HRVATSKI GEOGRAFSKI GLASNIK 84/2, 5–19 (2022.)

UDK 631.111.4(815.36)
911.37:631]815.36)

DOI 10.21861/HGG.2022.84.02.01

Original scientific paper
Izvorni znanstveni članak

Received
2022-03-01

Accepted
2022-09-12

Felipe da Silva Machado

Enhancing conceptual and practical understandings of small-scale farming resilience in the metropolitan countryside of Rio de Janeiro, Brazil

Rural-urban complexity can be seen across the Rio de Janeiro Metropolitan Region where land use, and economic and environmental policies have generated conflicts. In this context, agriculture has become juxtaposed with other functions and interests, which has resulted in a mosaic of diversified land use. These rural-urban interactions also provide opportunities to develop different types of knowledge that allow communities to develop resilience in an environment of spatial changes. The aim of this article is to analyse rural change and farming resilience in the Eastern Rio Metropolis, based on primary research undertaken in 2017 and 2018. The results provide useful insights for understanding the nature of rural-urban interactions in a metropolitan countryside that could, in turn, inform policies for promoting local and regional quality food systems and small-scale farming strategies.

Key words: small-scale farming systems, family farms, rural innovation, agriculture in metropolitan areas, Greater Rio de Janeiro

Ruralno-urbana složenost može se opaziti diljem metropolitanske regije Rio de Janeiro gdje način korištenja zemljišta te ekonomske i ekološke politike izazivaju sukobe. U tom je kontekstu poljoprivreda postala suprotstavljena drugim funkcijama i interesima, što je rezultiralo mozaikom raznolikoga korištenja zemljišta. Te ruralno-urbane interakcije također pružaju mogućnosti za razvoj različitih vrsta znanja koje omogućuju zajednicama da razviju otpornost uslijed prostornih promjena. Cilj je ovoga članka analizirati promjene u ruralnom prostoru i otpornost poljoprivrednika u istočnom dijelu metropolitanskoga područja Rija de Janeira na temelju istraživanja provedenih 2017. i 2018. godine. Rezultati pružaju korisne uvide za razumijevanje prirode ruralno-urbanih interakcija u ruralnim prostorima unutar metropolitanskoga područja koji bi, pak, mogli nadograditi politike za promicanje kvalitetnih lokalnih i regionalnih prehrambenih sustava i malih poljoprivrednih strategija.

Ključne riječi: mali poljoprivredni sustavi, obiteljska poljoprivredna gospodarstva, ruralne inovacije, poljoprivreda u metropolitanskim područjima, Veliki Rio de Janeiro

Introduction

Global processes have produced differences in farming systems and multifunctional agriculture in Brazil. Variation also occurs within regions, exemplified by rural-urban complexity observed across the rural hinterland of Rio de Janeiro (Bicalho, 1992; Bicalho and Machado, 2013; Hoefle, 2014). As the metropolitan area has expanded outward, land prices have increased, production strategies have changed, family members and workers have left to work in non-agricultural sectors, and farmland has been lost to urban sprawl and nature reserves. The challenges for rural areas in the early 21st century (Woods, 2011, 2012), such as resilience of farm communities to macro-scalar lock-in effects, have received more attention in recent years (Wilson, 2008; 2010; Darnhofer, 2010; 2014; Darnhofer et al., 2016; Machado, 2017; 2020; Ingram, 2018).

Urban centres and their surrounding rural hinterlands have been given prominence in recent rural research. New and emancipatory foodscapes have emerged in rural-urban space where alliances were forged between increasingly well-informed consumers and local farmers offering-food products via alternative distribution networks; thus acting as an environmental and social counter-force to intensive global food systems (Goodman et al., 2011; Marsden and Morely, 2014).

Densification of cities is presently one of the dominant strategies for urbanisation globally. However, how densification of cities is linked to processes in peri-urban landscapes is less well understood. This research starts with the hypothesis that global urbanisation has changed rural space and reshaped farming resilience in the metropolitan countryside of Rio de Janeiro, a study area affected by global processes such as urban sprawl, industrialisation, and environmental pressures. The aim of this article is, therefore, to analyse rural change and farming resilience in the Eastern Rio Metropolis, which has been affected by incorporation into metropolitan dynamics. The main objective of the study is to assess how urbanisation has affected the practices and spatiality of farming in the metropolitan countryside of Rio de Janeiro by investigating the resilience of small-scale fruit farming.

The research shows how different degrees of rural-urban interaction in Greater Rio de Janeiro have given rise to multifunctional diversity, farming resilience, and rural innovation. The Rio de Janeiro Metropolitan Area is located in industrialised Southeast Brazil and is the second largest metropolitan area in the country. The complexity of farming systems present in this region contributes to better understanding of the peripheral countryside, going beyond the view of inert space that is only subject to external interferences and actions. Studies of local and regional economies are not terribly concerned with determining boundaries, rather with how to "identify and trace the various connections and articulations which operate within and beyond it" (Goodwin 2013, 1, 182).

The concept of metropolitan countryside is used in this study to describe geographical spaces where agricultural land, rural-urban landscapes, and nature have become entwined in the dynamics of a metropolitan area as a result of geographical and/or functional proximity. The term of metropolitan countryside invites investigation of the effects of these entwinements, the possibilities of bringing rural and metropolitan space together, and questioning of the potentials of agriculture and rural-urban landscapes in the contemporary metropolitan and global context. The metropolis and the countryside are typically understood as relatively distinct and incongruent forms of geographical space. However, the case of Greater Rio de Janeiro offers rich evidence of affinities between them.

This study reveals that a group of farmers has been able to devise flexible strategies adapted to their available financial and natural resources. Different types of knowledge, innovations, and cross-scale linkages are part of this process, in which farmers are proactive in the face of rural change. This is often made possible by the differences between rural-urban interactions present in Brazilian metropolitan regions and their hinterlands, in contrast to those encountered in predominantly agricultural regions that are distant from and less affected by large urban centres. The research highlights patterns of small-scale farming and emancipatory possibilities in an urbanising and global society, whereby farmers have adapted to uneven processes of rural change that have arisen in Rio's metropolitan countryside over the years.

Addressing small-scale farming resilience at the rural-urban interface

The key contribution of the research has been to build upon academic knowledge of the complexity of farming in the metropolitan countryside. The inclusion of the voices of small-scale farmers allowed for an understanding of the relational agricultural systems that have been formed as a result of rural and urban interactions, and to demonstrate their dynamic and changing nature. It also revealed one of the most prominent features of contemporary rural localities in the way in which traditional rural economies have become woven into trans-local networks of production and consumption. These entanglements have implicitly forged new connections, interdependencies, and affinities between rural places and other rural and urban localities (Jones et al., 2019).

Lerner and Eakin (2011) discussed the emerging spaces that incorporate a mosaic of urban and rural worlds and reviewed the implications of these spaces for livelihoods and food production. This study contributed to the understanding of a relatively 'invisible' and under-researched farmers' community in a metropolitan countryside in Brazil. It attempted to deconstruct previous assumptions that the rural space is only subject to external interferences and actions. This study argued that the rural space should also be seen to possess its own dynamics and resilience that contributed to complex outcomes, in which the leadership of social actors created new forms of spatial ordering and adapted to scenarios of regional change.

Darnhofer (2010) examined farming as part of a set of systems across spatial scales, from farm to global, which encompassed the agro-ecological, economic, and political-social domains. Rather than focusing on production and efficiency, they argued that farm sustainability can be achieved through adaptability, learning, and change. Echoing the key themes within evolutionary economic geography, the authors suggested that, in the case of the farming sector, resilience is more likely to emerge when farmers have the capacity to transform the farm, if farm production is attuned to the local ecological carrying capacity, and when learning and innovation are targeted outcomes.

Small-scale farms play an important role in the countryside, yet their number is declining. This raises the question of what conveys resilience to small-scale farms, i.e. the ability to persist over the long-term by buffering shocks and adapting to change. Within the current approaches to farm resilience, two perspectives exist: the first focuses on material structures and highlights that farmer agency and wider social forces also play important roles. Darnhofer et al. (2016) argued a perspective focused on social relations, which has the potential to overcome both the structure-agency and ecological-social dichotomies.

Indeed, farms play an important role in maintaining social cohesion, producing food, providing energy from renewable resources, offering recreational and health care services, and maintaining cultural landscapes. At the farm level, empirical studies have focused mostly on the structures that enable flexibility, which is seen as key to the ability of farms to adapt over time. It is little surprise, therefore, that within this context of economic turbulence and ecological instability, the concept of resilience at the farm level has gained prominence in both political rhetoric and research. Darnhofer et al. (2016) built specifically on the concept of social-ecological resilience (Holling, 2001), as it emphasises the interdependence of social and ecological dynamics-two key aspects of farming-as well as the need to adapt and change, rather than the focusing on the ability to buffer shocks and return to 'normal'.

In recent years, agricultural sustainability has been linked with the concept of resilience, which emphasises dynamics, disequilibrium, and unpredictability in agricultural development. Learning to live with change and uncertainty and combining different types of knowledge appear critical for building resilience because change appears to be necessary for developing adaptive capacity (Folke et al., 2003). Among the diverse knowledge sources and learning forms that farmers use, Darnhofer et al. (2016) pointed to the particular role of farmers' experimental learning and networking in increasing the resilience of small-scale farmers. Thus, Šūmane et al. (2018) related the potential of informal knowledge in improving sustainability and resilience to its embeddedness in the specific social, economic, environmental contexts and its holistic character and dynamics in response to emerging opportunities, uncertainties, and risks.

The resilience of Brazilian farming systems faces a range of social, environmental, economic, and political disturbances and changes, such as market fluctuations, climate change, new technology, modification of governance structures, and operation at a range of scales. Brazilian agricultural policies usually focus on making agribusiness-farming systems more robust against shocks in the short term. However, a broader view of resilience is needed to ensure a sustainable small-scale agricultural sector in Brazil, which can develop farmer capacities and adapt farming systems to changing circumstances, as well as help to transform their agricultural models in order to maintain a long-term supply of food and public goods at the rural-urban interface.

Research methodology

New directions in rural geography have called for research that examines the impact of globalisation on everyday life (Woods, 2007; 2011; 2012). Using qualitative methods, rural studies of the effects of globalisation have provided new theoretical frameworks and insights into the rural domain via in-depth studies, bottom-up models, and multidimensional approaches. The purpose of this section is to describe the methodological approach applied in this research.

The present study used two different data sources to meet the research objectives: secondary sources (e.g. census data, published statistical data, historical records, research data); and in-depth methodologies to collect data, including interviews with key farming representatives (e.g. to understand how spatial processes have affected the dynamic of agriculture), and in-depth interviews (e.g. to understand complex issues of local cohesiveness and farming learning processes at the farm level). A key problem is the representativeness of the individual/stakeholder groups interviewed, and issues related to power networks (powerful actors are more likely to be heard) have to be considered throughout (Cloke et al., 2004; Flowerdew and Martin, 2005).

The stakeholders in the metropolitan countryside of Rio de Janeiro are many and heterogeneous, including farmers, non-farmers, local workers, residents, commercial marketers, community decision-makers, regional decision-makers, professional and public administration officials, and so forth. All of these actors actively participate in the process of rural change. Therefore, interviews can be very appropriate to collect various voices from different groups of people. Farmers were the stakeholder group selected as a key target audience for monitoring information concerning rural change and resilience.

The interviews with farmers were initially arranged by contacting community leaders in the study sites and the snowball method was used to garner further contacts. This sometimes involved going through "gatekeepers" (Cloke et al., 2004), at other times it involved "stratified snowballing" (de Wit, 2012), and participants were recruited mostly by personal invitation, i.e. they were contacted directly or via recommendations from others. The investigation involved seventy-seven interviews in total. Mobile interviews worked well with some farmers and rural extension officers who felt more comfortable being interviewed 'on the move' where they could point out features and challenges of farming whilst being asked questions. They also worked for farmers who preferred to be interviewed whilst going about their routines.

Case study

The Rio de Janeiro Metropolitan Region extends in an arc around Guanabara Bay, connecting two major cities, Rio de Janeiro and Niterói (Fig. 1). Urban pressure has always been more intense on the Rio de Janeiro fringe, the core city of the metropolitan region, while Niterói has grown at a slower pace. A first surge of urban expansion of Niterói occurred in the 1970s with the construction of the Rio de Janeiro-Niterói Bridge across Guanabara Bay, which connected the two cities directly. Greater change took place inland in the

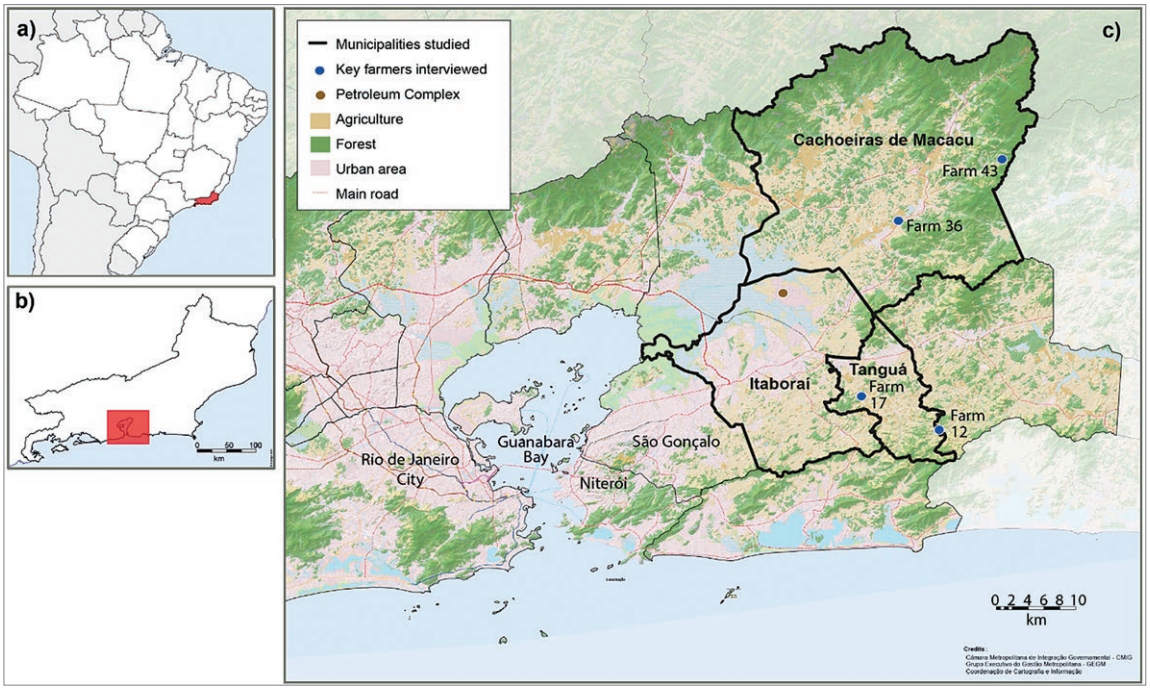

Fig. 1 Brazil, Rio de Janeiro State, Rio de Janeiro City, and the study area in the eastern part of the Rio de Janeiro Metropolitan Region.
Source: Câmara Metropolitana de Integração Governamental.

2000s when the COMPERJ petrochemical complex[1] provoked rapid urban expansion. If only new industry and housing development are considered, it would appear at first sight that trends are at work in the Eastern metro area which indicate that farming is destined to be eliminated. However, as this paper highlights, farming communities in this area are resisting but they face new challenges which demand adaptation.

Starting in the 1970s, the built-up area of Rio de Janeiro expanded outward and the metro population increased from 10.4 million inhabitants in 1991 to 12.3 million in 2016 (IBGE, 1991; 2010; 2016). New industrial and petroleum complexes and port facilities were built in the peri-metropolitan area but, according to IPEA (2012), the core still accounts for 53% of the metro population and 69% of gross internal product. Pressured by urban expansion and globalisation, rural activities have diminished in the metro region, but have not disappeared. This has raised issues concerning resilience and strategies for adaptation in a context of intense rural-urban land use competition.

Increasing competition from industrial, residential, and environmental functions are shown to present both opportunity and conflict for rural activities, thus creating a mosaic of diversified land use in both inner and outer metropolitan spaces. Some changes do not necessarily cause agricultural decline, rather they can induce rural development and adaptation wherein rural diversity responds to new demands of contemporary Brazilian society in the context of globalisation. Bicalho and Machado (2013) and Machado (2013; 2020) highlighted the resilience of rural space, wherein agricultural community stakeholders adapted to new situations as they arose in Greater Rio de Janeiro and its countryside over the years. New rural-urban interactions contribute to complex outcomes in which local actors create new forms of spatial order, and adapt to new scenarios of regional and global change.

1 The COMPERJ petrochemical complex transformed local economies in the Eastern Greater Rio de Janeiro. In addition to the refinery, a number of auxiliary industries were to be installed to attend to the various sub-processes of the new complex. This development created considerable employment opportunities in construction, industry, commerce, and services. However, this pressure has eased since 2015. In the wake of the worst economic crisis in Brazilian history, the construction of the refinery was suspended and may not be completed for years.

Rural dynamics in the Metropolitan Region of Rio de Janeiro have long been characterised by fragmented land ownership, land-intensive productive systems, and direct forms of marketing to consumers that are made possible by proximity to urban markets. Pressured by urban expansion and economic globalisation, rural activities have diminished in the metro region over recent decades, but have not disappeared. A 'rural Rio' still exists where, depending on the relative distance from the built-up metropolitan core, rural actors actively assert, negotiate, and practice their position in a multifunctional countryside.

The findings suggest that this is a rural area undergoing a process of change stemming from its incorporation into the metropolitan dynamics. It is a geographical space that reflects challenges of sustainability and multifunctionality in the global era. Even in the face of external pressures resulting from the new position of the metropolitan area in the dynamics of global rural-urban interactions, rural actors have responded to restructuring with multidirectional and multidirectional trajectories. The complexity of the Metropolitan Region of Rio de Janeiro and its countryside reveals diverse situations, and both resilient actors and actors vulnerable to the process of rural change.

Rural innovation of small-scale farming systems: fruit farming as an example of agricultural adaptation

Data on the number of farms and agricultural land use area in East of Guanabara Bay from 1960 to 2017 indicate multidirectional trajectories (Tab. 1). Part of this can be explained by the increases in population and urban activities discussed earlier and the decrease in the rural population in the coastal lowlands after the construction of the Rio-Niterói Bridge (1968–1974), which attracted a considerable amount of population to the region, and partly due to internal rural-urban migration in the municipalities in eastern Greater Rio. These changes also reflect the redistribution of economic activities. Due to the influence of COMPERJ (Petrochemical Complex), these municipalities have become part of a new phase of urbanisation and industrialisation in the Rio Metropolitan Region. Farms became smaller over the 1980–2006 period, but have since increased in size. This fact indicates that farming, particularly smaller-scale family farming, is reviving to an extent as agricultural activities re-establish themselves following the initial 'onslaught' of urbanisation.

The greater spatial mobility of the population due to the expansion of regional infrastructure and territorial integration of the state of Rio de Janeiro indicates the intensification of rural-urban interactions. Due to the urbanisation process and the new urban-industrial investments, greater mobility and population dynamics have allowed the migration of rural workers and members of rural families to other areas and urban sectors. The research argues that the process of rural change is not linear, and there may be resistance, resilience, and adaptation by groups of social actors.

Tab. 1 Number of farms and agricultural land use (hectares) in the municipalities of Magé, Guapimirim, Cachoeiras de Macacu, Itaboraí, Tanguá, Rio Bonito e Saquarema since 1960.

year	1960	1970	1980	1995	2006	2017
farms	3,812	8,761	10,856	3,959	3,713	5,440
hectares	157,062	166,558	159,158	103,363	85,777	99,301

Source: IBGE (1960–2017)

Tab. 2 Area of farmland by crop type in three peripheral case study municipalities of Greater Rio de Janeiro in 2016 used in this study (in hectares).

municipality	fruit	vegetables	tubers	total
Cachoeiras de Macacu	720 (36.7%)	44 (2.2%)	1,200 (61.1%)	1,964 (100%)
Itaboraí	95 (69.9%)	12 (8.8%)	29 (21.3%)	136 (100%)
Tanguá	764 (79.4%)	48 (5.0%)	150 (15.6%)	962 (100%)

Source: IBGE (2016)

The loss of rural workers to other sectors, for example, requires farming systems to increase labour productivity and profitability. Switching crops is an indicator of agricultural adaptation in this direction, including substitution of crops with lower market value for products with greater market value, such as planting permanent fruit crops (Tab. 2). Farming adaptation happens by combining different types of knowledge, social organisations, innovations, and cross-scale linkages in the production system. These factors have created relatively resilient systems at the farm level and have been part of the process of rural change and adaptation of small-scale farming systems in Brazilian metropolitan regions (Bicalho, 1992; Bicalho, 1998; Machado, 2013; 2020).

Municipalities more directly affected by urban encroachment tend to shift to fruit crops (Fig. 2) while others have expanded manioc cropping. Manioc is a root crop that also requires fewer workers. It is a local delicacy and thus has a guaranteed market in Rio de Janeiro (Tab. 3). Production of fresh vegetables near cities continues to be important and is a land-intensive activity which can be harvested multiple times per season on small plots of land. In general, farmers practice a combination of different crops and animal husbandry, so the metropolitan region can also be characterised as a poly-culture area.

Urban food supply dates from the first decades of the 20th century, with the formation of horticultural production areas by foreign immigrants (particularly Portuguese and Japanese) in small farms near the urban centres of Rio de Janeiro and São Paulo to supply these large cities with fresh products. The rapid growth of the urban population has raised the issue of food supply to cities. This policy for the creation of production areas was never explicit but, even so, agriculture near Brazil's major urban centres has been maintained, which has encouraged a strong presence of small-scale farmers.

Tab. 3 Agricultural production in the aforementioned peripheral municipalities of Greater Rio de Janeiro in 2017.

Municipality	Fruit		Vegetables		Tubers	
	Production (t)	Value (R$)	Production (T)	Value (R$)	Production (t)	Value (R$)
Cachoeiras de Macacu	16,340.2	25,810,600	11,519.5	14,346,828	15,033.9	18,710,822
Itaboraí	1,065.7	1,253,990	411.8	498,555	347.5	397,100
Tanguá	20,066.4	23,536,124	944.8	3,035,465	3,250.0	5,005,000

Source: EMATER-Rio (2017)

Fig. 2 Low-priced agricultural crops have been replaced by fruit crops that can produce high yields in small areas, Cachoeiras de Macacu, Rio de Janeiro
Source: Author (2017)

Small-scale establishments and the predominance of owners-farmers (Tab. 4) dominate the agrarian structure in the metropolitan countryside of Rio de Janeiro. In relation to the land structure in the municipalities of Cachoeiras de Macacu, Itaboraí and Tanguá, 82.2% of rural establishments have less than 20 ha (Tab. 5). This agrarian structure results in part from the hereditary division of land over generations, and it is common to find farmers who are the sons/daughters and grandsons/granddaughters of former owners who benefited from land reform projects. Both tendencies are associated with a fragmented land structure and family labour relations.

The land structure of small rural establishments with intensive production systems and the prevalence of family labour relations are typical of rural areas in and around Brazilian metropolitan areas. During interviews, farmers (36 and 40) showed productive strategies that prioritise crop substitution and more

Tab. 4 Number of rural establishments by legal status of farmer in Cachoeiras de Macacu, Itaboraí and Tanguá in 2017.

Municipality	Owner	Leased	Partner	On Loan	Occupant	Without property's deed
Cachoeiras de Macacu	75%	4.3%	8.6%	3.6%	1.5%	7%
Itaboraí	81%	5.7%	6.5%	3.5%	3.3%	-
Tanguá	79.9%	4.7%	1.8%	2.9%	1.3%	0.4%

Source: IBGE (2017)

land-intensive production systems to increase profit as part of farmers' resilience processes, thus maintaining productive agricultural areas in a rural-urban setting. In this highly unstable and complex space, strategies of productive adaptation have arisen amid the pressure for urban conversion.

Agricultural crops and changes in cultivation methods reflect regional transformations. Most rural establishments are small (Tab. 5) and use family labour. Many respondents explained that hired labour is scarce because many rural workers have left the agriculture sector for the urban, industrial, and service sectors. The increased demand for land for non-agricultural uses increases the price of land and makes it difficult to purchase more land to expand production. Consequently, land is intensely cultivated.

It turns out that some small and medium-sized farmers are adapting to urbanisation by adopting more lucrative activities, investing in new methods and forms of commercialisation of agricultural products (e.g. farmers 17, 36, 39, 40, and 41). Proximity to urban areas increases demand and competition for land and labour, but also increases the demand for agricultural products that can promote agricultural development. Low-priced agricultural crops, such as beans and corn, have been replaced by crops that can produce high yields in small areas. If the farmers have a little more land, they grow high-value fruits. Citrus cultivation has been re-stimulated and guava cultivation can generate considerable yields and income in the metropolitan context. High quality fruit is commercialised in the Metropolitan Region of Rio de Janeiro (Machado, 2013). However, opportunities must be perceived by farmers who are engaged with rural innovation (Bryant and Johnston, 1992)

In relation to the productive system, one element that deserves to be emphasised is the framework for substituting agricultural crops, which indicates dynamism and strategies for adapting agriculture to the rural-urban configuration, as discussed during interviews with farmers (12, 17, 33, 36, 40, and 43). Over the last few decades, there have been several changes in the production system and the introduction of new agricultural crops that have accompanied the appreciation of specific urban agricultural markets.

Since the end of the 1970s, fruit production has been the most resilient and adaptable to urban pressures and is becoming more important in municipalities, with some rural producers seeking to establish quality standards. Its suitability to the environment of the countryside of the Metropolitan Region of Rio de Janeiro is due to its profitability and continuous ability to generate income throughout the year, as argued by several policymakers (1, 4, 13, and 16) and additional farmers (12, 36, and 40). Specialised sets of a given crop are distributed in hillside and lowland areas. The slope is an area dominated by banana production, while the lowland tends to specialise in other fruits, especially guava and citrus (Tab. 6).

Rural areas close to large cities are also characterised by social heterogeneity, due to the multi-functionality of the contemporary rural spaces, which combine agricultural and non-agricultural activities. Bicalho

Tab. 5 Number of rural establishments by total area group in Cachoeiras de Macacu, Itaboraí and Tanguá in 2017.

Municipality	Less than 20 ha	20 to 100 ha	100 to 200 ha	200 To 500 ha	500 To 1000 ha	More than 1000 ha	Total
Cachoeiras de Macacu	83.5%	13.4%	1.9%	0.6%	0.5%	0.04%	2151 (100.0)
Itaboraí	79.5%	13.2%	3.3%	2.4%	0.9%	0.7%	448 (100.0)
Tanguá	83.7%	12.9%	2%	0.7%	0.5%	0.2%	441 (100.0)

Source: IBGE (2017)

Tab. 6 Agricultural production of the main fruit products in the municipalities of Cachoeiras de Macacu, Itaboraí and Tanguá in 2017 (tons).

Fruit	Cachoeiras de Macacu	Itaboraí	Tanguá
Banana	1,643.00	238.70	110.00
Coconut	665.00	46.80	490.00
Guava	12,085.00	-	-
Orange	350.50	583.00	17,959.00
Lemon	862.00	138.90	1,542.35
Passion fruit	735.00	-	-

Source: EMATER-Rio (2017)

(2008) indicated that, considering the agricultural exploitation of areas with strong rural-urban interactions, horticulture and fruit-growing activities stand out. They are also characterised by the presence of small-scale production with differentiated levels of capitalisation, intensive systems in the use of land and capital, and diversity in terms of the commercial purpose of production and the manner of placement on the market. Thus, it is possible to confirm that, in the process of spatial restructuring in the metropolitan countryside, agricultural activities that have traditionally been located in these areas of rural-urban interaction remain significant.

Small-scale farms resist pressures from urbanisation and industrialisation: changes from productivist systems to a quality turn in agriculture

Learning to live with change and uncertainty highlights the need to build and retain memories of past events, to abandon the notion of stability, to 'expect the unexpected,' and to increase the capacity to learn from crises (Berkes, 2007). At the farm level, this factor is mostly related to the perception and worldview of the members of the farm family, and to ensuring a degree of flexibility and adaptiveness.

The context of rural transformation presents challenges to agriculture in the metropolitan countryside of Rio de Janeiro. In recent years, rural areas have undergone spatial changes that include population mobility, conflict of land use, influence of external social actors on land prices, and strong pressure for conversion to urban-industrial use. The incorporation of peripheral municipalities into the Metropolitan Region of Rio de Janeiro also challenges the scale, when territorial planning involves global and regional issues in addition to local politics.

A decrease of rural workers, for example, requires adaptation of technical systems to suit a lower intensity of agricultural work. The process of switching agricultural crops is an indicator of the adaptation process. In the case study areas, there has been a substitution of crops of lower market value and volume of production with, in most cases, temporary to permanent crops of differentiated quality and greater market value. Substitution of temporary crops with fruit-growing products may also signify the adaptation of agriculture to the decrease in the number of rural workers and high pressure for profitable land use.

The valuable contribution to local food production that small-scale farming systems make within rural and peripheral regions, including the enhanced reputation of regions for their food expertise and culture, has been widely acknowledged (Ilbery and Kneafsey, 2000; Murdoch et al., 2000; Hinrichs and Welsh, 2003; Marsden and Smith, 2005; Tregear et al., 2007). Speciality food enterprises are a central topic of discussion in the growing body of agri-food systems literature around 'alternative food networks,' 'short supply chains,' and the 'turn to quality' since the turn of the last century. This literature has explored the territorial embeddedness of food systems, with a focus on alternative food networks that are associated with concepts of quality, trust, and place, in order to characterise this phenomenon as a turn towards the re-localisation of food (Moragues-Faus and Sonnino, 2012).

The importance of network building within this context has been highlighted by Ilbery and Kneafsey (2000), and the network concept has assisted in understanding the diverse forms of rural development (Murdoch, 2000). The network perspective recognises the myriad connections that occur between actors and institutions in different spaces and places. Relations and power dynamics between farmers was highlighted by Chiffoleau (2009) and Bowen (2011), and there have been calls from food systems scholars for greater examination of the context and environment within which alternative food networks operate (Sonnino, 2007; Bowen, 2011).

Urban centres and their surrounding rural peripheries, like the study area, have been given prominence in recent rural research. New foodscapes emerge in rural-urban spaces where alliances are forged between better-informed consumers with a health agenda and local farmers who offer organic and quality food products via alternative distribution networks, and so act as an environmental and social counter-force to intensive global food systems (Marsden and Smith, 2005; Goodman et al., 2011; Marsden and Morely, 2014).

Production of guavas is one of the most innovative activities as it involves new farming practices and marketing innovation in the form of packaging and branding to preserve the image and reputation of the product. This guarantees price stability, retains customer loyalty over time, and prices can be over two times higher than that for common guavas. This case illustrates how technical knowledge is gained over time in the transition towards quality production in the small-scale fruit sector and the importance of on-farm experimentation in the learning process. Setting up small-scale sweets production facilities is another way to add value to guava production as it allows farmers to make use of a larger amount of fruit which would otherwise be discarded. One producer has a farm with only 8.5 hectares but annually markets over 300 tons of a select branded guava, registered with the National Association of Industrial and Intellectual Property (ANPII) (Farmer 36). Prices received are over two times those for common guavas[2]. The following quote illustrates this process:

'*I have adopted high-quality guava production. We [small-scale farmers] have to adjust. I have used a bar code that permits the customer to know what product it is. It is for the customer to know that this product has good quality and its origin*' (Farmer 36, Cachoeiras de Macacu).

The promotion of local quality production has assumed a high profile in recent rural development strategies, as it promises a means of strengthening the position of traditional producers and their products. Production profiles and patterns are replaced by a kaleidoscopic representation, whereby the "multiplicity of technological and organisational productive systems co-exist. There is thus no longer a model of rural development but many possible trajectories" (Murdoch 2000, 413).

Marketing has also undergone considerable change as long market chains are replaced by more direct forms of selling produce, which reduces the number of intermediaries and lowers transaction costs. With closer contact with end consumers, farmers have learned how to cater to preferences, habits, values, and images

2 Fruit classification is part of the language of quality production and its adoption ensures transparency in marketing. Nowadays, most market classification is based on the number of fruits per box, which defines the type of guava fruit. Thus, to say that a guava is type 12 means that there are approximately twelve fruits of similar size in the box.

concerning the product offered. This is particularly evident in organic and fruit farming in which production is adjusted to consumer demand and not the other way around. Farmers (12 and 36) reflected on this issue throughout their interviews:

'*There are several issues that we have to observe, what the customer wants, and the quality*' (farmer 36 owns a farm with 8.5 hectares and annually markets 300 tons of a selected branded guava, Cachoeiras de Macacu).

During interviews, several policymakers explained that one of the most significant crises of citrus cultivation in Rio de Janeiro was the manifestation of pests in orchards. Other economic factors that also accentuated the crisis were the reduction of agricultural subsidies and State intervention in the context of the crisis of the Brazilian economy in the 1990s and the growth of citrus production in São Paulo state and its power in the domestic and global market. Because of economic market competition and natural crisis, most large farms abandoned orchards infected by pests and diseases. The tradition of citrus cultivation, the possibility of disease control, and alternative market dynamics in the context of small-scale production has allowed flexibility in the treatment, maintenance, and adaptation of small-scale farming.

Agricultural modernisation in other regions of Brazil and national interests in the country's second largest urban consumer market create challenges for agriculture in the peripheral countryside of Rio de Janeiro Metropolis. Other adaptation strategies have been the transition from productivist regimes to an agricultural quality system that can guarantee better prices via differentiation of products for the local and regional markets. In outdoors markets of Rio and its surroundings, it is possible to observe differences of price of 'Rio' or 'Itaboraí' oranges and products produced in other regions of Brazil. The same occurs with the guava crop, as seen previously, that has been commercialised in boxes selected for specific markets in Rio de Janeiro; resulting in the sale of a better-quality product, or in agro-industrial processing by the family farmers of Rio de Janeiro state who benefited from the National Program for Strengthening Family Agriculture (PRONAF) (e.g. farmers 36, 39, 40, and 41).

Crafts and traditional regionally identified products have also increased. As a result, in different parts of the rural periphery of the Rio de Janeiro Metropolitan Region it is common to encounter not just urban conversion but also contested countrysides, where farmers resist and adapt to urban encroachment. However, not all farmers have been able to seize new opportunities. Farmers who have good soil and have acquired some capital over time have been able to make the transition but farmers who have poor land, low capital, or land subject to flooding have not. An important point to emphasize is the importance of farmers being open to change, which also contributes to the complex outcomes dealt with here. This investigation has tried to show how many farmers in the metropolitan countryside have adopted new methods and creatively maintained agricultural activities in order to adapt to new scenarios of regional change.

Conclusion

One of the research questions is to understand the processes involved in adapting farming systems and the learning processes that social actors go through as part of their attempts to survive and prosper in a changing rural context. The spatial mobility of the population resulting from the improvement of regional infrastructure and territorial integration in Rio de Janeiro State has led to an intensification of rural-urban interactions. Via urbanisation and new urban-industrial investments, the mobility and dynamics of the population have come to include migration of rural workers and members of family farms to urban areas. However, the research argues that the process of rural change is not linear or one-dimensional, and there is evidence of resistance, resourcefulness, resilience, and adaptation by a certain group of social actors.

The changing nature of agriculture and its links to other rural sectors require the development of mixed knowledge and learning networks that include both agricultural and non-agricultural stakeholders. In some

cases, such mixed knowledge networks were clearly operating, but in other cases, there were cognitive, structural, or organisational barriers. These obstacles also point to the changes needed in agricultural research policy and rural extension services to respond better to farmers' learning and innovation needs (Diesel and Miná Dias, 2016; Šūmane et al., 2018; Meek, 2019). One way of encouraging these approaches and learning processes further would be to better target policies in Rio de Janeiro and beyond for the purpose of developing regional quality food systems and small-scale agricultural strategies.

The article highlighted patterns of fruit farming, and its quality within the contradictory relationship between urban, industrial, and global forces, on the viability of emancipatory foodscapes on the edges of a metropolitan region in Brazil. Land tenure and social formation are results of past agrarian history and influence the course of conversion of farmland to other uses as well as resistance or dynamic adaptation in rural-urban interaction. Farmers have long played a significant role in shaping rural landscapes, and their necessarily embodied practices and experimental knowledge create a particular relationship between themselves and the land. Once a fruit tree is planted, the land is in agricultural use. Fruit trees make things happen – they have re-shaped social relations and transformed the rural economy in the countryside of Rio de Janeiro Metropolis.

Acknowledgements

The research on which this article is based was funded by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES-Brazil), the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq-Brazil) and the Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ-Brazil). The author would also like to thank Professor Geoff Wilson for his invaluable help and guidance during their period of PhD research at the University of Plymouth, United Kingdom.

References

Berkes, F., 2007: Understanding uncertainty and reducing vulnerability: lessons from resilience thinking, *Natural Hazards* 41, 283-295. https://doi.org/10.1007/s11069-006-9036-7.

Bicalho, A. M., 1992: Agricultura e meio ambiente no município do Rio de Janeiro, in: Abreu, M.A. (ed.): *Sociedade e Natureza no Rio de Janeiro*, Prefeitura da Cidade do Rio de Janeiro, Rio de Janeiro, 285- 316.

Bicalho, A. M., 1998: Sustainable metropolitan agriculture in Brazil, in: Bowler, I. R., Bryant, C., Huigen, P. (eds.): *Dimensions of Sustainable Rural Systems*, Reijkuniversiteit Groningen, Groningen, 97-104.

Bicalho, A. M. 2008: Comercialização da produção familiar: canais de distribuição da hortifruticultura no abastecimento urbano, in: Oliveira, M. P, Coelho, M. C. N., Corrêa, A. M (eds.): *O Brasil, a América Latina e o mundo: espacialidades contemporâneas (II)*, Rio de Janeiro: Lamparina/Faperj/Anpege, Rio de Janeiro, 279-298.

Bicalho, A. M., Machado, F. S., 2013: Do agrário ao periurbano: o município de Cachoeiras de Macacu na Região Metropolitana do Rio de Janeiro, *Geografia (Rio Claro)* 38, 545-564.

Bryant, C. R., Johnston, T. R. R., 1992 : *Agriculture in the city's countryside*, University of Toronto Press, Toronto.

Bowen, S., 2011: The importance of place: re-territorialising embeddedness, *Sociologia Ruralis* 51 (4), 325-348. https://doi.org/10.1111/j.1467-9523.2011.00543.x.

Chiffoleau, Y., 2009: From politics to co-operation: the dynamics of embeddedness in alternative food supply chains, *Sociologia Ruralis* 49 (3), 218-235. https://doi.org/10.1111/j.1467-9523.2009.00491.x.

Cloke, P., Cook, I., Crang, P., Goodwin, M., Painter, J., Philo, C., 2004: *Practising Human Geography*, Sage, London.

Cloke, P., Marsden, T., Mooney, P. (eds.), 2006: *Handbook of Rural Studies*, Sage, London. https://dx.doi.org/10.4135/9781848608016.

Darnhofer, I., 2010: Strategies of family farms to strengthen their resilience, *Environmental Policy and Governance* 20, 212- 222. https://doi.org/10.1002/eet.547.

Darnhofer, I., 2014: Resilience and why it matters for farm management, *European Review of Agricultural Economics* 41, 461- 484. https://doi.org/10.1093/erae/jbu012.

Darnhofer, I., Lamine, C., Strauss, A., Navarrete, M., 2016.: The resilience of family farms: towards a relational approach, *Journal of Rural Studies* 44, 111- 122. https://doi.org/10.1016/j.jrurstud.2016.01.013.

de Wit, C., 2012: Interviewing for Sense of Place, *Journal of Cultural Geography* 30 (1), 120-144. https://doi.org/10.1080/08873631.2012.745979.

Diesel, V., Miná Dias, M., 2016: The Brazilian experience with agroecological extension: A critical analysis of reform in a pluralistic extension system, *The Journal of Agricultural Education and Extension* 22 (5), 415-433. https://doi.org/10.1080/1389224X.2016.1227058.

EMATER RJ (Empresa de Assistência Técnica e Extensão Rural do Rio de Janeiro), 2017: Acompanhamento Sistemático da Produção Agrícola, Rio de Janeiro.

Flowerdew, R., Martin, D., 2005: *Methods in Human Geography: a guide for students doing a research project*, Pearson Education, Harlow.

Folke, C., Colding, J., Berkes, F., 2003: Building resilience and adaptive capacity in social-ecological systems, in: Berkes, F., Colding, J., Folke, C. (eds.): *Navigating Social-Ecological Systems*, Cambridge University Press, Cambridge, 352-473.

Goodman, D., Dupuis, E. M., Goodman, M. K., 2011: *Alternative Food Networks*, Routledge, London.

Goodwin, M., 2013: Regions, territories and relationality: exploring the regional dimensions of political practice, *Regional Studies* 47, 1181-1190. https://doi.org/10.1080/00343404.2012.697138.

Hedblom, M., Andersson, E., Borgström, S., 2017: Flexible land-use and undefined governance: From threats to potentials in peri-urban landscape planning, *Land Use Policy* 63, 523– 527, https://doi.org/10.1016/j.landusepol.2017.02.022.

Hinrichs, C. C., 2003: The practice and politics of food system localisation, *Journal of Rural Studies* 19, 33- 45. https://doi.org/10.1016/S0743-0167(02)00040-2.

Hoefle, S. W., 2014: Fishing livelihoods, seashore tourism and industrial development in Coastal Rio de Janeiro: conflict, multifunctionality, and juxtaposition, *Geographical Research* 52, 198-211. https://doi.org/10.1111/1745-5871.12061.

Holling, C.S., 2001: Understanding the complexity of economic, ecological and social systems. *Ecosystems* 4, 390-405. https://doi.org/10.1007/s10021-001-0101-5.

IBGE (Instituto Brasileiro de Geografia e Estatística), 1960: Censo Agropecuário, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 1970: Censo Agropecuário, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 1980: Censo Agropecuário, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 1991: Censo Demográfico, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 1995/96: Censo Agropecuário, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 2006: Censo Agropecuário, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 2010: Censo Demográfico, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 2016: IBGE Divulga Estimativa populacionais dos Municípios em 2016, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 2016: Produção Agrícola Municipal 2016, Rio de Janeiro.

IBGE (Instituto Brasileiro de Geografia e Estatística), 2017: Censo Agropecuário: Resultados Preliminares, Rio de Janeiro.

Ilbery, B., Kneafsey, M., 2000: Registering regional speciality food and drink products in the United Kingdom: The case of PDOs and PGIs, *Area* 32 (3), 317-325. https://doi.org/10.1111/j.1475-4762.2000.tb00144.x.

Ingram, J., 2018: Agricultural transition: niche and regime knowledge systems' boundary dynamics, *Environmental Innovation and Societal Transitions* 26, 117-135. https://doi.org/10.1016/j.eist.2017.05.001.

IPEA (Instituto de Pesquisa Econômica Aplicada), 2012: *Governança Metropolitana. Rio de Janeiro*, IPEA, Rio de Janeiro.

Jones, L., Heley, J., Woods, M., 2019: Unravelling the global wool assemblage: researching place and production networks in the global countryside, *Sociologia Ruralis* 59, 137-158. https://doi.org/10.1111/soru.12220.

Levine, R. M., 1979: *Historical Dictionary of Brazil*, Scarecrow Press, Metuchen.

Lerner, A.M., Eakin, H., 2011: An obsolete dichotomy? Rethinking the rural–urban interface in terms of food security and production in the global south, *The Geographical Journal* 177, 311-320. https://doi.org/10.1111/j.1475-4959.2010.00394.x.

Machado, F. S., 2013: *Agricultura e Reestruturação Espacial na Interface Rural-Urbana: o exemplo do município de Cachoeiras de Macacu (RJ)*, M.Sc. thesis, Federal University of Rio de Janeiro, Rio de Janeiro.

Machado, F.S., 2017: Rural change in the context of globalization: examining theoretical issues, *Hungarian Geographical Bulletin* 66, 43-53. https://doi.org/10.15201/hungeobull.66.1.5.

Machado, F.S., 2020: Rural change and farming resilience 'on the ground': approaching a relational perspective to strengthen local governance in the Brazilian countryside. *People, Place and Policy Online* 14, 232–248. https://doi.org/10.3351/ppp.2020.4564648242.

Marsden, T., Morely, A., 2014: Current food questions and their scholarly challenges, in: Marsden, T., Morely, A. *(eds.): Sustainable Food Systems*: Building a New Paradigm, Earthscan/Routledge, Milton Park, 1-29.

Marsden, T., Smith, E., 2005: Ecological entrepreneurship: sustainable development in local communities through quality food production and local branding, *Geoforum* 36, 53-62. https://doi.org/10.1016/j.geoforum.2004.07.008.

Meek, D., 2019: The geography of education and the education of geography: agricultural extension and the political ecology of education, *The Professional Geographer* 7 (1), 65-74. https://doi.org/10.1080/00330124.2018.1455522.

Moragues-Faus, A.M., Sonnino, R., 2012: Embedding quality in the agro-food system: the dynamics and implications of place-making strategies in the olive oil sector of Alto Palancia, Spain, *Sociologia Ruralis* 52 (2), 215-234. https://doi.org/10.1111/j.1467-9523.2011.00558.x.

Murdoch, J., 2000: Networks – a new paradigm of rural development?, *Journal of Rural Studies* 16, 407- 419. https://doi.org/10.1016/S0743-0167(00)00022-x.

Murdoch, J., Marsden, T., Banks, J., 2000: Quality, nature, and embeddedness: some theoretical considerations in the context of the food sector, *Economic Geography* 76 (2), 107-125. https://doi.org/10.1111/j.1944-8287.2000.tb00136.x.

Sonnino, R., 2007: Embeddedness in action: saffron and the making of the local in southern Tuscany, *Agriculture and Human Values* 24 (1), 61-74. https://doi.org/10.1007/s10460-006-9036-y.

Šūmane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkpfs, T., des los Rios, I., Rivera, M., Chebach, T., Ashkenazy, A., 2018: Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture, *Journal of Rural Studies* 59, 232- 241. https://doi.org/10.1016/j.jrurstud.2017.01.020.

Tregear, A., Arfini, F., Belletti, G., Marescotti, A., 2007: Regional foods and rural development: the role of product qualification, *Journal of Rural Studies* 23 (1), 12-22. https://doi.org/10.1016/j.jrurstud.2006.09.010.

Wilson, G. A., 2008: From 'weak' to 'strong' multifunctionality: conceptualising farm-level multifunctional transitional pathways, *Journal of Rural Studies* 24, 367-383. https://doi.org/10.1016/j.jrurstud.2007.12.010.

Wilson, G. A., 2010: Multifunctional 'quality' and rural community resilience, *Transactions of the Institute of British Geographers* 35, 364-381. https://doi.org/10.1111/j.1475-5661.2010.00391.x.

Woods, M., 2007: Engaging the global countryside: globalisation, hybridity and the reconstitution of rural place, *Progress in Human Geography* 31, 485-507. https://doi.org/10.1177/0309132507079503.

Woods, M., 2011: *Rural*, Routledge, Abingdon. https://doi.org/10.4324/9780203844304.

Woods, M., 2012: New directions in rural studies?, *Journal of Rural Studies* 28, 1-4. https://doi.org/10.1016/j.jrurstud.2011.12.002.

Author

Felipe da Silva Machado felipemachado@ufrj.br
PhD, Postdoctoral Research Fellow, Federal University of Rio de Janeiro, Geography Department, Ilha do Fundão, Rio de Janeiro, 21941-590, Brazil,