

BIODIVERSITY CONSERVATION AND THE BRAZILIAN FOREST CODE:

**SMALL-SCALE FARMERS AND LAW COMPLIANCE IN
SOUTHERN BRAZIL**

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Thesis submitted in fulfillment of the requirements for Lund University International Master's Programme in Environmental Studies and Sustainability Science (LUMES).

Supervisor: Sara Brogaard, PhD

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*Não basta abrir a janela
Para ver os campos e o rio.
Não é bastante não ser cego
Para ver as árvores e as flores.*

*“Opening the window is not enough
To see the fields and the river.
Not being blind is not enough
To see the trees and the flowers.”
(Free translation)*

Alberto Caeiro (Fernando Pessoa)

ABSTRACT

Various strategies may be used to promote biodiversity conservation on private land and support conservation at the landscape level. Brazil has had a law that addresses this issue to some extent since 1934. It is called Forest Code (FC), and has been revised twice, in 1965 and 2012. One of the reasons that led to its most recent revision was insufficient compliance among landowners. Another argument was that it was difficult to conciliate agricultural practices and conservation needs as established by the FC in small rural properties. A case study was carried out in the municipality of Arroio do Tigre, state of Rio Grande do Sul, to investigate factors that influenced small-scale farmers' motivations to comply with the FC. Semi-structured interviews with small-scale farmers were carried out, and data was examined through thematic analysis. Findings demonstrate that diverse factors affected their compliance decisions by influencing their instrumental, normative, and legitimacy motivations for compliance. These factors are enforcement of the law, socioeconomic conditions, perceptions about forests, group behavior, distribution of costs and benefits, and contradictory governmental policies. Awareness about regulations also played a role. Strategies that could support increased conformity with the FC, as well as the possibility of the 2012 FC achieving greater compliance, and considerations on implications of the latest version of the law for biodiversity conservation are discussed.

Keywords: biodiversity conservation strategies; private land; regulation; compliance theory; Atlantic Forest.

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1. INTRODUCTION AND AIM

Many strategies have been used to promote conservation of biodiversity and of different ecosystems in the world, the creation of Protected Areas (PAs) being one of the most common approaches towards this goal. Nevertheless, it may not be sufficient because the conservation status of the surroundings of a PA has great influence on the ecological processes inside it (LAURANCE et al., 2012). Loss of habitat, fragmentation, as well as isolation and lack of connectivity among fragments negatively affect the movement of animals in the landscape, the dispersion of pollen and seeds, and the establishment of individuals. As a consequence, feeding and reproductive processes are impacted, and biological interactions changed, leading to vulnerability of populations, species and ecosystems (RODRIGUES and PRIMACK, 2001). Conservation at the landscape level therefore gains importance and relevance, and the debate on how to integrate agricultural practices with biodiversity conservation is prominent (HARVEY et al., 2008).

Various approaches can be used to promote conservation on private land, and they include both regulatory and non-regulatory instruments. While regulatory, command and control measures may not please landowners due to possible reductions on land available for other activities and income generation (TIKKA and KAUPPI, 2003); persuading them to conserve through non-regulatory strategies such as educational programs, technical assistance, market creation (DOREMUS, 2003), and payments for ecosystem services (PAGIOLA, 2008) is generally more socially acceptable (PALONIEMI and TIKKA, 2008). Nevertheless, non-regulatory strategies may not guarantee conservation needs are met since they are dependent on landowners' active participation (DOREMUS, 2003; MAYER and TIKKA, 2006).

Brazil is recognized as one of the most biodiverse countries in the world. While it has several PAs, which occupied approximately 9 % of its territory in 2006 (IBGE, 2006), these are unevenly distributed across its regions and biomes, and particularly concentrated in the Amazon (SAPAROVEK et al., 2010). Moreover, Brazil has had a law that addresses conservation at the landscape level to some extent since 1934. This

law is called *Código Florestal*¹ (“Forest Code”; FC), and has been revised twice, in 1965 and 2012. It is especially important for fragmented landscapes, and is the most important conservation strategy for private rural landholdings in Brazil (SPAROVEK et al., 2012), which occupy approximately 39 % of its territory (IBGE, 2006). However, evidence shows it has not achieved a high compliance level among landowners. Studies demonstrate that areas where native vegetation should have been maintained or restored are being used with different purposes (BACHA, 2005; DITT et al., 2008; OLIVEIRA et al., 2008; SPAROVEK et al., 2010; OKUYAMA et al., 2012), such as agriculture and cattle raising. In spite of this, few studies have addressed factors that influence landowners’ compliance with the FC (ALARCON et al., 2010; SANT’ANNA et al., 2012), even though they are the ones that ultimately make the decision on whether to conserve or not.

Insufficient compliance was in fact one of the factors that motivated the last revision of the FC in 2012 (SPAROVEK et al., 2012). This last revision occurred in the middle of a large debate. While environmentalists wanted to guarantee an enhanced effectiveness of the FC as a conservation strategy; people with connections to the agricultural sector, the so-called ‘ruralists’, defended a weakened law as the FC supposedly slowed down agricultural development in the country. On the other hand, Brazilian scientists claimed modifications to the FC should be based on scientific advances; they argued if alterations did not rely on scientific knowledge, negative environmental, social and economic consequences could occur (SBPC and ABC, 2011). With the end of the revision process, the most recent version of the FC is considered an environmental setback by many, mainly by professionals from environmental fields and academia.

My aim is therefore to investigate factors that influenced small-scale farmers’ motivations to comply with the 1965 FC. I was motivated by one of the arguments used by ‘ruralists’ to support a less strict law. It was argued that the 1965 FC jeopardized subsistence of this group of actors because of the need to set-aside part of their property for conservation, reducing the amount of land available for agricultural practices (REBELO, 2010). Through thematic analysis of semi-structured interviews with small-scale farmers, I examined factors that had an effect on compliance decisions with the

¹ Since 1965, the Brazilian Forest Code applies to all forms of native vegetation in the country, and not only to forests.

1965 FC in light of compliance theory (SUTINEN and KUPERAN, 1999; TYLER, 2006; RAMMCILOVIC-SUOMINEN and EPSTEIN, 2012). A case study was carried out in the municipality of Arroio do Tigre, state of Rio Grande do Sul, because it is characterized by the presence of family agriculture (KARNOPP, 2003; REDIN, 2011), and is located in the Atlantic Forest biome. This biome is considered one of the hottest biodiversity hotspots in the world (MYERS, 2000), and native vegetation remains mainly in fragments on private land (RIBEIRO et al., 2009). The research questions that guided this study were:

- What factors negatively influenced small-scale farmers' compliance with the 1965 FC, and how do they relate to compliance theory?
- How could these factors be addressed so as to increase small-scale farmers' compliance with the FC?
- To what extent were these factors addressed by the revision of the 1965 FC, and what could be its implications for biodiversity conservation?

I start the thesis by presenting an overview of the three versions of the FC, focusing on their implications for small rural landholdings. I then introduce compliance theory, and describe the methods used in the study. In the following section, the analysis of the factors that influenced small-scale farmers' motivations to obey the 1965 FC in Arroio do Tigre is carried out. I finish by discussing these factors in light of compliance theory, and addressing strategies that could support increased compliance of this group of actors with the FC. Considerations on the possibility of the 2012 FC achieving higher compliance and on implications of the latest version of the law for biodiversity conservation are also discussed. I believe my study contributes to the debate on conservation in Brazil. Furthering knowledge on this topic is important, and can add to the discussion and practices of conservation planning in this country.

2. THE BRAZILIAN FOREST CODE

Brazil has had a law that partly approaches native vegetation conservation, and thus biodiversity, at the landscape level since 1934. This law is called Forest Code (FC), and has been revised twice, in 1965 and 2012. Given that thoroughly discussing its revision

processes would go beyond the scope of this research, in this section focus is given to the main aspects of each of the three versions of the FC (1934, 1965, and 2012), and to their implications for small rural landholdings.

The 1934 FC was elaborated due to concern with firewood supply in urban areas as a consequence of forests being pushed away by coffee plantations in the beginning of the 20th century (SENADO FEDERAL, 2013). It had few conservation-related elements, which were given more space in the second version of the FC, enacted in 1965 (DRUMMOND and BARROS-PLATIAU, 2006). The 1934 FC classified forests into four categories: protective, remnant, model, and productive. Each of these types of forest had a different purpose. While protective forests were determined by their location, and aimed at protecting water resources, soils, dunes, rare native species, and scenic beauty, as well as public health and the country's borders; remnant forests were those in national, state and municipal parks. Model forests were planted forests; and productive forests were all forests not included in the other three categories, which could be exploited by means of permits. The 1934 FC also established that one quarter of rural landholdings should have their forests maintained, but native forests could in some cases be substituted by planted forests (BRASIL, 1934), demonstrating concern with wood supply, and not with forests themselves (SENADO FEDERAL, 2013).

Conservation-related elements gained attention in the 1965 FC, which applied to all types of vegetation and not only to forests. As this second version of the FC was valid for almost fifty years and went through modifications during this period, the overview provided here focuses on regulations that were in place when it was revised in 2012. The 1965 FC helped establish two conservation concepts that are still in use: *Área de Preservação Permanente* ("Permanent Preservation Area"; PPA), and *Reserva Legal* ("Legal Reserve"; LR). The former defines fragile areas that must have their natural vegetation preserved or restored so as to protect biodiversity and ecosystem services. PPAs are geographically defined, and cannot be used for any type of production; they include: (a) areas along water courses - the width of the PPA depends on the width of the water course; (b) areas around lakes and lagoons; (c) areas around springs; (d) tops of hills and mountains; (e) areas on hillsides with slopes greater than 45°; and (f) areas above 1800 meters of altitude (BRASIL, 1965).

On the other hand, a LR is not geographically defined, and corresponds to a percentage of a rural property where native vegetation should be maintained or restored so as to support conservation of biodiversity and ecological processes, as well as sustainable use of natural resources. Contrary to PPAs, LRs can be sustainably managed under a permit. While in the Amazon the LR is equivalent to 80 % of the area of a rural property, this amount is of 20 % in other Brazilian biomes, including the Atlantic Forest. According to the 1965 FC, if PPAs or LRs were degraded or removed without authorization, they had to be recovered; however, it was possible for a landowner to compensate the degradation of the LR in another area in the same watershed. Even though LRs and PPAs have different purposes, PPAs could be included in the computation of the LR under certain circumstances. In addition to PPAs and LRs, the 1965 FC also determined restrictive use for areas on slopes between 25° and 45° (BRASIL, 1965).

Concerning small rural landholdings, there were some distinctions between them and other properties. Small rural landholdings were defined in the 1965 FC as those in which most labor was carried out by the landowner and his family; at least 80 % of the family's income came from activities carried out in the property; and total area did not exceed a certain limit, which was 30 hectares when located in the Atlantic Forest biome. Differences for owners of small properties were the following: (1) possibility to carry out sustainable agro-forestry activities in PPAs under a permit; (2) option to compute fruit-tree plantations, including mixed plantations with exotic species, in the calculation of a LR that needed to be restored; (3) permission to include PPAs in the calculation of the LR as long as new clearings did not occur and the sum of PPAs and LR exceeded 25 % of the area of the property; (4) free registration of the LR in the documents of the property (as required by the FC), and technical and legal government support with this matter if necessary; (5) simplified procedures for requesting an authorization to clear an area; and (6) technical support for restoring the LR through seedling plantation (BRASIL, 1965).

The third and most recent version of the FC still uses the PPA and LR concepts. Their definitions, protection regimes, and location criteria are the same. The main difference between the 2012 FC and the 1965 FC is rather related to the extent to which these areas must be restored in case of non-compliance with the previous FC. Thus, while some PPAs no longer need to be recovered if they were cleared in the past, those associated

with water resources still need to be restored, but to a lesser extent. For example, restoration requirements of PPAs along water courses and around springs were reduced for those properties that are not in conformity with the law; nevertheless, so-called consolidated agricultural activities can only continue if soil and water conservation practices are in place in these areas (BRASIL, 2012). Another modification is that the classification of a few PPAs has changed. For instance, while the width of riparian PPAs was earlier based on water courses' highest level, it now depends on their regular level; and while areas around permanent and intermittent springs were previously protected, only those around permanent ones are so now (BRASIL, 2012). In the case of LRs, the 2012 FC establishes PPAs can be included in their calculation for restoration purposes as long as new clearings do not occur. Also, exotic species can be used in combination with native ones in restoration strategies of degraded LRs, and compensations are no longer restricted to the same watershed, but to the same biome. Regarding areas on slopes between 25° and 45°, they are still of restrictive use, but agricultural activities can be carried out provided that good agronomic practices are used (BRASIL, 2012).

The 2012 FC also makes differences between small rural landholdings and other properties, and some were already present in the 1965 FC. They include (1) simplified administrative procedures for joining a governmental program aimed at regularizing the environmental situation of rural properties, and to obtain a permit to manage the LR; (2) possibility to carry out low-impact activities in PPAs and in the LR; (3) less strict restoration requirements for deforested PPAs depending on the size of the property, i.e. the smaller the property, the less strict the requirements; (4) option to combine exotic and native woody species when restoring PPAs; (5) possibility to have a LR that does not reach the percentage required by the FC if the sum of all fragments of native vegetation in the property do not reach that amount; (6) option to use exotic fruit species when restoring the LR if they are combined with native ones; (7) opportunity to have economic gains in compensation mechanisms by maintaining the RL; (8) some technical and legal government support to regularize the environmental situation of the property; and (9) priority of participation in public programs aimed at providing technical support and economic incentives for compliance with the law, and for the adoption of better practices to harmonize agricultural activities and conservation (BRASIL, 2012). It is, however, important to mention that the definition of a small rural

landholding was changed in the 2012 FC. Although it still considers the same parameters as before: workforce, source of family income, and property area (BRASIL, 2006 and 2012); its area requirement is now based on a measurement unit called *Módulo Fiscal*. In the case of Arroio do Tigre, properties up to 80 hectares meet the area precondition for small rural landholdings (INCRA, 1980).

3. COMPLIANCE THEORY

Compliance theory allows an in-depth understanding of the motivations that lead individuals to obey or violate regulations (NIELSEN and MATHISEN, 2003). As a consequence, it encourages reflection on how to improve their effectiveness (WINTER and MAY, 2001), and on alternative strategies that could support the achievement of aimed goals. In addition, compliance theory also favors a broad analysis of compliance problems since multiple perspectives may be taken into account (NIELSEN and MATHISEN, 2003; RAMMCILOVIC-SUOMINEN and HANSEN, 2012). Considering biodiversity conservation is an important sustainability challenge, and sustainability science involves integration of different disciplines, problem-driven research, and holistic points of view (CLARK and DICKSON, 2003; PERRINGS, 2007), compliance theory has been applied to this research and is therefore detailed in this section.

Compliance can be considered as an action that is in accordance with a certain rule or request. As detailed in the subsequent paragraphs, there are different theoretical perspectives on the issue of why people observe or disrespect a rule, but they do not exclude each other and may be considered together. Understanding compliance behavior is particularly relevant for the process of developing laws because laws that are complied with are more effective in achieving their purposes (WINTER and MAY, 2001). Nevertheless, compliance behavior is generally not taken into account in this process, and unsatisfactory compliance is usually tackled with strict enforcement (SUTINEN and KUPERAN, 1999; NIELSEN and MATHISEN, 2003).

Initial research on compliance focused on an economic or instrumental perspective. This perspective emphasizes the role of rational choice in compliance decisions. It defends individuals consider the expected costs and benefits of compliance and non-compliance

choices according to the probability of being found in violation of regulatory requirements, and the sanctions that would be applied in such a case (BECKER, 1968). According to this point of view, while strict enforcement and high penalties would favor compliance, mild enforcement and low penalties would stimulate non-compliance (SUTINEN and KUPERAN, 1999). There are, however, compliance scenarios that cannot be fully explained by this perspective. These are cases in which the probability of being caught violating a regulation is low, gains expected from an illegal activity are greater than potential sanctions, and large compliance with a regulation is still identified (SUTINEN and KUPERAN, 1999). For this reason, normative and legitimacy perspectives on compliance have gained attention in the last decades, and compliance behavior is no longer seen as based solely on judgments of economic costs and benefits, but also on individual moral, social norms and aspects related to legitimacy (NIELSEN, 2003; RAMMCILOVIC-SUOMINEN and EPSTEIN, 2012).

The normative perspective refers to both individual moral and social norms. Individual moral is related to a person's internal principles and values that guide his or her attitudes (TYLER, 2006). It can lead an individual to comply with a regulation despite the benefits that could be obtained by not obeying it, or disrespect it when the probability of being caught is considerable (SUTINEN and KUPERAN, 1999). Individual moral is also important in the context of a community because it influences an individual's social influence on the other members. A social norm illustrates the behavior of the majority. As a consequence, if obeying a certain law is the most common behavior, compliance is the norm and it is favored by social influence, which discourages non-compliance (NIELSEN and MATHISEN, 2003). Informal social sanctions may occur in the case of nonconformity if it is against social norms. In this situation, social sanctions can take place even in the absence of formal governmental punishment. They may include becoming the topic of gossips as well as losing good reputation and respect of others, but their existence and extent are dependent on the reasons behind non-compliance behavior (GEZELIUS, 2004).

Another perspective on law compliance relates to legitimacy. It increases individual motivation to obey a certain rule due to feelings of obligation and responsibility, and not due to fear of sanctions or positive incentives (TYLER, 2006). According to this author, legitimacy is a "psychological property of an authority, institution, or social

arrangement that leads those connected to it to believe that it is appropriate, proper, and just” (TYLER, 2006, p.375). In the case of law compliance, legitimacy is related to acceptance of authorities who established the rule, acknowledgment of the processes through which it was elaborated and is applied, and recognition of the outcomes of its application (NIELSEN, 2003; TYLER, 2006); these elements are called political, procedural, and outcome legitimacy, respectively (RAMCILOVIC-SUOMINEN and EPSTEIN, 2012). For example, public participation in decision-making and transparency in the application of a law by the enforcing authorities favor procedural legitimacy; also, perceiving a law as effective to reach its goals, and consistent with current practices in the setting it applies to influences outcome legitimacy positively (NIELSEN and MATHISEN, 2003).

Considering there are different perspectives on law compliance, there are also distinct approaches to discourage non-compliance and promote compliance behavior. They are dependent on the perspective taken into account when analyzing factors related to compliance decisions. While the instrumental perspective would focus on strict enforcement and high sanctions (SUTINEN and KUPERAN, 1999); under normative and legitimacy ones, attention would be given to increasing cooperation among governing authorities and those being governed (MAY, 2005). This could be a result of either furthering public participation in decision-making and law-elaboration, or fostering discursive measures such as information and education that address both the problem that is perceived by the government, and ways of tackling it (NIELSEN and MATHISEN, 2003; MAY, 2005).

Despite a broad literature on law compliance, the application of such knowledge on the discussion about factors that influence compliance with laws on management of native vegetation and conservation is still limited (HANSEN, 2011; RAMCILOVIC-SUOMINEN and HANSEN, 2012). Although there are studies that address factors behind non-compliance with this type of regulation, broader reflections on the topic, particularly on how these factors impact individual motivations to obey the law, are lacking in most cases. Nevertheless, an analytical framework on forest law compliance based on compliance theory has been developed recently, and could potentially stimulate this debate. According to this framework, external context specific factors such as capacity of authorities to enforce rules, forest culture, and poverty affect an

individual's decision to comply or not with a specific regulation by influencing his individual motivations for compliance, which are dependent on his pondering on the costs and benefits of following a certain rule, personal and social norms, as well as legitimacy elements (Figure 1) (RAMCILOVIC-SUOMINEN and EPSTEIN, 2012). As detailed in the next section, this framework has informed this research.

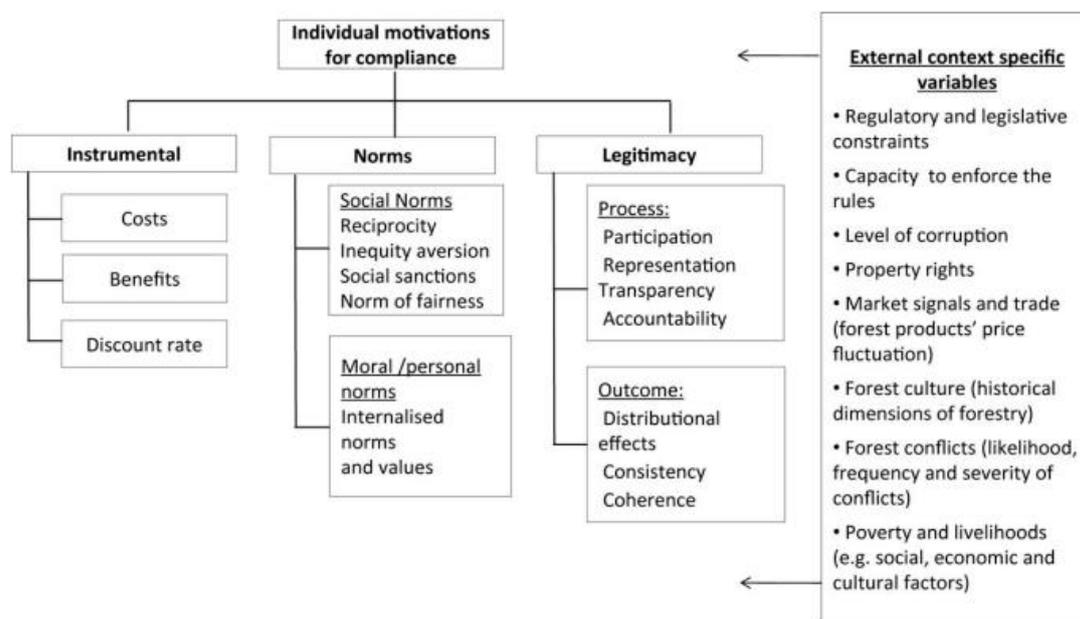


Figure 1 – Analytical framework on forest law compliance that has informed this research. Source: Ramcilovic-Suominen and Epstein, 2012.

4. METHODS AND STUDY AREA

4.1 Research Design

In order to investigate the reasons behind small-scale farmers' non-compliance with the 1965 FC, a case study was conducted in the municipality of Arroio do Tigre. Case studies are appropriate for research that aims to provide deep understanding of complex social phenomena within their real-life context (YIN, 2009). As it is the case of this research, they are particularly relevant for studies that deal with explanatory questions and contemporary events (YIN, 2009). In addition to being explanatory, this case study also has exploratory elements since available literature on compliance with conservation regulations is still limited in Brazil. The rationale adopted was that of a representative

(YIN, 2009), or exemplifying (BRYMAN, 2012) case, in which a suitable setting for the investigation was chosen (BRYMAN, 2012). Therefore, my aim was to put light into factors influencing compliance decisions with the 1965 FC in a context (small-scale farming) that is relatively common in Southern Brazil. Due to its colonization by European immigrants from the last decades of the 19th century, this region is characterized by the presence of small-scale agriculture (IBGE, 2006), and shares diverse cultural elements. Moreover, it is also almost entirely within the Atlantic Forest biome (RIBEIRO et al., 2009). For these reasons, even though I recognize that each community has unique social settings, the findings of this study could be generalized to some extent to other municipalities in Southern Brazil, and are therefore not completely restricted to the studied municipality.

4.1.1 Study Area

The municipality of Arroio do Tigre is located in the central region of the southernmost Brazilian state, Rio Grande do Sul (Figure 2). It has an area of 318.2 km² and is characterized by a rugged landscape with some hills, and several creeks and streams (KRIESE et al., 2012). Colonization occurred mainly from the last decades of the 19th century due to the arrival of European immigrants, who started developing agricultural and cattle raising practices in the region (KRIESE et al., 2012). Among the municipality's 12,248 inhabitants, slightly over 50 % (6,686 people or 52.86 % of the population) live in the rural area (IBGE, 2010). Most rural properties are small, and family agriculture is the most common practice (KARNOPP, 2003; REDIN, 2011). According to oral information gathered at the Municipality, 79 % of rural properties have up to 20 ha, and 97 % have up to 50 ha. While small-scale farmers grow different crops, tobacco is usually the main one for income generation; maize, wheat, beans, and soybeans are complementary sources of income (REDIN, 2011).

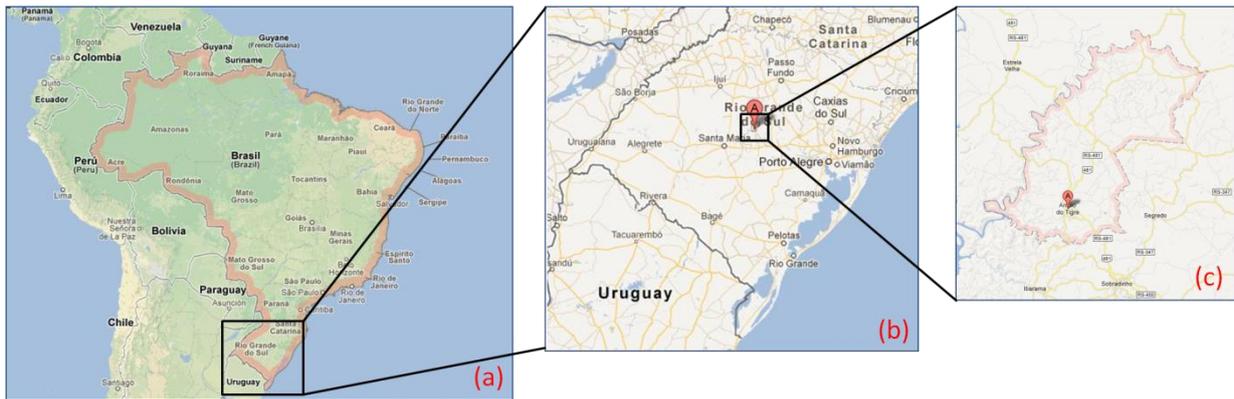


Figure 2 – (a) Location of the state of Rio Grande do Sul in Brazil; (b) location of the municipality of Arroio do Tigre in the state of Rio Grande do Sul; (c) and map of the municipality of Arroio do Tigre. Source: Google Maps.

4.2 Epistemological and Ontological Considerations

I adopted interpretivism as my epistemological perspective in the research. Being interested in the interviewees' point of view about the issue of study, it was necessary to have an approach that is sensitive to the fact that actions have a meaning for the social actor, and therefore need to be understood from his perspective and point of view. This epistemological perspective was combined with a constructionism ontological position because I perceive social reality as constructed through social interactions and involvement of individuals rather than being static and beyond their reach of influence (BRYMAN, 2012).

4.3 Data Collection and Analysis

4.3.1 Interviews

Data was collected by me through semi-structured, face-to-face interviews (ANNEX: Interview guide) in Portuguese with eleven small-scale farmers in February 2013. They were interviewed based on the criterion of being small-scale farmers according to the 1965 FC; snowball sampling, when interviewees refer to new relevant contacts; and accessibility. Thus, while some farmers were interviewed in their properties, others were approached in the office of a consultant on family agriculture that works in Arroio do Tigre. Semi-structured interviews were chosen because they ensure flexibility and put an emphasis on the interviewee's point of view, on how he frames and

understands issues and behaviors (BRYMAN, 2012). Interviews lasted on average forty minutes, and were guided by general open-ended questions, but additional questions were also asked depending on issues that came up during conversations. Two pilot interviews were carried out with local farmers I already had contact with a few days before actual data collection so as to test how well interviews were flowing. All interviewees were heads of farming households, and topics addressed in our conversations included general information about their properties, awareness about the regulations of the 1965 FC, compliance behavior, factors influencing compliance behavior, and perceived compliance of their peers. Since law compliance is a sensitive issue, all approached farmers were informed about the topic and objective of the research prior to the interview and given the option not to participate. I also assured them their comments and opinions would remain anonymous. While I was not initially sure if recording the interviews could affect farmers' interaction with me, I did not record three of the first interviews so as to assess this possibility. As a negative influence was not perceived, all other interviews were recorded with the consent of interviewees in order to facilitate a more detailed analysis later on.

4.3.2 Thematic Analysis

Thematic analysis was carried out so as to examine data gathered through the interviews. It was informed by an analytical framework on forest law compliance that considers that several context specific factors influence individual motivations to comply with forest rules (RAMCILOVIC-SUOMINEN and EPSTEIN, 2012; Figure 1). Thus, each contextual factor depicted in this framework was used as a preliminary theme affecting individual motivations for compliance with the FC in my analysis. A table in which each column represented one of these initial themes (regulatory and legislative constraints, capacity to enforce rules, level of corruption, property rights, market signals and trade, forest culture, forest conflicts, and poverty and livelihoods), and each line represented one of the interviewed farmers was built. By examining field notes taken during and shortly after each of the interviews, as well as their recordings, I added brief excerpts from interviews and comments to the table.

Moreover, this deductive analytical process was combined with an inductive one as new themes and subthemes emerged from data (e.g. awareness about regulations,

enforcement strategies, and desire to have an increased income), particularly through repetition of topics (BRYMAN, 2012). In this respect, two initial themes (i.e. poverty, and forest culture) were later converted into subthemes due to emergence of related subthemes affecting farmers' compliance decisions. During the analytical process, I also perceived it was necessary to include two themes and one subtheme directly derived from the normative and legitimacy individual motivations for compliance as they were approached by interviewees a number of times (i.e. group behavior, distribution of costs and benefits, and personal forest values). Also, some of the preliminary themes depicted on my table were later excluded as they did not come out throughout the analysis (i.e. level of corruption, property rights, market signals and trade, and forest conflict). A table with all themes and subthemes examined in the analytical section is shown below (Table 1).

Table 1 – Outline of themes and subthemes examined in the analytical section as factors that influenced small-scale farmers' compliance with the 1965 FC in Arroio do Tigre. They have been adapted from an analytical framework for forest law compliance elaborated by Ramcilovic-Suominen and Epstein (2012).

| Themes | Subthemes |
|--|---|
| Enforcement of the law ¹ | Enforcement level |
| | Enforcement strategies* |
| Socioeconomic conditions | Poverty |
| | Desire to have an increased income* |
| Perceptions about forests | Acknowledging benefits from conservation* |
| | Forest culture |
| | Personal forest values** |
| Group behavior** | Perceived non-compliance of peers** |
| | Social acceptance of non-compliance** |
| Distribution of costs and benefits** | |
| Contradictory governmental policies ² | |
| Awareness about regulations* | Awareness about regulations of the FC* |
| | Access to information* |

*Themes and subthemes that emerged from data

**Themes and subthemes directly derived from individual motivations for compliance

¹Renamed from the preliminary theme 'Capacity to enforce the rules'

²Renamed from the preliminary theme 'Regulatory and legislative constraints'

Quotations linked to the words of interviewees are extensively used to illustrate my findings in the next section, and demonstrate validity of the research (WHITTEMORE, 2001). They are indicated in italics and are identified with the number of the interviewee (*E: entrevistado*; I: interviewee). All quotations were carefully translated from Portuguese to English so as not to alter their meaning in the translation process.

4.4 Research Limitations

This study aimed to explore factors that influenced small-scale farmers' motivations for compliance with the 1965 FC so as to discuss, among other things, their potential compliance with the most recent version of this law, enacted in 2012. Nevertheless, the study has some limitations. For example, a common limitation in social research is that the researcher cannot completely put his own world view apart while collecting and analyzing data (BRYMAN, 2012). Therefore, even though I was interested in the interviewees' points of view about the issue of study, it is possible that my own perceptions influenced the way I carried out interviews, and analyzed data.

One could also argue that a relatively small number of farmers were interviewed in this study. This was mainly due to time restrictions. However, there was indication saturation had been achieved since new themes did not come up in the last interviews. Moreover, although not detailed here, I also had conversations with other relevant actors during my stay in Arroio do Tigre, such as a local consultant on family agriculture, a biologist working for the Municipality, and a representative from farmers' labor union. All factors perceived by these actors as affecting compliance decisions with the FC came up in my interviews with small-scale farmers. Nonetheless, considering I assumed all information and opinions expressed by farmers as authentic, a risk in my study is that farmers did not tell me the whole truth about their behavior and points of view even though I assured them their identities would remain anonymous.

5. ANALYSIS

Eleven small-scale farmers were interviewed in the study. They were all men², and were between 34 and 71 years old. Interviewees lived in their properties, which were situated in different regions of the rural area of the municipality and had between 7 and 27 hectares. In most cases, the property had belonged to the interviewee's family for at least two generations. Two types of activities were carried out in them, production for sale and income generation, as well as production for self-consumption of the family. While tobacco was typically the main crop for income generation, soybeans and maize were also grown with this purpose; production for self-consumption was diversified and included potatoes, cassava, beans, different fruits and vegetables, as well as livestock for meat and milk. Farmers also grew pasture if they had livestock.

Based on the interviews, in which conversations ranged from a farmer's compliance behavior to his perceptions about compliance of other small-scale farmers in Arroio do Tigre, a substantial part of rural properties in the city would not be in accordance with the 1965 Forest Code (FC). Through thematic analysis, seven themes related to factors that influenced farmers' compliance decision with this law were identified. They are (a) enforcement of the law, (b) socioeconomic conditions, (c) perceptions about forests, (d) group behavior, (e) distribution of costs and benefits, (f) contradictory governmental policies, and (g) awareness about regulations. Each of the themes is examined separately below. However, they are not necessarily independent from each other, being interconnected in several cases. Except for theme (g), the order in which themes are presented reflects how relevant I perceived them to be during interviews.

(a) Enforcement of the law

The enforcement of the 1965 FC is one of the themes that influenced small-scale farmers' motivations to obey the 1965 FC. It was addressed through two subthemes. First, as a matter of the law being enforced or not (enforcement level); and second, with respect to the way enforcement was carried out (enforcement strategies). Farmers

² Men are traditionally the heads of farming households, and usually the ones who are aware of all activities carried in the farm, as well as of the issues concerning them. I however acknowledge that female interviewees could perhaps have given slightly different answers to my questions.

reported they had never received the visit of environmental enforcing authorities, and the regulations established in the FC had never been demanded from them until a couple of years ago. This insufficient enforcement negatively affected farmers' compliance decision, as the following statements illustrate.

"(Se a fiscalização fosse mais forte) eu ia deixar a mata por causas das multas." (E3)

"(If enforcement was more rigorous), I would maintain the forest because of the fines." (I3)

"(Se ninguém for fiscalizar) eu não deixaria a mata voltar. Só se (a fiscalização) viesse e (dissesse) 'Tem que ter mata aqui, esse quadro tem que ser para reserva'. Assim por conta eu não deixaria. Se ninguém vier olhar, fica como está." (E6)

"(If no one enforces the FC) I would not let the forest come back. Only if an enforcing agent came and said 'You have to maintain the forest here, these area is for conservation'. On my own, I would not let the forest regenerate. If no one comes to look, it will remain as it is." (I6)

According to farmers, enforcement became stricter than before in the last two years, and it was lately based not only on reports to authorities, such as the police and the Municipality, but also on aerial monitoring, when environmental agencies fly over the region to verify the occurrence of new sources of deforestation. This enforcing strategy was not perceived positively by a number of farmers because it did not reach all rural properties evenly. While it could result in some being punished for breaking the law, the violation of others could go unnoticed as a consequence of not being evident from the air, for example. Also, relationships in the community would affect the likelihood of one being reported, and subsequently punished for infringing the law.

"Todos teriam que obedecer. Assim como eu preservo, os outros também deveriam preservar. Se um preserva e o outro não, eu acho que daí não funciona." (E2)

"Everyone should obey. The same way I preserve, the others should also preserve. If one preserves and the other does not, I think it does not work." (I2)

"Tem gente que limpou tudo, não sobrou mata. Agora tem outros ali que estão cuidando. Então, para evitar esse tipo (de atitude) tem que entrar uma lei rígida que cobra as coisas, em que há fiscalização. O que vai ter não sei, mas tem que ser mais rígido." (E8)

"There are people who deforested everything, there is nothing left. But there are others who are taking care (of the forest). Therefore, there must be a law that is firmly enforced to avoid

this type (of attitude). I do not know how it should be like, but it should be more rigorous.” (I8)

Another aspect of the enforcing strategy of the 1965 FC was that only new sources of deforestation were looked for and punished by the authorities. As a consequence, according to farmers, the possibility of someone that had recently cleared an area being caught by the authorities was considerable. For this reason, forests were no longer being removed due to the fear of getting fines. Nevertheless, the same authorities would not require that areas deforested in the past and that should have their vegetation recovered were restored. This situation contributed to a feeling of dissatisfaction among some farmers. They argued that whereas those who preserved the forest in the past could not remove it anymore, those who did not respect the FC had more land available for agriculture and other activities.

“E como esse também, um que conservou a terra dele e o outro que não... aquele que conservou é igual com o outro também. Ele não tem chance mais. O outro que preservou anos atrás não pode fazer mais nada, ele tem que acompanhar o outro que... Não pode mais derrubar, não pode mais usar. Isso eu uma parte acho errado porque aquele que poupou depois quando precisa não pode mais.” (E1)

“It is like in this case, a farmer who conserved the forest in his property and another farmer who did not... the one who conserved is like the other. He has no chance. The one that preserved (the forest) years ago cannot do anything anymore; he is like the other... He cannot deforest anymore, he cannot use (the land). I think this is partly wrong because the one that conserved the forest cannot remove it when he needs to.” (I1)

Also noticeable was that farmers compared the application of the FC and the occurrence of deforestation in their municipality, where clearings are usually small and affect a few trees or a small area, with deforestation that takes place in other regions of the country, particularly the Amazon, where the context is different and clearings of large proportion still occur.

“Aqui no sul são bastante rigorosos com os pequenos proprietários e lá na Amazônia continuam desmatando aquela imensidade. Acho injusto isso.” (E4)

“While here in the South they are very rigorous with small-scale landowners, great areas are still being deforested in the Amazon. I find it unfair.” (I4)

(b) Socioeconomic conditions

In the form of two subthemes, poverty and desire to have an increased income, socioeconomic conditions is also a theme in the analysis. Farmers argued that combining preservation and conservation in the context of the FC with agricultural practices was difficult in some situations. The size of the property, the slope of the terrain, the existence and distribution of water resources, the activities carried out in the property, as well as the number of people that depended on these activities for getting an income were all mentioned as factors affecting this possibility. In this context, the division of farms over time due to inheritance possibly played a role as it contributed to decreasing the average size of rural properties. Poverty was mentioned when farmers spoke about the experiences of neighbors and other people they knew rather than about their own. The quotations below show the opinion of some of the interviewees.

"Tem muitos colonos por aqui que só tem 5 hectares e tem 2 ou 3 filhos. Isso é muito pouco. E tem mata ali já, mas não é pra tirar. O que é que vão fazer?" (E1)

"There are many small-scale farmers that have only 5 hectares, and have 2 or 3 kids. This is too small. And there are forests there (in the property), but they cannot be removed. What are they going to do?" (I1)

"Passa uma sanguinha, é tantos metros. Passa um rio, e daí (são mais tantos)... Têm muitas propriedades de 6, 8, 10 hectares. Daquele outro lado do rio que eu falo, o vizinho... vão morar 4 famílias ali, vinte e seis hectares. Veja, embaixo passa o rio, e aqui do lado na divisa passa uma sanga. E daí? Eu não sei qual é a solução pra isso aí, como devia ser." (E8)

"There is a stream, that many meters. There is a river, then (more meters)... There are many properties that have 6, 8, 10 hectares. On the other side of the river, my neighbor... 4 families will live there, twenty-six hectares. Look, there is the river on one side, and then a stream at another one. Then what? I do not know what is the solution for this situation, how it should be." (I8)

The desire to have an increased income also influenced motivations to obey the FC and compliance decisions, and it is different from circumstances in which more arable land and areas for cattle are needed for the subsistence of the family. In this case, among some farmers, there was a belief that favorable areas for agriculture should not remain covered with forests; they should rather be used to enhance the production of the property, and the income of the family. This thought was particularly noticeable for flat

terrains, and areas that had been cleared in the past and were now used for agriculture instead of being recovered as determined by the 1965 FC.

"Se na minha propriedade não houvesse morros, afetaria minha decisão (de manter a mata). Se não tivesse os morros, não teria mais mata." (E3)

"If there were no hills in my property, it would affect my decision (to maintain the forest). If there were no hills, there would no longer be forests." (I3)

"Muitas vezes o rio passa no meio da propriedade, a fonte de água está ali num plano onde a agricultura se torna mais fácil. (...) Então muitas vezes se está desmatando por causa dessa questão." (E11)

"Many times, the river crosses the property; water sources are on flat terrains where agriculture becomes easier. (...) Thus, many times deforestation occurs because of this issue." (I11)

(c) Perceptions about forests

A farmer's perceptions about forests also influenced his decision to comply or not with the regulations of the FC. Within this theme, acknowledging benefits from conservation, forest culture, and personal forest values were subthemes. All but one interviewee referred to the role of forests to protect water resources, both in terms of quality and quantity. Some reported having perceived a decrease in the flow of rivers and streams in the last decades, as well as the drying of a few springs. These observations were attributed by some to a reduction in forest cover in Arroio do Tigre. As a consequence, most interviewees reported having forests or 'some trees' around springs and along watercourses in their properties, but not necessarily according to the parameters established in the FC, which were considered exaggerated by many.

"Ter mata (em volta de nascentes e na beira de cursos d'água) é uma coisa boa porque, onde não tem mata, essa sanga desaparece. Se não tem mata em roda, ela com o tempo termina; e, se tem a mata em volta, ela se conserva." (E2)

"Having forests (in the surroundings of springs and along watercourses) is a good thing because water sources disappear where there is no forest. If there are no forests, water disappears with time; and if there are forests, it remains." (I2)

"Na beira da água, a maioria concorda (em manter um pouco de mata). Está sentindo cada ano mais seco e quente, e vendo a água sumir." (E10)

"The majority agrees (to keep some forested areas) close to water sources. They feel years are getting drier and hotter, and see the water disappear." (I10)

To a lesser extent, the role of forests in preventing erosion and soil loss on steep areas was also brought up. Farmers usually said forests should be kept in those areas because it was not possible to make use of them for agriculture, and it was better to leave the forests than to remove them if the soil was not going to be used. Most farmers therefore said there were forests on steep areas in their properties.

"Se é uma área bastante inclinada, não tem como a gente plantar, produzir. Então, eu acho bom deixar ela (a floresta) preservada." (E2)

"If the area is very steep, we cannot plant, produce. For this reason, I think it is good to preserve the forest." (I2)

It was noticed that there was a difference in the way farmers perceived the requirements to preserve forests along watercourses, around springs, and on steep slopes, in comparison to the obligation to set aside the Legal Reserve (LR). They affirmed the first two were positive in terms of water conservation, and steep slopes were in any manner inappropriate for agriculture. On the other hand, once a LR is not necessarily associated with the protection of an essential resource such as water, or with unfavorable areas for agriculture, most farmers did not recognize a value in having (depending on the case) further 20 % of their properties covered with forests, considering it a loss of arable land. This view could be linked to how the region was colonized and occupied from the last decades of the 19th century, when forests were removed to make space for cultivation and livestock, and making small clearings every year was a common practice.

"Quando eu era criança... naquele tempo eles iam abrindo a cada ano... porque quase metade dessa área (do município) era em mata antigamente, no tempo do meu avô como se diz, bem atrás... para fazer lavoura. Naquele tempo era isso aí. O pessoal fazia lavouras porque era muito mato que tinha e ninguém pensava nisso de preservar." (E6)

"When I was a kid... in those times, they removed a bit of the forest every year... because almost half of this area (of the municipality) was formerly covered with forests, in the times of my grandparents, a long time ago... to make cultivated fields. It was like that in those times. People used to make cultivated fields because there was too much forest and no one thought about preservation." (I6)

"Você sabe, os antigos tiravam mato pra plantar. Aumentava um pouco a lavoura." (E8)

"You know, former inhabitants removed the forest to plant. It increased their cultivated fields." (I8)

Approximately one third of interviewed farmers said they followed all regulations of the 1965 FC. Some of these seemed to perceive a value in preserving forests despite losing areas that could be used for agricultural activities. They admired forests, and mentioned keeping forested areas was important for future generations. Nevertheless, even these farmers mentioned the FC demanded too much, particularly when it came to the LR.

"Essa área que tem a mata daria para trabalhar. (...) Não sei se foi pensando no futuro ou o que aconteceu. Então a gente deixou isso (a mata) aí e ficou. Quando o neto veio, ele queria um pedaço, um pedacinho lá, que é plano. Mas eu disse 'Não, deixa (a mata)'." (E8)

"I could work on this area that is covered with forests. (...) I do not know if I was thinking about the future or what. So we let the forest and it is still there. When my grandson moved in, he wanted some land, a piece of land that is flat. However, I said 'No, leave it (the forest).'" (I8)

"O pai sempre gostou (da floresta). Falava em derrubar mato nativo e ele brigava com nós." (E7)

"My father has always liked it (the forest). If we spoke about clearing an area, he would argue with us." (I7)

"Eu penso pra frente. Eu acho que se eu desmatava tudo que eu ainda tinha, pra mim pouco ou nada fazia uma diferença; mas eu acho que para os filhos e os netos... será que iam ter água? Sei lá o que podia acontecer... porque a natureza se cobra." (E11)

"I think ahead. I think if I deforested all forest I still have, it would not make such a difference for me; but I think for my sons and grandsons... would they have water? I do not know what could happen... because our actions towards nature have consequences." (I11)

(d) Group behavior

Two subthemes were associated with the influence of group behavior on small-scale farmers' motivations to follow the FC: perceived non-compliance of peers, and social acceptance of non-compliance. Several of the interviewees mentioned they believed at least half the small farmers in Arroio do Tigre were not in accordance with the regulations of the 1965 FC.

"Acho que a maioria não segue." (E3)

"I believe the majority does not follow it." (I3)

"Da maioria de 10, 3 deixa (a floresta); os outros derrubam." (E7)

"Out of 10, 3 maintain (the forest); the others remove it." (I7)

Curiously, despite this perceived high level of non-compliance, all farmers said they did not agree with the attitude of not respecting the law. However, non-compliance behavior was apparently justified in certain circumstances, such as poverty and unawareness about the FC regulations. Insufficient enforcement in the past also seemed to somehow justify not being in accordance with the FC in the present. Lack of awareness and insufficient enforcement were especially relevant for how farmers perceived the choice of not reforesting areas that had been cleared in the past and should have been recovered. Alternatively, poverty excused more recent clearings. Clearings carried out recently were seen in a different way by farmers because, according to them, now everyone knows there are laws protecting the forests, and specific rules for removing them.

"Eles desmataram quando não sabiam de nada. Então, o que é que eu vou dizer?" (E6)

"They deforested when they did not know (about the regulations). Therefore, what can I say?" (I6)

"Se eles não respeitam (o CF), eu acho que está errado porque eles estão sendo alertados que não podem desmatar." (E2)

"If they do not respect (the FC), I think it is wrong because they have been informed they cannot deforest." (I2)

Considering the attenuating factors mentioned above, it was not common for neighbors or acquaintances to denounce one another in case of noticing the other was not in accordance with the FC. Even in the situation a farmer did not agree with what another farmer was doing, accusations were unusual. The decision not to report a violation of the law in the latter case reflected two things: desire to avoid creating hostilities and jeopardizing relationships in the community; as well as the fact that the majority of farms in the municipality were not completely in accordance with the FC.

"Eu acho que se o vizinho está fazendo aquilo (desmatando) o problema é dele. Eu não vou me envolver porque eu não tenho nada com isso. Agora, eu vou pensar que claro que ele está errado, vai lá desmatar... porque o mato é para ficar lá." (E6)

"I think that if my neighbor is deforesting, that is his problem. I am not going to get involved because I do not have anything to do with that. However, of course I am going to think he is doing something wrong, deforesting... because the forest is supposed to stay there." (I6)

"Vizinhos não falam para não criar inimizades." (E4)

"Neighbors do not say anything to avoid hostilities." (I4)

"Eu ia denunciar um vizinho meu se eu também fazia o mesmo erro?" (E11)

"Would I report a neighbor when I committed the same mistake?" (I11)

Together, all these factors contributed negatively to compliance with the FC. Perceived non-compliance of others, social acceptance of non-compliance, and desire to avoid hostilities in the community collaborated with insufficient compliance. Additionally, the fact that farmers did not want to obey the law alone also affected their decision.

"E o meu vizinho lá do outro lado também tem lavoura a menos de 5 metros (de cursos d'água)." (E9)

"My neighbor on the other side also has cultivated fields that are less than 5 meters away (from watercourses)." (I9)

"(Eu cumpriria) se todo mundo fosse cumprir. (...) não adianta só eu." (E4)

"(I would comply with the FC) if everyone obeyed it. (...) if it is only me, it does not work." (I4)

(e) Distribution of costs and benefits

Many of the interviewees demonstrated dissatisfaction with the 1965 FC in the sense that it did not evenly distribute the costs and benefits of conservation among society. Farmers argued that while they were bearing with the costs of forest preservation and conservation by not being allowed to use all land in their properties, the entire society was gaining from their loss through things such as water protection and climate regulation, a factor which was pointed out by some interviewees. A few farmers also said these gains were not only for Brazilians, but for the whole world. Thus, a common

belief was that there should be some sort of economic compensation for those who follow the law, a compensation for maintaining the forests in their properties and contributing with the good of others. This opinion was particularly common in the case of the LR.

" (...) quem é que vai pagar nós pra preservar a RL? Porque lei é escrito no papel, e quem leva prejuízo é nós. RL é de quem? Para quem?" (E9)

" (...) who is going to pay us for preserving the LR? Law is written on paper, and we are the ones who are jeopardized. Who owns the LR? For whom is it? (I9)

"Isso (conservar a RL) devia até ser remunerado porque eu não estou tirando a renda nessa área, mas estou preservando a natureza. (...) Isso seria muito justo. Isso seria muito justo porque eu não estou ajudando só a mim, eu estou ajudando o mundo inteiro." (E11)

"This (conserving the LR) should even be paid for as I am not making an income in that area, but I am preserving nature. (...) This would be very fair. This would be very fair because I am not only helping myself; I am helping the whole world." (I11)

This discontentment with the distribution of costs and benefits of forest conservation was linked by a couple of interviewees to the elaboration of the 1965 FC. According to these farmers, more focus would have been given to conservation aspects than to agricultural practices and food production. Also, those making the laws would not be so familiar with the reality in rural areas.

"Tem que ter lei pra preservar, só não pode ter muitos exageros. (...) Por enquanto, a gente está vendo que eles estão vendo mais o lado da preservação; tem que considerar também um pouco o lado da produção." (E6)

"There must be laws for preserving (forests), but there cannot be many excesses. (...) For now, we see they pay more attention to the preservation side; the production side should also be considered a little." (I6)

(f) Contradictory governmental policies

The existence of contradictory governmental policies also influenced compliance with the 1965 FC. This theme came up in two of the interviews, and each of these interviewees cited a different situation to illustrate how this matter affected compliance with this law. One of them mentioned the government had indirectly incentivized deforestation in small farms by making it easy to get agricultural loans, and encouraging

production increases. By giving small-scale farmers the opportunity of buying tractors and other machinery with reduced prices and an extended period to pay them, the government would have stimulated the expansion of farming areas because farmers wanted to make their investment worth it, both enhancing their profit and also making the money needed for paying the loans back.

“O governo estimulava a desmatar. Primeiro estimulou e agora quer corrigir.” (E4)

“The government encouraged deforestation. It first encouraged and now wants to fix it.” (I4)

Moreover, the government would have incentivized non-compliance with the 1965 FC through *Banco da Terra* (“Land Bank”), a program initiated in 1999 by the *Ministério do Desenvolvimento Agrário* (“Ministry of Agrarian Development”) and substituted by another rural development program in 2003. Through long-term financing, *Banco da Terra* aimed to enable small-scale farmers without land to buy a rural property, and farmers who had a small property to acquire additional land to increase it up to a certain size, which varied depending on the municipality and was 20 hectares in Arroio do Tigre. This program also offered funding to farmers who wanted to make improvements in their farm, such as those related to infrastructure. According to the interviewee that mentioned this issue, the problem was that the government allowed farmers to buy land entirely covered by forests. Considering the reduced size of the properties, and that a farmer that had taken part in the program needed to cultivate the land so as to have money to sustain his family and pay for the loan, there would have been no choice but to deforest so as to free areas for agriculture in certain situations, areas that were occasionally protected by the FC.

“Uma coisa foi o crédito fundiário, o Banco da Terra. Eu tenho uma experiência bem próxima. Na época, foi vendido pra um conhecido 8 hectares de terra; dos 8 hectares de terra que ele comprou, não tinha 1 hectare que era lavoura. Era só mato. O que aconteceu pra ele? Ele teve que desmatar pra ter a subsistência... ele ia ter que pagar essa terra. (...) Umas áreas que nem podiam ser vendidas pelo Banco da Terra porque assim oh... (...) eu tenho que plantar e eu tenho que produzir... eu tenho que pagar, eu tenho dívida. Então, num caso assim, ele foi desmatando para poder plantar.” (E11)

“Agrarian credit was one case, the ‘Banco da Terra’. I have a very close experience. At that time, 8 hectares were sold to an acquaintance of mine; out of the 8 hectares he bought, not even 1 was of cultivated land. It was only forest. What happened to him? He had to deforest to get his subsistence... he would have to pay for that land. (...) Land that should not even be

sold by 'Banco da Terra' because... (...) I have to plant and I have to produce... I have to pay, I have a debt. Therefore, in a case like this, he was clearing to plant." (I11)

(g) Awareness about regulations

The theme of awareness was also relevant in the context of compliance with the 1965 FC given that a landowner did not have the chance to make a decision about complying or not with this law if he was not familiar with its details and their implications for his property. It emerged through two subthemes, awareness about the regulations of the FC, and access to information. Despite all interviewed farmers having heard about the FC before, it seemed that their familiarity with the parameters that applied to their properties was limited. For instance, even though they were aware the width of PPAs at the margin of watercourses depended on the width of the watercourse; some were not informed about the precise numbers. Two additional examples are that many interviewees said they did not know either about the differences in the protection regimes of PPAs and LRs, or the need to endorse the LR in the documents of the property. In fact, none of the interviewees had endorsed the LR. In some cases, this insufficient knowledge led farmers to think they were in accordance with the FC when they were actually not. In the first quotation below, a farmer's erroneous knowledge about the width of the PPA at the margin of a stream in the boundary of his property is illustrated; according to the 1965 FC, its width should be thirty instead of 5 meters.

"Já ouvi falar das leis (Código Florestal), acho que de quantos metros assim na sanga é para ter. Acho que 5 metros assim que nem nós." (E1)

"I have heard about the laws (Forest Code), I guess about how many meters we should have along streams. I think it is 5 meters in a case like ours." (I1)

"Assim mais ou menos a gente ouvia (falar do CF). Conforme o tamanho do rio que diziam. Tanta largura e daí tantos metros." (E6)

"We have heard more or less about it (the FC). They said it depended on the width of the river. The river is this wide, and then this many meters." (I6)

Almost all interviewees mentioned they came to know about the rules established by the FC through the media, especially the radio and the television. They also said they put these rules into practice in their properties with no technical support, and that additional information in case of doubts came from neighbors and other acquaintances. A minority

of the farmers reported seeking for information in the Municipality or their Labor Union, where more certain answers could probably be provided. Few, however, affirmed having looked for guidance in public institutions or with professionals that give advice on agricultural issues.

"A gente fala com um ou com outro conhecido (em caso de dúvida). Alguém sempre sabe mais que a gente, tem alguma informação a mais." (E2)

"(In case of doubts), we talk to an acquaintance. Someone always knows more than we do, and has some additional information." (I2)

"Às vezes, quando tem uma festa de aniversário, uma festa, a gente traz (o CF) nas conversas." (E7)

"Sometimes, when there is a birthday party, a celebration, we bring it (the FC) to the conversations." (I7)

It is important to call attention to the issue that most farmers did not demonstrate interest in seeking for accurate information about the rules established by FC, what could be due to several reasons, ranging from fear of being punished for violations to conservation rules to not considering them important as their enforcement was weak. A good example of this situation is that although all interviewees knew riverbanks were PPAs, only few had sought for precise information about the correct area in which forests should be preserved. Moreover, a few farmers said they attended informative meetings about the FC organized either by specific departments of the Municipality or by their Labor Union; however, these farmers mentioned only a small number of their peers was there.

"Somos nós mesmos (que colocamos em prática). A gente pensa que está certo ou errado e daí a gente faz." (E1)

"It is us (who put it into practice). We think it is right, or it is wrong, and then we do." (I1)

"É difícil juntar o pessoal em uma reunião para divulgar (o CF). Acho que é um pouco falta de instrução (incluindo conhecimento sobre problemas ambientais). Acham que é tempo perdido." (E4)

"It is hard to get the people together in a meeting to spread information (about the FC). I think it is a little due to lack of education (including awareness about environmental issues). They think they are losing their time." (I4)

6. DISCUSSION

Taking into consideration all factors examined in the previous section, the discussion is divided into three parts, which address each of the research questions that guided this study.

6.1 What factors negatively influenced small-scale farmers' compliance with the 1965 FC, and how do they relate to compliance theory?

As discussed in various studies on compliance with environmental, as well as forest regulations (WINTER and MAY, 2001; NIELSEN and MATHISEN, 2003; GEZELIUS, 2004; HANSEN, 2011; RAMMCILOVIC-SUOMINEN and HANSEN, 2012), compliance with the 1965 FC in Arroio do Tigre was also affected by different factors, factors that influenced all three motivations for compliance described earlier: instrumental, normative, and legitimacy. The instrumental motivation for compliance was influenced both by a weak enforcement of the FC in the past and by the enforcement strategy used more recently, which focused on recent clearings, and was probably unable to detect minor violations because of its reliance on aerial monitoring. In association with issues such as desire to have an increased income, subsistence needs, and lack of social sanctions in case of violation under certain circumstances, they incentivized or led to non-compliance behavior by potentially assuring more gains than losses in case of disobedience.

Likewise, many factors influenced normative motivations to comply with the FC. Although interviewees believed it was wrong to violate the law, perceived non-compliance of peers affected personal and social norms by favoring the development of justifications for not being in accordance with the FC, and consequently leading to social acceptance of violations in some situations. Additionally, former family practices related to clearing small areas of the property from time to time to make space for agriculture and livestock still influenced land use decisions, as well as farmers' individual perceptions and values related to forests. For this reason, small clearings were still carried out until recently, until farmers became more aware of the FC, and enforcement became stricter. The existence of contradictory governmental policies also

had an impact on the normative motivation to comply with the FC as it somewhat damaged moral duty, i.e. the government itself indirectly encouraged non-compliance.

Furthermore, farmers' motivation to follow the FC was also influenced by legitimacy-related elements. The combination of enforcement strategies that gave opportunities for the law to reach rural properties unequally with farmers' wish of not obeying the law alone; the difference between the previous practice of deforesting a little every once and a while, and the regulations of the FC; the difficulty for conciliating subsistence needs with conformity to the FC in some cases; as well as farmers not fully understanding the importance of the different regulations and parameters of the FC, and viewing the distribution of the costs and benefits of conservation as unbalanced in society. All these factors contributed to reduce the perceived legitimacy of the 1965 FC among small-scale farmers in the studied region. Also, there is indication that farmers see themselves distant from the decision-making process that led to the elaboration of the rules of the 1965 FC. This is illustrated in the following quotation, which was cited in the previous section: “(...) *they* pay more attention to the preservation side (...) (I6)”. However, inferences cannot be made given that the elaboration of the 1965 FC was only mentioned by a couple of interviewees.

Apart from distinct perspectives on compliance behavior, awareness about regulations played a relevant role in farmers' applying or not the FC in their properties. Despite all interviewees knowing about the existence of such a set of regulations, and having some knowledge about them, they seemed to be unfamiliar with their details. Although this limited awareness may be partly due to a relative lack of interest of farmers, which could have led them not to seek for additional and precise information on the FC and not to attend informative meetings, this may also be due to the modifications suffered by the 1965 FC during its period of validity, as it is easier to follow a law that does not change over time than one that suffers modifications (WINTER and MAY, 2001). Moreover, interviews revealed interviewees first got to know about the FC on their own, and applied its regulations in their farms mostly by themselves. Thus, insufficient technical support both in terms of spreading information on the FC and offering support for its application possibly contributed to non-compliance as well.

While motivations for compliance with the FC is a very much unexplored research topic, the findings of this study corroborate with those from Alarcon et al. (2010) and Sant'anna et al. (2012), in which aspects related to small-scale farmers' perceptions about this law are discussed. Limited awareness about the regulations of the FC, and economic difficulties to put them into practice are brought up by both groups of authors (ALARCON et al., 2010; SANT'ANNA, 2012). Nevertheless, Alarcon et al. (2010) point out that, in many cases, insufficient awareness could be the reason of the conflict between conservation and subsistence needs.

6.2 How could these factors be addressed so as to increase small-scale farmers' compliance with the FC?

As previously discussed, small-scale farmer's motivations for compliance with the 1965 FC were negatively influenced by different factors. Acknowledging these factors, and understanding how they affected motivations for compliance is important because it enables reflection on regulations themselves (WINTER and MAY, 2001), and also on how to achieve the goals they aim to. While there are different strategies to reach conservation objectives, including regulatory and non-regulatory ones, they should be feasible, effective, perceived as fair, and have positive future implications (DOREMUS, 2003). In Brazil, it would not be realistic to consider the substitution of a federal regulatory approach such as the FC by alternative, non-regulatory options since this legal instrument has been in place for a long time, and also aims at organizing the country's territory by setting common grounds for land use throughout all its regions. Moreover, non-regulatory instruments carry more uncertainties regarding their effectiveness than regulatory ones (DOREMUS, 2003; MAYER and TIKKA, 2006). Considering the context of small-scale farmers, I therefore argue for the potential benefits of complementing the FC with non-regulatory strategies (discursive measures, technical assistance, and incentive mechanisms) in order to increase compliance with this law, and achieve conservation objectives. Greater participation of farmers in decision-making could also have promising outcomes.

Keeping landowners informed about the specific regulations of the FC, as well as carrying out educational programs so as to favor an understanding about the issues tackled through them, and the reasons behind its parameters would be important.

Familiarity with regulations would give them the opportunity to put them into practice in their properties (WINTER and MAY, 2001). Combined with educational initiatives that foster comprehension of the meaning of rules, it could enhance both normative and legitimacy motivations for compliance (NIELSEN and MATHISEN, 2003). When asked about the importance of conserving forests (as this is the native vegetation in Arroio do Tigre), interviewees mentioned ecosystem services such as water provision, erosion control, and climate regulation; but they did not refer to biodiversity. This could explain why regulations on preservation in the surroundings of watercourses were generally more accepted (but not necessarily followed) than those related to LRs. Educational programs could therefore be positive as the FC focuses both on ecosystem services, and biodiversity (BRASIL, 1965). Modifications on land use practices could also be supported by these discursive measures because any differences with usual practices would perhaps not be perceived as meaningless.

Along with information and education, technical assistance would also be relevant as the application of the FC involves complexity due to its multiple rules, and requires several measurements of a rural property are taken, such as distribution of water resources and inclination of the terrain. It would possibly help increase legitimacy of the FC as it would no longer stand as a command and control policy alone. Likewise, this support could also reduce conflicts associated with subsistence needs that are due to unawareness about the possibilities detailed in the FC (ALARCON et al., 2010), and be linked to existing governmental initiatives of improving agricultural practices, such as rural extension programs. Although the 1965 FC stated small-scale farmers should get some technical assistance for the implementation of its regulations (BRASIL, 1965), this was rather unhelpful as it was not related to the initial basic procedures necessary for its application. Combined with technical assistance, the application of the FC in small properties would also reveal eventual difficulties to conciliate agricultural practices with conservation, and potentially encourage discussions on how to deal with such a situation.

In addition, the use of economic incentives could support the distribution of costs and benefits of conservation among the Brazilian society (NEUMANN and LOCH, 2002), increasing the legitimacy of the FC, and minimizing conflicts among conservation, subsistence needs, and agricultural practices. While regulations leave all conservation

costs to landowners, other strategies distribute them in different ways. For example, costs related to information and technical assistance are paid by the government, and thus shared among those who contribute with its revenue (DOREMUS, 2003). Another way of distributing conservation costs would be through payments for ecosystem services (PES) programs, in which landowners who employ conservation practices and contribute to the long-term provision of ecosystem services receive economic compensations for such practices (DAILY and MATSON, 2008; PAGIOLA, 2008; TALLIS et al., 2008). Nevertheless, developing and implementing such programs require considerations about the context to which they are to be applied, and careful reflection on various issues, such as their duration, the societal sectors that should help pay for conservation costs, and the amount landowners should receive for employing conservation practices.

The findings of this study also suggest farmers felt distant from the decision-making process on conservation strategies. This indicates greater participation in future decisions could foster their legitimacy (PALONIEMI and TIKKA, 2008) and help reduce conflicts related to subsistence needs, differences between usual and desired practices, as well as unawareness. Both the 1934 and 1965 FCs were enacted during periods in which Brazil experienced dictatorships. However, part of the complementary measures to its second version came through the *Conselho Nacional de Meio Ambiente* (CONAMA; “National Environmental Council”) (SPAROVEK et al., 2011), in which different societal sectors - including the agricultural one – are represented. Hence, there is an apparent need for better communication between those who represent farmers in such discussions and farmers themselves. In this context, it is important to consider that even though participation can potentially lead to the development of better policies by contributing to dialogue among different stakeholders (OLSSON et al., 2008; PALONIEMI and TIKKA, 2008), and promoting trust among them (REED, 2008); it should not be seen as a panacea solution. If not well-planned, participatory processes may merely reproduce power structures existent in society, and not allow stakeholders to really influence decision-making (ARMITAGE, 2008; REED, 2008).

In combination with all strategies mentioned above, it would be important that the FC is effectively enforced so as to minimize the instrumental motivation for non-compliance behavior, and diminish farmers’ concern of following the law alone. Nonetheless,

enforcement should not rely on strategies that either allow the FC to reach rural properties unevenly (e.g. aerial monitoring), or may jeopardize relationships in the community (e.g. denounces). The use of remote sensing techniques could therefore be an alternative (OLIVEIRA et al., 2008) since it allows detection of even minor violations depending on the resolution of the images that are used, and facilitates monitoring by enforcing authorities.

6.3 To what extent were these factors addressed by the revision of the 1965 FC, and what could be its implications for biodiversity conservation?

Considering that each of the aspects discussed above has the potential to encourage farmers' motivations for compliance with the FC, the extent to which they have been addressed in the revision of this law is now discussed. The 2012 FC does not refer to or introduce information or educational programs focused on fostering comprehension of the meaning and importance of its rules, but it states small-rural landowners should receive some technical and legal assistance to regularize the environmental situation of their properties. Nonetheless, as it was the case with the 1965 FC, the type of assistance specified in the law does not involve all steps necessary for its application. In spite of this, the possibility of the government initiating broader technical assistance initiatives to support small-scale landowners throughout all stages of the application of the FC is mentioned. Additionally, the possibility of the government developing and implementing economic incentive programs to promote conservation and law compliance through tax reductions, agricultural credit, and PES programs is also cited (BRASIL, 2012).

Concerning the elaboration of the 2012 FC, advances were made in the sense that public hearings were carried out in all states of the country so as to give voice to distinct opinions and perspectives. This allowed different groups to contribute to the draft of the new version of this law, which was submitted for voting at the Brazilian Congress. According to the congressman responsible for such draft, academics, political authorities (governors, mayors, etc), landowners and organizations that represent them, as well as NGOs were listened to during its elaboration (REBELO, 2010). Nevertheless, no information on how the opinions of these different groups were taken into account is provided (REBELO, 2010). Scientists, for example, claim their voice has not been

heard (SBPC and ABC, 2011; SPAROVEK et. al., 2012). In the case of the farmers interviewed during this study, they all affirmed to know the FC had been recently revised. Yet they were not aware about the modifications suffered by that law, and came to know about its revision through the media.

The enforcement of the 2012 FC is, however, more promising than that of its 1965 version. The 2012 FC establishes the need for all rural properties to be registered into a national database that incorporates information about PPAs, LRs, and other fragments of native vegetation; and also sets the ground for the creation of state level programs aimed at regularizing their environmental situation (BRASIL, 2012). The first initiative could facilitate monitoring and enforcement of the FC by allowing information provided by landowners to be crossed with satellite images. Also, it might reduce the probability of the law reaching rural properties unevenly, and allow the detection of small violations. Nevertheless, the risk is that while enforcement strategies become stricter, the other approaches that could support increased compliance with the FC do not follow the same trend and are not implemented, what could lead to negative consequences for the livelihoods of small-scale farmers depending on the size and characteristics of their properties, and on the agricultural activities they focus on. In this respect, regularization programs that give attention to the singularities of individual states could have positive outcomes.

An important difference between the 1965 and the 2012 FC is related to the extent to which areas that were cleared in the past, and are currently used with different purposes must be restored. As a result, conflicts related to weak enforcement in the past, poverty, as well as unawareness could be reduced. Perceptions about the law being too demanding could also be minimized. On the other hand, a drawback would be that farmers that respected regulations in the past may feel jeopardized in relation to those who did not and now have more flexible restoration guidelines. However, a more strict enforcement of the FC could also bring economic gains to small-scale farmers. In relation to LRs, a more rigorous enforcement of the law would require landowners who do not have it to either restore the vegetation in part of their land or make use of compensation mechanisms. Through these mechanisms, landowners who do not want to restore the vegetation in their property can pay another landowner to maintain more native vegetation than required by the FC (BRASIL, 2012). Nevertheless, small-scale

farmers can include their LR in such compensation schemes (BRASIL, 2012), and thus have economic returns from complying with the law.

Consequently, even though the new version of the FC could be more complied with than the 1965 FC due to its less strict regulations, this potential is also dependent on the capacity of the state to provide assistance, develop and implement programs of economic incentive, as well as monitor land use and enforce the FC when violations are detected. On the other hand, the same less strict regulations, as well as the non-implementation of information or educational programs, and an apparent still distant decision-making process could discourage farmer's compliance decision. Also, it is essential that governmental policies point to the same direction and are not contradictory. For these reasons and because the 2012 FC is still very recent, it is difficult to infer about its implications for biodiversity conservation as a result of compliance behavior. However, it has been argued the 2012 FC itself is negative for biodiversity due to its weaker regulations that allow the maintenance of agricultural activities in areas where native vegetation should have been conserved, the computation of PPAs in the calculation of LRs, the use of exotic species in restoration initiatives, and LR compensations to take place in the same biome rather than in the same watershed (SBPC and ABC, 2011).

While it is essential that conserved areas are able to realize their ecological functions, it is also important to reflect on whether it is better to have a strict law that is not complied with, or a less strict one that actually is. After all, biodiversity conservation and agriculture do not have to be incompatible. As evidenced in this study, the challenge of harmonizing agricultural practices with conservation needs calls for dialogue among different societal sectors and academic fields in improving and developing conservation strategies in a transdisciplinary way (REYERS et al., 2010). This could lead to the implementation of strategies that are more effective in reaching their goals, and generate fewer conflicts as the social context in which there are to be applied to is taken into account (REYERS et al., 2010). Unfortunately this is not an easy task given that transdisciplinarity requires not only the involvement of different actors and groups, but also that these actors and groups are able and willing to see the world in a more holistic way (MAX-NEEF, 2005), in a way that goes beyond their own backgrounds, opinions and experiences. Nevertheless, greater societal involvement in

the elaboration of environmental policies in Brazil in recent decades (DRUMMOND and BARROS-PLATIAU, 2006) could be an indicator that the country is on the right path.

7. CONCLUSION

Although the main approach towards biodiversity conservation has been the creation of Protected Areas, it has already been demonstrated that it is important to think at the landscape level if this goal is to be achieved. One of the most biodiverse countries in the world, Brazil has had a law that addresses this issue to some extent since 1934. It is called Forest Code (FC), and has been revised twice, in 1965 and 2012. This research was motivated by the recent revision of the 1965 FC, which in turn was motivated by insufficient compliance of landowners with its rules, and supported by the argument that the established regulations jeopardized subsistence of small-scale farmers. A case study that followed the rationale of a representative case was thus carried out in a municipality in Southern Brazil so as to investigate the factors that influenced small-scale farmers' compliance with that law. Findings demonstrate that diverse factors affected their instrumental, normative, and legitimacy motivations for compliance. Therefore, a purely instrumental approach focused on strict enforcement would not be successful in fostering their compliance behavior. The combination of discursive measures, technical assistance, incentive mechanisms, and increased participation in decision-making with strict enforcement of regulations could, however, be promising. Considering the 2012 FC only incorporates some of these strategies, and is still very recent, it remains difficult to infer about its impacts on farmers' compliance motivations and decisions. The findings of this study also draw attention to the need for transdisciplinarity in tackling the challenge of conciliating agricultural practices and conservation needs.

8. REFERENCES³

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9. ANNEX

Interview guide used in the interviews carried out with small-scale farmers.

- I) General information about the farmer the farm:
 - i) First name
 - ii) Gender
 - iii) Age
 - iv) Time living in the specific farm; ownership of the farm; if it already belonged to the family before
 - v) Size of the farm
 - vi) Main activities carried out in the farm
 - vii) Main income source

- II) Questions:
 - a) Are there water springs and streams in the farm?
 - b) What do you think about having forests along streams and around water springs?
 - c) What about having forests on steep slopes?
 - d) Has the amount of forests in your farm changed since you live here?
 - e) Have you ever heard about regulations that discuss the protection of areas along rivers, around water springs and on steep slopes?
 - f) If you have, what are you doing to follow these regulations? Are there any difficulties?
 - g) If you did not know about them, do you think you could follow them?
 - h) Have you ever heard about the Legal Reserve?
 - i) Do you think other farmers in this municipality follow the regulations of the FC?
 - j) Have you heard about recent modifications to this law?
 - k) Has your farm ever received the visit of an environmental enforcing authority?
 - l) Do you believe it is possible to combine farming with the protection of native vegetation as established by the FC?
 - m) If not, what could make that possible in your opinion? Would you like to give any suggestion?