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## Guest editorial

# Long-term perspectives on human occupation of tropical rainforests: An introductory overview

When thinking about tropical rainforests, these landscapes are often not automatically associated with their human occupants. Similarly, the role of humans in shaping and changing these habitats over long periods of time is often overlooked or marginalised. If human action is considered, the negative aspects of modern agroforestry, industrialisation and urbanisation are most often the focus. Yet, as the papers in this issue show, the earth's tropical rainforests have been inhabited by groups of modern humans for millennia, whether hunters and gatherers, plant managers or farmers. Some of these landscapes, such as the rainforests of Indo-Malaysia, may have seen continuous occupation by modern humans for more than 50,000 years (Barker et al., 2007), and Indonesian rainforests appear to have been inhabited by at least three different hominin species, either in turn or concurrently: *Homo erectus*, *Homo floresiensis* and *Homo sapiens*. The cumulative effects of the diverse ways in which people (and hominins) have adapted to and influenced the structure and composition of these inhabited landscapes are only just beginning to be understood.

The investigation of tropical rainforest environments has come a long way since the 'green desert' debates of a few decades ago (Bailey and Headland, 1991). Even though some of the key issues of this debate are unresolved, the conversation has generally moved on through a more informed understanding of the adaptive and broad-spectrum orientation of people to their environment. It is clear that modern humans did occupy tropical rainforest environments as they dispersed westward across Southeast Asia from Africa, even without agriculture, just as they came to inhabit almost every kind of environment on the planet. Evidence from Borneo and New Guinea shows that people occupied rainforest environments upon the colonisation of these large islands: Niah provides the earliest date for the occupation of Borneo (Barker et al., 2007); and sites in the mountainous interior of New Guinea exhibit some of the earliest evidence for human occupation and subsistence activities in the region (Summerhayes et al., 2010).

The temporal scope of the papers in this issue stretches from 2.5 million years ago to the most recent historic periods. Despite different discrete chronological foci, each paper addresses a similar theme, namely, to what extent have tropical rainforests been altered by the activities of humans? Are rainforests simply a highly biologically diverse landscape exploited by people, or (and to what degree) are the structure and composition of present-day rainforests in different parts of the world a human artefact?

This issue was originally conceived following a session at the World Archaeological Congress in Dublin, 2008, titled "Rainforest

as Artefact". The purpose of that session was to bring together scholars from a wide range of disciplines interested in the long-term history of human–rainforest interactions and of the histories of swidden farming and other forms of plant management in these regions. For many years researchers have been trying to identify the signature of human behaviour in tropical landscapes, untangle the interactions between human versus natural process, and determine the antiquity of occupation and of various plant management and agricultural practices. A strong message given in all papers was the need for multi-disciplinary and multi-focal research to properly address the human histories of these landscapes. The investigation of past human occupation of tropical rainforests has been enhanced in recent decades by the increased application of microbotanical techniques (phytolith, starch grain and parenchyma analyses), and the more systematic application of macrobotanical and archaeo-zoological field methods (Pearsall, 2001; Reitz and Wing, 2008). The papers in this issue use a wide range of archaeological, anthropological, botanical, environmental, geoarchaeological, and multi-proxy data to address their research programmes. The historical scope of this issue stretches from earliest occupation by foragers to more recent cases of the emergence and transformation of agricultural practices that have been adapted to these wet and warm tropical environments. The volume provides a global scope where each paper examines a distinctive lifeway within its regional context, including South America (Arroyo-Kalin, 2012; McNeil, 2012; Rostain, 2012; Stahl and Pearsall, 2012), West Africa (Höhn and Neumann, 2012; Logan and d'Andrea, 2012; Neumann et al., 2012), India (Kingwell-Banham and Fuller, 2012), Southeast Asia (Barton, 2012; Hunt and Premathilake, 2012; Sémah and Sémah, 2012), and Melanesia (Haberle et al., 2012; Kennedy, 2012; Torrence, 2012).

## 1. Rainforests as cultural landscapes

Debate has now moved on beyond conceptions of rainforests as 'virgin' or 'pristine' environments (Willis et al., 2004); rather they are more appropriately understood as cultural landscapes (Balée, 1989). As soon as people entered rainforests they began to change and adapt to them, even though the effects of these practices were highly variable through time and across space. The papers in this issue show that just as people modified the ecologies of rainforests, so too people evolved distinctive lifeways to inhabit these unique environments. We see evidence of forest manipulation alongside the earliest archaeological evidence in Borneo, New Guinea, Melanesia, and in Neotropical forests, where fire was often used to

modify forest composition, open up or encourage forest gaps for hunting and gathering, and perhaps to influence plant succession through management of secondary vegetation. Plant species, particularly edible species of fruit and nut trees, as well as species with other economic uses such as firewood and building materials, may have been early targets of forest managers. Such *in situ* practices may originate within the late Pleistocene in Southeast Asia and Melanesia and during Holocene occupations in South America and West Africa. Even subtle plant manipulations and translocations may have unforeseen, cumulative consequences and be responsible for significant genetic alteration through unintentional hybridisation occurring over millennia.

The nature of human occupation and use of rainforest environments were not necessarily linear or cumulative in the distant or recent pasts. Extensive areas of formerly cleared land have been recolonised by rainforest, and formerly degraded forests have been rejuvenated. For example over the long term, records for the Pleistocene demonstrate highly variable human impacts on montane environments of New Guinea, primarily exhibited through burning and the replacement of rainforest with disturbance and secondary taxa; yet none are more than localised phenomena and they are generally not cumulative. Most areas reverted back to rainforest after periods of more intensive disturbance, although in some locales disturbance to vegetation was sustained (Haberle et al., 2012). At a different temporal scale, extensive tracts of lowland rainforest in the Amazon Basin were formerly areas of settlement and cultivation, as evidenced by present-day *terra preta* and *terra mulata* soils, which reverted to forest following depopulation after European exploration of the continent (Arroyo-Kalin, 2012). Torrence (2012) records an interesting pattern of opportunistic use of secondary forests not created by human action, but by a prolonged period of volcanic activity in New Britain during the Holocene. In the lowlands of Ecuador human managed fallows (areas of deliberate managed disturbance) raised biodiversity to levels that can even exceed that found in high forests (Stahl and Pearsall, 2012), and forests appear to have been well managed by the Maya during the Early classic period, actually showing a recovery of forest from the Pre-classic period, as population density increased (McNeil, 2012). By contrast, Neumann et al. (2012) record the introduction of a savanna-adapted agricultural system (Höhn and Neumann, 2012) into the degraded Central African rainforest, coinciding with a climatic period of increased seasonality that resulted in a replacement of mature forest by pioneer formations.

## 2. The beginnings of agriculture

Rainforest environments in the lowland neotropics (Piperno, 2009; Piperno and Pearsall, 1998; Denevan, 2001), West Africa (Harris, 1976; Harlan, 1995) and New Guinea (Golson and Hughes, 1980; Denham et al., 2003) were places within which early agricultural practices emerged. Although each region has been presented as a possible centre of plant domestication and independent agricultural development, the conceptual and geographic boundaries of these centres are relatively diffuse and ill-defined. In each case, the putative centres blur into plant exploitation mosaics with neighbouring regions and the exogamous-endogamous contributions to early agricultural development remain to be determined. However, cultivation practices within tropical rainforest environments were distinctive and tended to be heavily reliant on vegetative forms of propagation, whether in swidden or more intensive forms of cultivation; and these forms of plant exploitation were characterised by a continued reliance on wild resources, including trees.

## 3. Commonality of practice

The mutual inter-relationships between people and their rainforest environments are exemplified by many papers in this issue. Despite the uniqueness of each cultural engagement, several commonalities can be elicited that enabled hunter-foragers to permanently inhabit rainforest landscapes in different parts of the world. These commonalities reflect a shared orientation of modern humans to their world, even though this orientation was differentially expressed in specific historical and geographic settings. Commonalities include: disturbance of the forest environment, primarily through burning, as well as localised modification of species composition of rainforest; exploitation of fauna through gathering, hunting and scavenging; a focus upon protein and starch rich plants, primarily trees and tuberous plants; and mobility.

## 4. The destruction of tropical rainforests and indigenous cultures

The rate of destruction of tropical rainforests increased during the Holocene, as populations increased and agricultural practices became more widespread. However, in recent decades the rate of deforestation has accelerated dramatically for subsistence agriculture, cash cropping, ranching and timber. As well as degrading or destroying the biodiversity of this unique ecosystem, these practices destroy the traditional cultures of the people who have adapted unique ways of life within these forests; these are the people who have, in part, created the rainforest ecologies. Consequently, the conservation of tropical rainforests needs to integrate ecological and cultural components; neither is likely to survive without the other.

## References

- Arroyo-Kalin, M., 2012. Slash-burn-and-churn: Landscape history and crop cultivation in pre-Columbian Amazonia. *Quaternary International* 249, 4–18.
- Bailey, R.C., Headland, T.N., 1991. The tropical rainforest: is it a productive environment for human foragers? *Human Ecology* 19, 261–285.
- Balée, W., 1989. The culture of Amazonian forests. *Advances in Economic Botany* 7, 1–21.
- Barker, G., Barton, H., Bird, M., Daly, P., Datan, I., Dykes, A., Farr, L., Gilbertson, D., Harrison, B., Hunt, C., Higham, T., Kealhofer, L., Krigbaum, J., Lewis, H., McLaren, S., Paz, V., Pike, A., Piper, P., Pyatt, B., Rabett, R., Reynolds, R., Rose, J., Rushworth, G., Stephens, M., Stringer, C., Thompson, G., Turney, C., 2007. The 'human revolution' in lowland tropical Southeast Asia: the antiquity and behaviour of anatomically modern humans at Niah Cave (Sarawak, Borneo). *Journal of Human Evolution* 52, 243–261.
- Barton, H., 2012. The reversed fortunes of sago and rice *Oryza sativa*, in the rainforests of Sarawak Borneo. *Quaternary International* 249, 96–104.
- Denevan, W.M., 2001. *Cultivated landscapes of Native Amazonia and the Andes*. Oxford University Press, Oxford.
- Denham, T.P., Haberle, S.G., Lentfer, C., Fullagar, R., Field, J., Therin, M., Porch, N., Winsborough, B., 2003. Origins of agriculture at Kuk Swamp in the Highlands of New Guinea. *Science* 301, 189–193.
- Golson, J., Hughes, P.J., 1980. The appearance of plant and animal domestication in New Guinea. *Journal de la Société des Océanistes* 36, 294–303.
- Haberle, S., Lentfer, C., O'Donnell, S., Denham, T., 2012. The palaeoenvironments of Kuk Swamp from the beginnings of agriculture in the highlands of Papua New Guinea. *Quaternary International* 249, 129–139.
- Harlan, J.R., 1995. *The Living Fields*. Cambridge University Press, Cambridge.
- Harris, D.R., 1976. Traditional systems of plant food production and the origins of agriculture in West Africa. In: Harlan, J.R., de Wet, J.M.J., Stemler, A.B.L. (Eds.), *Origins of African Plant Domestication*. Mouton and Co, The Hague, pp. 311–356.
- Höhn, A., Neumann, K., 2012. Shifting cultivation and the development of a cultural landscape during the Iron Age (0–1500 AD) in the northern Sahel of Burkina Faso, West Africa: Insights from archaeological charcoal. *Quaternary International* 249, 72–83.
- Hunt, C.O., Premathilake, R., 2012. Early Holocene vegetation, human activity and climate from Loagan Bunut, Sarawak, Malaysian Borneo. *Quaternary International* 249, 105–119.
- Kennedy, J., 2012. Agricultural systems in the tropical forest: a critique framed by tree crops of Papua New Guinea. *Quaternary International* 249, 140–150.
- Kingwell-Banham, E., Fuller, D.Q., 2012. Shifting cultivators in South Asia: Expansion, Marginalisation and Specialisation over the Long-term. *Quaternary International* 249, 84–95.

- Logan, A.L., d'Andrea, C., 2012. Oil palm, arboriculture, and changing subsistence practices during Kintampo times (3600–3200 BP, Ghana). *Quaternary International* 249, 63–71.
- McNeil, C.L., 2012. Deforestation, agroforestry, and sustainable land management practices among the pre-Columbian Maya. *Quaternary International* 249, 19–30.
- Neumann, K., Bostoen, K., Höhn, A., Kahlheber, S., Ngomanda, A., Tchiengué, B., 2012. First farmers in the Central African rainforest: A view from southern Cameroon. *Quaternary International* 249, 53–62.
- Pearsall, D.M., 2001. *Paleoethnobotany: A Handbook of Procedures*, second ed. Academic Press, Orlando.
- Piperno, D.R., 2009. Identifying crop plants with phytoliths (and starch grains) in Central and South America: a review and an update of the evidence. *Quaternary International* 193 (1–2), 146–159.
- Piperno, D.R., Pearsall, D.M., 1998. *The Origins of Agriculture in the Lowland Neotropics*. Academic Press, San Diego.
- Reitz, E.J., Wing, E.S., 2008. *Zooarchaeology*, second ed. Cambridge University Press, Cambridge.
- Rostain, S., 2012. Between Sierra and Selva: landscape transformations in the upper Ecuadorian Amazonia. *Quaternary International* 249, 31–42.
- Sémah, A.M., Sémah, F., 2012. The rainforest in Java through the Quaternary and its relationships with humans (adaptation, exploitation and impact on the forest). *Quaternary International* 249, 120–128.
- Stahl, P.W., Pearsall, D.M., 2012. Late Pre Columbian Agroforestry in the Tropical Lowlands of Western Ecuador. *Quaternary International* 249, 43–52.
- Summerhayes, G.R., Leavesley, M., Fairbairn, A., Mandui, H., Field, J., Ford, A., Fullagar, R., 2010. Human adaptation and plant use in highland New Guinea 49,000 to 44,000 years ago. *Science* 330, 78–81.
- Torrence, R., 2012. Volcanic disasters and agricultural intensification: a case study from the Willaumez Peninsula, Papua New Guinea. *Quaternary International* 249, 151–161.
- Willis, K.J., Gillison, L., Brncic, T.M., 2004. How 'virgin' is virgin rainforest? *Science* 304, 402–403.

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