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Abrupt vegetation transitions characterise long-term Amazonian peatland development

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Recent investigations of wetlands in western Amazonia have revealed the presence of extensive peatlands with peat deposits of up to 8 m-thick developing under a variety of vegetation types (Lähteenoja *et al.* 2012). Estimated to cover 150,000 km^2 (Schulman *et al.* 1999), these peatlands make a valuable contribution to landscape and biological diversity and represent globally important carbon stores. In order to understand the processes leading to peat formation, and the sensitivity of these environments to future climatic change, it is necessary to understand their long-term history. The extent to which peatland vegetation changes over time, the stability of particular communities, the controls on transitions between vegetation types and how these factors relate to the accumulation of organic matter are not yet known.

We report the first attempt to establish the long-term (millennial scale) vegetation history of a recently-described peatland site: Quistococha, a palm swamp, or *aguajal*, close to Iquitos in northern Peru. The vegetation is dominated by *Mauritia flexuosa* and *Mauritiella armata* and occupies a basin which is thought to be an abandoned channel of the River Amazon. We obtained a 4 m-long peat sequence from the deepest part of the basin. AMS-radiocarbon dating yielded a maximum age of 2,212 cal yr BP for the base of the peat, giving an average accumulation rate of 18 cm per century. Below the peat are 2 m of uniform, largely inorganic pale grey clays of lacustrine origin, which are underlain by an unknown thickness of inorganic sandy-silty clay of fluvial origin. Pollen analysis, carried out at $c.$ 88-year intervals, shows the last 2,212 years to be characterised by the development of at least four distinct vegetation communities, with peat accumulating throughout. The main phases were: (1) Formation of Cyperaceae (sedge) fen coincident with peat initiation; (2) A short-lived phase of local *Mauritia/Mauritiella* development; (3) Development of mixed wet woodland with abundant Myrtaceae; (4) Expansion of *Mauritia/Mauritiella* palm swamp vegetation $c.$ 1000 years ago representing establishment of the present day vegetation community.

Our results show that the vegetation at this site has undergone continuous change throughout the period of peat formation. The sequence of vegetation development is not straightforward, being characterised by abrupt transitions between vegetation types and reversals in the apparent trajectory of change. Overall this suggests that the system is highly dynamic on centennial to millennial timescales. This complexity may reflect vegetation responses to a combination of external (physical) and internal (biological) drivers and the presence of thresholds in the system. Future investigations will work towards understanding the processes that drive these vegetation transitions and predicting peatland vegetation responses to future climatic change.

References: Lähteenoja, O. *et al.* (2012) *Global Change Biology* 18, 164-178; Schulman, L. *et al.* (1999) *Nature* 399, 535-536.