bridge between this soil and the archaeological artefacts in the 1920s, opening new horizons for research on *terra preta de índio*.¹³

Towards the end of the twentieth century, *terra preta de índio* was approached by agronomists who often disagreed with the cultural attribution that was given to the soil (Petersen et al. 2001). In this period the nature-culture dichotomy in relation to the soil becomes more evident. In 1885 Hartt argued that TPI was the home of indigenous people who were attracted by the fertility of the soils (Kampf and Kern 2005), in 1944, Katzer put forward the idea that *terra preta de índio* was a place of old aboriginal colonisation. For the defenders of the natural genesis, *terra preta de índio* would have its origins in volcanic ashes and ancient lake sediments.¹⁴ The explanation that these scientists gave to the historical artefacts found on *terra preta* is that the fertility of the soil attracted indigenous people from other regions to settle there. However, the almost random distribution of *terra preta de índio* sites in relation to geological facts and its occurrence in high altitudes can make this hypothesis disputable (Hilbert 1955). In addition, this theory did not account for the phosphorus in the soil, which is a feature of human occupation. Gourou (1950) and Hibert (1955) believed TPI to be of archaeological origin. Up until the 1970s, it was believed that the artefacts in the soil proved that indigenous people chose those sites because of the high fertility of the soil. In 1966 Sombroek argued that TPI fertility was in fact a result of long periods of land occupation. Smith (1980) also stressed the key role of anthropic influence of the high fertility of TPI. Defenders of the cultural genesis believe that human occupation generated the soil. Since then, several studies have confirmed the anthropic origin of TPI (Kampf and Kern 2005). Therefore, the establishment of a sedentary village and intense use of the soil over a long period of time would be considered responsible for the creation of *terra preta*.

The fact that *terra preta de índio* was already known triggers changes in the conception of the Amazon as an inhospitable, virgin and homogenous place; nevertheless, some twentieth century scientists followed the line of thought in Julian Steward's research.

Julian Steward endorsed environmental determinism. The followers of this theory stressed the infertility of the Amazonian soil in all the non-riverine localities of Amazonia (Petersen et al. 2001). The areas with the largest sites of *terra preta* found until now are mostly located in white water rivers in the Amazon basin (Fraser 2010).¹⁵ That is not to say that other soils of the region are not used at all for

¹²Smith, Herbert. *The Amazons and the Coast* 1879.

¹³It is important to stress that the dark horizons were only recently considered anthropic artefacts.

¹⁴Faria (1946) is a defender of the natural genesis.

¹⁵The Açutuba site, for example, is by the river Negro.

agriculture. Fraser's research demonstrated that *caboclos* from the Madeira River have developed a management strategy with a classification of 'weak' and 'strong' landraces, and therefore being suitable for more fertile soils, such as *terra preta*, or less fertile soils (Fraser 2010). Along the same lines, Junqueira et al. (2011) demonstrated that secondary forest in *terra preta de índio* has a higher use value than the secondary forest in other soils (Junqueira et al. 2011). In other words, secondary forests in TPI soils are an example of traditional practices that can create extremely productive environments. As anthropic soils sustain a different secondary forest than other soils, they concentrate agrobiodiversity. Therefore, these soils could be more advantageous in situ conservation (Junquera et al. 2010).

The slash and burn system is highly practiced in the Amazon and it is said to be one of the triggering forces behind the destruction of the forest. This process in itself does not prevent the regrowth of the forest and it is sustainable at a small scale. Slash and burn is a traditional method of land use in tropical countries (Greenland et al. 1992; Glaser 2007). Small farmers burn the vegetation that would allow crops to grow. After that there is the fallow period when the land, now deteriorated, can recover. However, the increase in the number of people practicing slash and burn lead to greater biodiversity and nutrient loss. In addition, the intensification of the use of a soil, a process which diminishes the fallow period, makes the soil infertile. This scenario makes the slash and burn system unsustainable (Glaser 2007). The sustainability of this practice lies in the availability of enough land for the small producer to rotate through, leaving the land previously used enough time to generate its organic matter (Mattos et al. 2010), which means the fallow periods last up to 20 years (Steiner et al. 2004).

Although *terra preta de índio* contains large quantities of charcoal, the soil is not a product of burns. Slash and burn produces ash, not charcoal. In addition, large part of the carbon in the process of slash and burn is liberated into the atmosphere in the form of carbon dioxide (Mann 2005). The process used to produce *terra preta* was coined by Christopher Steiner as "slash and char", which is the process of low intensity burn, a cold burn with incomplete combustion, or carbonisation. This process releases less CO₂ into the atmosphere than burning does. Studies have demonstrated that the typical period for charcoal to realise carbon into the atmosphere is about 50,000 years (Ogawa and Okimori 2010).¹⁶

It is important to stress the fact that beginning in the 1980s *terra preta* started having more of an expressive space in the academy. Until the end of the 1960s there were 43 references in articles and books of *terra preta*. In the 1980s alone 42 new references were added to this list. In the 1990s that number went up to 78 (Woods and Denevan 2009).

Researches from different areas and different countries work together with *terra preta de índio*. The number of research entries has almost doubled since the 1960s. This means that only recently has attention been given to this theme.

¹⁶It is important to notice, however, that there is little information on how the charcoal is preserved in an agricultural field with frequent tillage.

Research entries started in 1874. This fact might seem odd, as explorers and scientists in the region had worked in the region from the sixteenth century onwards and it would be possible, if not likely, that some of them had encountered this black soil. However, archive research conducted by a number of scientists reached the same conclusion: there is no register of this soil before 1874 (Denevan 2009).

The knowledge about *terra preta* is connected, although indirectly, to an event in the United States. At the end of the American Civil War, some southerners preferred to migrate to Latin America rather than be reunited with the North. Therefore, colonies were set up in terrains with *terra preta* around 1867. This was the case of Panema, Diamantina and Taperinha, amongst others. A considerable number of colonies followed this format, which discards the possibility of it being a coincidence that all these people decided to settle in areas that by chance had *terra preta de índio*. The first to make the bridge between the colonies and the soil was Charles Hartt. After his work was published post-mortem in 1885, *terra preta* was only discussed in the academic environment again around 1903 by Friedrich Katzer in his work on Amazonian geology.

After Katzer's work, there were other leaps in time, and *terra preta de índio* only reemerged again in the 1920s. William Farabee was one of the actors responsible for this. The anthropologist published a paper in 1921 in which he mentioned a black soil characterized by old indigenous settlement. Another important author was the anthropologist Curt Nimuendajú, who published his paper on the excavations he conducted in the years before around the Tapajós River in 1925 and elaborated maps in which there were *terra preta* sites from 1923 onwards. These maps were published after his death. In 1933 Katzer's work was published in Portuguese.

The three decades that followed 1940s, 1950s and 1960s, witnessed several reports of Amazonian dark earths. In 1944, a section of Katzer's book published in 1903 was published in Portuguese under the title of *Terra Preta*. It was the first article specifically devoted to the subject to be published. It is important to stress that these papers discuss the possibility that the soil had a natural rather than a cultural genesis. In the 1960s Wim Sombroek initiated his work on *terra preta de índio*. His dissertation about the soils of the Amazon was published in 1966 and included descriptions of *terras pretas* located at the Belterra Plateau (Sombroek 1966). Sombroek identified some differences between *terra preta* and *terra mulata*. During the 1970s, there were some reports on the soils, but the publishing of another book about the region marked the decade. In 1971 Betty Meggers published *Counterfeit Paradise* (Meggers 1971). In her bestseller, Meggers mentioned *terra preta*, but left out its cultural genesis. The scientist defended the theory that the soil was the outcome of small, long lasting and recurring settlements. Although Meggers' theory has been criticised and other theories have emerged, that is not to say that her position has been dismissed. It still an influential theory (Neves 2006) that no one has yet proven wrong.

In the 1980s there was a marked increase in the number of papers on *terra preta de índio*. In fact, it is during this time that researchers Smith (1980), Kern and Kampf (1989), Andrade (1986), and Eden et al. (1984) published their works, and

there was a general increase in research done in this area which lasted for a decade. It is worth pointing out that in the 1990s climate change began to gain more space in the academic and media circles. After the Climate Change Convention was signed in 1992 and the Kyoto Protocol was elaborated in 1997, the climate change regime was consolidated. One of the important points in the discussions on climate change is carbon. The increase in importance of carbon, in particular the mitigation of climate change, could also have had an influence in the rise of interest in *terra preta*. *Terra preta de índio* drew attention not only due to its agronomic potential, but also for its possibility to store carbon, which can reduce emissions.

Within archaeology there were also changes that could have helped shape this new scenario. From the 1980s onwards, there was a gradual shift to problem-oriented research projects (Barreto 1998). It is important to remember that in 1977 the National Programme for Archaeological Research in the Amazon Basin (PRONAPABA in Portuguese)¹⁷ was founded. The advances made from the 1980s onwards, one of them being the rise of historical ecology, helped the questioning of the standard model.

Factors not always so clearly related to the research might have determined a focus in a given place. In Colombia, for example, the existence of the Revolutionary Armed Forces of Colombia could have influenced the research in that country, as it was extremely dangerous to go out in the field. In Brazil in the mid-twentieth century the archaeology discipline was not well developed and there were only a few researches being conducted, and most of them in the same place, the Marajó Island. These factors could have played a part in the obscurity of *terra preta de índio*.

It is important to stress the key role that Kern and her colleagues from the Pará Emilio Goeldi Museum had in *terra preta do índio* research from the end of 1980s until today. They have conducted extensive research and have contributed significantly to the advancement of knowledge regarding the soil horizon.¹⁸ Other scientists also played a key role by encouraging their students to carry out research on this topic. This was the case of Wolfgang Zech, who published an article in German on TPI in 1979,¹⁹ and E. Pabst, who carried out his masters and PhD research on the topic in 1985 and 1993 respectively.²⁰

¹⁷The Pronapaba was created by Clifford Evans, Betty Megers and Mario Simões in cooperation with many Brazilian archaeologists.

¹⁸For a list of the Museum group that researches terra preta de índio, go to http://www.museu-goeldi.br/pesquisa/ecologia/tpa/paginas_imagens/publi.htm and click on publication list.

¹⁹Zech, W. et al. *Analytische Kennzeichnung vom Terra Preta do Índio. Mitteilungen der Deutschen Bodenkundlichen Gesellschaft* [S.I.], v. 29, p. 709, 1979.

²⁰Pabst, E. *Terra Preta do Índio: Química, Caracterização e Significado Ambiental de uma Formação Arqueológica*. (1985). 362 f. Dissertação de mestrado - Faculdade de Geociências, Ludwig-Maximilian Universität, München, 1985.

Pabst, E.E. *Terra Preta—Ein Beitrag zur Genese-Diskussion auf der Basis von Geländearbeiten bei Tupi-Völkern Amazoniens*. 1993. 143 PhD. Gesamthochschule Universität Kassel, Kassel.

Perceptions of Amazonians Soils

Our most basic human need is food. In order to produce food it is important to have fertile soils. Agriculture is the basis for complex societies of the so-called ‘new world’ (Oliver 2001). Development of agriculture was crucial for societies in the Andes and in the Amazon. Before agriculture prevailed as the main source of food production, however, there was a period in which the interaction between human beings and plants was not so degrading. In searching for other plant species and food, human beings started to transform the landscape long before the beginning of regular cultivation.

Agricultural production has been an issue for centuries, and it is likely to remain so. Nevertheless, with the rapid increase in population in the nineteenth century, the search for arable land has become even more crucial. Population increase and the rise in the level of living standards, which triggers more consumption, are key issues in the current and future scenarios. Together with the need to provide food for a growing population, the need to sustain natural resources and the services provided by them have become a popular topic of research. In this context, land and soil have been important issues in the development of societies. Tropical rainforests, for its vast extension, have played a role in the development debate. This is also the case of the Amazon. Its soils, however, have been through a different set of representations. These different views of the Amazon soils have had an impact on how the government elaborates its policies for that region.

Three views of the Amazonian soils can be identified (WinklerPrinks 2002). The first view dates back to the Victorian age and is made clear in the writings of Henry Walter Bates in the mid-1800s. In his writings, Bates exalts the green and luxurious quality of the Amazon.²¹ His description of the rainforest gave birth to the idea that the Amazon was at the time very fertile, and therefore an important asset in agricultural production. His understanding originated from the European idea that once cleared, the forest soils were fertile. Bates was not the only one. In 1853 A.R. Wallace wrote *Travels on the Amazon and Rio Negro* where he exalted the “richness of the vegetable productions and universal fertility of soil, it is unequalled on the globe” (Wallace 1979: 247).

Many scientists went into the forest and had the duty to report back their findings. The exuberance of the Amazon rainforest led these scientists to believe that the forest was indeed fertile. The Western imagination was projected into the Amazon. Scientists from Oviedo to Buffon²² saw the forest as a conservatory, inhabited, incidentally, by a few humans (Descola 1996a, b). This view of the forest reduced the population that lived there to a secondary place in relation to nature, not even

²¹Bates arrived in the Amazon in 1848 with Alfred Wallace and stayed in the forest for 11 years collecting data of more than 8000 species that was sent to the British Museum.

²²Buffon wrote that the American Indian “was in himself no more than a first-class animal and, for nature, merely an inconsequential being, a sort of impotent automaton incapable of bringing her reform or succor.” (Euvres completes, VX: 443 in Descola).

being worthy of a cultural approach. Since the first encounters of European travellers with the South American rainforest, the latter was seen as a place of excessive nature, and therefore all that life was subject to natural logic (Raffles 2002).

Accounts that the soils were not as fertile as first believed were revealed as early as the 1920s. However, it was not until the second half of the twentieth century that the second view of the Amazon soils became dominant. After a few unsuccessful attempts to colonise tropical regions and boost agricultural production, the second view, which sees the soils of the forest as infertile, gained strength. This new reality triggered the studies of soils in those regions. In the Amazon, Wim Sombroek's dissertation on *Soils of the Brazilian Amazon* is still a milestone in the understanding of these soils. However, both academic and government articles came to the same conclusion. In Brazil, the project RADAM (1976) documented the poor fertility of most of the soils of the *terra firme* in the Amazon. As late as 1991 the Planning Ministry presented a document that highlighted this characteristic. Articles by Falesi (1974²³) and Sombroek (1984²⁴) also followed these lines.

The infertility of the soil is one of the driving forces of deforestation. The ashes from the burned vegetation bring a breath of fertility to the Amazonian soils for three to four years (WinklerPrins 2002). Sanchez et al. (1982) argued that it was possible to say that it was not feasible to harvest the acidic and infertile soils of the tropics. Regarding the Amazon rainforest, they stated that 75 % of the Amazon was covered by acid ferrasols (oxisols) and acrisols (ultisols) and only 6 % of the South American rainforest did not present great restrictions to agriculture. After slash-and-burn and the small period in which the soils stay fertile, they go back to its original state and farmers move on to other plots of land.

In order to overcome the view of the upland soils as infertile, solutions based on technology were suggested. Research conducted by Brazilian agencies in the 1980s demonstrated that with the right amount of fertilisers, these soils could be productive over the years. These conclusions, however, triggered two criticisms. First, they were believed to be true for the whole of the Amazon basin, which is not the case. It is hard to imagine a one-size-fits-all solution for the Amazon forest as a whole. Secondly, as it was in the 1980s and is now, most of the fertilisers are not accessible to most of the farmers in the region. Some authors argue that the infertility of Amazon soils was overemphasised to mine the previous idea of the soil as rich and fertile (Wagley 1953). Goodland and Irwin (1975) and their book on the Amazon are a good example of such authors. They argued that the soils of the tropics were infertile and the only viable way to have agriculture in the Amazon was through slash and burn.

Within this second view, the people that inhabited the Amazon before the arrival of the European were seen mainly as primitive egalitarian tribes that lived in small

²³Falesi states that latosols, which covered 70 % of the Brazilian Amazon, have low chemical fertility (Falesi 1974: 203). He goes on to say that the soils of the *terra firme* have, in general, low or average fertility (Falesi 1974: 227).

²⁴In this text, Sombroek suggests that new information on soils of the region had become available and earlier statements were being refuted (Sombroek 1984: 521).

and impermanent villages. The hostile environment was responsible for the lack of complex socio-political institutions (Parssinen et al. 2009). According to the argument, political centralisation as well as social stratification would be more prone to develop in an environment where the staple food that was crucial for the subsistence of the society could be stored (Roosevelt 1980).

In the timeline of the second view, the dichotomy between floodplain and upland was reinforced. Some authors, such as Petrick (1978) and Barrow (1985) argued that floodplain soils had higher agricultural use and should therefore be set aside for agricultural production, as they are today. Carneiro (1970) has also argued that in the 1500s, as too many people wanted a limited amount of productive land in the várzea, war would take over, which in turn would generate subordination of villages and chiefdoms. Roosevelt also played a part on the reinforcement of the *terra firme-várzea* dichotomy (Roosevelt 1980). The Amazon was described as being made up of 98 % terra firme (upland) and 2 % várzea (Hornborg 2005; Meggers 1984; Moran 1995). Despite the differences on how to explain the two main environments in Amazonia, scholars did use this dichotomy, which was considered a key feature of the forest for a long time and, to some extent, it still is today. The persistence of the dichotomy can also be due to the fact that it is broad enough to serve the social and natural sciences, easing the integration of findings from each area (Moran 1993). However, this dichotomy overlooks particularities—and therefore the opportunities—of the forest. A research topic that has challenged the *várzea-terra firme* dichotomy is the bluff model (Denevan 1996), which due to its location could have had a significant role in semipermanent settlements and food production.

Throughout the history of the tropics, one can identify a tendency towards homogenisation, which diminishes the diversity of this forest and simplifies its ecosystems. This also applies to the soils of the region. One of the reasons for this is that the results of studies done on parts of the Amazon (in uplands, non-floodplains) were expanded to the totality of the rainforest (Piperno and Pearsall 1998). Eswaran et al. argued that the maps produced in the 1970s are a source of this misconception, and that maps are designed for a specific purpose, which might not serve the same purpose for those who later use the map. Until the 1990s the soil maps that existed were too generalised. The data on tropic soils were collected mainly after the Second World War and originated from ad hoc observations as well as a small number of individuals. The FAO Soil Map of the World 1:5,000,000, published in the 1970s, shows a scenario that was different from what people were used to, demonstrating variability within the region and eliminating some of the misconceptions created about the forest's soils. Despite creating the FAO Soil Map of the World, some of these misconceptions remained. One reason for this is the terminology introduced by FAO, in both the Soil Map of the World and in the Soil Taxonomy, which was not appreciated by many scientists. In addition, there was an issue regarding the reliability of some maps (Eswaran et al. 1992). The Project RADAM Brazil, which began in the Amazon, had a scale of 1: 250,000. The Brazilian Institute of Geography and Statistics (IBGE in Portuguese) also released Brazilian soil maps in 1982.

Geography also played an important role in the homogenised view of tropical soils, which was a key feature in the first and second views. Everything between the Tropics of Cancer and Capricorn was considered tropical soil. Although that is the case, no variability within tropical soils was invoked. There was even a homogenised view amongst the different tropical forests in the world (Richter and Babbar 1991). A tropical soil is generally considered to be a deep, red, acidic soil that is well drained and has no clear horizons. This soil is linked to ferralsols. Five characteristics were associated with a tropical soil (Richter and Babbar 1991). They were: exceptionally intense weathered and leached, low soil organic matter; destructive weathering of soil aluminosilicate clay minerals; low nutrient retention capacity; ability to harden in an irreversible way once exposed to sun and air (air is valid only for plinthosols); and homogeneity regarding the soil chemical and physical properties.²⁵

The concept of tropical soil has been oversimplified and the relationship between soil and climate has been overemphasised. Factors that play a role in soil formation are climate, parent formation, time, biota and topography (Jenny 1994). By downplaying the role of other factors and putting climate on top, variability within tropical soils became a result of climate variability. As climate in the tropics is stable, one can jump to the conclusion that all the soil in the vast region of the tropics are the same. This view persisted for the greater part of the last century (Richter and Babbar 1991). Regardless of the parent material and the topography for a location, all soils within a climatic region must present definite characteristics related to that climatic region (Jenny 1994). This fact might have been taken to an extreme and helped cast a vision of soils as one, not with the same characteristics but the same soil all over the tropics. In addition, this emphasis on climate has helped to shape how soils in the tropics are popularly represented.

The lack of reliable data for soils in the tropics was a significant issue. This absence, or perhaps this flaw, was even noticed in the 1980s, when systematic soil surveys and maps were still missing. The lack of quantitative data on tropical soils has therefore led to misleading assumptions. Moran (1996) highlights that although there was a research boom in Amazonia from the late 1970s onwards, the ability to compare human ecologies had not been proved. This lack of data was also a feature of the anthropology of the region. So much so that the author stated that the forest was indeed a knowledge frontier (Moran 1985). Up until 1976, the knowledge about the history of the Amazon region before the arrival of the Europeans consisted of information on a few isolated areas (Meggers 1995).

Definitions about what a soil actually is and how it develops originated from researches carried out in the temperate zone. Traditional science fields such as botany and soil science were developed in the temperate zone, especially in Western Europe (Meggers 1974). Apart from the differences between tropical and temperate zone plants—nutrient storage capacity, growth, reproduction, amongst others—it is important to stress that the diversity of tropical forests are the complete

²⁵Richter and Babbar (1991: 325).

opposite of the uniform temperate forests. The different composition of soils in the tropics was not taken into account and the system did not encompass such variation.

In Brazil the introduction of the Amazon region in the development plans of the Government in the 1970s triggered the need to collect accurate data on the soils of the Brazilian rainforest. Soil surveys, as well as classification of the vegetation, geomorphology and land suitability were carried out for at least a decade (Richter and Babbar 1991). The wide variability in the outcome of the occupation of the forest, which started in the 1940s, reflects the lack of knowledge of soils of the region and their respective potential. Before the 1970s research, another research on soils of the region had been carried out in cooperation with US-AID and FAO. The maps produced then presented a wealth of soil data, but they were not very reliable compared to what is known today (Richter and Babbar 1991). In the FAO-Unesco mapping project, which took place in 1971, most of the Amazon basin was assigned a soil reliability class III, which meant that only general information was used to construct and develop the boundaries of the units. In other words, until the beginning of the 1980s, only a very slim part of the soil maps produced were actually based on observations.

Within the Brazilian scenario it is important to highlight two initiatives. First there was the RADAM Brasil project, which started in the Amazon and later spread throughout the whole country. The second initiative was the creation of the Soil Commission of the National Service of Agronomic Research. This Commission started the soil survey of Brazil, and its aim was to map the entire national territory. The Soil Commission organised the first Brazilian Soil Science Meeting, which led to the establishment of the Brazilian Soil Science Society. The lack of technicians and the need for soil surveys led the Commission to organise the first course on Morphology, Classification and Soil Mapping in 1954. The Institution went through several administrative changes and today it is known as Embrapa Soil, located in Rio de Janeiro, Brazil.

The soil survey conducted by EMBRAPA (1981) points out that there was an overestimation of ferralsols cover in the Amazon (Richter and Babbar 1991). The maps produced by EMBRAPA showed that 39.1 % of ferralsols cover the Amazon region rather than 67.4 % registered on the FAO-Unesco maps. According to EMBRAPA (1981), acrisols covered 30 % of the region, not the 15 % estimated by FAO-Unesco.

Although research started to be done to demonstrate the variability amongst tropical soils, reports reinforcing the belief that the soils of the tropics were infertile were also completed in the 1970s. In 1972 the Economic Development Institute of the International Bank for Reconstruction and Development launched a treatise, which stated that pure laterites as well as ferralsols covered a large part of the humid tropics (Eswaran et al. 1992). The document also specified that these were poor agriculturally or of no use whatsoever.²⁶ This helped solidify the idea that the soils were poor. The

²⁶Needless to say, this is no longer the case. It is also important to highlight that Brazil is seen as an “agricultural superpower” and that in three decades the Brazilian Enterprise for Agricultural Research became one of the leading institutions in the world on tropical agriculture (Rother 2007).

idea that soils of the tropics were infertile has been around since the 1960s. Many publications have emphasised this (Gourou 1966; Mcneil 1964; Goodland and Irwin 1975; Friedman 1977; Irion 1978; Reiss et al. 1980; Jordan 1985). This infertility precludes sustained agricultural production (Sanchez and Logan 1992).

Carl Sauer and Donald Lathrap played an important part in the research on agricultural origins in the tropics (Piperno and Pearsall 1998). The subject had not received much attention, and most of the work done in the area concluded that the region was hostile and it hampered cultural development (Steward 1946–1948; Meggers 1954, 1971). The Amazon rainforest was believed to have poor soils, which could not have sustained a considerable quantity of food production and, as a result, would not have allowed for a high-density population. The rainforest was seen as a barrier to indigenous survival due to its lack of resources (Roosevelt 1996).

The research conducted by Julian Steward and Betty Meggers played an important part in the history of the Amazon. The *Handbook of South American Indians* (1946–48) edited by Steward,²⁷ together with *Man and Culture in a Counterfeit Paradise* (1971) written by Meggers²⁸ enforced the view that the Amazon was in fact inhabited (Viveiros de Castro 1996). The theory that the environment had a determining action over the development of a society, as defended in these papers, became embedded in the view of the South American rainforest. This model presented the indigenous people that lived in the forest as occupying an intermediate evolutionary position. They were unable to generate the necessary economic surplus that would allow social stratification, political centralisation and craft specialisation. Despite the ecological differences between upland and floodplain environments, the Amazon was seen as an overall uniform forest, sparsely populated, and underdeveloped socially and culturally. Many anthropologists and archaeologists who follow the line of environmental determinism have adopted the view that the nature of nature in the South American rainforest prevented further development of small villages and shifting cultivation, emphasising the separation between culture and nature (Cleary 2001). Steward transformed his view into a discipline: cultural ecology. This had great influence in the study of Amerindians from then on. The theory of limiting factors was dominant until at least the 1980s (Viveiros de Castro 1996). The theories of Steward and his followers opposed nature and culture. An essential part of Steward's theory is adaptation. People have to adapt themselves to resources and opportunities given by their environments. This is the main reason for the differences between cultures (Balée and Erickson 2006). In the Amazon this was known as the standard model.

²⁷“The population density per unit area is a rough measure of the success of subsistence activities in the area, and it is correlated to some degree with cultural development.” Vol. 5 p. 655.

“From a technological and ecological point of view, the basic tropical forest culture is strikingly uniform so far as present data reveal.” Vol. 3 p. 885.

²⁸In 1954, Meggers wrote, “The evidence suggests that the environment exerts an insurmountable limiting effect on the cultures it supports as long as it permits only a hunting and gathering subsistence pattern, and that this limitation extends to all areas of the culture, even those that seem remotely or not at all related to the subsistence requirements.” (1954: 807).

Modern archaeological data started to arise in the 1960s, and a new picture of the forest was being delineated. Rather than being separate from a wider continental picture, the findings in Amazonia fit the broad spectrum of research of the Americas, from Mexico to Chile, setting the date of people in South America to before 12,000 BP²⁹ at least. The fact that it took over 30 years for that research to be recognised is related to the dates originated for Latin America, which go against the Clovis Model (Cleary 2001). Latin American findings that challenged the Clovis Model were ignored and suffered attack. Therefore, a view that the Amazon was not important to the history of the Americas before the arrival of the Europeans was disseminated and perpetuated. Today, only a small number of archaeologists dispute the idea that there were pre-Clovis traditions in South America (Balée 2010).

What can be called a paradigm within the study of the Amazon began to be refuted by European anthropology in the 1950s; but it was not until Levi-Strauss published *Mythologiques* in 1971 that structuralism grew to be prominent within Amazonian ethnology (Viveiros de Castro 1996). In the late 1960s, British scholars began to show interest in the subject from which they had abstained until then. Maybury-Lewis³⁰ and Riviere³¹ produced milestone monographs and their work marked the beginning of the contemporary phase of ethnology in Amazonia. The researches that arose in the 1970s demonstrated a combination of influences of European and North American schools. From then on there was a polarisation in the debate. On one side there were the followers of Steward; on the other side there were those who followed a structural-cultural reference. Although there was this polarisation, it is important to stress that certain aspects of Steward's book *Handbook of South American Indians* were present on both sides. The Amazon rainforest was still seen as the home of a small population that was dispersed and isolated in small, egalitarian, autonomous, self-contained groups without advanced technology (Viveiros de Castro 1996).

A new environment for research arose as a result of elements that were happening a few years prior. New discoveries regarding the population of the Amazon led to the new theories. These research focuses on the population number in the forest before the arrival of the Europeans attribute greater complexity to the groups and emphasise the importance of ecological characteristics and of long distance societal impact (Viveiros de Castro 1996). Another reason that helps to explain the change within the discussions about the forest was the consolidation of revisited anthropological theories of social formation of indigenous tribes. The realisation that the Amazon was not as homogenous as first believed, that it in fact it was extremely diverse, which in turn had an impact on the range of human activity

²⁹Before Present (1950).

³⁰David Maybury-Lewis wrote about his experience in the Amazon with the Sherente and the Krahó (1955–56 and a short visit in 1963) and with the Shavante (1958, summer of 1962 and a short visit in 1964).

³¹Marriage among the trio: a principal of social organization. 1969.

Photo 2.3 Juruá river in the state of Acre. *Source* Taken by Carlos Alberto Bernardo de Araújo



among forest inhabitants, was one of the main changes. Although the *terra firme-várzea* dichotomy was present in the researches, Emílio Moran, together with other researchers, demonstrated that the forest diversity, in pedological, zoological and botanical terms, did not fit into two boxes. This dichotomy hides the differences amongst the regions in the forest. The existence—and persistence—of this dichotomy has also led to misleading generalisations as results from one part of the *terra firme* were transported to another site with completely different characteristics like population and cultural evolution (Moran 1995). What about, for example, the tribal territory of the black water river, which until 1995 had not yet been demarcated? The *terra firme-várzea* dichotomy refers to white water rivers (Ribeiro 1995), leaving blackwater rivers out of the discussion. The culture of the people from the Amazon rainforest reflects indigenous culture, from the flora architecture to natural resources management and agricultural techniques. This in turn varies within the forest (Photo 2.3).

Anna Roosevelt's work shed light on other possibilities in the region. Her research was a reaction to Meggers' theory of environmental limitations.³² Roosevelt began publishing the results of her research on the Amazon in 1980. The evidences of cultural complexity discovered in her research, together with earlier descriptions of populations in *várzea*, led Meggers to propose that these people

³²The perspective of environmental limitation in the Amazon rainforest focused firstly on the infertility of Amazonian soils and then shifted its focus to lacking protein resources in the soils (Beckerman 1994: 178).

were in fact from the Andes or suffered their influence. Meggers argued that this phase of development, which would imply a more dense and complex society, appeared fully developed all of a sudden, which leads to the theory that there was an intrusion (Meggers and Evans 1973). She reinforced her previous argument that a society with a high level of social stratification could not be developed in a tropical environment with slash-and-burn agriculture, and even if such a culture penetrated that deep into the forest, it would not be able to sustain itself. This would fit the theory that the soil of the Amazon could not generate or sustain such complexity (Viveiros de Castro 1996).

In her work, Roosevelt concluded that the indigenous population of today represents the remnants of the people that survived the population decline after the arrival of the Europeans. The simplicity of the Amerindians today should not be representative of the simplicity of the population prior to the European encounter, which would reflect the limitations imposed by the environment. She, however, was not the first to oppose the dominant view of environmental determinism. Lathrap had put forward the idea that the South American rainforest was the birthplace of complex societies (Lathrap 1975). Carneiro had proposed a theory of political centralisation, in direct opposition to Meggers' ideas³³ (Carneiro 1995³⁴). Descola's research on the ecology and economics of the Achuar Jivaro is also important. He demonstrates, among other things, that the difference between the production potential of the Achuar that lived in the riverine or the interfluvial habitats was not so relevant in politically or economically.

Within the environmental determinism of Steward, Meggers and others, the adaptation capacity of the population is central in the explanation of how people survived.³⁵ The argument that rises from the simplification of complex social relations to propositions fits in the functionalist models of human adaptation (Nugent 1981).

The fifth centennial celebration of the arrival of the Europeans in the Americas may have contributed to spark interest in the historiography of the people that lived in the Amazon (Viveiros de Castro 1996; Stahl 1996). Research carried out in the forest, such as the work in Pedra Pintada (Roosevelt et al. 1996) demonstrated that the tropical environment, when compared to others, did not limit human development harshly. We should not be so eager as to define the inhabitants of Amazonia before the arrival of the Europeans as environmentalists or conservationists and to describe the forest as pristine or virgin (Stahl 1996).

³³To view critiques to Roosevelt's work, see Viveiros De Castro (1996).

³⁴In this article, Carneiro presents a critique of one of Roosevelt's articles and he goes over the main thesis of his work.

³⁵Meggers wrote, "Man is an animal and like all other animals must maintain an adaptive relationship with his surroundings in order to survive and although he achieves this adaptation principally through the medium of culture, the process is guided by the same rules of natural selection that govern biological adaptation." Meggers (1971: 4).

From 1980 Onwards

The third view derives from a set of new research directions. These investigations are called by WinklerPrins as post-modern, and represent a reaction to the previous perception that was dominant, inviting plural perspectives. The research that contemplates the third view deconstructed some assumptions of the rainforest. Firstly, the homogenisation of the region that was characteristic of the first and second views was broken, also hitting the floodplain-upland dichotomy. This dualistic view was no longer accepted to characterise the forest. Secondly, evidence of fertility such as *terra preta de índio* contested the representation of the soil as infertile. Thirdly, the idea that the soils of the Amazon precluded the development of conditions favourable to human development was being disputed. Although natural conditions do have an impact on population development, they are not static and over-imposing. The existence of *terra preta de índio* itself demonstrates that people were able to live in the region, shaping the history of the Amazon.

Throughout history the property of soils has played an important role in determining the cultural and economic development of a region (Eswaran et al. 1992). The fertility of alluvial soils formed the scenario where civilisations evolved. In the tropics, however, the situation was different. The highly weathered soils allowed farmers to use shifting cultivation or slash and burn agriculture. The misconceptions about tropical soils have had an impact that goes beyond food production, such as rural poverty, land degradation, deforestation and biodiversity. These misconceptions helped shape policies towards the use of the forest. Seeing the soil as highly leached also feeds into the theory that the region is not productive and the only way it can have a role in the development of the country is being a source of resources.

Two evidences counteract the idea that soils in the tropics are infertile (Sanchez and Logan 1992). First, the diversity of tropical soils is now documented by numerous and accurate database, together with the World Soil Map. Second, experiences in Asia and Latin America demonstrate that some so-called infertile soils can be managed in a sustainable manner. Soil diversity in the tropics is, at least, the same as it is in the temperate zone (Eswaran et al. 1992).

In the past three decades the third view of the Amazon has flourished. During the 1970s a critique of the dominant view at that time started to emerge, prioritising cultural constructions and giving less importance to the environment (Descola 1996a, b). Up until the 1970s, the Amazon was portrayed as an illusionary paradise that received people of different cultures, including the Andes (Gomes 2008). Due to limitations imposed by the environment, these cultures receded into tropical society conditions.

In the 1980s, however, the forest was portrayed as the home of late-coming societies with powerful chiefdoms, complex social organisation and political hierarchy compared to those of Mesoamerica. During this time, evidence that past human occupation was greater than initially thought when the Europeans arrived became more widely known, together with the idea that the Amazon environment

had been modified. The clues were there, from large mounds close to the mouth of the river to anthropic soils and dikes (Stokstad 2003). The Amazon, seen as a luxurious forest, impenetrable and uniform, started to be seen for the plurality of its realities, being Amazons, and not just one Amazon, over all the extension of the forest. The Amazon is as diverse as an area of continental size can be (Moran 1996).

Before the emergence of this view, the indigenous population of the region was seen as being small and having had little impact on its surroundings. Research conducted on the region, however, has demonstrated that that was not the case. New research led to empirical evidence that contested the theory that the Amazon could not support and therefore allow dense population to develop (Roosevelt 1994). These changes in the understanding of the Amazon as a plural and altered environment are the result of a dynamic and complex history of human-environment interactions (Heckenberger et al. 2007).

Despite the fact that evidence contradicting the dominant view set up by Steward and Meggers was available before the 1980s, it was only then that researchers began to voice more explicitly alternative narratives for the Amazon (Raffles and WinklerPrinks 2003). From the 1980s onwards, a growing number of researchers such as Raffles, Hecht and Posey, Balée, Denevan, Roosevelt, Smith, Demeritt, Haraway, Clement rejected the idea that the forest was pristine and that the population of the region had a passive role in their own history and in the history of the forest. In addition, rather than reassuring the nature-culture divide, they proposed a more hybrid conception of a natural-cultural landscape. Their argument partially reflects the idea that nature is socially constructed as a discursive practice and that the separation of nature and culture is both historically and culturally particular to post-Enlightenment European thinking (Raffles and WinklerPrinks 2003). The use of nature, or natural resources, grew as a result of the demand for resources for production. In charge of this demand was what can be called the first ruthless capitalist class (Williams 1980). The members of this class were eighteenth century agrarians who set the foundations of the industrial capitalism that followed.

To account for the evidence of complex societies in the Amazon, scholars argued that it was the result of migration from the Andean highlands (Parssinen et al. 2009). However, further research showed that landscape management allowed human for development, which in turn led to complexity. Sophisticated techniques, such as elevated terraces for agriculture and fishponds, enabled the necessary intake of protein. From 1980s onwards, scholars have discovered evidence of complex societies before the arrival of Europeans in upland areas. Examples of this are the earthworks studied by Porras (1987) and Salazar (1998) in the Ecuadorian Amazon and the regional integrated systems described by Heckenberger and colleagues.

Terra preta de índio soils are not the only evidence that the Amazon was the home of indigenous populations. Geoglyphs found in the Amazon, which could only be identified after deforestation, are also evidence that the forest has a greater history than once believed. Keeping with this view, more attention has been given to indigenous knowledge regarding the management of the soils, which is intrinsically related to cultural aspects of these groups that live in the Amazon

(WinklerPrins 2002). The biodiversity of the Amazon was a result of a cultural history that took place over a long period of time. In contrast to what one would assume, Balée found that anthropic forests are in fact more biodiverse than undisturbed ones (Viveiros de Castro 1996).

Evidence of complex societies in the Amazon is growing. Three civilisations stand out: the Marajoara, the Tapajônica and the Maracá. The Marajoara dates from 500 to 1500 AD (Kampf and Kern 2005) and is known for the ceramic and the earthworks in Marajó island. Dating has shown that Marajoara sites were continuously occupied for 500–1000 years. The area of Santarém was probably the centre of the Tapajônico chiefdoms. One can find evidence of a large population settlement in villages by the várzea that extend for kilometres. Dating of their ceramic reveals that the ceramic of the tapajônico chiefdoms were produced between 900 and 1200 AD. The Maracá civilisation lived in the state of Amapá by the Maracá River between 1300 and 1550 AD. In the region, several urns were found. Another example is the upper Xingu region. Scientists conducted research in the region and found evidence of settlement planning and supralocal integration (Heckenberger et al. 2008). Road networks, pre-European towns and villages are seen across the region.

This shift in research also triggered a shift in the way people saw the inhabitants of the region. Before the change in the way the forest was seen, the population of the forest was thought to be small and limited by the environment, and were described as passive, with no agency. After the third view became more prominent, the people of the forest were seen as Amazonian environmental engineers who transformed the environment they lived in.

Accepting the fact that the forest is not pristine and has been modified requires a review of the understanding of human development in the region. The landscape has a cultural history. Landscapes are legacies of past human occupation in the infrastructure of the forest, and they have a social and cultural capital (Stahl 2008; Erickson 2003). The life style of the people that lived in an area is embedded in the landscape, including anything from their technology to their rural shrines. The extensive areas of *terra preta de índio* found, the geoglyphs, the pre-European cemeteries with funeral urns, and more than 300 rock art locations in Brazil leads to the conclusion that the Amazon was in fact largely inhabited pre-1500 (Hornborg 2005).

The Amazon is the most biodiverse place in the world (Cleary 2001). No taxonomy, be that scientific or indigenous, fully comprehends its variety. There is a lack of research regarding the Amazon, and the available information can therefore be misleading. For example, the earliest radiocarbon dates from sites in the Upper Xingu River are from 900 AD. That does not mean that occupation started later in that area; it can also mean that there is an absence of research there, which can lead to ill assumptions (Cleary 2001).

The long-term history of the region is not very well known, but looking at indigenous occupation, which is linked to standing forests, can reveal key information. It is estimated that one fifth of the Brazilian Amazon is indigenous land (i.e. cannot be used for any other purpose; it belongs to the indigenous groups that live

in it), and it represents an important obstacle to deforestation.³⁶ This means that the way these groups manage the forest is unique and has had positive results in terms of continuity of land use, and further research into traditional land use techniques should be looked into for future ways of preserving the forest (Heckenberger et al. 2007).³⁷

Looking back at the traditional knowledge of the inhabitants of the Amazon, *terra preta de índio* may also unravel key information. *Terra preta*'s existence has been acknowledged since the nineteenth century, but it was not until the 1980s that its importance was widely recognised (Cleary 2001). Although other issues also played a part in the rise of interest in *terra preta*, the changes referring to the soil of the tropics and the evidence of past occupation were also important in this re-discovery.

The Past, the Present and *Terra Preta*

When Orellana and his crew went down the Amazon River and into the Amazon for the first time in 1542, the tropical scenario was different from the one we know today. Huge villages that spread as far as the eyes could see are mentioned in Carvajal's testimony. Carvajal, a priest who was part of the crew, kept a record of all that was seen when the crew went down the river (Carvajal 1934). This is the first description of the Amazon River and of the tribes that lived by it (Porro 1995). The main tributaries of the Amazon River were only explored in the eighteenth or nineteenth century.³⁸ The decision to register what was seen in the trip was based on the belief that if their leader survived—the one who let them go down the river

³⁶Although by Law these lands are for indigenous use, there is a history in Brazil of indigenous land being invaded, which creates conflict. One example is Raposa/Serra do Sol, an indigenous land for the Macixu in Roraima, Brazil. The land was demarcated and it was approved by President Lula in 2005. However, this demarcation has been contested by non-indigenous people and by the state of Roraima. The non-indigenous people, rice producers and cattle ranchers, disputed the demarcation and refused to leave their land. As with the demarcation of the indigenous land, all those non-indigenous people have to be re-settled. One of the problems was that most of the producers did not have land titles and therefore were not entitled to compensation. The situation reached a level of such tension that the federal government had to send in soldiers from the National Security Force. Another key case was the invasion of the Yanomami land by miners in the 1980s. There were reports of 40 thousand people invading the reserve, which had great impact on the indigenous population. In 2011, with the high price of gold in the international market, people feared that same situation would happen because invasions were already being reported. Source: <http://www.ipam.org.br/mais/noticiasitem?id=1389>.

³⁷This is not to say that I am defending the view of the indigenous population as natural conservationists, a very romantic view. The argument is that indigenous people do have knowledge regarding the forest that can be less destructive than the ones pursued by those outside the forest.

³⁸It is important to stress that the first written records are from these dates, but some people believe it occurred before then.

to search for food—Orellana and his crew's act would have been understood as treason.

The expedition that followed Orellana's was Pedro Urzua's (1560–1561). He wanted to take the same route as Orellana. Urzua and his crew went down the Amazon River from Marañon to the Atlantic Ocean (Porro 1995). There are four reports from this trip and they draw attention because of the accounts of large villages with plenty of resources. Sadly, Urzua was killed by Lope de Aguirre, one of his lieutenants. Aguirre got lost in the many rivers of the Amazon and did not fulfil the mission (Gadelha 2002).

The arrival of the Europeans brought diseases as well as wars and slavery (Neves 2006).³⁹ In the following century the indigenous population in the Americas decreased between 90 and 95 % of what it was before the arrival of the colonizers (Clement 1999). The difference between what was reported by Carvajal and what was found by the naturalists who went in incursions in the region two or three hundred years after Carvajal, added to the content of the priest's reports, led many people to believe that Carvajal had made those stories up.

The Amazon has been the natural habitat of populations for centuries. The occupation of the region started at least eleven thousand years ago (Neves 2009), and there is the possibility that it began even before that time. Excavations in the Pedra Pintada cave in the municipality of Monte Alegre, Pará, date back to 9200 BC. Excavations in a grotto in the state of Mato Grosso do Sul revealed artefacts dating from 12,000 BC.⁴⁰ Different areas of the Amazon were already inhabited in 7000 BC and they had evidence from different localities, such as Carajás and high Orinoco.

The emergence of *terra preta de índio* represents a social and economic structural change in the populations. Societies that occupied TPI sites were more sedentary and less mobile and maybe more territorial than their ancestors (Neves 2006). *Terra preta* sites in Rondônia are 4000 years old (Neves 2006). However, in other areas of the rainforest *terra preta de índio* began to be formed around 2000 years ago when evidence of sedentary and a more populated settling emerged.

Amazonian dark earths demonstrate that indigenous populations that lived in the forest modified the Amazonian environment. Human occupation results in the modification of the landscape through several instruments. One of them is domestication. This is a cultural process in which human knowledge of the consequences of environmental manipulation is acquired and enhances with time (Clement 1999).

³⁹Animals as well as humans carry disease. Besides all the diseases brought by the Europeans—smallpox, influenza, measles—there were also the diseases carried by animals. In Europe human beings were accustomed to be around animals such as horses and pigs, but that was not the case with the indigenous population. Mann (2005) discusses an episode in Southern United States in which it is argued that pigs were a source of contamination of zoonotic diseases, such as anthrax, brucellosis, leptospirosis, trichinosis and tuberculosis (Mann 2005: 109).

⁴⁰It is worth pointing out that this site was not in a good state of preservation, which means we must take this information with care. New excavations are needed to confirm it.

This is the knowledge that can help the elaboration of policies for a more sustainable development in the region.

Two central theories delineate the debate on human occupation and adaptation in the Amazon, an area of study that is strongly influenced by cultural ecology (Politis 2001). The first theory defends the thesis that foragers represent the original population that progressively moved upland during the Holocene period. From then on they lived a nomadic life with few resources. The second theory defends the thesis that tropical forests in general, and the Amazon in particular, are such hostile environments, incapable of supplying the necessary nutrients for human development that human occupation of the forest depended on domestication of certain types of plants. It is important to notice, however, that it is agreed among archaeologists that the first people of the Amazon arrived without domestication (Balée 2010).

The archaeological debate in the Amazon lived—and still lives—a duality. Betty Meggers and Clifford Evans, researchers of the ecologic anthropological line, dominated for most of the twentieth century the discussion regarding archaeology, and therefore the history of the Amazon. They defended the idea that the Amazon watershed was inside the area of influence of the innovation centre of the Andes, where agriculture, ceramic and the state would be developed (Neves 2006). To explain the richness of the ceramic from Marajó Island, Meggers and Evans argued that the populations of the island came from the Andes and settled there but they did not find enabling conditions to develop.⁴¹ This was the reason why they went from complex to simple societies (Neves 2006). In the 1960s and 1970s, Mario Simões and Anna Roosevelt⁴² conducted researches in the region and demonstrated that the thesis defended by Meggers and Evans was unsustainable, as the culture from the island dated almost 1000 years, from the IV to the XIV century. If the culture lasted so long, it suggests that there were ecological conditions to maintain such culture. The ceramics from the Marajoara phase are the oldest representation of the policroma tradition in the Amazon.⁴³

The arrival of the Europeans in the Amazon triggered changes in the indigenous population (Neves 2006). Nowadays the majority of indigenous lands are in areas away from the Amazon River, the riverbed of the watershed, as it is in the high Negro River or in the Guianas Plateau. Archaeological sites, some of which are very large, are located in the regions next to the Amazon and Solimões Rivers.

⁴¹Meggers and Evans (1957) argue that the Marajoara culture is a mixture of more advance circum-Caribbean and sub-andean cultures (1957: 418).

⁴²Roosevelt is an important actor in Brazilian archaeology as she certified that ceramic production in the lower Amazon in the 8th millennium bp (Neves 1998: 2). She was not the first to suggest that date, but she received wide recognition for her work, which was published in detail. The evidence acquired by her work pushed the chronology of the Amazon rainforest to the 11th millennium bp.

⁴³“The policroma ceramics are marked by the decoration in red, burgundy, orange and black over a white base. Similar to the ceramic from the Marajoara phase, the policroma ceramic are decorated with modelated, incision, excision, etc.” (Neves 2006: 61).

The pre-colonial population density is a topic that still triggers heated debates. Meggers presented a discrete estimation of 1.5–2 million inhabitants in the entire watershed (Clement 1999). The base for this estimation was the carrying capacity of the soil. William Devenan presented other numbers. He believed that the watershed was the home to 3–5 million people and that the Northern part of South America was home to 5–7 million people. If Meggers is one extreme, Meyers is the other. The author estimated that the high Amazon (the Peruvian, equatorial and west of Brazil Amazonia) was home to 10 million people.

Agriculture and Soil

The Amazon was said to be unproductive precisely because of the soils. Without soils capable of holding large populations, the region would be destined to have a low population density (Meggers 1971). The *várzea-terra firme* dichotomy is also used as a base for the argument for the environmental limitations of the forest to cultural development (Gomes 2008).⁴⁴

The Amazon is far from being a homogenous space and there are several Amazons within the Amazon. This diversity is present, for example, in its rivers. The Amazon River is responsible for one fifth of all the fresh water that goes to oceans around the world. The rivers of the forest are divided according to a classical typology proposed in the nineteenth century. The rivers that are born in the Andes are called white water rivers as they have a muddy colour. The rivers that are born in the Guianas or the central plateaus (in Brazil) are known as black water rivers. These do not carry rich sediments and nutrients in their water, so they do not fertilise the lowlands that they flood (Neves 2006). The Amazon suffers great variability regarding the rain pattern. In the central Amazon, the dry period, or the period when the rain frequency diminishes considerably, lasts from July until September. In the high Amazon River in the Northern hemisphere, May is the dry month. The changes in the rain pattern have a great impact on the life of the population. In the dry season fishing is better because the fish have less water to swim in, making the catch easier. That is not to say, for example, that the floodplain-upland dichotomy should be replaced for another dichotomy, that of white and black water rivers.⁴⁵

Black water rivers were named ‘rivers of hunger’ by the first naturalist who went in the Amazon (Moran 1991). In fact, many generalizations on the ecological

⁴⁴Regarding this argument, one interesting question is why people do not apply this argument to civilisations from other rivers, such as the Nile River or the Yellow River, or the Euphrates River. Why is this only used in the context of the Amazon?

⁴⁵One would have to include clear water rivers in this division, making that a threefold division of rivers.

limitations of the Amazon rainforest are based on the situation of these rivers.⁴⁶ However, black water rivers are heterogeneous within themselves with a wide range of vegetation. One might expect malnutrition among the population of such systems, but that is not the case; instead, it reveals the creative capacity of the population in this area. Ribeiro (1995) presents a detailed picture of the indigenous population of black water rivers, describing their social structure, exchange systems and economic life. What is seen as a variety of cultures living in a system was thought to be of less importance.

The view of the Amazon as untouched is associated to what Denevan called 'the pristine myth'. A virginal place is one in which the animal life and the vegetation have never been manipulated by humans (Clement 1999). The myth is based on the idea that the Americas—not only South America, but the entire continent—was savage, untouched by humans (Mann 2005).⁴⁷ Referring back to the reports left by Carvajal when he went down the Amazon River with Orellana, scientists did not give any credit to expedition reports because the forest was seen as an untouched place. If the forest was indeed untouched, the reports could not have been true.

Bearing in mind the argument above, it is important to rethink the vision of the Amazon as an untouched forest, debunking the myth of savage nature. Human occupation could subtly transform the environment in countless ways. The Amazonian landscape is in great part of anthropogenic origin. William Balée estimates that 12 % of the forest originates from changes made by humans in the environment (Mann 2002). Some believe that the whole forest is anthropogenic. The occupation of the forest took place more than 10,000 years ago (Neves 2006). It is worth pointing out that in some areas of the Amazon the population reached six digits. Studies on anthropic soils in an interdisciplinary way are crucial as they can reveal the impact of humans in the environment in the long-term. This type of research is not restricted to the chemistry of the soil, but there are more ample processes in which chemistry is one piece of the puzzle (Graham 1998).

In summary, the Amazon was already inhabited when the Europeans arrived to colonise the Americas. This occupation was not uniform in relation to time and space and neither in relation to the diversity of the peoples; some would live in hierarchical societies and other were nomads (Neves 2006). It is important to stress that the people that live in the forest today are the descendants of the indigenous populations that occupied the forest before the arrival of the Europeans, although there have been great changes in demographic density and geographical location. Another point that deserves to be highlighted is the fact that human occupation before the arrival of the Europeans still has an important role in the current human occupation. The cities of Manaus, Santarém and Tefé and many others were constructed in archaeological sites.

⁴⁶The vision of the Amazon with poor soils that cannot hold cultivation for more than one or two years resembles more the reality in back water rivers (Moran 1993: 36).

⁴⁷Diegues makes a bridge between the vision of the Amazon as untouched and the establishment of parks with no human habitants in them (Diegues 1997: 316).

Amazonia as a Pristine Forest

The accounts of luxurious virginal forests from the sixteenth century onwards dominated the discourse about the Amazon. The pristine view reflected the writings of romanticists and primitivists of the nineteenth century, such as Hudson, Thoreau and Parkman. Painters also played a part in the reinforcement of this view, such as Catlin and Church (Denevan 1992). The writings of European authors of the sixteenth and seventeenth centuries described the inhabitants of the Amazon as a society of nature (Raffles and WinklerPrinks 2003). Although the forest was inhabited, there was what could be called an insistence in seeing the native Amazonians as an embodiment of nature (Slater 1996). In the nineteenth century scholars theorised about the perceived backwardness of the people, which is closely linked to the cultural ecological narratives of late twentieth century. The history of the study of the population of the Amazon reflects a persistency to label them as subordinated to nature, and the forest as a space of nature rather than a space of society (Nugent 1993). Embedded in this view is the perception of Amazonians as passive and as having no active role in the transformation of the landscapes in the region.

The Amazon represents a mystery invented by the Europeans (Gondim 1994). Before their arrival in the Amazon, there was a sense of exhilaration that was repeatedly replaced by despair. The native man was seen as a burden and did not receive the same treatment from the travellers as did the fauna and flora of the forest. The native man was seen as the destabilising agent in the social order imposed by the white man.

In addition to the view of a pristine landscape, there was the view of the indigenous people that lived there, which was thought to be a small and benign population (Denevan 1992). They were the ‘good savages’, those who did not alter their environment and lived in tune with nature. This is not to say that the impact that the pre-European indigenous population had the same impact on the landscape as the Europeans after the 1500s. The type of transformation was different, as were the reasons for them. There are two issues that must be stressed: the extent of the modifications and the form of modifications. One example of the form of modifications is the axe. The Europeans brought with them the metal axe. Before their arrival there were only stone axes, which were very inefficient in removing big trees, an action necessary for itinerant agriculture. Studies have demonstrated that clearing a forest area with a wood axe demands 60 times more time and energy than with a metal one. The historical system of alternating short periods of plough with long fallow periods only became possible with the arrival of metal axes (Denevan 2009). The introduction of metal axes can be seen as a technological revolution.⁴⁸

⁴⁸That is not to say that agriculture became more productive. Denevan (2009) argues that there was an involution after the introduction of metal axes, and that agriculture before the Europeans was more intensive and more productive.

To see the natives as ecological ‘noble savages’ comes with implications. When environmentalists appeal to the ecological native, they are sending a very powerful message that legitimises their discourses and practical objectives (Ulhoa 2005). The so-called primitivism of indigenous people carries with it an uneven power relationship with Europeans, thus characterising the colonial civilising processes. As a result, these representations of indigenous people put them in a position of needing help. Representing the natives as savages albeit noble also carries implications, such as the belief that their territories need to be protected.

Redford (1991) stresses that one must be careful with the ‘noble savage’ and he makes a connection between the study of traditional knowledge and the myth of the ‘noble savage’. The ‘noble savages’ are pure sinless human beings who live in conformity with nature and are incapable of modifying nature in any way. Evidence from the Amazon and from other places shows that this is not the case.⁴⁹ One might even wonder if the question of whether traditional people are conservationists or not is even key to the discussion. Rather we should be asking ourselves why we are judging these people, and when we speak of healthy environment, who that environment is for (Posey 1998).

The Amazon and its native population were seen as ‘the others’, different from the West. ‘The others’ is a way to refer to what is different. Western discourse of ‘the others’ would regard these differences as a feature of inferiority or weakness (Ulhoa 2005). In this context, three fictions regarding the Amazon rainforest are maintained (Nugent 1993). The first fiction is that there is a social vacuum in the Amazon. The second refers to the image of the forest as rustic. The third fiction is that there are unlimited resources. These three fictions are identified throughout the history of the forest.

It is important to analyse how nature was seen by the people who were in a position of power at the time. Modern thought sees nature as separate from culture and it has given nature an ontological priority (Dwyer 1996). The idea that culture is a product fits well with a tradition of thought that has had an evolutionary perspective. The idea of nature as the western world saw it, as wilderness, is imaginary. The nature and culture relationship presents a paradox. In one moment they are opposed to one another, and in another moment they appear as a continuum. This stirs discussions on what role culture and nature play. Is nature a limiting factor or a pool of resources? Is culture a creative force or an end product (Strathern 1980)?

The wilderness as we understand it today is linked to romanticism⁵⁰ (Cronon 1995); it came to represent the sublime, the sacred. The wilderness embodied everything that went against the failings of the human world. This idea brings to the forefront another paradox. This vision of the wilderness places the human being

⁴⁹Redford goes on to say that by seeing the indigenous population as noble savages, living in harmony with nature and with the knowledge that we need to survive in a world with an environmental crisis puts a lot of pressure on these communities. “The future”, he goes on, “is on a mosaic of different information from different places. One of them is traditional knowledge.”

⁵⁰Cronon said that the wilderness was linked to romanticism and to the idea of a frontier.

outside the natural realm. If that is the case, there is no solution for the environmental problems that we face (Cronon 1995). In addition, the terms ‘wilderness’ and ‘wild resources’ are unacceptable as they carry with them connotations of *terra nullius*, which excludes the indigenous population that was there in the first place.

The Amazon rainforest has triggered the rise of many theories, both popular and scientific, which were developed by the West (Heckenberger 2005). Tropical countries are seen as opposed to the West.⁵¹ Brazil, a tropical country almost from top to bottom, is the embodiment of the tropical. ‘The other’, that is part of this tropicality, would be nothing more than a backward person, subordinated, an archaic who has stopped in time. This vision, which obviously has been extended to the Amazon, was part of the evolutionary theories of the West. The South American tropical forest illustrates the pre-civilisation conditions of society, which was understood by the Europeans as being in opposition to their condition. This idea of Amazonia as a backward environment was reinforced by the theory that was dominant for decades and that saw the environment of the region as a limiting factor for cultural development.

The pristine myth related to the Amazon rainforest has lasted many centuries. Sauer, as early as 1958, challenged the view of other scholars that the forest was untouched by arguing that the indigenous used burning, swidden, as well as manipulation of composition to alter the forest (Denevan 1992, 2009). It is important to notice, however, that indigenous alterations are not restricted to burning; they managed the number, the distribution and the kind of species on their land.

The roots of the pristine myth cannot be pinned down only in the arrival of the Europeans and their accounts of luxurious forests. If that were the case, the myth would not have persisted until this day. The myth originates from the accounts of eyewitnesses that were unaware of what they were seeing. The modifications that today seem clear were not so three or four hundred years ago. It is also important to note that most of the accounts of wild and uninhabited land were made 200 years after the arrival of the Europeans (Denevan 1992), especially from 1750 to 1850, when lands in the interior of the Americas began to be cleared and exploited, and those accounts flourished. By then the indigenous population had already been reduced drastically. At the time of European incursion, forests did seem thinly populated and, as there was not a great number of people managing the forest, they appeared untouched. This image was echoed until the 1990s.⁵²

Another fact could have played an important role in the continuity of the myth. It has been argued that before the 1970s there were only 50 completed monographs on the indigenous population of the Amazon (Viveiros de Castro 1996). From 1970s

⁵¹In this case the West includes Europe and the United States and not the countries that are geographically in the west of planet Earth.

⁵²See, for example, Shetler, 1991. *Three Faces of Eden*. In *Seeds of Change: A Quincentennial Commemoration*, ed. H.J. Viola and C. Margolis. Washington: Smithsonian Institution Press.

onwards, however, especially in the 1980s, many advances were made not only on ethnological studies, but also regarding ecology, archaeology, history and ecology.

The landscape is like a text; it tells a story. However, information provided by the landscape is not readily accessible to scientists as the transformations in the landscape can be discreet and is shaped by human behaviour, in other words, by culture (Balée and Erickson 2006). In the study of the relationship of humans and nature, historical ecology emerges as one key theory. The landscape perspective sees human activity in a continuum, not in localised places. This perspective reinforces the link between archaeology and historical ecology (Stahl 2008). It stands in contrast to the deterministic role of the environment that dominated the discussions on the Amazon in the second half of the 20th century. Whereas landscape ecology makes a distinction between landscape with human interference—in most degraded landscapes—and without human interference, historical ecology does not make such division. In addition, it does not consider humans as just other animals; it understands the human species as being a key and as a mechanism of dynamic through disturbance (Balée and Erickson 2006).

Historical ecology rejects the adaptationist assumptions underlying cultural ecology, which refuses the idea that human agency can shape the environment in a positive⁵³ way over time. Intentional or not, human agency can produce levels of environmental disturbance, which are important for guaranteeing environment resilience. In the context of the Amazonian forest, the historical ecology approach is based on the idea that historical events, rather than evolutionary ones, are responsible for the main changes in the human-environment relationship (Balée 1995). The research programme refers to the interactions between society and the environment through time, and it also refers to the implications of these in the understanding of the formation of cultures and landscapes in the past and now (Balée 2006). Historical ecology revolves around three conceptions. They are *événement*, *conjoncture*, and *longue durée*. In other words, short-term episodes, repetitive statistical patterns over a period of time, which could be 25 or 50 years, and patterns through centuries. Historical ecology goes back to the dialectical relations between human behaviour, or acts, and nature behaviour that are illustrated in the landscape (Crumley 1994). The landscape holds physical evidence of the decisions that were made as well as cultural practices that were part of the lives of the human inhabitants of a given population.⁵⁴

To say that the South American rainforest is not pristine and untouched as once believed does not imply that its indigenous population is similar to the population of the region today. In the past populations were able to organise themselves and interact with their environment instead of taming it (Heckenberger et al. 2007).

⁵³By positive I mean increasing the richness and equitability of nature through enhancing biodiversity (Balée and Erickson 2006: 4).

⁵⁴Balée presents four postulates for historical landscape: human activity has affected a great part of the globe; there is no predetermination to either conservation or destruction; the pathway of landscape is historically contingent; humans and the landscape that was created by their activities cannot be seen as separate from one another.

The idea of the ‘good savage’ that has little or no impact in their environment has also been overturned. This, however, does not mean that a comparison between pre-Columbian groups and agri-business is possible.

The choice of words is very important in setting the context in which one stands. Conservation biologists use the term ‘wild nature’ to describe patches of land with high biodiversity that are untouched rather than ‘high biodiverse’ (Willis et al. 2004). The choice of words does not come without implications. This is also true when one chooses the words wilderness or jungle to describe the South American rainforest. Wilderness suggests the original state, immaculate, having an Edenic quality, and therefore something that must be preserved, thus attracting many people. Jungle, on the other hand, has a negative connotation (Slater 1996). When the Amazon was described as a ‘green hell’, the jungle was not a paradisaical place. Whereas the inhabitants of wilderness are natural, the jungle inhabitants are off-putting. Seeing the Amazon as the wilderness or as the jungle oversimplifies the region, and the Edenic representations of the Amazon dehumanises its inhabitants though idealisation (Slater 1996). Understanding the Amazon as pristine has political implications.

The view that dominated the study of the Amazon reflected an anti-historical position. The lack of archaeological data for the forest played a role in the strive for this view (Nugent 1981). Ecological studies also had a part in the maintenance of this view, implicitly feeding the idea that there was no proper anthropological object in the South American rainforest apart from the residual tribal fragments that remained.

Amazonian Legacies and Their Importance

The history of a determined site is rooted in its ecosystem functions (Foster et al. 2003). Therefore, environmental history is a key element in the understanding of ecology. The realisation of the importance of the past in understanding ecology today has been gaining force since the 1990s. Before that the implications of historical use were not taken into account. The reasons for this change are fourfold. First, ecological studies started focusing more on regional scales where current and past human impact could not be overlooked. Second, researchers started to realise that most of what they thought of as ‘natural areas’ had more human impact than initially believed. Third, researchers recognised that legacies are extremely persistent and consequently could not be ignored. Fourth, there was a greater recognition that history has, and therefore adds, explanatory power to the way we understand both modern structure and function, and helps diminish issues regarding management for future scenarios. Forest composition and ecosystem functioning are a result of land use by humans in the past.

History and politics began to play a greater role in research by helping in the understanding of the relationship between humans and their habitat (Moran 1996). The individual exists between society and its habitat, and the individual makes

decisions that affect their habitat. It is important to remember that individual decisions are not made in isolation. To understand the decisions made by individuals it is necessary to understand the historical traditions of individuals in a given society. The context in which the decisions were made needs to be analysed. The importance of context—historical, cultural, environmental and political—shines light on the floodplain and upland dichotomy, as the upland does not encompass any variation cannot therefore explain adaptive strategies (Moran 1991).

If the forest is seen as anthropogenic, with a past of human modification, there can be undesired consequences. It could be argued that if in the past the Amazonian environment was able to maintain large populations, this means that the indigenous population today is under-exploiting their resources (Meggers 2001). This argument could be used to justify and push for more agricultural production as well as for development projects.

Soils have memories, so to say. They store information not only about past climate conditions but also about how they were formed in the first place. Land use leaves traces on soil properties that are long lasting and have important implications, be that in forests or grasslands (Foster et al. 2003). Agriculture, forest burning as well as grazing trigger physical, chemical and biological changes in soil property. Change in vegetation has an impact on the microbial population of soils, which in turn has an effect on the susceptibility of the soil to invasive species.⁵⁵ To sum up, legacies have a key effect on all the soil properties, demonstrating that the study of the history of land use is crucial for a more comprehensive understanding of a particular land.

The extent and nature of the pre-Columbian human impacts on the Amazon is a topic that is currently in the spotlight. It has been recognised that past-human occupation did occur. However, its scale is still unclear (McKey et al. 2010). In the late Holocene period, indigenous populations in the lowland of South America started altering the landscape intensively. *Terra preta de índio* is one example of these modifications.

Within 250 years of the arrival of the Europeans in the Americas, almost all the land throughout the continent had undergone changes (Turner and Butzer 1992). Upon the arrival of the Europeans in the new world, however, North and South America had a variety of land types, which also varied in the extent that it had been, from less disturbed to completely transformed land. These modifications occur not only in areas of easy access, but also in sparsely occupied areas. Fire was one of the methods most used for transforming the land. It can be argued that throughout the Americas, from Canada to Argentina, the landscape had been modified, and yet it is striking that the first impression of the Europeans when they arrived was able to remain intrinsically in our minds for so long.

The population that lived in the forest prior to the European encounter had to understand the environmental conditions and work with what was available to

⁵⁵Research on pollen and phytoliths, for example, are carried out to help reconstruct plant use in the past.

produce food. The Amazonian population used a diverse set of agricultural systems, not only swidden agriculture. This was only one way in which the environment was altered. Areas of semi-intensive use in the past differ in terms of ecological parameters from the land use of indigenous groups today (Heckenberger et al. 2008). The fact that the forest tolerated indigenous societies in the past cannot be transferred to contemporary forest population (Nugent 1981).

The Amazon has changed together with its population and its economic activities. It is now confronted with urban problems. The South American rainforest followed the same patterns that was seen in Brazil, and 70 % of the population is now living in urban centres (Homma 2005). It is important to notice that the most important cities of the region are located on archaeological sites. In other words, recent populations settled in the same locations where past populations did.

The understanding that the forest is heterogeneous has not yet been incorporated into public policies (Garda et al. 2010). Land occupation as well as planning projects has not taken on such information. Numbers referring to endemism, forest cover loss and forest protection vary widely within the Amazon, and they need to be addressed using different tools and different policies.

Archaeology in the Amazon can be extremely important in providing evidence regarding the history of the South American tropical forest (Roosevelt et al. 1996). Past human activities have shaped the landforms and the biotic communities of the forest for one thousand years. Well-documented paleo-ecological sequences are missing (Roosevelt et al. 1996) as well as more comprehensive archaeological excavations (Piperno and Pearsall 1998; Parssinen et al. 2009).

Terra preta de índio is one evidence of past population in the Amazon. The existence of geoglyphs also demonstrates that there were versatile cultures in the Amazon rainforest (Parssinen et al. 2009). Geoglyphs are found in the uplands and in floodplains. The number of *terra preta* sites in the Amazon suggests that the population in the forest before the arrival of the Europeans were in great part sedentary and large in numbers (Smith 1980). In addition, the Amazon also has shell mounds, another feature of long-term occupation in the region.

Changes in the Amazon are not restricted to terrestrial landscape. Riverbeds were also modified to better suit the population that lived in the forest, and the effects of these changes alter the landscape in many scales (Raffles and WinklerPrinks 2003). Studies on botanical and ethnobotanical data allowed scholars to reach the conclusion that earlier theories about the Amazon rainforest were incomplete. Evidence brought by their research confronted the idea that the forest had no potential and that human disturbance was negligible (Rival 2006). The biodiversity in the Amazon rainforest cannot be explained solely by geophysics events and environmental gradients (Balée 2000).

What happened after the arrival of the Europeans is well known. Their conquest disrupted the native societies in the region, and the impact on the size of the population in the Amazon and in the Americas as a whole can be seen as the greatest demographic disaster in history (Lovell 1992). Diseases from the west, brought by the Europeans, spread rapidly in a population that was not protected

against them. Some of these diseases, like the common cold and smallpox, triggered the demise of the Amerindian population. In addition to the diseases brought by humans, there were the diseases brought by animals (Mann 2005).

Where to from Now

Today agricultural producers want *terra preta de índio* because they are attracted to its production potential (Neves 2006). Registrations show that in some places the soil was used intensively without the need of fertilizers for almost 40 years (Petersen et al. 2001). Moreover, the soil is very resilient to mechanical cultivations. A research carried out by Teixeira and Martins (2003) demonstrated that although cultivated TPI and TM areas show signs of deterioration, they are still more productive than the adjacent ferralsols. That is so even with recent cultivation.

Terra preta de índio is a key feature in the climate change debate for two main reasons. First, because of the reproduction of its fertility. Second, because the soil is found in the Amazon rainforest, which is a key feature in the reduction of emissions from deforestation and degradation debate, the forest directly impacts the climate in the world. Because of the reproduction of its fertility, *terra preta* is also part of the food security debate. Biodiversity governance is in the centre of the international discussion on the environment, which is extremely important for the Amazon.

The quality of *terra preta* soils led scientists both in Brazil and abroad to research the production of a new soil management system.⁵⁶ This is how biochar was born. Biochar is produced through pyrolysis, which is burning with or without a low record of oxygen (Mangrich et al. 2011). The results so far have been interesting. The presence of biochar in the soil increases fertility and it can also help decrease the emission of other GHG gases, such as nitrous oxide (Mangrich et al. 2011). Nevertheless, experiments with biochar have not showed expected results, which call into question what is the real contribution of biochar.

It is important to stress that the amount of carbon in the soil is a key factor in the discussions on climate change (Fearnside 2009). In the legal Amazon, soils store 138 GtC up to 8 m, which is almost double the amount in its vegetation of 80 GtC.⁵⁷

The limiting factor for sustainable agriculture in the Amazon is soil fertility (Novotny et al. 2009).⁵⁸ As the soil has maintained its fertility throughout the years, it has been argued that *terra preta de índio* holds a key to sustainable agriculture in the tropics (Glaser 2007).

⁵⁶It is important to stress that biochar is a soil amendment, not a soil fertiliser.

⁵⁷This data refers to the vegetation in 1990.

⁵⁸Sustainable is very tricky word, and it must be used carefully. In this sense, sustainable refers to the ability of a soil to produce harvest. That does not mean that the farmer will profit from what he/she has produced, the point here is that there will be a production and it will be sustained through time.

Needless to say, all of this research is a great contribution, but one should not forget the small farmers in the Amazon. Are these improvements for the small farmer or for the big producers? Are these technologies going to reach small producers or is this a method of generating carbon credits?

The soil of the Amazon tells us a very different story from the one that has been told for many decades. The three distinct perceptions of South American tropical soils demonstrate how diverse these views were, including a region with extremely fertile soils, which was assumed by those who saw the forest, to a region described as 'green hell'. In the 1980s a third view emerged, a view that allowed for more than one reality in the forest.

In the 1980s the scenario really began to change. The representation of the Amazon changed from a homogenous place with a small population to a heterogeneous forest capable of holding much more than what was initially thought. There should be an S in the end of the word Amazonia. The perceptions were not harmless to the extent that they had no further implications. Policies for the Amazon forest reflected these representations.

Archaeological findings that helped to reshape the understanding of Amazonia show that the environment did not represent a constraint to social development. The recognition of past complex societies in the Amazon stresses the importance of recognising cultural rights in discussions regarding the future of the forest. *Terra preta de índio* is key to the development of future policies towards the forest as the existence of this soil breaks some of the misconceptions about the forest.

Many people that work in the field of anthropology and history agree that conceptions of nature are in fact socially constructed and that they differ based on cultural and historical determinations (Descola 1996b). Because of that, a dualistic view of the world should not be imposed, as an ontological paradigm on other cultures in which the dualistic view, or the western view, was not appropriate. This was the result of two events: a critique of the western metaphysics and epistemologies and ethnographic research.

The idea of nature is vague (Descola 1996b). As a result, nature has been used in more than one set of dichotomies: nature-culture, nature-mind, nature-supernature. It is important to notice that in all these distinctions, nature has been the all-encompassing totality that defines the features of that which it opposes. The relationship between culture and nature has been revised. Culture is both a creative force and the final product, while nature is both a resource and a limiting feature (Strathern 1980). The research that prevailed before the 1980s privileges uni-focal views to explain scenarios that were multi-focal (Moran 1996). It is important to stress that the so-called hostility of the Amazonian environment has never been proven through historical research (Heckenberger 2005).

The ecological conditions of any given place are crucial for the cultural development of the population that inhabits it. This assertion, however, does not come without reservations; there are three points to consider (Heckenberger 2005). First, the ecological parameters of the Amazon are in great part still unknown. Second, productive environments such as riverbeds, are more common than previously

thought. Third, one cannot forget that other ecological characteristics are also part of this equation.

The emphasis on equilibrium, stability and homeostasis was dominant until the 1970s. From then onwards, gradually, there was a shift towards a non-equilibrium disturbance (Stahl 2008). History and temporal dynamics began to have a more crucial role in ecological studies. Although this shift did occur and most scholars, as seen in their literature, reject, or at least understand the difficulty in defending the idea of wilderness, the underlying assumption that humans react to their environment is still very much present. To see the environment as a product of nature consequently means that there was once such a 'pristine' environment, untouched by humans. Here it is also important to notice that the pursuit of this wilderness is reflected in preservationist policies. The irony now is that we need human interference to maintain 'wild' ecosystems and species.

Legacies of the past are still quite evident, and they do play a role in the forest today. What we may learn from findings and how new policies based on them will be elaborated, will shape its future.

To fully understand the history of the *terra preta de índio* research it is important to look at the history of the Amazon as one chapter within a broader history. In the next chapters of this book I will focus on the history of the Amazon in the national scenario (Chap. 3), in the international scenario (Chap. 4) and how the forest appears in the current discussions on sustainable development and reduction of emissions of deforestation and degradation (Chap. 5). Together, these chapters will provide a comprehensive view of why *terra preta de índio* was out of the agenda, why it emerged when it did and how it fits in the current discussions on the South American rainforest.

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