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SYNOPSIS

A New Framework for Natural Resource Management in Amazonia

Nidia Noemi Fabré, Vandick da Silva Batista, Maria Olívia de Albuquerque Ribeiro, Richard J. Ladle

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INTRODUCTION

The Amazon rainforest has an iconic position in the global conservation movement: not only is it the largest continuous tropical rainforest in the world, but it also encapsulates many of the greatest challenges facing twentieth century conservation. However, while deforestation and its potential impact on global climate systems (Malhi et al. 2008) grab most of the headlines, it is easy to forget that Amazonia is also home to a large and diverse human population (Ribeiro and Fabré 2003). In addition to the remaining indigenous tribes, there are many settlements and scattered communities of fishermen and farmers of mixed ethnic origins. The support and active engagement of these communities in conservation and sustainable resource management is essential for the success of any conservation or sustainable development initiative.

Unfortunately, numerous studies have demonstrated that implementation of co-management or community-based management of natural resources is far more difficult to achieve than the abundant rhetoric that promotes it. Moreover, each failed initiative makes it harder to establish the levels of trust and cooperation that are essential ingredients of successful management systems. Even without the handicap of previous failed initiatives, successful community-led management of natural resources is exceedingly complicated and there are many potential barriers to its successful implementation (Brockington et al. 2008):

(1) Conflicts over resource use—especially issues such as fishing rights—may prove intractable problems for which mutually satisfactory resolution may not be possible. In this context, participation of local stakeholders may merely give a platform for the legitimization of vested interests in the guise of community aspirations (Cooke and Kothari 2001).
(2) Existing or historic political, cultural or administrative structures may not have the flexibility to enable effective local community involvement, and may even result in disempowerment by forcing local stakeholders to interact within an intrinsically biased framework (Cooke and Kothari 2001).
(3) There may be insufficient political will to facilitate a move toward participatory management, especially if there are many and competing vested-interests involved.
(4) There may be insufficient interest or engagement of the local stakeholder community in the management of the resource to create strong and democratic local organizations. If the participatory process is perceived as being externally imposed and local stakeholders do not fully "buy-in" to it, then the process may break down when the initiative finishes or when financial support is withdrawn.
(5) Insufficient time may be allocated for the creation of local organizations and stakeholder groups and/or refinement of the participatory process.

As a consequence of these limitations, well-meaning attempts at promoting co-management of natural resources have often increased, rather than decreased, social conflict (Waters 2006) leading some researchers to argue that there is a "need for much more complex and empirical approaches for doing conservation with local communities"

(Brockington et al. 2008, p. 110). Brockington and his colleagues go on to suggest that a "more open-ended, empirical approach is much more likely to help us find approaches that are effective, equitable and more in line with local needs and values" (p. 111).

In this research synopsis, we describe one such open-ended empirical approach to community-based natural resource management, developed over an 8-year initiative in a rainforest community in Amazonas State, Brazil. The conceptual basis of the approach, dubbed sustainable open systems/SOS (Ribeiro and Fabré 2003), was to gather detailed information on the cosmography (environmental knowledge, ideologies, and identities collectively developed and historically located) that the community uses to establish and to maintain its territory, and use this as the basis for sustainable management and formal resource use agreements. The term 'open systems' was chosen to reflect the inevitable flux of people and resources in and out of the management area or system.

To better illustrate the SOS approach we present data from one of our case studies that took place in the Manacapuru district of Amazonas State, Brazil. The inhabitants of this district are broadly representative of the non-tribal peoples of Amazonia, being composed of individuals of mixed descent with different degrees of historical and cultural affiliation with the surrounding rainforest. Most families engage in productive activities that are common in inhabitants of the Amazon floodplain such as fishing, collecting and small scale agriculture (Furtado 1993a, 1993b). An eight year project was initiated in 1998 by the multidisciplinary PYRÁ research group (Integrated Program of Aquatic Resources and Floodplains) with the aim of designing a co-management system for local fisheries that was clearly aligned with local customs and practices and which would provide a robust framework for the development of sustainable practices.

A SUSTAINABLE OPEN SYSTEMS FRAMEWORK

A sustainable open systems (SOS) framework is characterized by a better understanding of the territorial and socio-economic relations of Amazonian populations. More specifically, the approach deliberately incorporates notions of the right of access of local people to natural resources, including goods and ecological services. It is based on the concept of communal property, starting with the establishment of norms and criteria for the community's use of natural resources. These factors can be used to regulate the access to external users of the system, assuming that they obey the reification and institutionalization of these norms as outlined in community-endorsed agreements of integrated use (see (4) below). The SOS approach thus aims to take account of the complex and dynamic nature of natural resource exploitation and seeks to incorporate environmental knowledge, ideologies, and to collectively establish historically located identities that define and maintain territorial boundaries.

The SOS framework approach has the following five main phases:

Diagnoses—Self-Identification of Communities and Management Units

The self-identification of the geographic extent of the management unit by the community is essential to help define the limits of the open system and to help residents develop a sense of group identity. The main goal of this phase is to achieve a transdisciplinary understanding of (i) socioeconomic relations, (ii) social reproduction (the processes that maintain the characteristics of a given social structure or tradition), and (iii) the diversity of availability of environments and their forms of use. This understanding can be used to define the livelihoods of Amazonian communities.

Thus, one of the first tasks of the case study research team was to define the units of co-management using the results of an in depth assessment of the socio-economic and environmental situation of the community. In our illustrative case, two management units (Cururu and Jacaré) were self-defined by local residents (Fig. 1). These areas contain partially flooded dendritic lakes located in floodplain areas (known as *terra firme* forest). Both prospective management units were indicated by more than 500 local people during open meetings with community leaders, community residents, external users and institutional representatives, and agreed upon in a final meeting in 2000. Thus, the units were not externally imposed, but rather were chosen on the basis of a variety of factors including the historical patterns of exploitation, the territorial claims of the inhabitants, types and restrictions on logging, use of induced fire for agricultural purposes, and application of customary regulations for agriculture and commercial fishing.

Identification of Extractive Practices and Norms of Use

The co-production of clear rules and norms of use for extractive practices is a clear requisite for effective co-management of natural resources. However, the development of such rules needs to carefully align with existing practices and behaviors, the identification of which requires carefully constructed, long-term assessment of extractive practices.

Within the management units of our case study, inhabitants were observed to conduct specific activities such as farming or small scale agriculture in relation to the spatial

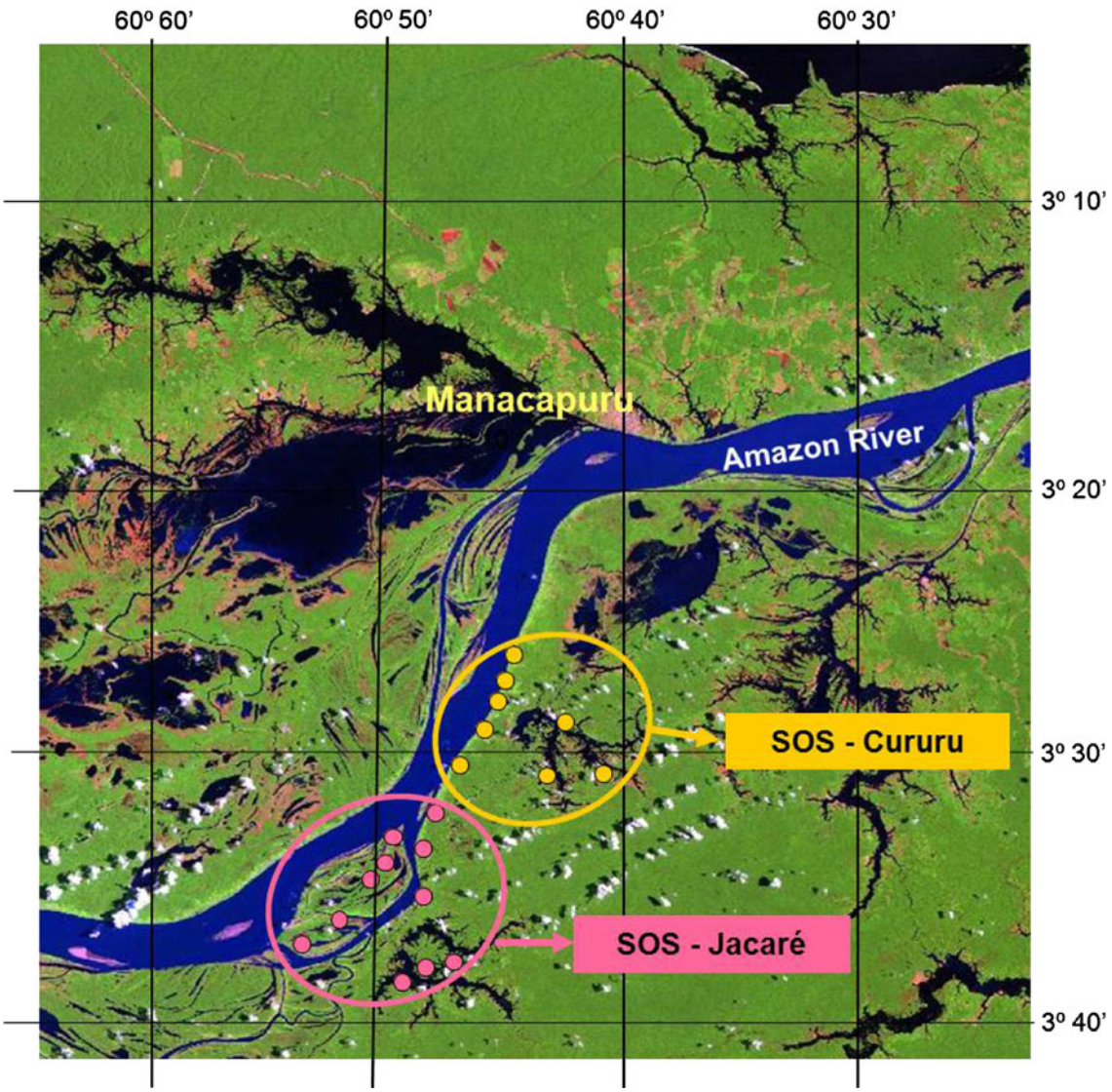

Fig. 1 Cururu and Jacaré sustainable management units, Manacapuru District, Amazonas, Brazil. *Small circles* represent identifiable social units (communities)

and temporal availability of resources—which in turn are primarily influenced by seasonal shifts in water level (Moran 1981; Fabré and Ribeiro 2003). For both management units fishing was one of the most important subsistence (and income generation) activities with a per capita consumption of fish of ~500 g during the wet season and ~600 g during the dry season (Garcez et al. 2010). This activity is particularly important during the wet season when migrating fish use the lakes and flooded forest as a route to the upper reaches of the basin (Batista and Fabré 2003). As the river level increases, the aquatic territories expand facilitating access to the *terra firme* and increasing the extractive activities (e.g. forestry, hunting and açaí palm fruit collection). During the high water period, it is also easier to access local markets by traveling through the complex watershed configuration.

During the dry season, agricultural activities largely replace the extraction of wood and non-wood products. However, fishing opportunities still exist since sedentary fish frequently become concentrated in land-locked temporary lakes increasing their vulnerability and accessibility. Such highly localized and concentrated resources are frequently used by a number of social units (communities) within the SOS (Fig. 2), thereby increasing the probability resource use conflict. Within the Cururu management system, Lake Cururu is an example of such a localized resource, and is heavily used by the surrounding communities during the dry season (Fig. 2). The identification of the lake as a potential conflict area by the local communities was an important symbolic step that brought focus to discussions about collective interests and motivated them to exercise social control to minimize the conflicts.

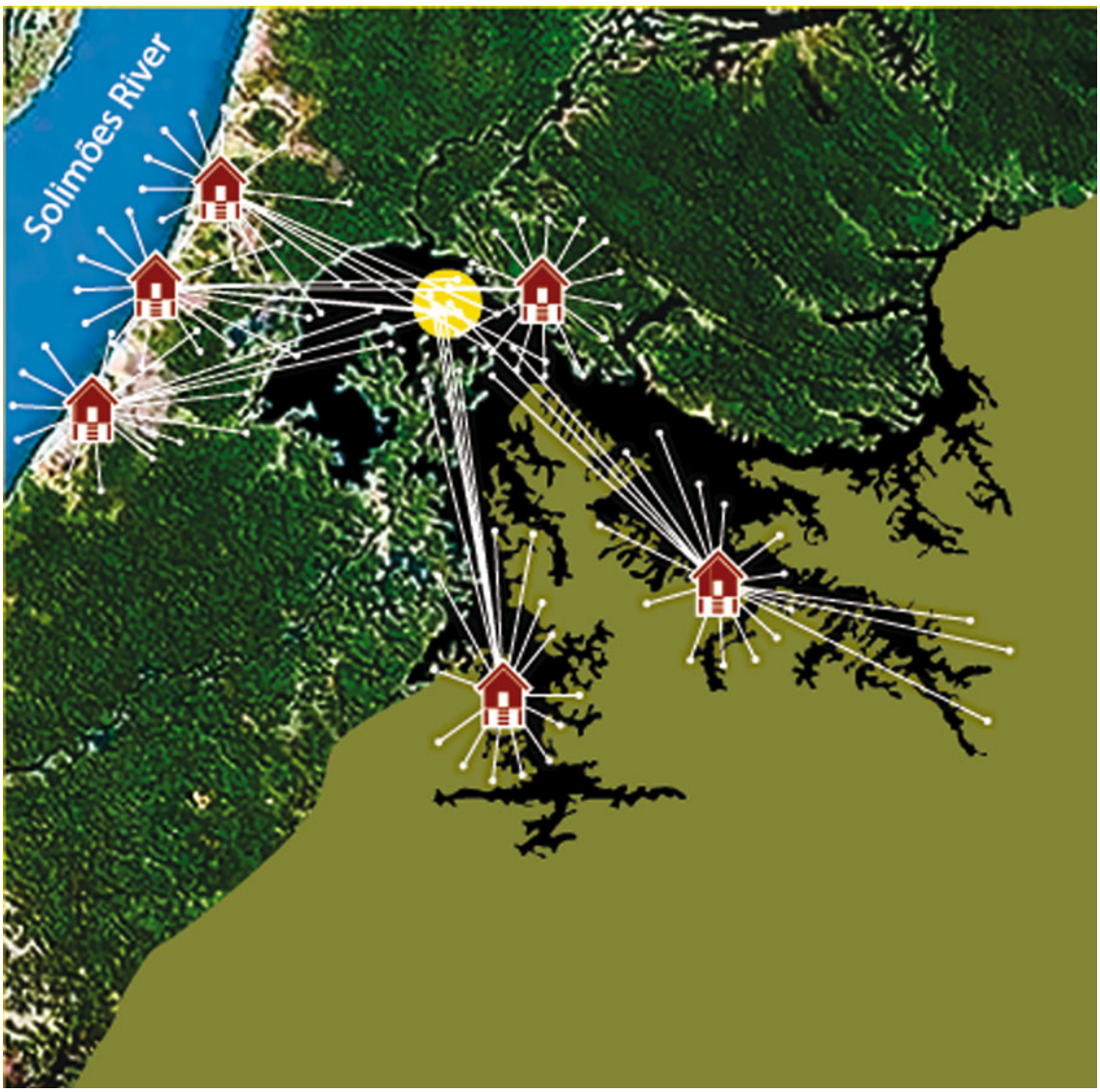

Fig. 2 Schematic representation of the Cururu SOS indicating the territorial relationships among six social units (communities: represented by house symbol). *White lines* represent the distance travelled to exploit a microhabitat. The area of maximum overlap in exploitation (and conflict) is the centre of the fisheries resource in Lake Cururu (*yellow circle*), an important microhabitat exploited by all the surrounding communities

Mapping Resource Use

Understanding temporal and spatial patterns of resource use is an important pre-requisite for developing and implementing co-management arrangements. By mapping territories, micro-habitats, frequencies of use and other measures of exploitation, it is possible to identify key areas and periods of resource use conflict.

As previously mentioned, the deepest area of Lake Cururu serves as a dry season refuge for several sedentary fish species, such as peacock bass (*Cichla* spp.) and pirarucu (*Arapaima gigas*), surubim (*Pseudoplatystoma fasciatum*), acará-açu (*Astronotus ocellatus*). This area is heavily used by several social units ('communities') during certain times of year, and as an important area of communal interest, heavily contributed to the identification of the Cururu management unit (see (1) above). Although multiple communities exploited the lake, use levels varied with distance and the territories of different communities encompassed distinct microhabitats that were also exploited to a greater or lesser degree.

The key finding of the mapping exercise was that there was an understandable tendency for communities to more heavily exploit areas close to their residences (most often less than 0.5 km and not further than 5 km), independent of the activity and the position of the residence relative to the

lake (Fig. 3a, b, c). Correspondingly, the area adjacent to residences was also characterized by higher appropriation intensity, territorial defence and care of resources, when compared to the territory as a whole. This pattern of resource use and behavior is broadly predicted by the homeland concept (Raffestin 1993) whereby each social group that integrates into a system, locally recognized as communities, exercises a form of property rights over the territory. This process becomes increasingly apparent in relation to the degree of individual or collective dependence on the natural resources, and where the cost of the exploitation is low and the benefits high.

It should also be noted that as the diversity of subsistence activities changes throughout the year in relation to water levels, so do the dimensions of the territories exploited by different social groups. For example, as would be anticipated there is a larger concentration of microhabitats for fishing close to the residences during the dry season as compared with the wet season (Pereira and Fabré 2009).

Reification: Agreements of Integrated Use

A key stage in the implementation of the co-management framework was the reification and codification of the observed norms of practice into an 'Agreement of Integrated Use' for each management unit. These agreements were subsequently institutionalized by means of a legal determination (*Portaria*) of IBAMA (Brazilian Institute for the Environment and Renewable Natural Resources) which allowed them to be officially designated as collaborative management units. The main benefit of the Agreement of Integrated Use is not so much that it legalizes the operation of the self-identified geographic units, but that it tightly links the users of the system into a partnership with government and non-government institutions.

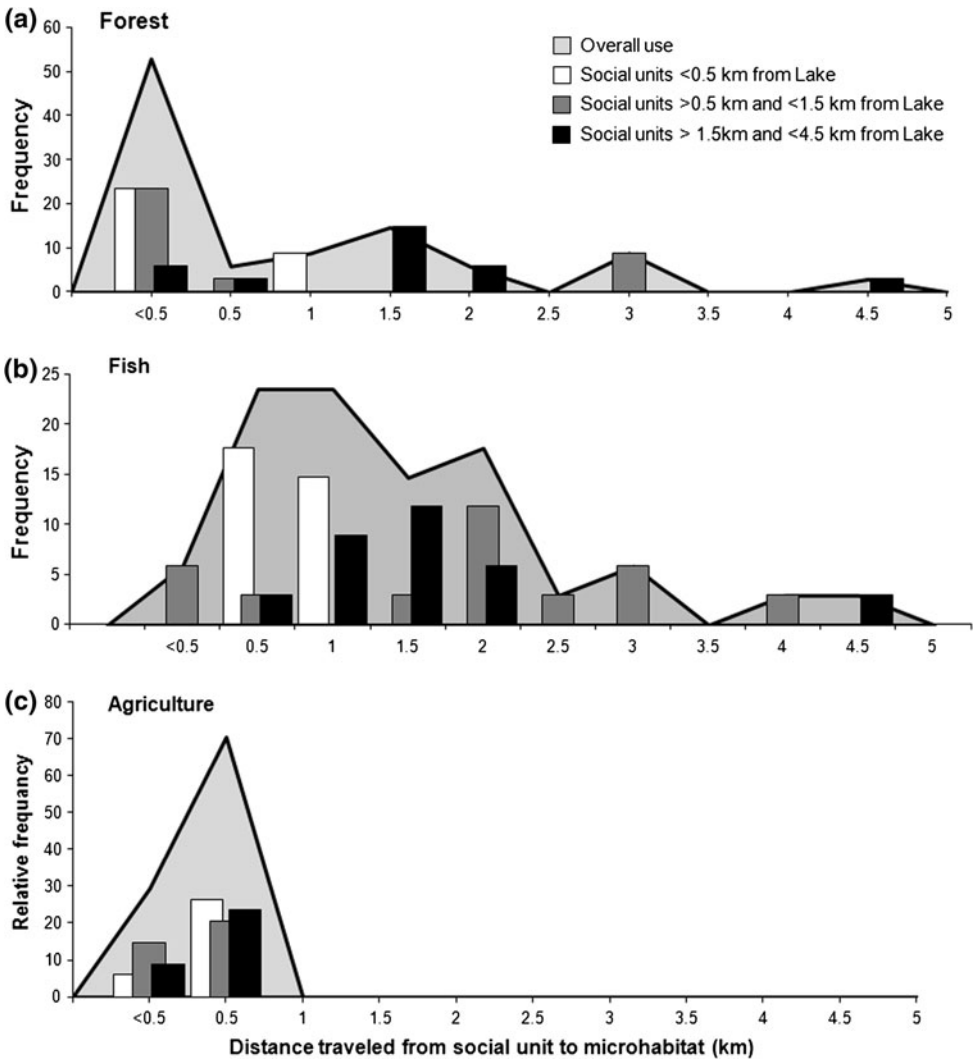

Fig. 3 Frequency of use of forestry, fishery, and agricultural microhabitats for exploitation of natural resources in relation to the distance traveled by the residents of Cururu SOS

Monitoring and Evaluation

The final phase of the SOS framework approach is designed to promote flexibility, adaptation, and other characteristics that are important for successful adaptive management. Two classes of sustainability indicators were developed for monitoring the Amazonian systems in the study: (i) indicators of participatory monitoring and self-assessment (local agents), and; (ii) an external evaluation system (based on the use of experts and consultants)—details of this phase are fully described in Ribeiro and Fabré (2003).

CONCLUSIONS

The Brazilian Constitution of 1988 made provisions for the creation of extractive reserves, and the rights of extractivist communities were given some protection as part of the government's *Nossa Natureza* ("our nature") Program (Rylands and Brandon 2005). Such formal recognition provided impetus for the creation of protected areas which were specifically tailored to the sustainable use of natural resources. However, protected areas are not, in themselves sufficient to ensure the continued protection of Amazonian forests and the vital ecosystem services that they provide.

Robust systems of community lead sustainable management of natural resources need to be developed that are flexible enough to incorporate the inevitable fluxes of people and resources in and out of the designated management area. The SOS framework outlined here represents such an approach, specifically designed for the historical and cultural context of Amazon forest communities and which provides a potentially robust framework for conservation outside of protected areas in the Amazon. Nevertheless, the success of the SOS approach comes at an unavoidable cost: as various authors (e.g., Brockington et al. 2008; Gruber 2010) have noted there are no easy solutions to achieving long-term sustainability, and no short-cuts in the painstaking process of collecting data, constructing informal and formal organizations, and building much needed trust among interested parties. We believe it is a cost worth paying if it increases the sustainability of this globally unique ecosystem and the diverse peoples who call it home.

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Nidia Noemi Fabré
Address: Institute of Biological Sciences and Health, Federal University of Alagoas/UFAL, Praça Afrânio Jorge, s/n, Prado, Maceió, AL 57010-020, Brazil.
Address: Integrated Program of Aquatic Resources and Floodplains of Federal University of Amazonas/PYRÁ-UFAM, Manaus, AM, Brazil.

Vandick da Silva Batista
Address: Institute of Biological Sciences and Health, Federal University of Alagoas/UFAL, Praça Afrânio Jorge, s/n, Prado, Maceió, AL 57010-020, Brazil.
Address: Integrated Program of Aquatic Resources and Floodplains of Federal University of Amazonas/PYRÁ-UFAM, Manaus, AM, Brazil.

Maria Olívia de Albuquerque Ribeiro
Address: UNINORTE Amazonas, Science and Technology Secretary of Amazonas State, SECT-AM, Integrated Program of Aquatic Resources and Floodplains of Federal University of Amazonas/PYRÁ-UFAM, Manaus, AM, Brazil.

Richard J. Ladle (✉)
Address: Institute of Biological Sciences and Health, Federal University of Alagoas/UFAL, Praça Afrânio Jorge, s/n, Prado, Maceió, AL 57010-020, Brazil.
Address: School of Geography and the Environment, University of Oxford, Oxford, UK.
e-mail: richard.ladle@ouce.ox.ac.uk