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Local Environment

The International Journal of Justice and Sustainability

ISSN: 1354-9839 (Print) 1469-6711 (Online) Journal homepage: https://www.tandfonline.com/loi/cloe20

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To cite this article: Gracie Verde Selva, Natasha Pauli, Milena Kiatkoski Kim & Julian Clifton (2019) Can environmental compensation contribute to socially equitable conservation? The case of an ecological fiscal transfer in the Brazilian Atlantic forest, Local Environment, 24:10, 931-948, DOI: 10.1080/13549839.2019.1663800

To link to this article: https://doi.org/10.1080/13549839.2019.1663800

LOCAL ENVIRONMENT
2019, VOL. 24, NO. 10, 931–948
https://doi.org/10.1080/13549839.2019.1663800

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Can environmental compensation contribute to socially equitable conservation? The case of an ecological fiscal transfer in the Brazilian Atlantic forest

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ABSTRACT

Regions of high biodiversity often coincide with regions of poverty and conservation can imply economic and social costs for poor resident populations. Environmental compensation is considered a tool to reduce socio-environmental conflict, improve the equity of conservation and promote sustainable development. The intricacies of specific socio-ecological systems may determine how compensation payments are interpreted locally to produce outcomes. This research examines the social perceptions of an ecological fiscal transfer which intends to compensate the local public administration for the substantial costs of conservation in a hotspot of biological and social diversity in the Brazilian Atlantic forest. In this context we explore whether financial compensation (1) influences local perceptions of the conservation regime, (2) contributes towards the reconciliation of human-conservation conflicts and (3) triggers any meaningful socio-economic improvement that would counter the local costs of conservation. Results show that environmental compensation is not widely recognised as effectively benefiting the community. Local authorities consider compensation insufficient to enact a sustainable development agenda. Environmental compensation could play an important role in a policy mix for socially equitable conservation by being explicitly linked to community benefits, especially to fostering local livelihoods. The collaboration of actors operating across multiple governance levels may improve the institutional capacity of local actors to produce effective outcomes.

ARTICLE HISTORY
Received 4 June 2018
Accepted 16 August 2019

KEYWORDS
Ecological fiscal transfers; environmental compensation; socially equitable conservation; traditional communities; biodiversity; Atlantic forest

Introduction

Conservation of biodiversity is a global priority, with protected areas a key strategy. Yet regions of high biodiversity often coincide with regions of poverty (Fisher and Christopher 2007), and the implementation of protected area can imply economic and social costs for resident populations (Adams and Hutton 2007). Protected areas that impose limitations on livelihoods may face local resistance, leading to detrimental outcomes. Providing monetary compensation may contribute to the social equity of conservation interventions (Ferraro and Kiss 2002; Rosa, Kandel, and Dimas 2004). The impacts of compensation for communities affected by exclusionary conservation regimes are not well understood (Holmes and Cavanagh 2016). Environmental payment interventions must be examined at the level at which they effect change, where the local context adapts and interprets policy to produce results (Van Hecken et al. 2018). This research examines the social

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perceptions of a long-running, government-funded environmental compensation scheme in a hotspot of biological and social diversity in the Brazilian Atlantic forest, where local public administrations typically have limited access to resources and low institutional capacity. The research determines if the receipt of compensation alters local opinion of a conservation regime which has implied high costs for resident communities, or creates economic opportunities that contribute towards equity and well-being.

The costs of conservation and the role of environmental compensation

The creation of conservation areas and the level of human interaction permitted within them are often determined by ecological and economic factors, without consideration of social and political aspects (Adams and Hutton 2007). The social impacts of protected area on local populations can include displacement, economic vulnerability, food insecurity, loss of rights to land and access to resources, social disarticulation and the loss of traditional, cultural and spiritual practices (Adams and Hutton 2007; Cernea and Schmidt-Soltau 2006). Limitations are placed on infrastructure development and options for income generation are reduced (Ring 2008)

Local government will also inevitably bear some costs of hosting protected areas within their jurisdiction (Droste et al. 2015). Local authorities rarely have the opportunity to influence decisions about the designation of protected areas, and are mostly uncompensated for the associated costs (Ring 2008). Often the economic opportunities afforded by the presence of intact nature, such as tourism, are not captured, particularly in areas where institutional capacity is low. The high cost of conservation for local authorities may also create a misalignment of conservation interests across spatial and political scales (Balmford and Whitten 2003). It is rational, economically speaking, for local governments to be disinterested in, or even opposed to, the designation of protected areas in their territory (Ring 2008; Santos et al. 2014).

Access to compensation schemes is advocated as a potential positive outcome of environmental conservation and a promising opportunity in a policy mix for equitable conservation (Barrett et al. 2013; Dudley and Stolton 2010). Payments may have the potential to address the costs of conservation borne by those who have direct influence on the management (or mismanagement) of ecosystems (Ring 2008). Research points to the effectiveness of compensation schemes in improving protected area management in tropical countries (Bruner et al. 2001), and their potential for poverty alleviation (Farley et al. 2011). Receiving payments may improve local perceptions of conservation, reducing conflict and aligning local economic interests with regional and global conservation objectives, making biodiversity conservation a viable land use (Droste et al. 2015; Ferraro and Kiss 2002). Payments have also been shown to both foster intrinsic motivation for conservation and cause crowding out of this motivation once payments are applied (Agrawal, Chhatre, and Gerber 2015; Rode, Gómez-Baggethun, and Krause 2015). Environmental compensation may stimulate a local agenda for sustainable development, potentially reducing poverty, improving perceptions of protected area and easing conflict between communities and conservation (Borie et al. 2014; Milder, Scherr, and Bracer 2010; Ring 2008).

The way that payments are made and the local context within which they occur influences outcomes (Cetas and Yasué 2017). In cases where local institutions for natural resource management have been developed, the intricacies of that socio-ecological system may determine how conservation payments are interpreted locally to produce outcomes.

Socio-ecological systems are complex adaptive systems where social and biophysical agents interact at multiple scales (Janssen and Ostrom 2006). The breadth and diversity of these human–nature interactions is reflected by a diversity of practises for managing natural resources. Traditional ecological knowledge, accumulated through observation, internalised into culture and transmitted through generations, informs traditional management practises. Traditional ecological knowledge is an attribute of societies with historical continuity in resource use, not necessarily restricted to tribal or Indigenous groups (Berkes, Folke, and Colding 2000).

Institutions within socio-ecological systems are rules or constraints, both formal and informal, that structure human interaction (Berkes 2004). They are shared understandings about the actions that are required, permitted or prohibited (Ostrom and Crawford 2005). Access to natural resources is governed by institutions, and in the case of people living within conservation areas, institutions may be both legislative and customary. Customary institutions may be central to maintenance of environmental condition and resilience, particularly when those institutions are governed by stable communities and protected from outside forces (Gibson, McKean, and Ostrom 2000). When customary institutions are replaced by regulatory institutions through top-down processes of conservation, traditional management practices, cultures and economies are eroded, often with detrimental outcomes for the environment and society (Gibson, McKean, and Ostrom 2000).

Protected areas and compensation in Brazil

Brazil is the most biologically diverse country on the planet (Mittermeier et al. 2005). Between 2003 and 2008 Brazil was responsible for over 70% of new land protection globally and over a quarter of Brazil's territory is designated as reserves (Jenkins and Joppa 2009). The Brazilian legislative platform for protected area incorporates social, economic and environmental considerations, however, is often not implemented, monitored or enforced effectively (Schneider 2013). Management is often dominated by economic or ecological, not social factors and limited by insufficient resources (Diegues 1995). Protected area in Brazil often implies costs and causes conflict for local populations (Rochadelli, Santos, and Schneider 2015).

It has been asserted that the long-term maintenance of protected area depends on the consent, support and participation of the local population (Adams et al. 2004; Kremen, Merenlender, and Murphy 1994). Conservation that is considered illegitimate or inequitable by local populations will be resisted both overtly and covertly, and positive outcomes may be jeopardised (Cavanagh and Benjaminsen 2015; Ostrom and Cox 2010). Concurrently, the perception of legitimacy and equity in conservation programmes is an integral factor of their long-term success (Ostrom and Cox 2010). Whilst local forces may not prevail in influencing conservation decisions taken at higher levels, the way communities interact with protected areas after their establishment may be influential on the quality of conservation achieved and the wellbeing of the people involved (Rochadelli, Santos, and Schneider 2015). Acknowledging the local costs of conservation and providing compensation accordingly is considered important to the success of conservation endeavours (Rosa, Kandel, and Dimas 2004).

In many Brazilian states, complementary law has been passed which recognises and compensates the costs of conservation incurred at the local level. Local government is compensated for the opportunity costs of hosting protected area through an ecological fiscal transfer (EFT), known as the Ecological ICMS (ICMS-E). EFTs redistribute public revenue between government entities based on ecological criteria to compensate or incentivize environmental protection (Ring 2008; Droste et al. 2015). The Brazilian ICMS-E was the first example of an EFT (Ring 2008), however, interest in the mechanism is increasing. Portugal introduced their own version of an EFT in 2007 (Santos et al. 2012) followed by India (Busch and Mukherjee 2017). There is interest and some pilot projects regarding their application in France (Borie et al. 2014), Germany (Schröter et al. 2014) and Indonesia (Mumbunan, Ring, and Lenk 2012). Research also points to their potential use Europe-wide (Droste et al. 2018) and in a global arrangement (Farley and Costanza 2010). Despite the interest in this type of policy mechanism, there is insufficient evidence on the local outcomes of EFTs to understand if and how they can lead to beneficial socio-environmental outcomes.

The ICMS-E is the longest running example of an EFT. The ICMS (known domestically as *imposto sobre circulação de mercadorias e serviços*) is an essential source of tax revenue for state and municipal governments (Soares, Gomes, and de Toledo Filho 2011). It refers to tax levied on sales and services and applies to transportation, communication services and general supply of goods, similar to value-added tax in other countries. The governments of each state levy the ICMS, and, as defined by the constitution, 25% of this revenue is returned to the municipalities within that state. Three-quarters

of this total is returned to municipalities based on their economic output, hence municipalities with more economic activity receive a greater share of ICMS revenue. The remaining quarter (i.e. 6.25% of the total ICMS) is distributed based on criteria defined by each state government, for example, population, area or agricultural production. State governments determine these criteria in order to address distributional equity or to incentivise particular activities.

Seventeen state governments have included ecological distributive criteria with the percentage allocated to the ecological criteria varying from 0.5% to 13%. This has become known as the ICMS-E. The ecological criteria which constitute the ICMS-E differ from state to state and cover diverse themes from soil conservation and fire prevention to solid waste management and the organisation of municipal structures for environmental management (Hempel 2006). In some cases, innovations have occurred such as the use of socio-environmental criteria (Schneider 2013) and the fostering of public-private partnerships for conservation (May et al. 2002).

Aim of the research

This research examines two versions of the ICMS-E using case studies from the Atlantic forest region, where local actors experience high costs of conservation and environmental conflicts are common (Teixeira 2004). Forest dwellers are often invisible in management strategies, except as the recipients of punitive measures for practising traditional subsistence activities which have become environmental crimes (Ferreira, Negrelle, and Zanatta 2011). Protected area regulation has eroded traditional institutions for natural resource management. The questions guiding the research are:

(1) How do different stakeholder groups view the conservation regime in their municipality?
(2) How aware are stakeholder groups of the compensation received for the presence of protected area?
(3) Are any benefits perceived from the compensation and does this reduce conflict?
(4) Is compensation sufficient to stimulate the development of viable livelihoods?

The research contributes to the limited available literature on the social dimensions of economic instruments for conservation and human well-being. If economic instruments are to contribute to the effective management of socio-ecological systems, it is necessary to understand their reception by local actors and the resulting outcomes. The lessons derived from this analysis may be useful for policy-makers, planners and anyone with an interest in economic instruments for socially equitable conservation.

Methodology

Case study descriptions

The research was conducted in 2016 in two Brazilian municipalities: Guaraqueçaba, Paraná state and Cananéia, São Paulo state. Guaraqueçaba is situated on the north coast of Paraná, at the São Paulo border, neighbouring Cananéia (Figure 1). Both municipalities are amongst the most economically disadvantaged of their respective states (IBGE 2010), and are located in the largest continuous remnant of Atlantic forest. The Atlantic forest is the most threatened biome in Brazil; only 12% remains intact (SOS Mata Atlântica 2018). Its conservation is of high national and international priority (UNESCO 2011). Around 98% of Guaraqueçaba's territory is under environmental protection; in Cananéia the figure is 75%.

The region was home to Indigenous people belonging to the Carijó and Tupiniquim groups prior to the arrival of Portuguese colonialists in the early 1500s (Martins 1995). From the seventeenth century, enslaved men and women were trafficked from Africa (Priori et al. 2012). The process of

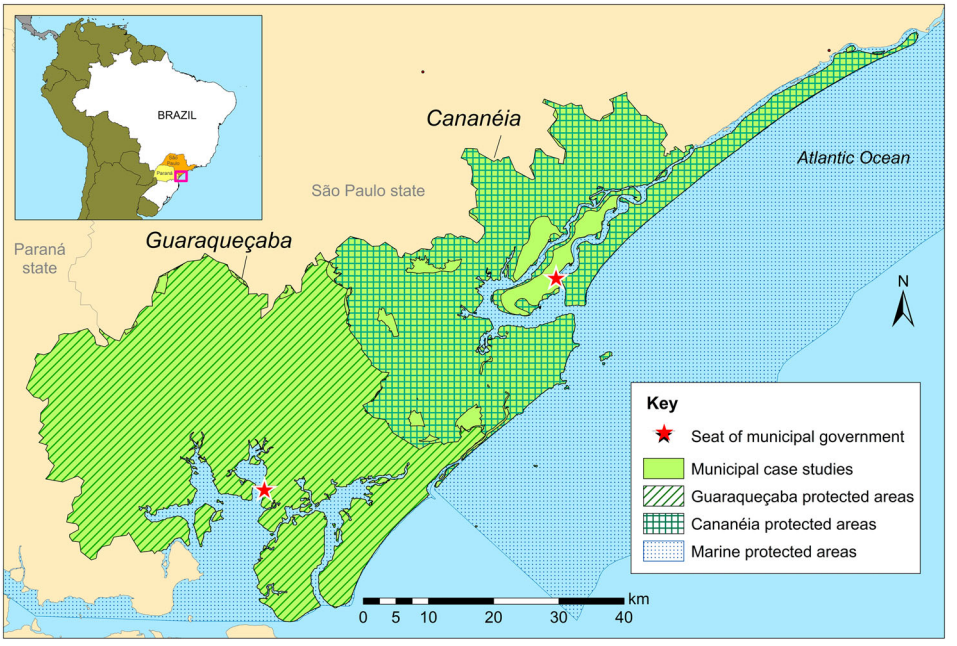

Figure 1. Map of the study area. PA coverage compiled from UNEP-WCMC (2018).

miscegenation over centuries has led to the development of culturally differentiated communities with unique traditions, social organisation and livelihoods (Diegues et al. 1999).

Fundamental to the definition of these traditional communities is the existence of a system of agricultural production and natural resource management marked by intimate ecological knowledge (Diegues et al. 1999). There are two types of non-Indigenous traditional communities in the study region; *Caiçaras* and *Quilombolas* (Diegues et al. 1999; Priori et al. 2012).

Caiçaras can be understood as communities formed with ethno-cultural contributions from Indigenous tribes, Portuguese colonisers, and to a lesser degree African people (Diegues et al. 1999). Subsistence agriculture and fishing are the mainstay of livelihoods, supplemented by forest resource extraction. *Caiçaras* have developed an itinerant and collective agricultural system known as *pousio*, which reduces soil degradation and allows forest to regenerate (Campos, Sulzbach, and Komarcheski 2013).

Quilombolas are of African origin, descendants of men and women enslaved by colonialists. Their ancestors, fugitives of forced labour, found refuge in remote locations of difficult access and over time communities were established (Priori et al. 2012). Their isolation led to the development of a distinct culture and way of subsisting in the forest (Priori et al. 2012).

The implementation of protected area in this region started in the late 1960s, but increased rapidly in the 1980s. The mosaic of reserves includes classifications from sustainable use to strict protection. The whole region is also under the Atlantic Forest Decree, which is very restrictive, prescribing a moratorium on the use of forest products except with specific authorisation by the relevant environmental agencies. A preservationist approach to implementing reserves placed resident communities in conflict with the conservation regime, side-lining them from decision-making and criminalising subsistence activities (Marangon and Agudelo 2004). Land use restrictions impact on all aspects of livelihoods including extractivism, fishing and hunting (Rochadelli et al. 2013). The traditional agricultural system has been eliminated, along with the cultural and religious activities associated with the harvest (Marangon and Agudelo 2004). There has been little investment in the social welfare of inhabitants or policies aimed at supporting the local economy, for example,

through technical support to help farmers adapt agricultural systems to the conservation restrictions (Marangon and Agudelo 2004). Rural communities lack alternative forms of economic activity and remain heavily reliant on natural resources as a means of income and subsistence, despite the illegality of many extractive activities (Dumora 2006).

The ICMS-E began in Paraná in 1991 and in São Paulo in 1993, assigning a small percentage of the flexible portion of ICMS revenue to compensate protected area, with more restrictive reserves attracting higher financial compensation. The ICMS-E is an important source of revenue for each municipality. In Guaraqueçaba the ICMS-E accounts for 20-30% of the total annual budget, whilst in Cananéia it provides 10%.

There are key differences between the ICMS-E in the two states. In Paraná, local government legislation that supports biodiversity conservation can result in a higher return from the ICMS-E, creating incentives for local conservation (Loureiro 2002). In São Paulo, the value of the ICMS-E is unaffected by local activity. In Paraná, the ecological payment is made separately from the rest of the ICMS, making the value transparent, whilst in São Paulo the value received as environmental compensation is not obvious. ICMS-E revenue is not earmarked for environmental purposes and may be used as required by local government.

Data collection

This paper presents results from semi-structured interviews with community representatives ($n = 21$) and local government actors ($n = 9$) in the two municipalities. Interviewees were selected through reputational and positional sampling (Scott 2017). The perspectives of park managers, environmental NGOs and researchers working in the region ($n = 16$) complement the results from the two main stakeholder groups. Interviews were conducted in Portuguese by the lead author and were recorded and transcribed verbatim. The software programme Nvivo 9 was used to manage, code and analyse the transcripts to determine key themes amongst different stakeholder groups. Quotes have been translated by the lead author.

Results

The results section is divided into two parts. The first addresses how stakeholders view conservation regulated by state institutions, as opposed to the traditional institutions which previously governed natural resource management. The second section reports on the level of knowledge of the ICMS-E and how compensation influences perceptions.

The legitimacy of environmental conservation

This section highlights how members of rural traditional communities distinguish between conservation supported by traditional institutions, or local rules and norms, and conservation imposed since the 1980s by state and federal regulation and enforced by environmental police. Community responses from across both municipalities were aligned, however, responses from local government differed. This section is divided into the themes that recurred during interviews.

Framing the forests

Almost all respondents acknowledged that conservation of the environment was of fundamental importance, however, the stakeholder groups (community and local government) framed the forest differently. Traditional communities from both municipalities framed the forest in cultural terms, with natural resources forming the basis of livelihood activities,

> We can't go to the market to buy meat every day. Besides, it's part of our culture to hunt.

> My parents … used nature, they lived off farming and fishing. There was no other way. But they cared for everything. We have always preserved. If I am going to cut a tree I need to know why I am cutting it. If it's not really necessary, I don't cut it.

In Guaraqueçaba elected members of local government self-identified as belonging to the traditional communities of the region, however, their discourse focused on the utility of the forest and its economic potential,

> I am Caiçara. We are environmentally rich. The municipality does its part to preserve because it is for our own benefit. Our autonomy is attached to the environment; to agriculture, organic production and tourism.

In Cananéia, local government respondents working on environmental issues had a similar view,

> I see this region today in a marvellous light, with extremely rich potential.

Politicians working outside of the environmental secretariat in Cananéia asserted that the forest was important but emphasised the difficulties imposed by conservation. A high-ranking local official stated,

> There are many things we can't do here because of the environment.

Local support for the state and federal conservation regime

Despite considering forest conservation important, respondents from rural communities did not accept the role of the government in conservation, identifying themselves as responsible for the forest being intact today, and opposing the conservation regime.

> Before people talked about conservation, before IBAMA [the federal environment agency] existed, the traditional population already had a culture of preservation. Everything that has been deforested in our state was not done by the traditional inhabitant, he is the one who always respects nature.

> If you take away the salary of the government conservationist will he stay to protect the forest? No, we are the ones that care for this place.

In Guaraqueçaba, local government expressed how they were sidelined in decisions about conservation,

> Public policies are made in air-conditioned offices in the capitals of the country. Conservation needs to be developed with social responsibility, but we, who live in the place, suffer all the consequences.

Rural communities highlighted their mistreatment throughout the implementation of protected area, as if they were responsible for forest degradation.

> Some [protected] areas were instituted way up from the top and it's not good. Every time it gets more restrictive, the law doesn't let you do anything.

> Actually, who deteriorated nature was not us. The traditional inhabitants, by our way of living, preserve. We might take a tree to build a fence, but it's for subsistence, no one here has an industry.

Agricultural incentives were responsible for the arrival of large-scale agriculture to the region in the 1970s, which led to significant deforestation and the displacement of many local communities to marginal areas (Teixeira 2004). With the implementation of protected areas, ranchers and farmers were remunerated to leave, and the remaining agricultural communities became the focus of government agencies, collaborating with conservation NGOs, in the creation of management plans for the reserves (Diegues 1995). Interventions in the region focused on preventing those communities from adversely affecting the forest, rather than addressing the deep poverty, poor access to services and absence of economic opportunity (Teixeira 2004). Whilst authorities did not acknowledge the role of the communities in the condition of the preserved forest throughout this process, communities attribute traditional institutions with having guaranteed the intact state of the forest across centuries,

> Conservationists say, "you have to understand that this forest is conserved." But it always has been, for the 500 years we have been here. This is not a privilege of NGOs or management. It was the wisdom of the Indigenous people, of the Caiçara. They secured this place for you to benefit today.

> We created some community restrictions so that we could have oysters until today, and we do. We have one of the spaces that has the most oysters in the municipality of Cananéia.

A government representative from Guaraqueçaba also described the role of local institutions in preserving the forest over time,

> Us, Guaraqueçabanos, it's not that we don't accept rules or accept impositions to maintain the environment. Everything you see here was maintained by our people, throughout all of this time.

However, the erosion of customary institutions by the imposition of government regulation were also described by a rural community member,

> We would go and cut palm heart, but we never cut the palm that had a flowering stem. We knew that it would give a lot more. But not today. Today they get that flowering palm. Why? They need to escape the surveillance. They have to be quick, so they end up cutting everything.

Respondents also described how food was cultivated clandestinely, with small plots hidden within the forest. This phenomenon of "guerrilla agriculture" is considered a mechanism of resistance used by rural populations against the imposition of conservation (Cavanagh and Benjaminsen 2015).

Positive impacts of protected area

A beneficial aspect of protected area was recognised; protection from outsiders, as acknowledged by a resident of the Cardoso Island state park in Cananéia,

> In our community, when it became a park, at the time it was good for us because it was a time of land grabbing. Some people had sold their houses to tourists and the women of the community became maids. Nobody could work for themselves anymore. Then the park came and the summer houses were demolished.

Parks were also recognised as having some effect in protecting the region from over-exploitation. Many respondents identified "outsiders" as a threat to the ecosystem, with poachers and palm heart collectors invading the area,

> We are surrounded by reserves, and that's good because we need them, otherwise the environment here would be much worse.

> There was a big invasion of people from the outside, mostly in the capture of crabs. They were taking tonnes of crabs from here.

However other participants believed that the protected area had deteriorated customary institutions, and without an appropriate level of monitoring had worsened overexploitation by outsiders,

> The exploitation of palm heart, which was a way of life, had a kind of control. Today it is prohibited and there is no control. So, people go into the forest and steal the palm heart. We're at the mercy of these palm heart thieves.

Conflict between local inhabitants and outsiders that extract palm heart for the black market has been documented in this region, with records of violent encounters between local communities and poachers (Rocha 2015).

Negative impacts of protected area

Local stakeholders described how they were sidelined by the approach to conservation. The process of demarcation and implementation was perceived to have focused on the conservation of biodiversity, in most cases without acknowledging the role of humans in conserving that system. The mayor of Guaraqueçaba asserted that,

> When they thought about the environmental protection of Guaraqueçaba they thought of everything, the water, the animals, the plants. But they forget the most precious good which is my people. I am against that. I can't tell a

> father not to cut a palm heart when I can't offer anything else for his son to eat. If they can't plant, how can they survive?

Criminalisation of activities associated with subsistence livelihoods strongly impacted the cultural and economic well-being of rural communities,

> Here is just one big restriction, everything is prohibited since they created the park. The government put the environmental police onto the communities. Without giving any support to the people, everything was prohibited.

Respondents described the fines and prison time experienced by friends and family, and the sometimes-violent encounters with environmental police. The alienation experienced by local communities through the processes of state conservation has set them in opposition to state conservation,

> During the implementation, the worst mistake they made was to not have positioned us as friends, but on the side. Then you end up not having an ally, but an enemy of preservation.

The limitations placed on subsistence activities were described. In some categories of protected area it is possible to request authorisation for certain land-use activities, however, the process was considered,

> … really complicated. When you manage to get authorisation the time to do the planting has already passed, so everything is backwards.

There is also a perception that the intention of environmental agencies is to inhibit the local population until they are no longer able to persist, leaving the area for its intended vocation of biodiversity preservation,

> If you say no to everything, how will he go home and have food, medicine, access to schools? What is the counter offer for him to be able to live? I don't understand where they want to get. Do they want all my people to leave here?

> Living here is all very complicated. We're living off our stubbornness. We won't give up.

Representatives from local government also acknowledged the difficulties in governing under the land use restrictions.

> There are a lot of things that need to be done and they don't happen because we can't take down trees and other things, bring industry.

Community members were aware of their inability to make demands or participate meaningfully in conservation and development decisions. They were also cognisant of their role in being subjugated to the conservation regime,

> We know what we must do for the state. For our people to do any kind of renovation or repair, anything, they have to ask permission. We know everything we owe to the state … but the state doesn't provide us with any kind of support.

> We are fragile inside [the reserve]. We've heard a lot said, like, "you can't do that, you are living under state control". Gee, we were born here, we cared for here. But we don't have any strength, none at all.

Government officials also described a lack of support from the upper echelons of government as a barrier to improving the conditions of the municipality.

> What's missing for us is investment from the state or federal government.

> The municipality doesn't have the conditions to stimulate our economy. So, I went to seek collaboration with the state government. I didn't have success.

The inhabitants of the study site consider themselves responsible for the preserved state of the forest, feel alienated from state processes of conservation and suffer high negative impacts from

land use restrictions. There is little difference in responses between the municipalities, particularly from rural communities, who share a similar history of exclusion, restriction and surveillance. The forests are considered integral to local culture, identity and economy, however, forest preservation through state control is rejected. The imposition of reserves without acknowledgement of the complex socio-ecological relationships that comprise the foundations of the local economy and culture has set the local population in opposition to the conservation regime.

Knowledge of the ICMS-E and perceptions of protected area

This section provides results on how well stakeholder groups understand the ICMS-E mechanism, if they perceive any benefits, such as improved access to services or infrastructure, or improved financial autonomy and whether this impacts on perceptions of conservation. The two case studies are presented separately, because, whilst community responses were similar, respondents from the two local governments exhibited different levels of knowledge of and interaction with the compensation provided by the ICMS-E.

Cananéia

Under ICMS-E legislation in São Paulo the ICMS-E renumerates the presence of state parks, regardless of local policy decisions. Respondents from the local government of Cananéia generally displayed little knowledge of the ICMS-E, unaware of its value or how it worked. One government representative phoned the treasury for more information,

> I asked them what was the percentage of revenue that came from the ecological part, but they couldn't tell me.

Another took a guess, estimating an amount less than 10% of the actual value,

> It's not a lot, see? I calculate that it must be 400 thousand a year, more or less. [This information] is not well disseminated, few people know about the resource.

The ecological portion of the ICMS revenue arrives in municipal accounts together with the rest of the ICMS, which is designated to a large degree, proportionally to local economic activity. In Cananéia the small percentage (0.5%) of the tax revenue that is destined to compensate protected area, accounts for 60% of all revenue received from the ICMS, a fact completely unknown to government representatives outside of the environmental secretariat. It is possible to determine this number through a simple calculation, however, the design of the mechanism does not provide any reason for public authorities to seek information about the value that protected area are contributing to local budgets. The ecological value is not separated and is not used for any particular purpose. How this value (10% of the total annual budget) was spent was unknown, with the mayor of Cananéia responding,

> Sincerely, I do not have this knowledge.

Another high-ranking official stated,

> I really don't know, because it's not divulged. There must have been some improvements in some projects from the money of the ICMS-E, but I don't know, there's no disclosure, no direction, you know?

Respondents from within the environmental secretariat, contrastingly, had good knowledge of the ICMS-E, could describe the values involved and recognised its economic significance. Although no-one knew how it was spent, respondents were able to make suggestions about how the revenue could or should be used,

> We have problems, because the people who live in the protected areas can't plant or use the resources. This money could be used for projects, like organic agroforestry for example, to create a way for them to sustain themselves. It would be good to return this benefit to the population in the conservation areas.

The ICMS-E appeared to have little or no impact on the perception of local government towards conservation. The members of the environmental secretariat did not have sufficient political sway to push an alternative agenda for the use of the money. Poor knowledge of the ICMS-E and a firm position that forest conservation was the cause of many economic difficulties meant that the compensation was seen as inadequate,

> The municipality would have to receive much more to compensate for this loss, because it's for the municipality, right? There are so many things we can't do.

The presence of the environmental compensation was not divulged publically. Community members were almost entirely unable to describe anything about the ICMS-E mechanism. The only exception was a member of a highly organised community living inside a state park, who knew about the mechanism and suggested how it should be used,

> It is an indemnity that the municipality receives, of which they should pass 5% to the communities. But most of the communities don't have the organisation to enter into an agreement with the prefecture. We already tried to do this, but were unsuccessful. We're going to try again next year.

It was recognised that better knowledge of the mechanism might improve the transparency of the use of the resource and even stimulate debate on how it was spent, described by an employee of the environmental secretariat,

> I think that if the population knew about the ICMS-E, it would have another vision. It would demand that public powers invest it in terms of projects in the communities.

A lack of knowledge of the ICMS-E by both local government and community in Cananéia meant that the compensation had very little impact on the relationship between government, rural communities and conservation. With scarce knowledge of the value received and its application, the compensation did not alter perceptions of the conservation regime, was not linked explicitly to improvements in service provision or local infrastructure and did not alleviate human-conservation tensions. This is in contrast to Guaraqueçaba, where the ICMS-E mechanism provides a financial incentive for local conservation activity.

Guaraqueçaba

In Guaraqueçaba the 2.5% of ICMS distributed to ecological criteria generates almost 75% of the ICMS revenue received. As the ecological part enters municipal accounts separately, the economic importance of the protected area is visible. Local government displayed much greater knowledge of the ICMS-E across all departments, with the mayor particularly involved in discovering how to use the mechanism to its full potential,

> I went to learn more about the ICMS-E to know how to work with it. It enters as a "free" resource, for example it can be used to pay salaries. But I understand that it should be directed to environmental questions to involve the population in environmental preservation.

The ICMS-E distribution in Paraná includes a quality index, measured annually, which takes into account local government legislation that impacts on the quality of the protected area and the environment generally. The mayor was knowledgeable about this incentive and had endeavoured to create public-private partnerships to enable better management of private reserves, which would result in a higher return from the ICMS-E,

> I proposed that we … pass along a percentage to the owners of private parks for them to maintain their areas and for the municipality to keep receiving the ICMS-E. Everyone agreed that this was a good way to return the money to those who preserve. But we didn't manage to put anything into practice.

There were barriers to directing public funds to private reserve managers, so these private-public partnerships were never implemented. Instead, a social programme with environmental benefits was created that rewarded women with basic food and hygiene products in return for collecting waste

from the shoreline and sorting it for recycling. According to the mayor this was the first-time money from the ICMS-E was destined to anything other than payroll in Guaraqueçaba, although over three-quarters is still used for that purpose. The incentive effect of the ICMS-E appears to have produced a higher level of engagement in environmental questions by local politicians.

A third of Guaraqueçaba's economy was based upon the administration and the provision of local services. Approximately 18% of the population between the ages of 16 and 65 were engaged in salaried employment, with the municipal government the largest employer, responsible for two-thirds of formal jobs in the municipality (IBGE 2010). However, access to the ICMS-E resource was insufficient to trigger improvements in the social and economic condition of the wider population, especially given the low capacity of local government.

> We should have big projects in the environmental area so that families could be independent of the prefecture but we lack infrastructure from the state and federal government. I have my own vision, but it's no use for me to launch a project. If I don't have investment I don't have any way to sustain a project. The ICMS-E isn't sufficient to enable this in any way.

Despite a reasonable level of interaction with the ICMS-E at the level of local government, very little information had trickled down to the community. Some community respondents had heard the ICMS-E mentioned but could not describe what it was, its value or how it worked,

> The ICMS-E? I heard something about it at the meetings of the park council, but no, I don't know.

One individual from Guaraqueçaba who worked as an environmental journalist had good knowledge of the ICMS-E, but explained that the rest of the community,

> … doesn't know. Sometimes they know because I tell them. I'll chat with a friend at the bar. But generally, no one knows.

Whilst rural communities don't commonly understand how the ICMS-E works, they do understand that the conservation of the forest generates benefits that spill over municipal boundaries,

> I can't do anything, so I know it's preserved. But somebody is benefiting from this forest staying standing. The state is winning, somebody is winning. We can't do anything and someone else gains.

There was confusion about forest payments in some communities in Guaraqueçaba due to NGO activity. Starting in 1999 an NGO based in the state capital, in coordination with The Nature Conservancy and funded by American automotive and energy companies to the value of US$18.4 million, purchased land in the region for the establishment of three private reserves for a carbon credit programme (Kill 2014). Rural communities were aware of this agreement and the large sums of money involved, creating a sense of resentment that "*someone*" was benefiting financially from the forest. The scheme was considered unjust as it excluded local inhabitants from areas they had previously utilised for subsistence activities, whilst not providing any perceived benefits.

> The money goes to the NGO, it doesn't benefit us. But beyond getting all the money and not returning any resources to the community, they want to restrict what we can do even more.

According to the NGO, around 10% of the total budget was spent promoting sustainable development activities around the reserves, including beekeeping and certified organic banana projects, as well as capacity building and training of local employees (TNC 2010). The private reserve situated in Guaraqueçaba generates 10% of the ICMS-E received annually. Nearby communities were unaware of these outcomes and unsure of the relationships between the stakeholders, however, they suspected that the government had benefited from the arrangement,

> We know that the prefecture collected a lot from this reserve, but until today, there wasn't even a cent passed through to the communities.

The resentment created by the establishment of the private reserves and the carbon credit programme meant that community perceptions of conservation were further eroded. There was a

lack of knowledge of the ICMS-E generated and no perception of any local improvements for rural communities arising from the revenue it produced. Misconceptions about the NGO also led to over-estimations of the presence and activity of environmental organisations in the municipality,

> Lots of people say there are around 80 environmental organisations active in Guaraqueçaba that receive resources. The NGOs are really rich.

Community members were extremely sceptical of many NGO activities and livelihood projects were rejected,

> The Guaraqueçabano doesn't believe any more in environmental projects. We don't accept the NGOs because their discourse isn't that of the Caiçara, it's different.

> They [the NGO] came here with an example of how to grow bananas. They wanted to change how we do it, how we've always done it. They wanted to close part of our land to make a demonstration for people to see and they put up a big sign of their organisation. Actually, I think what they wanted was to take all our land, to turn it into a private reserve.

The implementation of private reserves and the transactions that had occurred between environmental NGOs and corporate interests had a lasting impact on community sentiment towards conservation,

> I saw the paper, a contract for 10 million dollars between an American company and the NGO. Then they closed off the area and treated it as if it was their stronghold. The native loses. Then he gets angry, goes in there and cuts the trees. The NGO employees, each one well dressed, with a new laptop computer, walk there in front of the natives, who have never had anything, and complain because he cuts palm hearts. That's aggressive. The social cost is very high and it generates anti-preservation.

In summary, better visibility of the value of the compensation provided by the ICMS-E and the presence of financial incentives has led to engagement with the ICMS-E by local government and its partial application to an socio-environmental project. Rural communities do not perceive any benefits stemming from the compensation, and so the ICMS-E has no positive impacts on the relationship between forest inhabitants and protected area. Concurrently, a carbon credit programme and the implementation of private reserves created resentment about the distribution of economic benefits being created by the intact forest

Discussion

This research has shown that environmental compensation through the ICMS-E was ineffective in altering the perceptions of stakeholders towards a conservation regime which implied high local costs. This may be largely related to insufficient knowledge of the compensation mechanism and imperceptible positive benefits from the application of funding. These findings provide lessons which can inform the development of compensation schemes that are more effective in resolving environmental conflict and contributing to socially equitable conservation which include viable livelihood opportunities;

(1) The application of environmental compensation should be transparent and explicitly linked to benefits tangible to the communities most affected by conservation.
(2) Environmental compensation should be seen as one tool in a multidisciplinary approach to conservation which supports the development of local livelihoods as a key policy focus.
(3) Monetary compensation may not be sufficient to overcome the barriers faced by local actors confronting low institutional capacity. Horizontal and vertical collaboration may improve capacity of local stakeholders.

These points are discussed before final remarks are made on the potential role of EFTs in a socially equitable conservation policy mix.

Linking revenue to tangible outcomes: transparency and knowledge sharing

Communities have poor knowledge of the ICMS-E and their lived history of land use restriction and conflict with environmental police led them to perceive protected area as undesirable and illegitimate. Communities did not identify any positive benefits from compensation. A lack of transparency and knowledge of the ICMS-E and other conservation payment schemes had created resentment and mistrust in the community, particularly in Guaraqueçaba. This exacerbated feelings of injustice, as locals believed that profits were being generated by conservation, whilst they, the traditional stewards, bore the costs. The ICMS-E, instead of creating a bridge between communities and conservation, contributes to creating a larger gap. This is partly derived from the mistrust that the population has of local authorities and could be improved through increased transparency in the application of financial resources.

Dissemination programmes that explicitly link ICMS-E revenue to local service provision, infrastructure or livelihood programmes, could improve the relationship between people and parks and help reduce resentment, as summed up by a park manager,

> If a person sees a medical centre with a sign that says, "resourced by the ICMS-E of the National Park of Superagui" for sure their opinion will change, because then the benefit is materialised, you closed the cycle. This is fundamental.

Composing between 10% and 30% of the total budget in the case study municipalities the IMCS-E certainly contributes to the local provision of services. This was not recognised by the broader community. A participatory approach to the use of a percentage of the ecological compensation may improve local outcomes. A deliberative environmental council, with adequate civil society representation, could determine the application of a part of the revenue, thus increasing the transparency of the application of the funds.

Compensation as a tool to support livelihoods

Environmental compensation may have a role in alleviating conflict created through exclusionary protected area as part of a multidisciplinary approach that embraces the complexity of socio-ecological systems and their customary institutions. This approach has implications for social justice and may also improve conservation outcomes. Research suggests that the social and economic outcomes of protected areas for local inhabitants is a stronger predictor of conservation outcomes than the physical and management characteristics of the reserve (Oldekop et al. 2016).

Whilst not all customary institutions are aligned with the conservation of biodiversity, there are numerous examples from within Brazil and around the world of Indigenous and traditional natural resource management practices and knowledges being integrated into effective conservation systems (Schröter et al. 2014; Berkes, Folke, and Colding 2000; Posey 1985; Bhagwat and Rutte 2006). Conservation that is governed by rules that contradict daily patterns of resource use will be ignored (Gibson, McKean, and Ostrom 2000). Where people are respected as a part of the natural system and conservation is considered legitimate, compensation may be invested to adapt traditional subsistence activities to the restrictions of conservation. Livelihood strategies should focus on enabling an autonomous and dignified economic future, aligned with local cultures of preservation and thus adequate to cultural needs and conservation restrictions. This was summed up by a community member from Guaraqueçaba,

> We don't want money, we want a means to create an income. We don't want help, we want support. We want to live in our own corner, by our own sweat.

There are examples from the region of this study where institutional collaboration and recognition of the legitimacy of the local population has delivered livelihood and environmental outcomes, including the harvest of *cataia* (Myrtaceae: *Pimenta pseudocaryophyllus*) leaves by women in Barra

do Ararapira. This isolated community in Guaraqueçaba is located in a strictly protected national park. There are stringent limitations on livelihood activities, few economic opportunities and extremely poor infrastructure development and access to services. Through collaboration with park managers, the women's association gained permission to extract *cataia*, a leaf with culinary and medicinal properties, from within the park. Environmental technicians determined a sustainable harvest of *cataia*, and the women collect and dry the leaves to sell, improving their financial autonomy without any negative implications for the environment. There may be scope for environmental compensation payments to fund similar initiatives, co-developed by communities and government or non-government institutions.

As ICMS-E payments are made directly to local government barriers may exist in applying the funding to specific livelihood programmes. The ICMS-E could potentially be applied for these means, however, in a context of poor access to resources local government may be unwilling or unable to divert funds to such initiatives. Of the three spheres of government in Brazil, federal, state and municipal, the municipality is the least well resourced, least efficient and least technically skilled (Batista 2015). The institutional capacity of local government is a barrier to the effective application of ICMS-E funds to ensure socio-environmental outcomes. Collaboration and support across the levels of governance will be a key aspect to enabling local government to derive the most benefits out of limited resources. EFTs that are developed within a context of weak institutions and scarce resources should include a package of collaborative capacity building activities that support municipal administration's effective application of funds.

The role of EFTS in a socially equitable conservation policy mix

As part of a policy mix to address the complex interactions of socio-ecological systems, EFTs can play an important role in addressing the conservation costs incurred by decentralised public actors (Droste et al. 2015). Maintaining healthy and resilient natural systems generates many benefits, but also entails economic and social costs. Where a protected area is implemented, costs concentrate to the local level, while the benefits, such as dispersed environmental services like climate regulation and carbon sequestration, as well as option, existence and bequest values, are enjoyed largely by the global community (Balmford and Whitten 2003). This unequal distribution of the costs and benefits of conservation is of particular concern in creating socially equitable conservation, as the distribution at global and local scales of these costs and benefits can reinforce existing inequalities between and within countries (Adams and Hutton 2007; Holmes 2007; Oldekop et al. 2016). For this reason EFTs, particularly in developing regions, should not necessarily be seen as a direct source of funding for conservation. In Guaraqueçaba the ICMS-E funding was vital to the local administrations ability to pay the salary of public servants and its application for other activities could compromise the realisation of local administrative responsibilities.

Whilst the outcomes of EFTs in any policy mix will be highly context specific, this research indicates that the ICMS-E had little impact on the environmental outcomes of protected areas, a finding supported by other research (Santos et al. 2014). The inclusion of incentives in Paraná, intended to motivate progressively greater commitment to environmental protection and management, has not led to significant environment outcomes due to barriers such as insufficient institutional capacity and poor access to financial resources at the local government level.

EFTs should be established with a clear intended role within a policy mix, whether that be compensation, with funding available for free use, or incentive, intended to stimulate conservation activity. If intended as an incentive to environmental protagonism by local government, multilevel collaboration may be necessary. Inherent in the formulation of effective policy mixes is the inclusion of a multilevel governance perspective, where horizontal and vertical interaction across and between governance levels utilises the capacities of different stakeholder groups to produce outcomes (Berkes 2007; de Oliveira Faria and Magrini 2016). This could support the effective and efficient application of EFT funding by local government.

Conclusion

This research has explored how environmental compensation impacts on the relationship between people who live in and around reserves and the conservation regime under which they exist. Rural communities considered themselves as stewards of their environment, however, were subjected to strict environmental regulation with high social, cultural and economic impacts. The environmental compensation received by the municipality was not recognised as producing any tangible benefits for the community. It was not perceived by local authorities as sufficient to compensate for the local costs of conservation or to enact meaningful socio-economic or environmental projects. Environmental compensation could play an important role in a policy mix to address the local costs of conservation. However, effectiveness in achieving positive outcomes depends on the larger political, social, institutional and environmental context within which compensation occurs, how it is communicated and how the funding is applied locally. Through the comparison of two versions of the ICMS-E it has been possible to identify ways in which compensation payments can fit into a policy mix to address the inequitable distribution of the costs of conservation, contributing towards conservation that legitimises the presence and activities of traditional forest stewards whilst providing opportunities for socio-economic development and wellbeing.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by Australian Government Research Training Program (AGRTP) Stipend Scholarship.

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