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Looking back and looking forward: Exploring livelihood change and resilience building in a Brazilian coastal community

Deborah Santos Prado [a, *], Cristiana Simão Seixas [b], Fikret Berkes [c]

[a] Biology Institute, University of Campinas (UNICAMP), Rua Monteiro Lobato, 255 – Cidade Universitária Zeferino Vaz, Campinas, São Paulo, Brazil
[b] Environmental Studies and Research Center, University at Campinas (UNICAMP), Rua dos Flamboyants, 155 – Cidade Universitária Zeferino Vaz, Campinas, São Paulo, Brazil
[c] Natural Resources Institute, 303-70 Dysart Road, University of Manitoba, Winnipeg, MB R3T 2M6, Canada

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ABSTRACT

In Brazil, as in many other tropical countries, coastal communities have been dealing with a complex dynamics of change, mostly related to the degradation of ecosystems, growing tourism and changing government policies, with consequences for natural resources conservation and management. Understanding how these communities are dealing with such change and the trade-offs provide insights for building resilience. In this paper, we investigate how a Caiçara community (traditional group of mixed heritage) has been dealing with social-ecological changes over the last 50 years, and how these changes have affected the livelihood resilience. Livelihood pathway analysis revealed how the system behaved historically and how the past dynamics influenced and may continue to influence resilience building. In face of challenges and disturbances, the coping and adaptive strategies used by this community have helped to maintain the diversity of livelihood options and ecosystem services, which contributed to resilience. Self-organization, collective action and political agency were important components to deal with crises mainly related to territorial disputes concerning overlap with protected areas. The trade-offs in social-ecological system dynamics were related to the geographical isolation of the community (located on an island), the creation of protected areas, and the use of tourism income as a livelihood strategy. Over the years, social cohesion has weakened due to increased economic rationality and conflicts – which may undermine social-ecological system resilience in the future.

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1. Introduction

Coastal communities worldwide are experiencing rapid changes in livelihoods. In Brazil, living along the southeastern coast in the Atlantic Forest Region are the Caiçara, a traditional group of mixed heritage (indigenous Brazilians, African and European descendants), who historically has combined small-scale fishing with small-scale agriculture and plant resource extraction for their livelihood (Sanches, 2001; Begossi et al., 2010). The complex dynamics of change that several communities have been dealing with are mostly related to the degradation of coastal ecosystems, growing tourism and changing government policies in general, including pressures concerning natural resources conservation and management (Hanazaki et al., 2007). In this paper, we investigate how a Caiçara community dealt with social-political and ecological coastal changes during the last 50 years and how these changes have hampered or contributed to livelihood resilience.

We define livelihood following Chambers and Conway (1992) as the "capabilities, assets (including both material and social resources) and activities required for a means of living". The concept is about individuals, households or communities making a living and coping with uncertainties. According to Allison and Ellis (2001), the livelihood approach centres on the links between assets, the activities in which households can engage with a given asset profile, and the mediating processes (institutions, regulations etc.) that govern access to assets and to alternative activities. In this regard, a livelihood is said to be sustainable when it can cope with stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Scoones, 1998; Ashley and Carney, 1999).

This interpretation of livelihood sustainability, with emphasis on

* Corresponding author.
E-mail addresses: deborah.stprado@yahoo.com.br (D.S. Prado), csseixas@unicamp.br (C.S. Seixas), fikret.berkes@ad.umanitoba.ca (F. Berkes).

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coping with stresses and shocks, is strongly related to resilience (Berkes, 2011). Resilience is the capacity of a social-ecological system to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure, identity and feedbacks (Walker et al., 2004; Folke, 2006). Resilience theory offers a vision of sustainability (Berkes and Seixas, 2005), and this concept embraces change as a basic feature of the way systems work and develop, and therefore is especially appropriate in times when changes are a prominent feature (Chapin et al., 2009).

A few studies have attempted to link livelihood approaches and social-ecological resilience (Marschke and Berkes, 2006; Knutsson and Ostwald, 2006; Gwimbi, 2009; Sallu et al., 2010; Hanazaki et al., 2013; Goulden et al., 2013). An important factor in assessing resilience is analyzing the way in which livelihoods change over time, in response to various drivers (Vaitla et al., 2012). De Haan and Zoomers (2005) bring to the discussion the concept of a livelihood pathway, assuming that strategies are made within a specific historical and economic context and are constantly shaped by institutions and social arrangements.

In the social-ecological systems perspective, the past events can have large effects on subsequent dynamics, which generates path dependence i.e. that links current dynamics to past events and lays the foundation for future changes (Chapin et al., 2009). We understand that new situations may be evaluated in light of past experiences, but not static in the sense that it determines livelihood in a fixed way. In a forward-looking analysis for management, we consider that understanding the drivers of change and how the system behaved in the past, can provide insights into how historical dynamics have shaped the current system and what effects they might have in the future (Resilience Alliance, 2007).

Livelihood approaches take into consideration assets and strategies available to deal with change. According to Bebbington (1999), assets or capitals are not simply resources that people use in gaining a livelihood, but are what gives them the capability to be and to act. In this sense, the greater the range of options and innovations (i.e. diversification strategies, Ellis, 1999), the greater the chance to combine and transform assets for building livelihood resilience. However, when some things are gained, others may be lost (McShane et al., 2011) and few studies attempt to point strategies for trade-offs. In a world of persistent ecosystem changes and poverty, approaches to conserve biodiversity while also furthering well-being (Armitage et al., 2012), indicates that across a variety of places and contexts, trade-offs can and do occur (McShane et al., 2011). Following Janssen and Anderies (2007), understanding the trade-offs associated with a specific social-ecological system context are also important to manage resilience. More explicit acknowledgment of trade-offs may lead to more resilient and sustainable outcomes.

In this paper, we aim to understand the main drivers of change affecting local livelihoods, as well as the responses to these drivers by the community or households. Following Seixas and Berkes (2003), we interpret cycles of change as adaptive cycles to investigate resilience-building in a coastal community of southeastern Brazil and its livelihood pathway over the last 50 years. We examine how changes and decision-making in livelihood activities contributed to the enhancement or loss of resilience. The historical case approach helps to analyze livelihood pathways and to assess responses as coping mechanisms or adaptive strategies. We follow Davies (1993), who defines coping mechanisms as short-term responses to situations that threaten livelihood systems. Adaptive strategies, on the other hand, are considered long-term responses, in which households and communities change their productive activities and modify local rules and institutions to secure livelihoods. According to Allison and Ellis (2001) livelihoods approach can help to bring a fuller understanding of fishing communities' adaptive strategies into the policy arena of management.

After describing the study area and research methods, we present the livelihood pathway and the main drivers of change affecting Aventureiro village in the last 50 years. We use the adaptive renewal cycle (Holling, 1986; Gunderson and Holling, 2002) as a heuristic model to understand the periods and cycles of change in livelihoods (Goulden et al., 2013). Next, we discuss how changes in livelihood activities were occurring and how some choices and strategies contributed to livelihood resilience. Finally, we raise some points regarding trade-offs for resilience building.

2. Study area and methods

The Aventureiro village is located at Ilha Grande, an island in the municipality of Angra dos Reis, Rio de Janeiro State, southeastern coast of Brazil. It is the largest island in the state and the third largest in Brazil. The whole area is situated within the Atlantic Forest Region and is one of the most biodiverse areas in Brazil.

The study site was located on the southern part of Ilha Grande, it is one of the smallest and most isolated villages. According to oral information, current residents are descendants of people who have lived there for at least four generations. People are considered traditional Caiçara and the community is composed by approximately 90 residents and 20 households, who still practice subsistence activities, such as fishing. There is no grocery store in Aventureiro and the residents buy almost all their supplies in Angra dos Reis, which is approximately two and half hours by motor boat.

The demography of Aventureiro has not changed much in the last 16 years (Seixas and Begossi, 2001). There is only an elementary school, and high school age youth have to go to the neighboring village Provetá (approximately 6 nautical miles of distance), or to Angra dos Reis (approximately 13 nautical miles of distance) to complete their studies. There are no medical services nor any municipal electric power or water treatment. Most households have their own electric oil generators and the water system is comprised of a simple network of rubber hoses to bring water from nearby streams.

The community is surrounded by a diverse and well preserved environment (sand beaches, lagoons, mangroves, forest, rocky shores and the sea). There is an important archaeological site located within the area. All these factors have contributed to conservation initiatives since the 1980's, both in terrestrial and marine zones. A no-take Biological Reserve (Reserva Biológica da Praia do Sul) and a no-take Marine Park (Parque Estadual Marinho do Aventureiro) were located over and in front of the community land, respectively (Fig. 1).

Fieldwork took place between September 2011 and July 2012 and was based on: (i) participant observation of all livelihood activities, (ii) livelihood surveys (including qualitative and quantitative data) with all 20 Caiçara households, (iii) semi-structured interviews with fishermen, and (iv) a review of scientific and grey literature as well as public policies relevant for the area in the last 50 years (Table 1).

We carried out participant observation (Bernard, 2006) of the various livelihood activities (i.e. small-scale fisheries, agriculture, manioc flour milling, home garden production, marine invertebrate gathering, handicrafts and local tourism) with different households. We also observed other aspects of daily life, such as meetings, social and religious events. The participant observation allowed for a deep understanding of how livelihood activities are changing in terms of resources use, management, and importance over time. It also contributed to build good relationships with the community.

The livelihood survey was carried out in each of the 20 Caiçara households, lasting from 30 to 50 min. The interview target was the

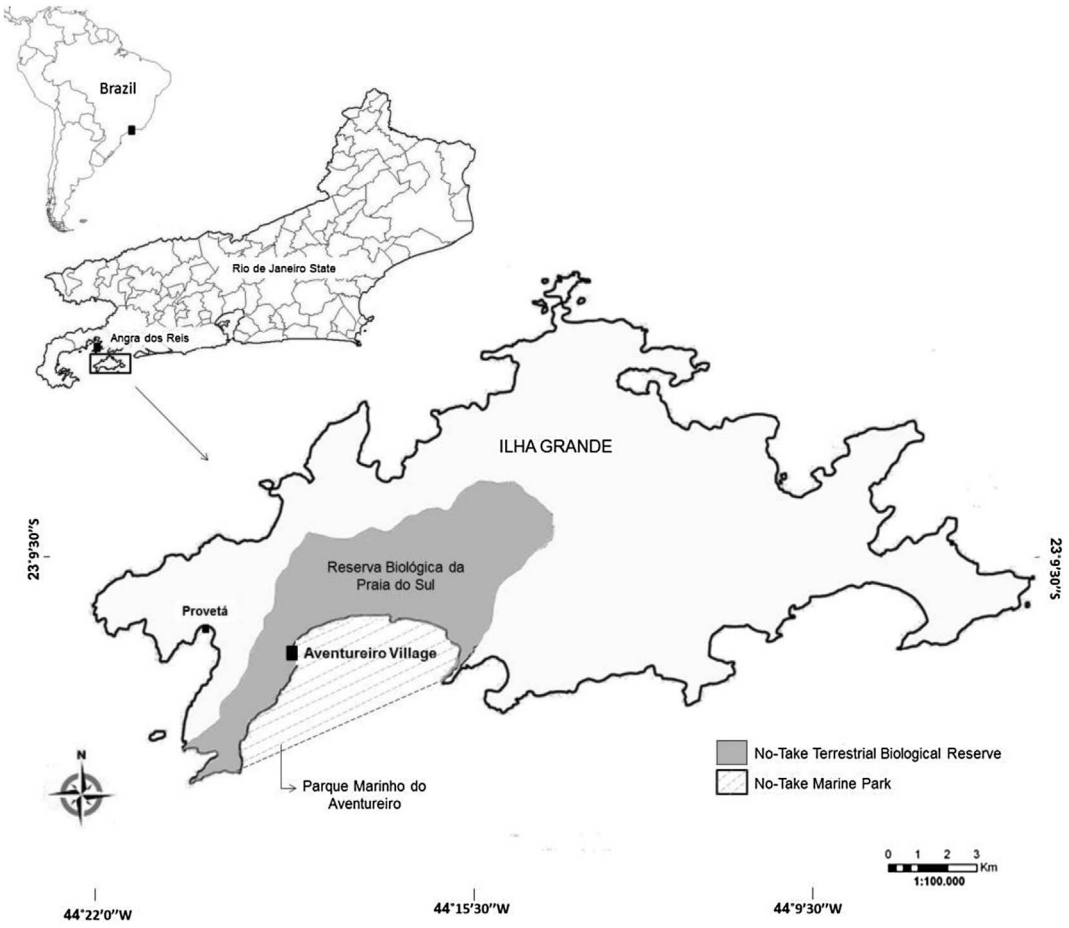


Fig. 1. Study site: Aventureiro village on Ilha Grande, Angra dos Reis municipality, Rio de Janeiro State, Brazil; The limits of the two Protected Areas until May 2014 (No-take Terrestrial Biological Reserve: Reserva Biológica da Praia do Sul; and the no-take Marine Park: Parque Marinho do Aventureiro).

Table 1
Research framework: the scope of analysis, theoretical approaches and the field methods used to assess livelihood resilience at Aventureiro village.

Livelihood resilience assessment		
Scope of analysis	Livelihood pathway Drivers of change	Responses to social-ecological changes
Theoretical approaches	Sustainable livelihoods (Chambers and Conway, 1992) Adaptive renewal cycle (Holling, 1986; Gunderson and Holling, 2002)	Coping mechanisms and adaptive strategies (Davies, 1993)
Field methods	Livelihood surveys Secondary data	Semi-structured interviews Participant observation

female head of the household; however, in cases of absence, the husband or the eldest member of the household was invited to participate. Historically, the role of women in Caiçara society has been extremely important, due to the diversity of livelihood activities that they carry out and for maintaining the domestic group and cohesion (Adams, 2000). In addition, considering that the field researcher (D.S.P) was a young female, targeting women for the first set of interviews was a methodological strategy for an entry point and acceptance in the community. Themes addressed in this survey included all activities the households used to practice (who was involved, how it was performed, and how it has changed over time); the main drivers of change they had to deal with; food security; well-being and their future livelihood perspectives. The survey was designed in a structured way and the questions were applied in the same sequence to all respondents.

Complementing the livelihood survey and participant observation, we carried out semi-structured interviews with fishermen ($n = 10$) between the age of 24 and 64 years, addressing environmental changes and adaptive capacity. The interviews lasted on average 40 min and aimed to systematize the environmental episodes that brought changes to the households. The data collection also included a review of scientific and grey literature as well as public policies relevant for the area (in local, regional and national levels for the last 50 years). Data analysis was based on Sustainable Livelihoods Approach, concerning the livelihood pathway of the system and the decisions and actions people take in response to change and according to the options available. In face of drivers of change, we analyzed the strategies of the households and the community, looking for coping mechanisms and adaptive strategies.

3. The livelihood pathway: dealing with changes and uncertainties

The livelihood pathway of Aventureiro village over the last 50 years was rebuilt based on secondary data and the livelihood survey. We identified four cycles of change (Fig. 2) that were triggered

mainly by public policies regarding environmental conservation and development.

3.1. Until the 1960's: small-scale agriculture and local artisanal fishing

Until the early 1960's, livelihoods in Aventureiro consisted basically of shifting agriculture and artisanal fishing which ensured subsistence for all the households. A few household earned money selling dried fish and some agricultural products. Other natural resource-related activities included extraction of forest products, marine invertebrate gathering, small animal raising and hunting. The community isolation was marked by the lack of motorized vessels and the trade of agriculture products was carried out mainly with the neighboring villages. Collective work was quite common for construction of houses, beach seining and manioc flour production in communal mills. There was a strong cultural sense of reciprocity during this time, in addition to networks for goods' exchange and sharing, which strengthened social capital within the community.

3.2. From 1967 to 1994: crewing in large purse-seining boats

With the national government incentives for industrial fisheries in 1967, the possibility of employment as crew on purse-seine boats became an opportunity for a new income source. This trend took place not just in Aventureiro but in most of the small coastal communities in the south and southeastern Brazil (Diegues, 2008; Idrobo and Davisdon-Hunt, 2012).

At that time, men spent most of the month, year around (except during full moon) fishing out on purse-seine boats. This new activity brought to households an increase in financial capital, and at

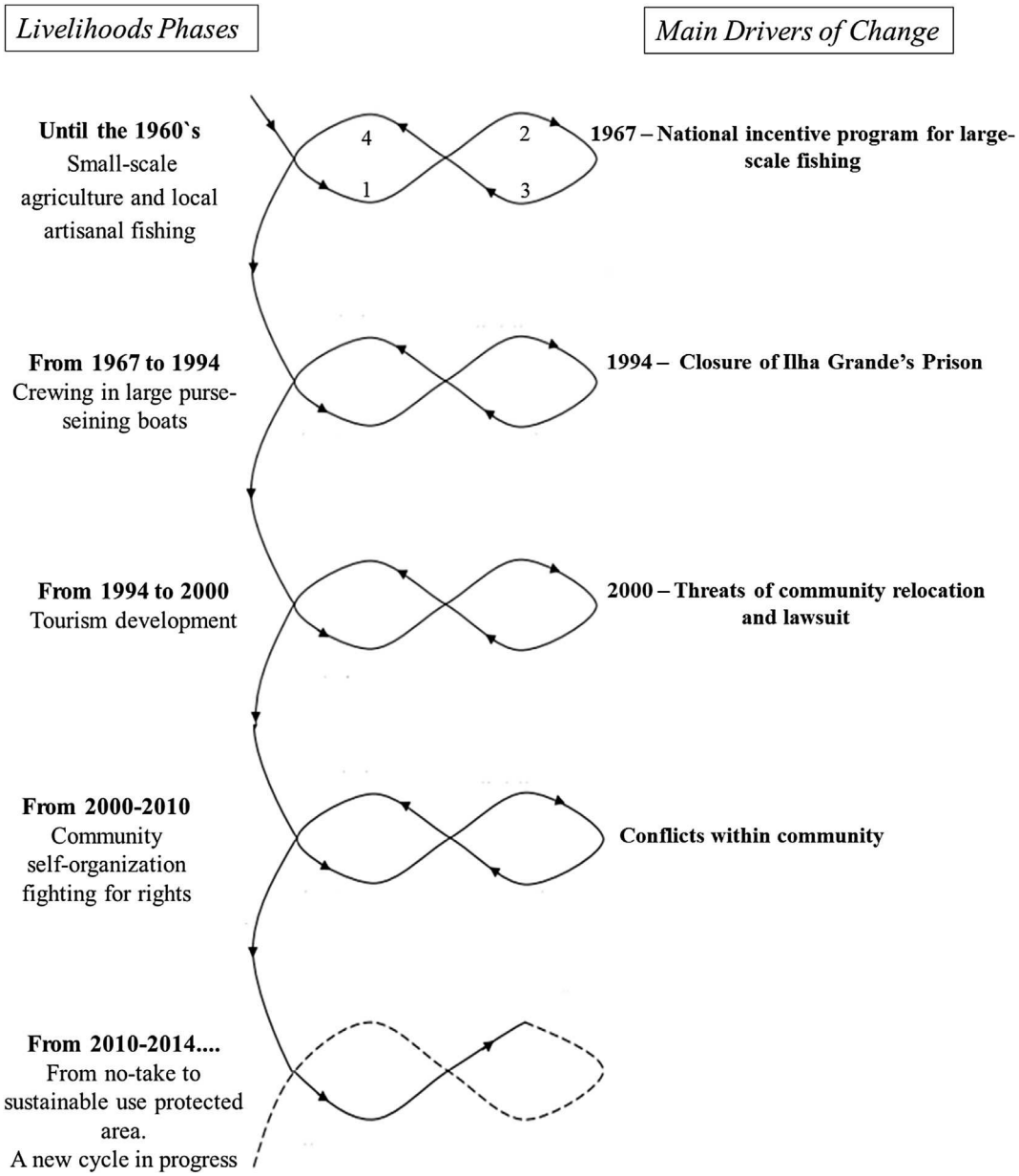


Fig. 2. Sequence of adaptive renewal cycles (*sensu* Gunderson and Holling, 2002) regarding livelihood changes at Aventureiro village, since the last 50 years. The system goes through adaptive cycles of release (phase 3) and renewal (phase 4) triggered by the drivers identified. After renewal, the system goes into growth (phase 1) and conservation (phase 2) until it becomes more vulnerable to others drivers, that may trigger a new release. The numbers identified for each phase are the same for all cycles identified.

the same time, an economic rationality different from the subsistence economy based on small-scale agriculture and local fishing. The male labor in agriculture had been replaced by their work in larger scale fisheries, which was seasonal and uncertain since it was extremely dependent on catch returns. Hence, the traditional subsistence activity of shifting cultivation was carried out mainly by women, children and older men who were not employed by purse-seine boats.

Other events triggered changes to the coastal communities in this historical period. In 1974, Highway BR-101 was built linking the two most important Brazilian cities (São Paulo and Rio de Janeiro) to most parts of the southeastern coast of the country. Furthermore, at the local level, two no-take PAs were created, overlapping with the territory of the village: A terrestrial no-take Biological Reserve (in 1981) and a no-take Marine Park (in 1990). The terrestrial PA in particular, became a source of stress for households, as resource use and land occupancy at the village site became technically illegal as of 1981.

At the beginning of the 1990's, sardine overfishing and greater unpredictability of the catch, coupled with the closure of Ilha Grande's prison in 1994 (which had prevented tourism development for security reasons), promoted the emergence of another source of income to Ilha Grande and to Aventureiro households: Tourism-related activities.

3.3. From 1994 to 2000: tourism development

Over time, households have been improving the tourism related services, which consist basically of "camping areas" in backyards of Aventureiro houses, food sale (in small restaurants) and boat trips. The new sources of income brought more financial capital and therefore physical capital (e.g. vessels, electric power generators, furniture and household appliances, such as TVs). At the same time, the ongoing increase of tourists in the village raised a conflict with the state environmental agency (Fundação Estadual de Engenharia do Meio Ambiente, FEEMA) in charge of the two PAs in that period. This conflict intensified over the years, up to a crisis point in 2000. Threats from the state environmental agency and municipal government were intense, and a lawsuit by the State Public Prosecutor Office (Ministério Público do Rio de Janeiro) to displace the residents to areas outside the Biological Reserve came as shocking news to local households.

3.4. From 2000 to 2010: community self-organization fighting for rights

Facing the eviction threat, the residents created a community-based organization (CBO), an association that claimed land rights in an organized way. Other accomplishments of the CBO included an agreement in 2006 about tourism-related activities. This agreement included the state environmental agency, the municipal government and the community. This agreement was followed after another shocking event in the high tourism season of 2006: The prohibition of tourism camping sites at Aventureiro by the municipal government. Supporting the community association in this period of crisis, local NGOs and university groups acted as mediators and capacity building organizations, helping with the writing of documents and to obtain publicity through the media. Eight months after the ban, the community won the right to maintain camping areas in their backyards and the agreement was reached.

3.5. From 2010 to 2014: from no-take to sustainable use protected area

Conflicts about the establishment of protected areas on community lands are a worldwide problem (Adams and Hutton, 2007); this is no different in Brazil (Diegues, 2008; Almudi and Berkes, 2010). In 2000, a new national law regarding conservation protected areas (SNUC) was issued in Brazil, providing rules for the establishment and management of all types of PAs. SNUC categories of PAs include both no-take PAs and sustainable-use PAs; the latter allows for livelihood maintenance within such area. For instance, Extractive Reserves and Sustainable Development Reserves (RDS) allow for the maintenance of human populations, such as Caiçara, inside PA boundaries, while protecting livelihoods and culture as well as the natural environment. Since the SNUC law was issued, people living inside no-take PAs, created in a top down manner prior to SNUC, have the possibility to request the reclassification of a no-take PA into a sustainable-use PA. Aventureiro community was attempting since 2008 to reclassify part of the Biological Reserve overlapping with the community land and the Marine Park into a Sustainable Development Reserve, which would include both terrestrial and marine areas. The attempts to reclassify the PAs lead to a state law proposal in 2010, which had been analyzed by the state legislature of Rio de Janeiro. Since the law proposal was elaborated, a conflict emerged in the community among those being in favor and those against the reclassification. This reclassification is likely to bring changes regarding who is allowed to live inside the reserve, how natural resources will be used and managed, and how tourism activities will be controlled. For example, at the end of the study period in 2012, there were two non-Caiçara households of recent residence living in the community, who would probably need to move if the RDS would be created. Other non-Caiçara people who bought second homes in Aventureiro or were born at Aventureiro and lives in other places while still exploring tourism activities in the village were also concerned on the restrictions the reserve may impose on them. Despite the conflicts, in May 28th, 2014, the RDS of Aventureiro was created by a state law (n. 6793). This new driver may bring another cycle of change to the system.

With this analysis, we can understand how the system behaved in the past and how the past dynamics influenced and continue to influence resilience building (Ross and Berkes, 2014). Following Chapin et al. (2009), the recognition of these changing properties of the livelihood pathway through the lens of adaptive cycle "suggests that effective long-term management and policy-making must be highly flexible and adaptive, looking for windows of opportunity for constructive policy shifts" (p. 17).

4. Adaptive responses – nurturing diversification of livelihoods

Throughout the periods of change highlighted in Fig. 2, we identified the main social-ecological events and/or drivers of change affecting local livelihoods based on the livelihood survey, semi-structured interviews, participant observation and secondary data. We also identified coping mechanisms or adaptive strategies developed at the household or community levels (Table 2). Most drivers of change at Aventureiro over the last 50 years were originated at levels above the community level; that is they emerged from municipal, state and national policies. These drivers pertained to security issues (municipal), biodiversity conservation (state), and fisheries development (national). When changes involving the whole community were at play, such as the threat of eviction, the system showed self-organization and political agency.

Aventureiro PAs have contributed to inhibit potential external drivers affecting coastal resource conservation, such as real estate development. As well, the restrictions in agriculture practices and the increase in alternative livelihood activities contributed to an increase in the area of forest cover. Sea and wind conditions have

been the major environmental source of vulnerability in Aventureiro in this regard. Prolonged rough seas (locally called *frente frias*, literally translated as cold front) make the maritime access impossible with consequences for purchasing most food items on the mainland. It also affects local small-scale fishing, and in face of food shortage, people resort to food loans and sharing networks. Moreover, during rough seas, extremely high tides generates fear and insecurity, especially in those households living close to the beach and who already had part of their houses destroyed in the past. Collective action and mechanisms that mediate people's agency to respond and adapt have been shown to be an important way to analyze resilience (Schwarz et al., 2011). The conflicts over the possibility of changing PA categories have contributed to a decline in participation of locals at community association meetings and to a weakening of social cohesion that was apparent when the community was under threat.

Over the last 50 years, while facing especially social-political changes, livelihood diversity at Aventureiro has increased. Even though it has been configured differently among the households, no livelihood activity common in the 1960's has disappeared, but new ones have been added (hunting became an illegal activity, hence it could not be assessed). In each household six livelihood activities on the average were carried out in 2011–12, and the full range of activities is summarized in Fig. 3. These strategies include tourism-related activities (i.e. camping, boat trips and small restaurants), home garden cultivation and agriculture, non-timber forest products (NTFP) extraction, small-scale/artisanal fishing, crewing in larger-scale fishing, construction, handicrafts, wage employments (mainly public sector jobs), marine invertebrates gathering, and chicken and other animal raising. Except for tourism, handicrafts, wage employment and pensions, the other activities consisting of livelihood strategies are mostly for subsistence and are therefore an important component of food security and well-being, generating knowledge and options of choice in times of adversity.

An interesting aspect regarding the main income of the most households is their acknowledgment during the survey of mainly fixed and safer sources of income, even if they are not the most profitable: such as salaries, pensions or both (12 households). The tourism high season, for example, can provide much revenue in a short amount of time. However, tourism income is not guaranteed throughout the year, especially for those houses that are located on the hill far from the shore. According to the interviewees, 90% of the households who had tourism as an economic activity mentioned that this is a source of income only during the high season and holidays. When asked about well-being, 85% of households stated that their quality of life had improved over time and 15% mentioned that it was the same, had not changed. None of the interviewees declared a decrease in their family's quality of life. When questioned "What could improve your well-being in the future?" most of households answered that local jobs for their children and chances for them to get a college degree and a future occupation could improve their well-being.

The possibility of a stable job has always been a choice associated with well-being for households at Aventureiro village. When fishermen started to work as crew members on purse-seine boats, they were looking for opportunities for financial improvement. The decision to leave this activity, for most of households, was not due just to another possible source of income, but also as an increase in their well-being. Working as crew on large boats was never considered a pathway for well-being for fishermen at Aventureiro. Working on larger-scale fisheries is a synonym for labor exploitation, being far from family, physical exhaustion and danger/risk. This can be illustrated in the following fisherman quotation "I do not want to fish in the [industrial] vessel anymore. The vessel's owner is getting rich and the fishermen are suffering and getting poor. They pay how much they want for what we fish".

Small-scale fishing, on the other hand, remained an important activity to the community. Eighty percent of the Caiçara households had at least one person fishing two to three days per week on average. Among those 16 households, all mentioned that practice the activity to feed, six of them sell outside the community, and three others sell at their local restaurants. Fisheries at Aventureiro as in other fishing communities is not just an important source of food security but also a source of local ecological knowledge (Hanazaki et al., 2013; Oliveira and Berkes, 2014), and a way of life which provides social and cultural identity (Coulthard, 2008; Trimble and Johnson, 2013). An assessment of the small-scale fisheries at Aventureiro, within a 15-years interval (1995/1996–2011/2012) has shown that fishing spots have remained the same; a small diversification in fishing gears and vessels was observed; and there has been an increase on the average of catch per fishing trip, while the composition of species has been similar in both periods (Prado, 2013; Prado and Seixas, 2014).

Table 2
Events of change and responses in Aventureiro livelihood pathway. The responses are classified as adaptive strategies or coping mechanisms in the household or community level.

Drivers or events	Responses identified	Response type
Incentives for large-scale fisheries (1967)	With the incentive police to fisheries modernization in Brazil, all households at Aventureiro used the opportunity as a possibility of employment (crew on trawlers) and improvement in financial conditions.	Adaptive strategy/household level
Security issues (the 70, 80 and 90's)	Prisoners escaping of Ilha Grande's prison and possibilities of kidnappings or robberies were a constant threat. Women and children used to get together in a single house of the community during the night. Older men who were not fishing were on vigilance overnight	Coping mechanism/community level
Prison's closure (1994)	Households used the opportunity to explore the tourism activities – another strategy to livelihoods *portfolio*	Adaptive strategy/household level
Lawsuit and threats resident's eviction (2000)	Facing a crisis about possible eviction, the community responded by creating a community-based organization to represent their interests. Among other things, it fought for their right to stay in the area and claimed other rights, such as transportation to school.	Adaptive strategy/community level
Camping prohibition for eight months (2006)	Due to the loss of this important income, some households have adapted rooms in their homes to welcome tourists. Men returned to fish on trawlers and local fishing intensified. The community claims to government and environmental agency led after negotiation the right to explore tourism and camping site again.	Coping mechanism/household level
Cold fronts lasted a month and prevented the entry or exit of boats (2010, July)	People used the only way of access, a hiking trail of about 40 min to the next community – for a month. Loan or exchange of food among households were common	Coping strategy/household level

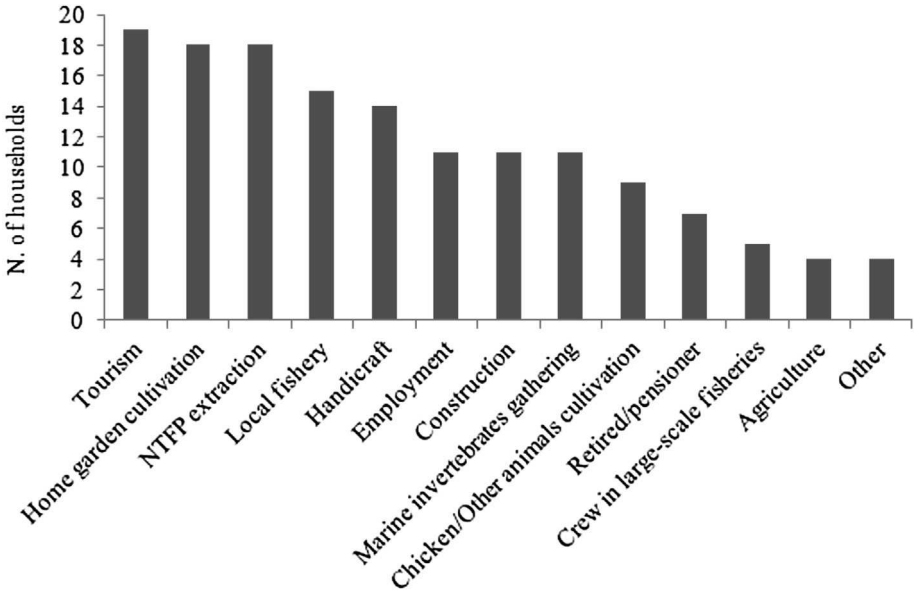


Fig. 3. Diversity of livelihoods in 2011–2012. Frequency of household participation in different activities for one or more members.

Shifting cultivation, a traditional component of Caiçara culture, does not exist at Aventureiro anymore. Hanazaki et al. (2013) observed a similar situation in most coastal communities of Paraty region, the neighboring municipality. This type of agriculture, which requires clearing and burning forest patches to open agricultural plots has been prohibited by environmental regulations and has changed livelihoods. As well, shifting cultivation requires collective work, which is increasingly rare (Hanazaki et al., 2013). Until 2012, only three households (15%) were practicing small-scale agriculture at Aventureiro, but using the same plot of land over the years rather than shifting it. All these three households still produced manioc flour, an important component of Caiçara diet, and they sell it or exchange it for fish or other food items. At the same time, home garden cultivation was carried out by 95% of households. Interviewees mentioned a total of 59 plant folk names (out of 237 citations), most of them fruit trees and vegetables.

The ability to conduct different types of activities provides a knowledge base and skills that can be activated in times of crisis. As stated by Ellis (2000), households and individuals can also move back and forth between choice and necessity, seasonally and across years. As noted in 2006, with camping prohibited in local backyards, coping mechanisms of the households included the return of men as crew on large fishing boats, the intensification of local fishing, and arranging extra rooms inside local houses to host tourists.

5. Resilience trade-offs

Different components of the social-ecological system experience trade-offs and selective pressures every day (Janssen and Anderies, 2007). Regarding resilience, scale is critical (Levin and Lubchenco, 2008) and trade-offs occur across space and time (Rodríguez et al., 2006). Based on the analysis of Aventureiro livelihood pathway, and how households and the community dealt with changes, we identified some elements that involve trade-offs. We chose three factors to highlight the inherent complexities involved in this pathway, calling attention to their importance in any future decision-making processes: (i) The *geographical isolation* of the community, which is a characteristic of the system; (ii) conservation regulation such as the *Protected Areas* (*PAs*), being a driver of changes; and (iii) *tourism*, as a strategy for maintaining livelihood (Fig. 4). Below we discuss each of them.

The social-ecological system that was investigated is a relatively isolated community located at the open ocean side of a large island. In this regard, we understand that isolation, as a characteristic of this social-ecological system, is an important factor to be considered in order to understand the current phase of the system, based on previous difficulties it had faced. While isolation generates difficulties for households (such as restrictions on access to food markets and decreases some sources of well-being, such as health services and education access), it also ensures less exposure to other source of vulnerability, especially from urban centers. These sources of vulnerabilities include a complete dependence on money and, at the same time, greater competition for jobs. Difficulty in accessing the community and vulnerability to sea conditions were found to be an explaining factor for many of the subsistence activities still being practiced by households, resulting in livelihood diversification. A similar finding was also reported by Hanazaki et al. (2013) in isolated Caiçara communities of Paraty which had higher dependence in natural resource-related activities.

As discussed, the government's conservation policies were found to be an important driver of change at the local level. The PAs remain a source of disturbance for the households, in terms of land rights, management practices and local resource use. The people of Aventureiro have been coping with the “illegality” of their livelihoods, and with various prohibitions and conflicts with the state environmental agency. At the same time, during the analysis and in comparison with other villages on Ilha Grande that are not in the same area, the terrestrial Biological Reserve had buffered real estate development because construction is restricted inside this PA. The sale of lands to outsiders has been a common practice in southeastern coast of Brazil, and many people who sold their land close to the shore had move to marginalized areas or to urban centers. This situation was also reported by Nayak et al. (2014) as an economic driver that has led to social marginalization for many other coastal communities in the region.

The Caiçara are in constant contact with outsiders and subject

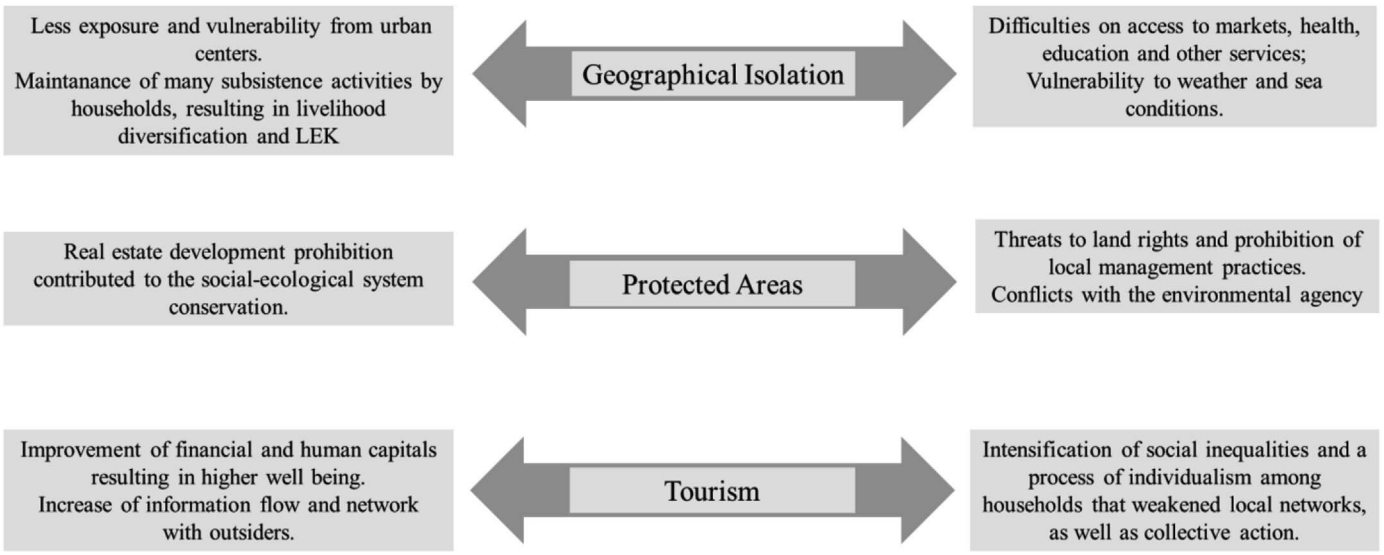


Fig. 4. Geographical isolation, protected areas and tourism: factors that highlight the trade-offs and inherent complexities involved in the livelihood pathway of Aventureiro in the last 50 years.

to economic and cultural influences of the Brazilian society (Begossi, 1998). Finally, tourism, as another strategy in the livelihood portfolio, promotes lower dependence on natural resources for households and improves financial capital, which ensures higher well-being in terms of comfort, accessibility to mainland (by buying or renting boats) and financial security. Tourism activities offer better information flow between locals and outsiders, and the latter became important partners in the periods of crisis, helping the community in their land claims. We also understand that tourism in this coastal village brings management capabilities, personal attributes as attitude to work and entrepreneurship to perceive opportunities, therefore increasing the human capital.

However, income from tourism has increased social inequalities among households in Aventureiro, especially due to the fact that the houses situated in flat land near the beach attract most of the tourists and can earn more money, compared to houses on surrounding hills. Easier access to money can generate a process of individualism among households, weakening sharing networks, as well as collective action; all contributing to a weakening of local social cohesion. Furthermore, the lower dependence on resources may trigger a decrease in local ecological knowledge mainly among youth, who are increasingly dedicating more time to tourism and less to other subsistence activities, which require extensive knowledge of the local environment. Besides that, as pointed by Forster et al. (2014), regarding flexibility to change conditions in the Caribbean island of Anguilla, tourism-dependent livelihoods are potentially vulnerable if future environmental change negatively affects tourism demands.

In a forward-looking perspective to the implication of our results for decision makers is that “one recipe does not fit all”. The analysis of trade-offs need to be considered, balancing both the positive and negative aspects of any management decision. Based on our analysis and for the short-term decisions, we suggest a strengthening of the institutions for local management and governance, considering the cross-scale connections. Building trust and a shared management between the community and the government if not met may compromise the systems resilience.

The creation of the RDS opens a new window for experimentation and institutional rearrangement, and perhaps a new path for participatory governance. In order to monitor the effect of the shift from the No-take area to RDS management, coordinated data achievement of social, economic and ecological indicators should be addressed in a participatory way. We hope the present study could also serve as reference in terms of livelihoods diversity into no-take areas, and that the lessons learned from this transition be of help for other communities in the future.

6. Conclusions

Historical approaches help to explain resilience-building at community and other levels (Berkes and Ross, 2013). The last 50 years of livelihood system pathway analysis revealed how the social-ecological system of Aventureiro dealt with the changes that shaped livelihoods and influenced resilience-building at household and community levels. In face of challenges, households took advantage of the opportunities to improve their income and well-being. They used coping mechanisms to deal with adverse weather and maritime conditions, as well as territorial disputes at the community level. Facing disturbances, such as eviction threats, the social-ecological system showed self-organization and political agency, which can be attributed to the social capital built through previous collective activities. Various coping and adaptive strategies maintained the diversity of livelihood options and flexibility, which contributed to resilience building. On the other hand, we identified a weakening of social cohesion over the last few year explained by the increased economic rationality and conflicts that must be points of attention and a source of resilience loss in the future.

The Aventureiro case provides the insight that the resilience of Caiçara livelihood over the past half century has been the result of buffering social-political and environmental disturbances, through both coping and adaptive strategies, in at least two levels of organization, household and community. This emphasizes the need for multi-level resilience analysis of social-ecological systems. Moreover, our case highlighted that livelihood resilience may be a result of trade-offs among community geographical location, conservation drivers and development drivers. In the case of Aventureiro, such trade-offs has contributed to generate resilience for local livelihoods. Most Caiçara communities along the coast of Brazil have been dealing with similar threats to livelihoods, and some have been more resilient than others (Nayak

et al., 2014; Hanazaki et al., 2013; Begossi et al., 2010). Future research may unpack such trade-offs in other coastal communities while investigating options and opportunities to improve livelihood resilience and well-being.

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