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Developing Sustainability in the Brazilian Amazon: Twenty Years of History in the Mamirauá and Amanã Reserves

DEBORAH DE MAGALHÃES LIMA *and* NELISSA PERALTA*

Abstract. This paper discusses the ability of Sustainable Development Reserves to *embed* (in Karl Polanyi's sense) the economy into the environment through the development of protocols for the sustainable management of natural resources. Based on two decades of work in the Mamirauá and Amanã Sustainable Development Reserves, we question whether the results are good, fair and viable by comparing two alternatives: unregulated markets and fully protected reserves. We evaluate the interest in sustainability; discuss who benefits and who pays for it; reflect on its potential to reduce inequalities; and discuss its economic and political viability.

Keywords: sustainable development, conservation, Amazon, participatory management

Introduction

For almost three decades, the expression 'sustainable development' has gone through several changes in its semantics, user audience and reputation. Recently, the expression has been linked to the proposal to develop a 'green capitalism' with sustainable technology and ecological consumers. To its critics, it is a concept with broad appeal but little specificity; it is seen as inherently reformist, avoiding issues of power, exploitation and redistribution. For them, it makes use of the conventional institutions of an industrial society

Deborah Lima is a Professor of Anthropology at the Universidade Federal de Minas Gerais. Email: deb.m.lima@gmail.com. Nelissa Peralta is a Senior Researcher at the Instituto de Desenvolvimento Sustentável Mamirauá (Mamirauá Institute for Sustainable Development, IDSM). Email: nelissa2013peralta@gmail.com.

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without abandoning the pattern of modernisation or transforming the ideals of capitalist production.

However, recognising the problems of sustainable development should not lead us to the abandonment of the political commitment to sustainability as a value that penetrates modernity with the aim of subverting it. Unfortunately this is exactly what we do when, on the basis of a superficial analysis, we discount experiments carried out with the aim of ensuring sustainable practices, particularly in places like the Brazilian Amazon, where it is imperative to formulate alternatives to free markets.

In Brazil, the nine-state region known as ‘Amazônia Legal’ covers 1,174,258 km² and conservation units occupy 23.5 per cent of the territory.¹ In this area, public authorities develop different types of environmental protection, following the specifications of the Sistema Nacional de Unidades de Conservação (National System of Conservation Units, SNUC). This legislation divides the conservation units into two groups: those for full protection and those for sustainable use.² The goal of the first group is to ‘preserve nature’, allowing only indirect use that does not involve the consumption, harvesting or destruction of or damage to natural resources. In the case of sustainable use, the goal is to reconcile human presence and nature conservation. The legal definition of sustainable use covers (i) the maintenance of ecological and environmental characteristics; (ii) the guarantee of social justice; and (iii) the economic feasibility of the exploitation of natural resources in the territory.³

The differences between full protection and sustainable use are not limited to human presence. Full protection reserves are a perfect image of Western self-consciousness, in which the human species is excluded from the idea of nature. On the contrary, in the units for sustainable use, the proposal is inclusive and the legislation provides that ecological sustainability can involve the regulation of market trading. Sustainability allows us to submit the economy to a concept of ecology, which is understood as the relationship between organisms and the natural environment, and also includes values and conceptual assumptions.⁴

Sustainable use is an original and creative exercise, necessary to react to what Karl Polanyi called the ‘utopia of the self-regulating market’, an idea of an autonomous economic domain where prices are adjusted freely by the

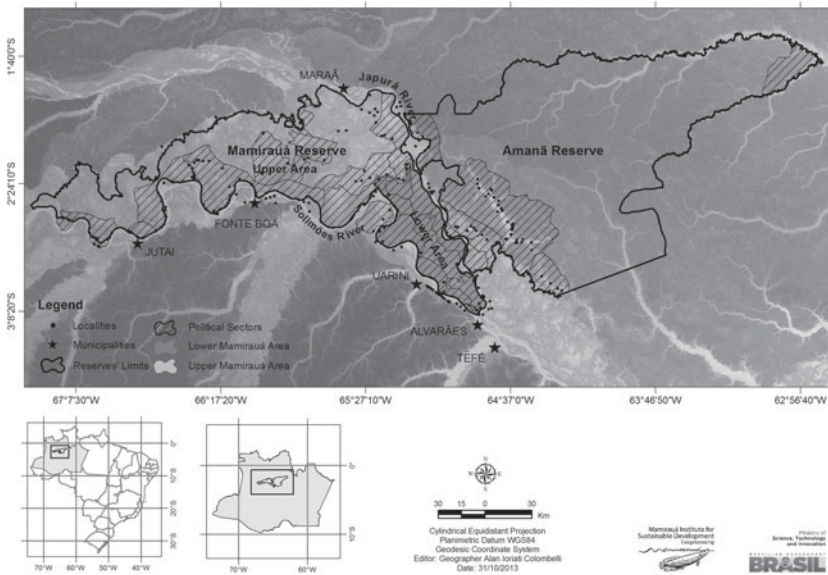
¹ Adalberto Veríssimo et al. (eds.), *Áreas protegidas na Amazônia brasileira: Avanços e desafios* (Belém: Imazon; São Paulo: Instituto Socioambiental, 2011), p. 19.

² The category of ‘Sustainable Use Reserve’ (SUR) refers to the group of four types of conservation units with human residents, one of which is the Reserva de Desenvolvimento Sustentável (Sustainable Development Reserve, RDS).

³ Sistema Nacional de Unidades de Conservação da Natureza. Decreto 9.985, July 2000 (Brasília: IBAMA/MMA, 2000).

⁴ Gregory Bateson, *Steps to an Ecology of Mind* (Chicago, IL: The University of Chicago Press, 2000).

Figure 1. Location of the Mamirauá and Amanã Reserves, Amazonas, Brazil



Source: Mamirauá Institute, Geo-processing Division.

supply and demand of goods. Polanyi characterised the process of the institutionalisation of the market economy as involving two movements. The first is guided by the ideology of the free market and treats the economy as if it were not embedded in social and environmental matrixes; the other, the interventionist reaction, is motivated by the need for market regulation to correct injustices generated by the economy’s rule over society.⁵

In this article, we discuss sustainable use as an intervention of this latter type, which acts against the freedom of the market and promotes embedding the economy in society and embedding society in the environment. We explore the practical and epistemological consequences of these re-embeddings, submitting sustainable management to three tests: whether it is good, fair and viable. These issues are discussed with reference to the process of instituting the first two Reservas de Desenvolvimento Sustentável (Sustainable Development Reserves, RDSs) in Brazil, the Mamirauá RDS and the Amanã RDS. The Mamirauá and Amanã RDSs, in total, consist of 3,474,000 hectares of land with 270 communities and 14,500 inhabitants (Fig. 1). We draw upon the results of research and extension activities achieved after more than 20 years of work in these reserves.

⁵ Karl Polanyi, *The Great Transformation* (Boston, MA: Beacon, 1965).

After two decades, it is now possible to review the results of sustainable management activities in relation to initial expectations, taking into account the values that guided the implemented actions. With this in mind, we pose the first question, whether sustainable management is good. We describe the parties involved, we determine for whom management is a good proposition and we briefly present the alliances between those who were mobilised by the implementation.

The second issue stems from the first and addresses the question of justice. The development of a desired action may or may not be fair, depending on the consequences of the action and which criterion of justice is employed. The results of the action can be evaluated positively but implementation may depend on sacrifices that are not equally shared – a common situation in conservation projects, in which poorer populations follow management protocols that generate benefits for a much broader audience. Finally, even though it may be a good proposition, desired by a local majority and comprised of well-distributed costs and results, the implementation of a project may not be viable. This brings us to the most pragmatic question: how do we do sustainable management? After 20 years of experiments in participatory management in Mamirauá and Amanã, we can adequately respond to the question of how to carry out sustainable management.

Our long-term involvement in the creation of the reserves and our participation in the sustainability practices discussed here inform the questions we pose and the selection of relevant data to answer them. In addition to being retrospective, this examination points to the potential of developing sustainability, showing the importance of greater political and academic commitment to address the complexity of sustainability development. Among several protocols for sustainable use established in Mamirauá and Amanã, our analysis focuses on the management of the pirarucu (*Arapaima gigas*), one of the most important fishery resources of the region. The case studies involving the definition of fishing rights illustrate critical points in the process of creation of sustainable use practices.

Economic History of the Mid-Solimões Region and the Creation of Sustainable Development Reserves

Until the first half of the twentieth century, the economy of the mid-Solimões region was built around a system of commercial exchange called *aviamento*, mainly associated with the extraction of latex to produce rubber for the international market.⁶ In *aviamento*, a rural producer is tied to a *patrão* (plural *patrões*), a merchant and/or landowner who has power over a *freguês* (client)

⁶ Roberto Santos, *História econômica da Amazônia: 1800–1920* (São Paulo: T. A. Queiroz, 1980).

by virtue of their debt–credit relationship, often through the supply of manufactured goods on credit in exchange for extractive products. In the traditional form of *aviamento*, money did not circulate, even if the accounting was done in currency values. The *patrão* was the principal link between rural producers and the market; he/she exclusively provided the goods necessary to meet their modest consumption. As the basis of social relations of production in rural Amazonia, *aviamento* was responsible for the constitution of a well-defined class structure: on one side the elite, *patrões* and merchants who controlled areas of extraction such as rubber trails, brazil-nut fields and lake systems through the monopoly of market exchanges; and on the other, small rural producers – rubber tappers, nut collectors, indigenous people and peasants who were forced to accept the unequal conditions of *aviamento* relations in order to acquire manufactured goods.

The *aviamento* system was dominant until the 1970s, when Amazonia went through a rapid process of urbanisation that increased demand for extractive and agricultural products needed to supply growing urban centres. The demand for manioc flour, a regional staple food, gave way to the monetisation of the rural economy and allowed producers to become independent of the *patrão*. The growth of urban markets also spurred the migration of the younger generation of traders to nearby cities, contributing to the decline of rural trading and to the dispersion of families previously tied to a patron–client relationship. Occupation patterns and forms of territorial control were thus redefined: settlements were formed on riverbanks, which river-based merchants (*regatões*) could access, and the territories of the *ribeirinhos* (river folk) became informally outlined by the actual needs of kin groups for arable land and lakes for fishing.⁷

The growth of urban centres also increased demand for fish. Benefiting from technological innovations, the fishing sector expanded, exerting more pressure on natural resources. The decline of traditional *aviamento* relations of production made room for a new type of player in the market: commercial fishers with boats of ever-increasing productive capacity. These new urban agents lacked ties to a fixed territory and aimed to develop highly profitable enterprises. Their activities led to the overexploitation and decline of fish stocks, thus directly affecting the rural population which depended on fish resources for subsistence and income generation.

The new social situation also opened up a space for a progressive sector of the Catholic Church in the mid-Solimões region. Between 1970 and 1980, the Movimento de Educação de Base (Movement for Grassroots Education) and other organs of the Catholic Church encouraged kin groups, dispersed along

⁷ Deborah M. Lima, 'Equidade, desenvolvimento sustentável e conservação da biodiversidade', in Edna Castro and Florence Pinton (eds.), *Faces do trópico úmido: conceitos e questões sobre desenvolvimento e meio ambiente*, 1st edn (Belém: Cejup, 1997), pp. 285–314.

different rivers, to form communities as a way to collectively fight for social rights. The Catholic Church encouraged communities to become economically independent and to secure access to fish resources and lands for agricultural production. In the mid-1980s, local leaders formed the Movimento de Preservação de Lagos (Lake Preservation Movement) to fight for rights to access, use and control fishing territories, thereby actively confronting commercial fishers and former patrões.

In adopting the environmental discourse as part of its political agenda, the Lake Preservation Movement created the foundation for a new model for conservation areas in the mid-Solimões region. The movement's lack of legal and financial support led it to ally with environmentalists active in the region. This socio-environmental partnership – that still persists today – was fundamental for the design and establishment of a new type of conservation unit.

Broader socio-political changes allowed for the growth of the socio-environmental movement in the Brazilian Amazon. At the national level, the process of re-democratisation opened up channels for policies leading to the creation of less authoritarian, top-down conservation areas. State environmental agencies began to interact with the scientific community to develop environmental policies⁸ and the scientific community also began to align itself with social movements. Socio-environmentalism came to represent an alternative to the orthodox environmental movement, which was more removed from social movements and political struggles for social justice.⁹ The shift towards socio-environmentalism occurred in parallel with similar changes taking place on an international level. By the end of the 1980s, the political agenda of international cooperation had shifted from an east–west to a north–south focus,¹⁰ which moved the environmental question to the top of the international agenda and increased the availability of financial resources for environmental projects. These investments were associated with international cooperation agreements settled in large United Nations conventions and were characterised by notions of sustainability and social justice. Many integrated conservation and development projects (ICDPs) across the globe received financial support from international conservation agencies. In the Brazilian Amazon, this allowed a greater emphasis on sustainability to replace the exclusively economic notion of development.

⁸ Eduardo Viola and Hector Leis, 'A evolução das políticas ambientais no Brasil, 1971–1991': Do bissetorialismo preservacionista para o multissetorialismo orientado para o desenvolvimento sustentável', in Daniel Hogan and Paulo Freire Vieira (eds.), *Dilemas socioambientais e desenvolvimento sustentável* (Campinas: Unicamp, 1995), pp. 73–102.

⁹ Juliana Santilli, *Socioambientalismo e novos direitos* (São Paulo: Instituto Internacional de Educação do Brasil and Instituto Socioambiental, 2005).

¹⁰ Roberto P. Guimarães, 'O desafio político do desenvolvimento sustentado', *Lua Nova: Revista de Cultura e Política*, 35 (1995), pp. 105–24.

Reservas Extrativistas (Extractive Reserves, RESEX) and RDSs emerged within this context. Legally recognised today as belonging to the group of Sustainable Use Reserves (SURs), these models were drafted on the basis of two pioneer experiences: those of the Alto Juruá RESEX in Acre state and of the Mamirauá RDS in the mid-Solimões region, Amazonas state. The SNUC national legislation looked to these local experiences as models for the creation and management of new categories of conservation areas.¹¹ After a period of initial enthusiasm, doubts remain as to whether the results of the new sustainable practices are good, fair and viable. To determine if the proposition is good, we look at the impacts of RDSs, examine possible alternatives, and review the socio-environmental pact established at the time these conservation areas were created.

Is Sustainable Use Good?

In terms of socio-environmental regulation, conservation areas for sustainable use fall between two extreme alternatives. The first brings together the (private and public) spaces where the market economy can act freely without having to meet environmental parameters beyond those set forth by environmental legislation such as the Forest Code, the Law of Environmental Crimes and the National Policy on the Environment. The second alternative pertains to full protection reserves where there is neither a market nor people.

Strictly speaking, indigenous lands can be included in the first group. Yet, in these lands, we find different levels of market integration, guided by cultural references to environmental use that minimise the impacts of market exploitation on the environment.¹² In 2012, the National Policy of Territorial and Environmental Management of Indigenous Lands was set up with the goal of ‘ensuring and promoting the protection, restoration, conservation and sustainable use of natural resources of land and indigenous territories’.¹³

Private lands may become Private Reserves of Natural Heritage recognised under SNUC if owners formally adopt environmental constraints. In the Amazon in particular, the Instituto Nacional de Colonização e Reforma Agrária (National Institute for Colonisation and Agrarian Reform, INCRA) has deployed environmentally differentiated settlement models

¹¹ Ibid.; Mary Helena Allegretti, ‘A construção social de políticas ambientais – Chico Mendes e o movimento dos seringueiros’, unpub. PhD diss., University of Brasília, 2002; Mauro W. Barbosa Almeida, ‘Direitos à floresta e ambientalismo: Seringueiros e suas lutas’, *Revista Brasileira de Ciências Sociais*, 19: 55 (2004), pp. 33–53.

¹² Deborah Lima and Jorge Pozzobon, ‘Amazônia socioambiental. Sustentabilidade ecológica e diversidade social’, *Estudos Avançados*, 19: 54 (2005), pp. 45–76.

¹³ Política Nacional de Gestão Territorial e Ambiental de Terras Indígenas (PNGATI). Decreto 7.747/2012. Available at www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/decreto/d7747.htm (accessed 10 Jan. 2017).

(agricultural–extractive, forestry and sustainable development projects) in which concession contracts for land use rights are conditional on the drafting of plans geared toward sustainable management and the reduction of deforestation. Fishery agreements are also listed as actions aimed at promoting sustainability, as regulated by the norms set forth by the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute of the Environment and Renewable Natural Resources, IBAMA) in the 1990s.

These and other initiatives that promote the conservation and sustainable use of natural resources by restricting mercantile stimulus from resource exploitation are becoming more common. The difference between these initiatives and conservation units for sustainable use is the degree of effectiveness of the management proposals. In the reserves, the government provides support for environmental protection and the development of protocols for efficient management designed specifically for local conditions, which can make sustainable use plans more effective.¹⁴

As for fully protected reserves, their relevance to the Amazon is controversial.¹⁵ They are more suitable in highly threatened areas where the economic pressure on the environment needs radical protection measures. In the interior of the reserves for sustainable development, zoning must include internal, total preservation zones with the objective of establishing areas of refuge for the repopulation of species exploited in other reserve zones. This can be a more suitable understanding of fully protected reserves, to replace the pessimistic view that defending nature involves removing the human species.

In social terms, reserves for sustainable use ensure occupancy security for residents, given the precarious nature of land regulation in the Amazon. In the RDSs and RESEX, the land is considered public domain with the rights of use assigned to the inhabitants. In addition, the compliance of resource utilisation with sustainability criteria ensures that livelihoods will be secured over the generations.

Considering the possible options and that the Amazon is not and probably never will be simply a collection of reserves for sustainable use, when and where would it be good to have such reserves? It is fair that they should be created only when they reflect the interests of the people directly affected. To some

¹⁴ Antonio Oviedo and Marcel Bursztyrn, 'A quem confiamos os recursos comuns: Estado, comunidade ou mercado? Lições aprendidas com o manejo da pesca na Amazônia', *Sociedade e Estado*, Brasília, 18: 2 (2003), pp. 177–98; Nelissa Peralta, 'Toda ação de conservação precisa ser aceita pela sociedade: Manejo participativo em reserva de desenvolvimento sustentável', unpub. PhD diss., University of Minas Gerais, 2012.

¹⁵ Henyo T. Barreto-Filho, 'Da nação ao planeta através da natureza: Uma abordagem antropológica das unidades de conservação de proteção integral da Amazônia Brasileira', unpub. PhD diss., University of São Paulo, 2001; 'Notas para uma história social das áreas de proteção integral no Brasil', in Fany Ricardo and Valéria Macedo (eds.), *Terras indígenas & unidades de conservação da natureza: O desafio das sobreposições* (São Paulo: Instituto Socioambiental, 2004), pp. 53–63.

extent, the SNUC ensures this is done by submitting the designation of new conservation areas to public consultation. The growth in the number of conservation units for sustainable use, which today total 196 in the Legal Amazon (or 14 per cent of the territory), suggests that local populations support them. This was the case with the creation of the Mamirauá and Amanã RDSs as well. The reserves are the outcome of the ecological mobilisation of the ribeirinhos meeting local demands to ban commercial fishing in their areas.¹⁶

The battles fought in the 1980s and 1990s pitted small fishers against fleets of commercial fishing boats in an unequal and unfair competition in which the costs of resource depletion affected only the locals. The threat to the livelihood of the ribeirinho people, whose household economies depended significantly on the environment to survive, was imminent. A continuous decrease in fishery stocks added to the historical experience of the extinction of local species, such as the pirarucu, which had been over-exploited since the colonial period.

The Lake Preservation Movement, created in the 1980s to delineate fishing zones, established areas for the exclusive use of the communities. Lists with the names of the *várzea* (floodplain) lakes assigned to the communities were published in municipal laws but had little legal effectiveness and lacked monitoring mechanisms. Residents received the announcement of the creation of these reserves well and accepted the invitation to participate in their implementation.¹⁷ As a result of the support for the protection of lakes in the reserves, environmental improvements were noted in a short time and fish stocks were restored. In addition to the restoration of fish stocks, trees, birds and turtles are once again abundant.

As a result of the connectivity of lakes and the flood pulse dynamics of flooded forests,¹⁸ areas where fishing is regulated function as source habitats

¹⁶ Even though the state government decreed the Mamirauá reserve, its establishment began only after a slow and patient process of consulting community members, in which Afonso Carvalho and Antônio Martins played key roles. The project was a collective effort involving scientists, international development institutions and local leaders. The main protagonists have already passed away. Gordon Armstrong of the former UK Overseas Development Agency, Joaquim Martins from the Boca do Mamirauá and Antônio Martins from Jarauá, two Mamirauá RDS communities, and, especially, José Márcio Ayres of the Museu Paraense Emílio Goeldi and Wildlife Conservation Society, left important legacies.

¹⁷ Deborah Lima, 'Equity, Sustainable Development and Biodiversity Preservation: Some Questions about Ecological Partnerships in the Brazilian Amazon', in A. Henderson, C. Padoch and J.M. Ayres (eds.), *Ecology, Conservation, and Development of the Amazonian Várzea* (New York: New York Botanical Garden Press, 1999), pp. 247–63; José Márcio Ayres, Ana Rita Alves, Helder Queiroz, Miriam Marmontel, Edila Moura, Deborah Lima, Aline Azevedo, Marise Reis, Paulo Santos, Ronis da Silveira and Donald Masterson, 'Mamirauá: The Conservation of Biodiversity in an Amazonian Flooded Forest', in Henderson et al. (eds.), *Ecology, Conservation, and Development of the Amazonian Várzea*, pp. 203–26.

¹⁸ José Márcio Ayres, *As matas de várzea do Mamirauá* (Brasília: MCT/CNPQ e Sociedade Civil Mamirauá, 1993); Wolfgang Junk, Peter Bayley and R.E. Sparks, 'The Flood Pulse Concept in River–Floodplain Systems', in D.P. Dodge (ed.), *Proceedings of the*

for fish populations.¹⁹ The fish choose these areas for breeding and, with the rise in water level, they disperse and repopulate other areas. The central location of the reserves, in the heart of the Amazon, with six urban centres close by, results in the reserves playing a fundamental role in the supply of fish. Through this role, the reserves provide an essential environmental service – ensuring food security for the city and the interior. Monitoring of fish stock data shows that, since the creation of the reserves and the restriction of free access to these areas, the supply of fish in the Tefé municipality has remained stable over the years 1992–2007.²⁰ Recent research shows that average annual per capita fish consumption in Tefé (30 kg) is four times greater than the Brazilian average (7.33 kg/person/year).²¹

Another important result was the development of a system for the sustainable management of the pirarucu. This allowed for the commercial exploitation of this important species, which had been banned by Amazonas State in the past owing to a decline in natural populations.²²

The history of the commercial exploitation of the pirarucu dates back to the colonial period. Fishing outposts for supplying military troops, called *pesqueiros reais*, gave way to trading posts or fishing camps controlled by traders to exploit resources using an indigenous and mestizo labour force.²³ Patrões and their agents explored the region at the confluence of the Japurá and Solimões rivers and were precursors to various communities encountered in the Mamirauá and Amaná reserves today.

In the mid-1990s, just after the reserves were created, pirarucu represented 50 per cent of all fish caught for sale and 15 per cent of the income of local

International Large River Symposium. Canadian Special Publication of Fisheries and Aquatic Sciences, 106 (1989), pp. 110–17.

¹⁹ In ecological management ‘source’ means an area of supply in source–sink dynamics, an ecological principle whereby habitats can be distinguished in terms of their position as sources (providers) or sinks (receptors) of resources. See Lawrence E. Hurd, Raniere G. C. Sousa, Flávia K. Siqueira-Souza, Gregory J. Cooper, James R. Kahn and Carlos E. C. Freitas, ‘Amazon Floodplain Fish Communities: Habitat Connectivity and Conservation in a Rapidly Deteriorating Environment’, *Biological Conservation*, 195 (2016), pp. 118–27.

²⁰ Pollianna Ferraz, Daiza Lima and Ellen Amaral, ‘Estatística do monitoramento do desembarque pesqueiro na região de Tefé – Médio Solimões’, *Série Desembarque Pesqueiro*, I (Tefé: IDSM, MCTI, 2012).

²¹ Pollianna Ferraz and Ronaldo Barthem, ‘Estatística do monitoramento do desembarque pesqueiro na região de Tefé – Médio Solimões: 2008–2010’, *Série Desembarque Pesqueiro*, II (Tefé: IDSM, MCTI, 2016).

²² Ellen Sílvia Ramos Amaral, ‘O manejo comunitário de pirarucu (*Arapaima gigas*) como alternativa econômica para os pescadores das RDS’s Amaná e Mamirauá, Amazonas, Brasil’, unpub. Master’s thesis, Federal University of Pará, 2009.

²³ Lurdes Furtado, ‘Origens pluriétnicas no cotidiano da pesca na Amazônia: Contribuições para projeto de estudo pluridisciplinar’, *Boletim do Museu Paraense Emílio Goeldi*, 1: 2 (2006), pp. 159–72.

residents.²⁴ Between the years 1993 and 1998, 70 per cent of pirarucu caught were smaller than 1.5 metres, the minimum catch size permitted by the legislation. This reduction in the average size of the pirarucu indicated that the species was being exploited at non-sustainable levels.²⁵ In 1996, a state law prohibited commercial fishing of pirarucu in the entire state of Amazonas. This ban affected the inhabitants of the Mamirauá reserve, impacting the local economy.²⁶

The negotiation of management procedures among the local leaders and the zoning of the reserve did not eliminate commercial fishing of the pirarucu, which continued to threaten the sustainability of fisheries.²⁷ It was important to make pirarucu management viable in order to meet fishers' demands and also to build a strategy towards the sustainability of the activity, given that the mere prohibition of commercial exploitation in 1996 had not been effective.

The initial project was developed in an area of the Jarauá sector of the Mamirauá reserve that included four communities and 70 fishers. This area was chosen because of the importance of the activity for local livelihoods, the productivity of its lakes, the level of community organisation and the history of locals' participation in the process of reserve establishment.²⁸

Pirarucu management is a system that relies on the definition of sustainable fishing quotas based on population estimates. Local fishers use their traditional knowledge to count the number of pirarucu in a delimited area based on their ability to identify individuals. To determine the accuracy of the estimates based on local knowledge, an experiment was conducted comparing them with the

²⁴ Helder Queiroz and Arluce Sardinha, 'A preservação e o uso sustentado dos pirarucus em Mamirauá', in Helder Queiroz and William Crampton (eds.), *Estratégias para manejo de recursos pesqueiros em Mamirauá* (Brasília: MCT/CNPQ e Sociedade Civil Mamirauá, 1999), pp. 108–41.

²⁵ Helder Queiroz, 'Natural History and Conservation of Pirarucu, *Arapaima gigas*, at the Amazonian Várzea: Red Giants in Muddy Waters', unpub. PhD diss., University of St. Andrews, 2000.

²⁶ João Paulo Viana, J. M. B. Damasceno, L. Castello and William G. R. Crampton, 'Economic Incentives for Sustainable Community Management of Fishery Resources in the Mamirauá Sustainable Development Reserve, Amazonas, Brazil', in Kirsten Silvius, Richard Bodmer and José Fragoso (eds.), *People in Nature: Wildlife Conservation in South and Central America* (New York: Columbia University Press, 2004), pp. 139–54.

²⁷ Leandro Castello, 'A Socio-Ecological Synthesis on the Conservation of the Pirarucu (*Arapaima*) in Floodplains of the Amazon', unpub. PhD diss., State University of New York, 2007.

²⁸ João Paulo Viana, Leandro Castello, José Maria Batista Damasceno, Ellen Silvia Ramos Amaral, Guillermo Moisés Bendezú Estupiñán, Caroline Arantes, Gelson da Silva Batista, Danielle Sequeira Garcez and Saide Barbosa, 'Manejo comunitário do pirarucu *Arapaima gigas* na reserva de desenvolvimento sustentável Mamirauá, Amazonas, Brasil', in Ana Paula Prates and Danielle Blanc (eds.), *Áreas aquáticas protegidas como instrumento de gestão pesqueira* (Brasília: MMA, IBAMA, 2007), pp. 239–61.

Figure 2. Pirarucu Fishing in Mamirauá Reserve 2013



Photos courtesy of: Ricardo Oliveira.

scientific mark and recapture method. Results showed a positive correlation between counts made by fishers and those made by scientists.²⁹

Based on this evidence, IBAMA allowed fishing quotas of pirarucu to be estimated by local fishers. The fishers counted the stock of adult pirarucu in the lakes and were allowed to catch 30 per cent (the sustainable percentage as defined by scientists) for sale. In three years, the population of pirarucu in Jarauá grew by nearly 350 per cent and the average income generated by the management of pirarucu increased by approximately 800 per cent between 1999 and 2005.³⁰ In the year 2005, this was equivalent to an income of R\$2,200.00 per household.³¹

In 2004, IBAMA issued instructions that permitted the management of pirarucu in conservation units and areas covered by fishery agreements. With the government's consent, the pirarucu counting method developed in Mamirauá was used throughout the Amazon, becoming a tool for conservation and sustainable use of the species. The simplicity of the method of counting pirarucu was ideal for community management because resource users themselves conduct stock evaluations and make management decisions (see Fig. 2).³²

Strictly speaking, the creation of the reserve had already granted the communities exclusive rights to the lakes but, in practice, this exclusive use became reality only with the onset of environmental protection activities referred to as *guardar lagos* (protecting or reserving lakes) backed by government environmental agencies. The protection of specific areas occurs via

²⁹ Leandro Castello, 'A Method to Count Pirarucu *Arapaima gigas*: Fishers, Assessment, and Management', *North American Journal of Fisheries Management*, 24 (2004), pp. 379–89.

³⁰ Viana et al., 'Manejo comunitário do pirarucu *Arapaima gigas*'.

³¹ Nelissa Peralta, Edila Moura, Ana C. Nascimento and Deborah M. Lima, 'Renda doméstica e sazonalidade em comunidades da RDS Mamirauá: 1995–2005', *Revista Uakari*, 5: 1 (2009) pp. 7–19.

³² Castello, 'A Method to Count Pirarucu'.

local fisher expeditions, by guards paid by fishers' organisations or both.³³ 'Guardar lagos' guarantees the recovery of stocks and leads to the recognition by outsiders of locals' rights to lakes and resources.

With technical assistance from the Mamirauá Institute, the communities set up fisher organisations to carry out zoning measures and govern the use of resources by means of norms approved by their members. Local leaders organise rotas for surveillance trips and calculate quota shares, collect technical information and negotiate sales. The fishing licences are issued annually by IBAMA on the basis of the quotas established by the inventory of the previous year. Annual fish capture is conducted during the dry season when fish stocks concentrate in isolated water bodies and is carried out either collectively or individually.³⁴ The division of the proceeds from the sale follows pre-established criteria such as participation in meetings and task forces for surveillance, and respect for the rules of resource use.

This example shows how sustainable use, in line with the goals set by the SNUC to ensure 'the survival of environmentally renewable resources', was developed and approved. The sustainable management of the pirarucu is regarded favourably in the region because it serves the interests of the residents of the reserve and promotes the sustainability of the species.

Support for the reserves in general and the management systems in particular has been confirmed in regular forums presided over and assisted by reserve users. Since the first consultations on the designation of the Mamirauá RDS, great efforts have been made to implement decision-making mechanisms based on broad democratic participation. The most important participation forums are the annual meetings – 20 such meetings have already been conducted in Mamirauá and Amanã – where representatives from all communities participate, discuss and debate the operation and functioning of the reserves. In addition to the general meetings, there are more restrictive forums in individual sectors and communities. The conservation units have, as the highest decision-making body, a deliberative council with members from local communities and public and private sector organisations.

Support for sustainable management does not mean that everyone agrees on the management specifications. There are many conflicts between neighbouring communities that compete for the right of access to particular lake systems. Among the fishers, there are many who resist environmental regulations – whether specific community management or national environmental legislation – despite

³³ Ellen Amaral, Nelissa Peralta, Caroline Arantes, Ana Cláudia Gonçalves and Isabel Sousa, 'Principales acciones y lecciones aprendidas con la gestión participativa del paiche en Mamirauá', in Luis Collado, Edgardo Castro and Max Hidalgo (eds.), *Hacia el manejo de las pesquerías en la cuenca amazónica: Perspectivas transfronterizas* (Lima: Instituto del Bien Común, 2013), pp. 101–15.

³⁴ Amaral, 'O manejo comunitário de pirarucu (*Arapaima gigas*)'.

recognising the need to preserve the conditions for the reproduction of fish. The management rules often cause controversy in light of market demands (including demands from local patrões with whom community members have formed personal bonds) and family needs. On the other hand, in many cases, the local protection measures for resources cannot mitigate the actions of external users and communities feel that they end up ‘conserving for others to take’.

For the mid-Solimões region, the two alternatives to SURs are far from ideal. The option to open up a free market has already had negative results. Among them are the so-called ‘Fish Wars’, with violent clashes involving the ribeirinho communities and large fishing boats, and the drastic reduction and local extinction of species of economic value, which also impact associated species. The second option – turning the reserves into full protection units, forbidding the exploitation of resources and relocating residents – would be impractical, considering the importance of this extensive floodplain area to the regional economy and the personal cost of relocating families to an uncertain future. In addition, the experience shows how difficult and costly it is to protect vast areas in the Amazon through unilateral state actions.³⁵ The sustainability of the local resources motivates residents in the reserves to act for resource protection, restricting the free market exploitation of these areas. Nevertheless, for this reason, residents must have a guarantee of access to resources and the means necessary to develop sustainable uses.

Between the free market and total preservation – opposite ideals defended by different sectors of government and civil society – sustainable use is the most suitable option for the mid-Solimões region. It benefits the residents, protecting them from competition from commercial fishing fleets, and ensures the replacement of fishing stocks, the productivity of fishing in the near future and for generations to follow, and fish supplies to the urban market.

Issues of Justice

A positive evaluation of the development impact of sustainable reserves is not enough; we also need to question the extent to which their results are fair. In this study, we focus on the relationship between the human population and the environment from the point of view of market mediation. This way, we avoid the mistake of attributing essentially sustainable conduct to traditional populations, simply because sustainability is a result of a type of relationship with the market and not an intrinsic characteristic of their way of life.³⁶

³⁵ José Márcio Ayres, Richard Bodmer and Russel Mittermeier, ‘Financial Considerations of Reserve Design in Countries with High Primate Diversity’, *Conservation Biology*, 5:1 (1991), pp. 109–14.

³⁶ Barreto-Filho, ‘Da nação ao planeta através da natureza’; Lima and Pozzobon, ‘Amazônia socioambiental. Sustentabilidade ecológica e diversidade social’.

The market offers monetary rewards to those who turn environmental resources into goods (the products of labour offered for sale). The social and environmental consequences of market operations are not taken into account – the central point of Polanyi's criticism of the self-regulated market. Critics of the RDS experience argue that it is not fair to restrict the freedom of inhabitants to commercially exploit natural resources as they wish. However, the pact with the traditional population is based precisely on making a commitment to maintain the exploitation of the environment at sustainable levels in exchange for the guarantee of land tenure rights.³⁷

To raise questions about the suitability of SURs in relation to the sustainability pact is to return to the original debate, because it was the action of a social movement that originally defended the regulation of resource use. In protecting a way of life – autonomous domestic peasant production with low environmental impacts based on traditional knowledge of biodiversity – the social environmentalist movement of the 1980s and 1990s fostered the creation of the 'traditional populations' category.³⁸ The emergence of this new political category allowed participants to become the subject of specific rights, such as those advocated by the *Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais* (National Policy for the Sustainable Development of Traditional Peoples and Communities, PNPCT).³⁹ The defining characteristic is not ethnic identity but an interest in maintaining a harmonious relation with the environment. In the absence of a sustainability pact, there would be no reserves for sustainable use. Thus, this may not be the best line of questioning. If it were, we would go back to the two previously discussed alternatives: the conditions of a non-regulated market or fully protected reserves.

Criticism of the reserves should focus on another aspect: exclusivity. Although there are various initiatives aimed at promoting the sustainability of the environment and not all are coordinated by the state, the presence of the state in SURs ensures that the law is respected. It is only in comparison to situations outside of these reserves, where the free market economy does not comply with environmental legislation, that required sustainability practices seem like 'coercion'. The injustice is in the fact that the sustainability pact is not extended to all areas. Correcting this injustice does not require

³⁷ The sustainability pact can be understood as a socio-environmental contract, alternative to the 'state of natural freedom of the market'. Fully protected areas, on the other hand, can be seen as ruled by a Hobbesian view in which, according to José Heder Benatti, humans are destroyers of nature; the creation of protected areas by a strong state is the only guarantee of preservation: José Heder Benatti, 'Unidades de conservação e as populações tradicionais: Uma análise jurídica da realidade brasileira', *Novos cadernos NAEA*, 2: 2 (1999), pp. 107–25.

³⁸ Santilli, *Socioambientalismo e novos direitos*.

³⁹ Created in 2007 by Decree No. 6040, it regulates the promotion of sustainable development for traditional peoples and communities.

ending sustainable use but ensuring that it has a more intensive and extensive application. This way the costs of environmental services will be divided among a larger number of members of society. If we were to apply the criterion of justice that Amartya Sen calls ‘transcendental’,⁴⁰ economic enterprises throughout society would need to carefully abide by the limits of nature.

Since this is not likely to occur, and using the comparative criteria of justice advocated by Amartya Sen, we can judge that the pact to maintain sustainability in RDSs incurs injustice because people in the reserves provide an environmental service to society at large but do not receive fair compensation. Some forms of recognition of the benefits provided by reserves are beginning to appear, such as the Bolsa Floresta (Forest Grant/Allowance), initiated in 2008 by the Amazonas government, which paid families living in conservation areas a reward for non-deforestation. In the Mamirauá and Amanã reserves in 2011, 67 per cent of families received an average Bolsa Floresta of R\$695.50 per year or 8 per cent of the budget of the recipient household.⁴¹

Usufruct Rights

Another important dimension of justice relates to the formal relationships that people establish regarding environmental resource use. The creation of rules guiding resource use is one of the most complex issues that the development of sustainability has to face. Here, the main actors involved in the process of developing sustainable protocols are the local reserve users and the institutions responsible for the conservation areas: the Instituto de Desenvolvimento Sustentável Mamirauá (Mamirauá Sustainable Development Institute, IDSM), the Centro Estadual de Unidades de Conservação – Amazonas (State Centre for Conservation Areas – Amazonas (CEUC), IBAMA and the Deliberative Council of the Reserves.⁴²

The category ‘local users’ encompasses residents of the Mamirauá and Amanã reserves and those who live in adjacent areas but have gained customary rights of use of reserve resources. Official administration of the reserves is in the hands of the state agency, CEUC, which has three technicians in charge of reserve management. Formally, the Deliberative Council, presided over by

⁴⁰ Amartya Sen, *The Idea of Justice* (Cambridge, MA: Harvard University Press, 2009).

⁴¹ One example is the Forest Allowance Programme. Established in 2008 by the Amazonas government, it compensates families for avoiding deforestation in SURs. Funds come from Reduction of Emissions resulting from Deforestation and Degradation (REDD) mechanisms. See Secretaria de Estado de Meio Ambiente e Desenvolvimento Sustentável, *O valor dos serviços da natureza – Subsídios para políticas públicas de serviços ambientais no Amazonas* (Manaus: SDS/CECLIMA, 2010).

⁴² For more information on this set of actors, see Helder Queiroz, ‘A reserva de desenvolvimento sustentável Mamirauá’, *Estudos Avançados*, 19: 54 (2005), pp. 183–203; Edila Moura, ‘Práticas socioambientais na reserva de desenvolvimento sustentável Mamirauá, estado do Amazonas, Brasil’, unpub. PhD diss., Federal University of Pará, 2007.

CEUC, takes important decisions regarding management. The IDSM, supported by the Brazilian Ministry of Science, Technology and Innovation, is also a major player. The institute carries out scientific research and technological development, and provides assistance for natural resource management in Amazonian conservation areas. With its base in Tefé, IDSM was an initiative of the primatologist Márcio Ayres. The institute employs approximately 200 people, including researchers, technicians and administrative personnel.

The development of sustainable use protocols must originate from the customary notions of the right of access to natural resources. The negotiations involve dealing with ‘bundles of rights’ distributed in ‘layers’, more or less overlapping each other, and are defined in terms of their cultural–ideological, legal–institutional and everyday social practices.⁴³ The reference to layers of property rights is a heuristic device to briefly portray a ‘plural’ context in which rules for sustainable use are developed in the mid-Solimões region. The plurality of rights, powers and responsibilities makes the definition of access to resources a complex question – one that precedes and influences rights to selling fish.

The cultural–ideological references adopted by reserve residents are informed by two fundamental values: the notion of ‘usucaption’, which confers rightful ownership through possession and articulates rights of occupation and use, and a fairness ethic or an aversion to inequalities, especially present among those considered the residents’ ‘equals’. We will see these notions in use in the empirical case presented below.

Fishing agreements are made official in a legal–institutional framework that involves state organisations and institutions representing local fishers, such as fishers’ unions and community associations. These institutions seek to reconcile cultural–ideological references and bind them in legal–institutional protocols. The difficulties of this process are enormous, as the empirical case below also shows.

In everyday practice, the notion of rights is activated in a comprehensive way. Negotiations regarding the right to use resources involve another ‘bundle of rights’ in addition to those taken into account when drafting the regulations, brought as contextual reference by all actors – be they ribeirinho users of the reserves or technicians of environmental institutions. Among the ribeirinho users, the scope for the articulation of rights is greater and includes notions of kinship, territory, and economic practice. It is also influenced by religious, political and ethnic alliances and affiliations.⁴⁴ The

⁴³ Franz von Benda-Beckmann, Keebet von Benda-Beckmann and Melanie G. Wiber (eds.), *Changing Properties of Property* (Oxford: Berghahn, 2006).

⁴⁴ We do not address the complex question of rights tied to the new claims to indigenous recognition, as this requires more detailed analysis. See Deborah Lima, Mariana Souza and Rafael Barbi, ‘Organizações indígenas e as políticas de reconhecimento no médio

identification of the realm of rights influencing negotiations is not always clear. The amplitude of and overlapping between rights might be the reason why community leaders have defended different positions throughout the negotiations over management rules, alternating between opposite political positions. The results of negotiations can, in turn, take different paths, depending on the criterion of justice incorporated – whether egalitarian, utilitarian or libertarian.⁴⁵

In the mid-Solimões region, property rights are conferred mainly by labour and a positive differentiation is made between the product of labour and the product of nature. Since fish is a natural resource and labour is invested only in its extraction, access to it is, at its core, free. On the other hand, enclosing (*fechamento*) lakes is acknowledged as an effort that produces significant increase in fish stocks. The strenuous work of guarding lakes (*guardar lagos*) is considered a labour investment in fish production – as it guarantees the restocking of lakes – thereby conferring specific rights over production. In turn, lake enclosure ratifies usufruct rights because the act of protection is itself understood as the exercise of a territorial right granted to the community that lives nearby.

Living near lakes confers usufruct prerogatives on residents. This is associated with the customary notion of tenure rights of a radial territory with enough area to guarantee their livelihood, including fishing and agroforestry areas. This traditional form of territorial occupation corresponds to the concept proposed by José Heder Benatti⁴⁶ of ‘agroecological tenure’ and also the concept adopted as the legal framework of SURs in Brazil. The principle of usucaption is implicit in this notion.

In disputes over fishing rights, prerogatives of birthright are among the strongest arguments presented by claimants. A native is considered a ‘child of the place’ (*filho do lugar*). This expression acknowledges the existence of a relation between a person and their place of birth that is also granted by labour – in the sense that natives are regarded as a creation of the place. Birth gives rights of precedency over the place but these must be ratified by residency and use of the territory. In the case of fishing lakes, guarding (*guarda de lagos*) exercises these rights.

Solimões’, in Carlos Alberto Ricardo and Fany Ricardo (eds.), *Povos indígenas no Brasil 2006/2010* (São Paulo: Instituto Socioambiental, 2011), pp. 349–52. See also Priscila Faulhaber, ‘“Ambientalização dos conflitos”, indigenismo e lutas sociais no Médio Solimões: as terras indígenas e o projeto Mamirauá’, *Revista Antropológica*, 15: 22 (1) (2011), pp. 97–117.

⁴⁵ Sen, *The Idea of Justice*.

⁴⁶ José Heder Benatti, ‘Posse coletiva da terra: Um estudo jurídico sobre o apossamento de seringueiros e quilombolas’, *Revista CEJ/Conselho da Justiça Federal*, 1: 1 (1997), available at <http://daleth.cjf.jus.br/revista/numero3/artigo07.htm> (accessed 10 Jan. 2017).

The delimitation of communities' territories is often disputed, depending on the proximity of localities and the population density of the surroundings, in which case borders will be more or less fluid. While the definition of these territories can remain tacit, fishing accords require that boundaries and lake classification categories be defined with precision. This gives rise to potential disputes regarding the attribution of fishing rights and the categorisation given to lakes – for community use, commercial use or total preservation.

In the Amanã and Mamirauá reserves, geopolitical sectors are the main territorial loci for the definition of sustainable use protocols. Management of territories is based on agreements reached after intense negotiations involving the communities of each sector, marked by diverse demands and disputes for use rights, mediated at times by government agencies or the Mamirauá institute.

We chose the case of the Pantaleão lake system to illustrate one of these processes because it was the first to extend fishing rights in the reserve to urban fishers. The example displays a complete cycle in the process of establishing the socio-environmental pact – if we remember that it began with a dispute between locals and urban-commercial fishers. The fact that both now negotiate and share resources on a sustainable basis is a victory for the socio-environmental pact over market dominance.

An Inclusive Agreement – the Pantaleão Case

This case involves the negotiation of access rights to the Pantaleão lake system, located in Amanã reserve. Fishers from Tefé had been long-term users of this area. Yet, after the creation of the reserve in 1998, they lost access to lakes, which became the exclusive right of residents of the São José sector of Amanã reserve. Lake closures caused discontent among urban fishers⁴⁷ and intensified the historic disputes with rural ribeirinhos for control of fishing areas.

These clashes had taken place since the time of the Lake Preservation Movement in the 1980s, when local communities prevented outsiders fishing in their lakes, including fishers from Tefé. When the Mamirauá reserve was officially established in the 1990s, members of the Fishermen's Union of Tefé were acknowledged as legitimate users of the reserve. In 1993, specific lakes were allocated for the use of urban fishers from the towns of Alvarães, Tefé and Uarini. Their representatives were asked to submit management proposals conforming to the commitment to

⁴⁷ Neide Esterici, Isabel Soares de Sousa, Ana Cláudia Torres Gonçalves and Paulo Roberto Souza, 'Perspectivas da conservação: Exemplo de um processo em curso na Amazônia brasileira', in Ana Célia Gomes, Maria Cristina Manesch, Sônia Barbosa Magalhães and José Maria Carvalho Ferreira (eds.), *Organização social do trabalho e associativismo no contexto da mundialização: Estudos em Portugal, África e Amazônia* (Belém: NUMA/UFPA, 2010), pp. 189–212.

conservation and sustainability of the lake systems.⁴⁸ The organisations never presented a proposal, mainly because their members did not acknowledge the rights of the residents of the reserves. They also did not recognise the Mamirauá Institute's role in negotiations, and continued to fish in these areas. This further hindered negotiations and in 1997, the lakes were closed to urban fishers. After that, there was an upsurge of invasions in the reserve. Urban fishers, backed by politicians and urban traders, organised large groups of nearly 90 people to invade community lakes. The great invasions of this period showed the potential advantage of including urban fishers in fishing accords, particularly because environmental protection activities conducted by volunteers, in cooperation with IBAMA, were not successful in responding to the pressure placed on natural resources by these actors.

From 1998 to 2001, a long process of negotiations between the Fishermen's Union of Tefé and residents of the Mamirauá reserve took place, reaching an agreement to grant fishing rights to urban fishers. However, urban fishers requested access to areas that residents had already assigned as permanent preservation zones. The communities, on the other hand, only conceded access to lakes with low fish productivity.⁴⁹

After the initial deadlock, the Tefé Union decided to switch their demands to the Amanã reserve, bidding to negotiate access to the Pantaleão lake complex. The terms of the proposal were negotiated in the following years, gaining force after 2004 when the union secured institutional backing from IBAMA and the Mamirauá Institute; the agreement was then also extended to include fishers from Alvarães. After just two years of protecting lakes, urban fishers landed their first catch and used the income to invest in infrastructure and equipment for more efficient protection of the area.⁵⁰

The dispute between artisanal and urban fishers derives from the disparity between their fishing capacities, economic orientation and motivation.⁵¹ The increased fishing capacity of commercial fishers, driven by their entrepreneurial search for profit, gave them a significant advantage in relation to local fishers. As a result, the latter group felt unjustly treated because they had to struggle for subsistence in an increasingly depleted environment owing to the presence of commercial fishers. Small-scale fishers from neighbouring towns, in turn, were financially dependent on merchants and fishing entrepreneurs opposed to conservation⁵² and, for this reason, were initially not inclined to embrace

⁴⁸ Marise Batista dos Reis, *Arengas & picicas: Reações populares à reserva de desenvolvimento sustentável Mamirauá no estado do Amazonas* (Belém: SCM; IDSM, 2005).

⁴⁹ Amaral et al., 'Principales acciones y lecciones'.

⁵⁰ This agreement was made official by IBAMA, through the Normative Instruction (IN) no. 19 of 24 June 2009.

⁵¹ The history of the ribeirinhos in terms of political struggle comes from this impasse, with very important results along the Amazon and Solimões rivers.

⁵² Esterci et al., 'Perspectivas da conservação'.

ecological sustainability or negotiate their inclusion in the socio-environmental pact. Throughout the impasse between artisanal and urban-commercial fishers, the Church and the Mamirauá Institute took a clear position in defence of the weaker party and against the unsustainable exploitation of fisheries. However, the socio-environmental alignment produced a new injustice – that of excluding small-scale urban fishers who had historically used the area.

After 2000, the situation changed, when urban fishers proposed their entrance into the conservation pact, appealing to their historical rights (*'we have always fished there'*). From the technicians' perspective, the inclusion of urban fishers was also a strategy to *'have one more ally'* and *'reduce the number of invasions'*. Evoking criteria of distributive justice (*'there is fish for everybody'*), the technicians helped to extend use rights to urban fishers. However, in order to retain their access to fishing areas and reinforce their historical rights, urban fishers also had to invest labour in the protection of lakes to increase fish stocks, which in turn, conferred their own assertion of use rights over the lakes.

The Pantaleão lake complex case was one of the first to solve the issue of how to include urban fishers in the socio-environmental pact. It illustrates how it takes a long time to reach agreements and how a high degree of flexibility is needed for them to be adjusted, so that they answer to different demands. They are furthermore temporary, since conditions and demands change over time. It also shows that one of the greatest opportunities of sustainable management, in this case involving fisheries, is the possibility of including external actors as partners of protected areas through the negotiation of accords.

Is Sustainable Use Viable?

It is difficult to disagree with the position that sustainability is a good proposal and that, with guarantees of democratic participation and flexible protocols, it can result in fair outcomes. The challenge is how to ensure the viability of sustainable use over time. Ensuring the livelihood of those directly involved in achieving sustainability results, at levels consistent with their expectations, is not a given. Maintaining a sustainability pact that involves institutional actors and traditional populations is not simple. However, once established, what has sustainable use shown us in terms of economic return to the families involved? What is the political viability of the sustainability pact today?

The Economic Viability of the Socio-environmental Pact

Researchers in ecology define sustainable management as the adjustment of exploitation rates to natural resource regeneration. In the long term, the

adoption of fishing quotas can produce different economic results for the fishers' families: an increase, a reduction or no change in their previous monetary returns. The question becomes how to prioritise the sustainability of the resource, taking into account the character of local domestic economy.

Until the end of the twentieth century, peasant household production accounted for most of the income of the reserve residents. Over the last decade, there has been a steady increase in the contribution of new social benefits to the household budgets of low-income families, such as cash transfer programmes, rural pensions and environmental compensations that affect rural families all over Brazil. In addition to the increase in the purchasing power of these families, social benefits also increased the circulation of money in rural areas. Benefits provided a more stable income, free of the seasonal variation that rural production imposes, especially in the seasonally flooded areas of the mid-Solimões region. A study of the local household economy in 2010 confirmed that rural production activities, which until ten years before were the main income source, accounted for just 37 per cent of all earnings. Social benefits accounted for 44 per cent of income, while 19 per cent came from salaries and wages for services.⁵³

In 2010, the average monthly income was R\$754.00,⁵⁴ a 17 per cent increase in relation to 2005 values.⁵⁵ Among surveyed families, 66 per cent bought durable goods and work equipment. Although purchases represented only a small accumulation of durable goods when compared to the national average, the effects were noticeable. Among the most frequently found goods in communities today are canoes with small outboard motors and televisions. The acquisition of these items guaranteed transportation and communication for residents and effectively reduced their isolation; it allowed them to participate more in town life and to have direct access to urban goods and services. Even with these improvements, however, the population remains disadvantaged: 62 per cent of all households have per capita income below the national poverty line.⁵⁶

This scenario shows the importance of assessing just how much natural resource use contributes to household economies. In absolute terms, incomes from rural production increased nearly 90 per cent in relation to the previous period. It is only by considering the recent evolution of household economies that we can assess the success of sustainable management. Of the households studied, 33 per cent partook in fish management; they had

⁵³ Nelissa Peralta and Deborah Lima, 'A Comprehensive Overview of the Domestic Economy in Mimirauá and Amanã in 2010', *Uakari*, 9: 2 (2013), pp. 33–62.

⁵⁴ In 2005, the annual average exchange rate was US\$1.00 = R\$2.43 and, in 2010, the annual average rate was US\$1.00 = R\$1.76.

⁵⁵ Peralta et al., 'Renda doméstica e sazonalidade'.

⁵⁶ One must take into consideration that direct access to natural resources provides ribeirinhos with greater economic autonomy than they would have in cities.

average family incomes of R\$10,258.00 per year. Families that did not participate in management had an annual income of R\$8,458.00. The 21 per cent difference is statistically significant ($p < 0.05$). Fishing income is 143 per cent higher in households that participate in management as compared to non-participants.

Sustainable fish management thus increases income and provides for greater monetary stability. Residents acknowledge the economic viability of management to the extent that they have requested an expansion in activities to include more families and new management programmes for other natural resources such as caimans (*Melanosuchus niger*), arowanas (*Osteoglossum bicirrhossum*), and timber. However, the economic gains of reserve management require a greater political commitment to sustainability because these gains can undermine the socio-environmental pact, as the following case illustrates.

The Political Viability of the Socio-environmental Pact – the Jarauá Case

This case addresses pirarucu management in the Jarauá sector of Mamirauá reserve, where the first management experiment took place in 1999. Until 2003, the Jarauá fishers sold all the pirarucu they caught to a single buyer, as requested by IBAMA, who argued that this was a simpler way to oversee production. In 2004, however, the buyer did not honour his purchasing contract and 44 per cent of the total fish catch was lost. After being tricked in this way, the Jarauá fishers' association decided to catch fish without following management protocols in order to compensate for the financial loss. The example illustrates how the fishers' lack of commercial knowhow and weak market position leaves them with little guarantee of economic success, and how economic losses can both discourage fishers and undermine management results.⁵⁷

In the years that followed, pirarucu population estimates in the Jarauá lakes made by local fishers increased, to a point where the numbers surpassed the estimates for ecological viability made by specialists. Suspicion as to whether or not the total number of pirarucu counted in the lake system had been over-estimated increased when fishers were unable to catch the total permitted quota.

When questioned, fishers admitted to tampering with the fish counts. Some of them *counted up* while others *counted down*, either over- or under-estimating the number of pirarucu in the lake. According to informants, estimates were increased to obtain higher quotas. Conversely, those who counted down did so as a precaution so that 'fish would never run out'. More experienced fishers stated that both groups, i.e. the 'over-estimators' and the

⁵⁷ Ellen Sílvia Ramos Amaral, 'A comunidade e o mercado: Os desafios na comercialização de pirarucu manejado das reservas Mamirauá e Amanã, Amazonas, Brasil', *Uakari*, 3: 2 (2007), pp. 7–17.

‘under-estimators’, were interfering with management. Those who counted down decreased the group’s quota and those who counted up put management at risk ‘because few pirarucu would be left for the next year’ or ‘you could count a lot and not have fish’ and as such, raise suspicions regarding fish counts.

To settle the question of pirarucu estimates in Jarauá, the technicians proposed a method for recounting,⁵⁸ a type of peer auditing in which fishers were called from other regions to make new counts to be compared with initial counts. The relative difference between the two counts was 103 per cent, well above the counting difference of 30 per cent fisheries specialists consider acceptable. Because the discrepancy was not a question of the lack of ability to assess stocks, the possibility of an intentional overestimation was confirmed. In addition to problems with fish counts, there were also issues with the management of fish resources in the Jarauá region. Efforts to protect lakes were considered feeble, internal disagreement regarding the division of the catch was noted, and some members questioned the behaviour of the board of directors of the Jarauá fishers’ association. For instance, close relatives of directors, who lived in town, were given the same share as members living in the community, in contradiction of the association’s own rules. In the face of these problems, the Mamirauá Institute withdrew institutional support for Jarauá fishers’ organisation in 2010 in an attempt to prevent the case from setting a precedent that could very quickly undermine adherence to sustainability premises.

In 2011, Jarauá fishers elected a new board of directors and requested the support of the Mamirauá Institute for reforming management activities. The institute suggested the participation of other fishers in the agreement, from the neighbouring town of Alvarães and from the Liberdade sector. Initially, Jarauá fishers wanted to maintain exclusive use of *their* fishing lakes but decided later to negotiate: ‘from the beginning, people have said that there are too many lakes for just a few communities; so now we will not be able to continue to use the whole area’. The fishers here were referring to the fact that the Jarauá sector has comparatively few fishers for its exceptionally large and very productive lake area.

The new partners in the Jarauá fishing agreement, the Alvarães Union and the Liberdade Sector, went without quotas in 2011, understanding that only after they had invested labour in the protection of the area could they earn the benefits of management. After new rules of association were signed, participants carried out fish counts, caught 700 pirarucu and earned R\$168,000.

The decision to overestimate fish to obtain greater quotas had different motivations. The first was the payment of a debt incurred by the fishers’

⁵⁸ Lorena C. de Araújo Andrade, Ellen S. R. Amaral, Nataluzo B. da Silva and Helder L. de Queiroz, ‘Recount Pirarucu: A Method for Assessing the Quality of Pirarucu Countings’, *Uakari*, 7: 1 (2011), pp. 29–40.

association to purchase expensive equipment. The association's lack of experience with bank financing and the pressure of high interest charges were heavy burdens. It was also important for them to affirm their right to define their quotas autonomously. This was informed by a general scepticism about the scientific definition of quotas (30 per cent) and their own confidence in the capacity of fish stocks to recover, as they had witnessed before. Honouring debts was considered more important than attending to outsiders' criteria of ecological sustainability. In addition, community leaders considered the risk of losing institutional support to be low.

The actual loss of technical support, however, hindered pirarucu management and reduced residents' earnings. Once more, debt played a fundamental role in residents' decision-making. Fishers realised they could not pay their debts without income from pirarucu management and sought the Institute's support. The Institute agreed to help on the condition that they accepted the inclusion of other users in the agreement. In the end, the Jarauá fishers accepted these conditions because of a general belief in an ethos of distributive justice.

The decision made by the Mamirauá Institute was motivated by the need to remain impartial to all fisher groups to whom they provided technical support. Being lenient with Jarauá would have put their credibility at risk, making it difficult to demand compliance with sustainability protocols from other groups. Despite proof of overestimates of fish counts, the other agencies responsible for the conservation area (CEUC and IBAMA) questioned the decision to suspend technical support. However, the Mamirauá Institute maintained its resolve, remaining true to its commitment to the ecological and political sustainability of management. The recommendation to include Alvarães and Liberdade in the agreement was, in turn, a strategy to balance the structure of power over the fishing areas and to distribute access to fish resources in a more equitable manner.

Conclusion

This paper has reviewed the RDSs. Based on results from the Mamirauá and Amaná RDSs, we show that the proposal to develop sustainability in inhabited protected areas is a good proposal, comparatively fair and socially viable, requiring coordinated efforts to ensure the renewal of the socio-environmental pact. Constant efforts from those involved in the implementation of the reserves and flexibility to negotiate amendments to the agreements among the parties to the management are essential components of sustainable use.

The reserves for sustainable use must ensure that socio-environmental pacts encourage democratic participation not only in the process of creation but also in all subsequent stages. The institutional framework is starting to build a

working model and creating internal jurisprudence to address conflicts, beginning with the idea that conflict is one component of the socio-environmental pact. The construction of management standards invariably involves negotiations and disagreements; therefore, conflict should be predicted as a regular occurrence. By tackling two forms of fundamentalism at once – that of the market and conventional environmentalism – the conflict in the reserves should be taken not as evidence that the development of sustainability is bad, unfair or impractical, but that it is difficult and needs greater support.

The empirical cases described here illustrate some of the principles that Elinor Ostrom⁵⁹ identifies as the basis of sustainable common pool resources management: a clear definition of territorial boundaries, rules adapted to local conditions, guarantee of broad participation of resource appropriators and simple conflict resolution mechanisms. However, as we have shown here, with the Mamirauá–Amanã RDS as an example of SURs in Brazil, in the Amazon institutional support for articulating subjects and mediating conflicts is an indispensable condition to ensure the development of sustainability.

The greatest political value of SURs is the power to propose a regulatory framework for economic exploitation based on ecological constraints that are specifically established to meet the socio-environmental context of each particular reserve. We want to conclude by noting another politically significant result of SURs, which is no less important. In addition to utilitarian benefits, the practice of sustainability can change the way we look at the relationship between society and the environment.

SURs represent a serious attempt to put the ‘socio-environmental’ binomial pair to work in the sense that they adopt sustainability as a parameter for the relationship between society and the environment. Through this practice, the negotiation of protocols for the management of natural resources sheds light on the engagement of the parties – with each other and with the environment – giving economic practice the recognition of mutual and successive embeddings, to return to the terminology of Polanyi. Sustainable management involves agreements that are sensitive to the embedding of the economy in society and of society in the environment.

The achievements of these re-embeddings result from a connection between knowledge systems (traditional and academic), promoted by practices that require them to communicate. In this ecology of ideas, or ecology of mind to use the words of Gregory Bateson,⁶⁰ conceptual divisions that set the

⁵⁹ Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990).

⁶⁰ Bateson, *Steps to an Ecology of Mind*. The idea of an ecology of mind was launched by Bateson in the 1970s as an alternative epistemology for the natural sciences. Proposing an understanding of the relationship between organism and environment in semiotic terms, nature is

human apart from nature, the biological sciences apart from social sciences, and science apart from traditional knowledge, are challenged in practice by the activities of sustainable management.

In this light, pirarucu management may be seen as a self-regulating system guided by verbal and non-verbal messages produced in the course of the interactions between the fish, researchers and fishers.⁶¹ In this system, the parameter for embeddedness is the notion of sustainability, negotiated in a particular way when the pirarucu are counted and the fish quota is estimated. A count 'of more' may lead to the cancellation of management, as was seen in the example of Jarauá. A count 'of less' is both a preventative measure to cover any overestimates and an expression of ecological sensitivity, motivated by 'respect'.

The environmental sensitivity demonstrated in pirarucu management, which serves as a counterpoint to the rationality of the market, is more instrumental than mythopoetic. However, the feeling of respect associated with counting 'less' resonates with Amerindian modes of relating to the environment that that prevailed among ribeirinhos up to three generations ago. A central principle of this mode of relating with the world is that 'everything has or can have an owner'⁶² or mother. Among the examples of mothers and owners of living beings and of landscapes (such as the mother of the fish, the owner of *tracajá* turtles, etc.), a particularly illustrative example of mythopoetic ecological sensitivity is found in the relationship with the mother of the manioc fields (*mãe da roça*). Among older generations of ribeirinhos, manioc fields were conceived as living organisms; the planting of a special area called the heart of the field (*coração da roça*) marked its birth and the harvest its end. The heart was always kept clear of weeds and could not be stepped on. The relationship between farmers and the farm organism was informed by respect and gratitude towards the owners of resources.⁶³

considered as more than material, and the mind extends beyond the skin that envelops the organism. Bateson especially criticises the fact that we ignore one elemental truth – that organisms that destroy their environment destroy themselves. He felt the urgency to propagate this epistemology to overcome the fallacy of the separation between philosophical thought and natural history. Through his work, he demonstrated the importance of understanding the mental aspects of all biological processes.

⁶¹ The connection is broader, including, in one direction, the entire pirarucu food chain and, in the other, the market consumers.

⁶² Carlos Fausto, 'Donos demais: maestria e domínio na Amazônia', *MANA* 14: 2 (2008), pp. 329–66; Eduardo Galvão, *Santos e Visagens – um estudo da vida religiosa de Itá, Amazonas* (São Paulo: Companhia Editora Nacional, 1955).

⁶³ Deborah Lima, Angela Steward and Barbara Richers, 'Trocás, experimentações e preferências: um estudo sobre a dinâmica da diversidade da mandioca no médio Solimões, Amazonas', *Boletim do Museu Paraense Emílio. Ciências Humanas*, 7: 2 (2012), pp. 371–96.

The process of colonisation in the Brazilian Amazon introduced market trading through aggressive measures such as the Directorate Act and the avia-mento system.⁶⁴ The great transformation that gave rise to the social order today wrote the positions of coloniser and colonised into Brazilian history and society. In the mid-Solimões region, one of the most ancient regions of colonisation in the Amazon, traders and small rural producers are heirs to a colonial structure in which power was associated with the control of trade in the market. This is nothing new, but referencing the process of the market institution in the region is a good way to think about a reversal in this course of ‘disembeddings’ and to imagine the potential of sustainable management to introduce new ways of thinking. This does not mean going back to the past or denying a market economy but correcting how we look at the relationship between our ‘human organism and its environment’ and reviewing the ‘disembedding’ notions with which we operate. Sustainable management establishes an ecology that is sensitive to the extensions between the organisms. To perceive it as a living organism is a step towards Bateson’s ecology of mind and toward native ideas of the mid-Solimões region.

Spanish and Portuguese abstracts

Spanish abstract. Este artículo discute las Reservas de Desarrollo Sustentable en términos de su habilidad para incorporar (*to embed*, en el sentido de Karl Polanyi) la economía al medio ambiente a través del desarrollo de protocolos de manejo sustentable de los recursos naturales. Basado en dos décadas de trabajo en las Reservas de Desarrollo Sustentable del Mamirauá y Amaná, nos preguntamos si los resultados son positivos, justos y viables al comparar dos alternativas: un mercado desregulado y las reservas completamente protegidas. Evaluamos el interés en la sostenibilidad; discutimos quién se beneficia y quién paga por ella; reflexionamos sobre su potencial para reducir desigualdades; y discutimos su viabilidad económica y política.

Spanish keywords: desarrollo sustentable, conservación, Amazonas, gestión participativa

Portuguese abstract. Este artigo discute a capacidade das Reservas de Desenvolvimento Sustentável de embutir (*to embed* no sentido de Karl Polanyi) a economia no meio ambiente através do desenvolvimento de protocolos para o manejo sustentável dos recursos naturais. Com base em duas décadas de trabalho nas Reservas de Desenvolvimento Sustentável de Mamirauá e Amaná, questionamos se os resultados são bons, justos e viáveis em comparação a duas alternativas possíveis: mercados não

⁶⁴ See John Hemming, *Red Gold: The Conquest of the Brazilian Indians, 1500–1760* (Cambridge, MA: Harvard University Press, 1978); Barbara Weinstein, *The Amazon Rubber Boom, 1850–1920* (Stanford, CA: Stanford University Press, 1983).

regulados e reservas de proteção integral. Avaliamos o interesse pela sustentabilidade; discutimos quem se beneficia e quem paga por seu desenvolvimento; refletimos sobre o seu potencial de redução das desigualdades; e discutimos sua viabilidade econômica e política.

Portuguese keywords: desenvolvimento sustentável, conservação, Amazônia, manejo participativo