

YERBA MATE LANDSCAPES: FOREST USE AND SOCIO-ENVIRONMENTAL CONSERVATION*

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1 Yerba Mate: farmers, forests, management and landscapes

The negative effects of environmental degradation and concern for them increase day by day. Conservation efforts to counter that degradation are often based on the exclusion of human populations. However there have been some experiences and there are some initiatives in course endeavoring to reconcile conservation and the local population's sustainable use of natural resources. Against that background this paper discusses the possibilities for, and limitations of the management of Yerba Mate (*Ilex paraguariensis* St Hil.), a native species of the Araucaria forests of significant economic and cultural importance, in regard to the conservation of remaining systems of native forest, from the socio-environmental conservation point of view. The discussion is based on a study, involving family farmers, of a landscape in which it is indeed managed, in one of Brazil's main Yerba Mate-producing regions, the northern plateau of the State of Santa Catarina.

One of the most visible and high-impact aspects of environmental degradation is the cutting down of native forests. Quite often agricultural activities and rural inhabitants are associated to deforestation processes. However, making use of forest lands does not necessarily mean they must be cleared of trees because in the course of history there have been examples of the use of the forest environment as a space for the introduction of production practices, but combining the use of natural resources with conservation of the environment (STEENBOCK et al., 2013; LYNCH, 1990).

Conservation based on human exclusion has been questioned not only from the socio-economic point of view but also in ecological terms insofar it is not easy to demonstrate the existence of completely pristine landscapes, that is, landscapes that have

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not been altered in one way or another by human activities. It has been found that even forest landscapes thought to be native formations are actually the result of interactions between natural processes and human activities as various studies on the influence of indigenous populations' activities on the formation of the present-day Amazon forest (POSEY, 1987; CLEMENT, 1999; MAGALHÃES, 2011) or the expansion of Araucaria forest formations (BITTENCOURT;KRAUSPENHAR, 2006; SCHMITZ, 2009; REIS;LADIO, 2012; REIS et al., 2000).

Accordingly. It is necessary to enlarge the embrace of what we understand to be conservation, departing from an approach limited to addressing the 'natural world in isolation and, instead, incorporating social, cultural and economic aspects as well; in short, a socio-environmental conservation.

Yerba Mate is a species native to forest formations that include the Araucaria Forest (Mixed Ombrophilous Forest) and it is of considerable social and economic importance in much of Brazil's southern macro-region (COELHO, 2018). It is Brazil's leading non-wood extractive product in terms of production quantity and occupies fourth place in product value in that category (IBGE, 2013).

In that light, native Yerba Mate could be an important stimulus for environmental conservation due to its occurrence in the sub-canopy strata of the forest and its notable economic value which confers value on the 'standing forest' thereby contributing towards the conservation of both the remaining forest systems and biodiversity through the traditional management of that native arboreal species. Various studies have established the link between Native Yerba Mate management and environmental conservation (SOUZA et al. 2005; HANISCH et al., 2008; LOPES, 2011; MATTOS, 2011; MARQUES et al., 2012; MARQUES, 2014; MATTOS, 2015; REIS, et al., 2018).

The northern plateau of the state of Santa Catarina (*Planalto Norte Catarinense* - PNC) is one of the leading producers of Native Yerba Mate and it still has a considerable forest vegetation cover and a great concentration of families engaged in family-based agriculture (MARQUES, 2014).

It should be underscored that, in addition to its economic and environmental importance, Yerba Mate has a high degree of cultural significance for the local inhabitants of the PNC insofar as it is an activity intimately linked to local and family traditions (CORREIA et al., 2011; MARQUES et al., 2012).

However, the Yerba Mate systems present in the native forests that farming families manage in traditional ways are subject to agricultural modernization processes based on a logic that contemplates: the simplification of agro-ecosystems; opening or rather clearing off forest lands; and the implantation of mechanized, single-crop farming with the use of agricultural pesticides and chemical fertilizers, all jeopardizing the socio-environmental conservation potential of the Yerba Mate extraction activity.

This research has been based on the hypothesis that there is great diversity among the situations of the Yerba Mate systems in the aspects of: the differing management systems, their possible meaning and significance in the eyes of farmers themselves; and in the differing social, political and economic influences that they are subject to, thereby forming a considerable variety of different landscapes and consequently a variety of different

capacities for contributing to socioenvironmental conservation. Given that context, the overall objective of this research is to study the different landscapes of the extant Yerba Mate systems in the PNC and their relationships with socio-environmental conservation in the ambit of family-based agriculture as part of an endeavor to contribute towards the sustainable management of the Yerba Mate systems and the forests they occur in as a whole.

2 Use and conservation: constructing the Yerba Mate landscapes

Managing a given species or the space it occurs in has to do with 'agriculture' which is materialized by means of agricultural practices and they are what configure the landscapes. In the case of a native species, the management occurs because there is human intervention in the population of the species and, consequently, in the local landscape. There would be no such management were it not for the fact that the product of species management has economic and cultural value for the communities that undertake it (REIS et al, 2000; VIEIRA; WEBER, 2000; STEENBOCK, 2009). Thus, if such management is to be evaluated in an embracing and integrating manner, it is necessary that the ecological and agronomic aspects be contextualized and that the social, economic and cultural aspects that influence that management be taken into account.

With the above considerations as presuppositions, the field research proposal is to analyze the possibilities and the limitations of the different types of management of Yerba Mate systems in regard to socio-environmental conservation from the 'social' standpoint, embracing economic, political, cultural and environmental aspects and also addressing physical and ecological aspects.

It is the conjunction of the social and environmental aspects that configures the landscapes which change according to the management practices and to what the Yerba Mate may mean to the farmers who are also liable to be influenced by public policies specifically directed at that sector.

Those, then, are the general categories of analysis the research deals with: the Yerba Mate landscapes, what Yerba Mate means or signifies for the local farmer, the management practices and the public policies targeting the respective sector (although the present text does not directly address this last category).

The landscape tends to be made up of a mosaic of different conformations, depending on the scale adopted for the analysis, and those conformations are what can be considered landscape units. In the present research, the landscape unit (DELPOUX, 1972; ZONNEVELD, 1990; MONTEIRO, 2000; NUCCI et al. 2004) is a portion of the Earth's surface that presents a certain degree of homogeneity as a result of physical, social and biological dynamics, which may be repeated in a similar way and is susceptible to identification by an observer in the field. This study was unfolded in a Landscape Unit (LU) perspective, that is to say, the study considered that a given rural property is formed by a mosaic of different LUs each one with its own peculiarities and differences. The research highlighted those LUs that are home to different types of Yerba Mate formations, the Landscape Units of the Yerba Mate systems.

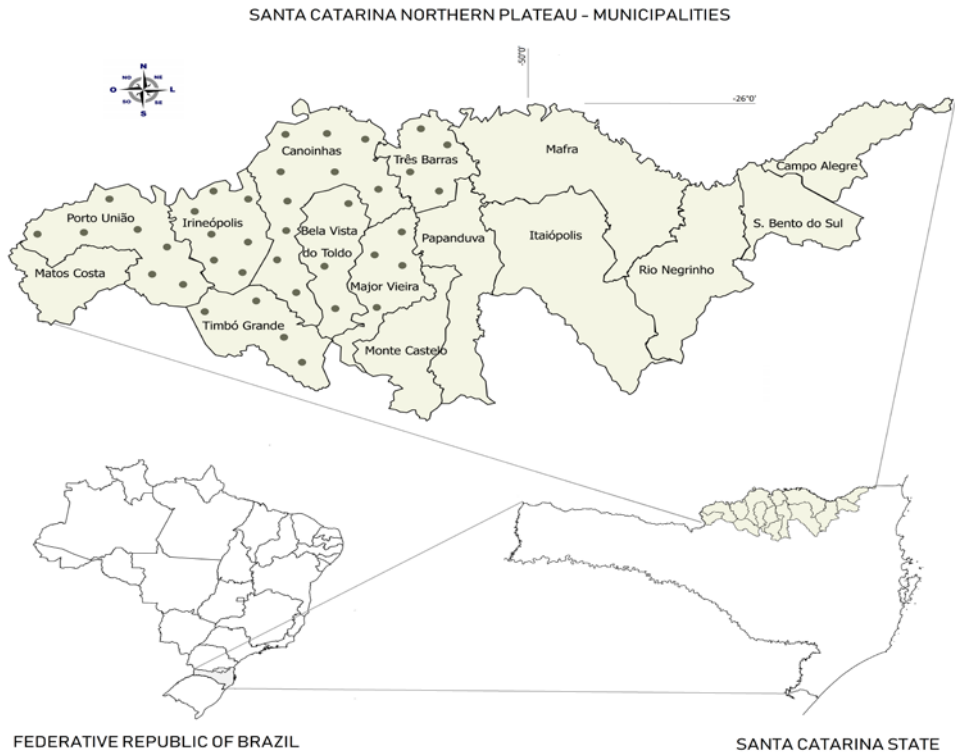
The investigation involved qualitative research and quantitative resources such as descriptive statistics. One of the great challenges was how to represent the great diversity of situations among the Yerba Mate producers in the PNC. To that end the principles Minayo (2010) recommended were adopted. That authoress considers that the qualitative sample must take into account various criteria that make it possible to address the more important aspects representing the universe the research investigates in order to develop a well-orientated sample.

The sampling was designed to contemplate the different profiles of Yerba Mate producers identified with the assistance of four Yerba Mate processors from the municipalities of Canoinhas and Três Barras and confirmed by technical staff of the Santa Catarina state government institution (EPAGRI) responsible for rural extension activities in the region.

Again regarding the sample, the intention was to encompass family farmers with production volumes in three different categories: up to 10 tons (70% of the sample; from 10 to 20 tons (20%) and over 20 tons (10%) and, furthermore, that the sample should include representatives of the main production systems that family farmers in the northern plateau of Santa Catarina (PNC) engage in, namely, tobacco, milk and grains. The farmers were selected on the basis of meetings with the EPIAGRI and complemented by names taken at random from a list of Yerba Mate suppliers provided by the Yerba Mate processors. Priority in sampling was given to farmers from the seven municipalities in the PNC with the highest production levels of Yerba Mate, all located in the western part of it (Figure 1).

Minayo (2010, p. 197) recommends that “determining the quantity of interviews should obey the criterion of saturation”, that is, up until when the number of informants allows for an understanding of whatever is being studied. That saturation was achieved with the 25th interview, but the interviews went on until a total of 40 properties had been surveyed.

Figure 1 – Northern Plateau region of the State of Santa Catarina showing the locations of properties belonging to the family farmers interviewed.



Source: elaborated by the authors.

The interview used a semi-structured script combining open-ended and closed-ended questions and divided into three parts: 1) a characterization of the family, the property and the production systems; 2) the family's relationship with the Yerba Mate extraction activity in general, inquiring into economic, cultural and environmental aspects; 3) more specific aspects of the Yerba Mate activity and their management of it. It should be explained that the part investigating the 'significance' of the extractive activity and of the Yerba Mate vegetation for the farmers was centered on the economic aspect (generating income/stability) and on the cultural/affective aspect associated to family traditions (pleasure in working with Yerba Mate). Adaptations were made to the script after the first four interviews. It was decided not to record the interviews so as not to embarrass/inhibit the interviewees. However, permission was requested to record some of the farmers' statements. The study of the data was based on Content Analysis (BARDIN, 1977; MINAYO, 2010).

66 Yerba Mate formations in 40 properties were evaluated, using a specific assessment and trajectory routine in the locations, complemented by information gleaned from

the interviews, while the evaluation and delimitation of the Yerba Mate landscapes was based on determinant and descriptive indicators.

The *determinant indicators* used to classify the landscapes were: the physiognomy of the vegetation (forest or non-forest formations). The origins of the Yerba Mate systems (native or planted); the presence of domestic animals (constant presence or not); association with crops (associated or not); and the conservation status of the forest vegetation. This last was evaluated on the basis of a set of sub-indicators: basal area, canopy layers, canopy cover, and the presence of grass species.

The construction of the Forest Conservation Index (FCI) took into account the need for the assessment to be fast and low-cost. Accordingly, the study adopted the Fournier Scale (FOURNIER, 1974), commonly used in forest science studies, whereby a score is attributed based on visual estimates. 5 classes of attributes were determined for each sub-indicator and they were rated on a scale from 1 to 5; the higher the score number the better the state of forest conservation.

The sub-indicators were evaluated visually but the basal area was measured using a Bitterlich relascope. The total of the points awarded for the four sub-indicators could range from 4 to 20 points the latter score representing a very well preserved forest. The various degrees of conservation established are displayed in Chart 1.

Considering that the FCI is strongly correlated with the denseness or openness of the forest canopy which can be easily visualized, the study used terms to refer to the intermediate forest formation conditions such as “open” or “very open” but without using a specific term for the most conserved or closed canopy condition. The forest formations were divided into the categories “Mata” (forest) and “Caíva” which is a local term used to denote varying degrees of altered forest formation associated to the establishment of pastures and raising livestock, usually cattle.

Based on all the above criteria and indicators, the study identified 13 distinct types of Yerba Mate landscape units (YMLUs) as represented in Chart 1. It should be noted that only Yerba Mate systems with areas of at least 0.2 hectares or responding for 20% of the total annual production were considered to be YMLUs. To avoid having to represent a multitude of different situations some of them were included in the YMLU most similar to their condition, identified on the same property.

Chart 1 – Yerba Mate Landscape Units (YMLUs) identified in the northern plateau region of Santa Catarina.

Physiognomy	Origin of Yerba Mate trees in production (> 50%)	Constant presence of animals	Associated with agriculture	Forest Coverage Index (FCI)	Yerba Mate Landscape Unit Denomination (YMLUs)
Forest	Native	No	No	≥ 16,00	1. Yerba Mate System in Forest
				< 16,00 > 08,00	2. Yerba Mate System in Open Forest
		Yes		≥ 10,00	3. Yerba Mate System in Caíva
				< 10,00 ≥ 7,00	4. Yerba Mate System in open Caíva
				< 7,00 > 5,00	5. Yerba Mate System in Very Open Caíva
	Planted	No		< 16,00 > 08,00	6. Planted Yerba Mate System in Open Forest
		Yes		< 10,00 ≥ 7,00	7. Planted Yerba Mate System in Open Caíva
Non Forest	Native	Yes	No	(1)	8. Open Native Yerba Mate Systems - <i>Potreiro</i> *
		No		(1)	9. Open Native Yerba Mate Systems – Deforested
			Yes	(1)	10. Open Native Yerba Mate Systems – Crops
	Planted	No	No	(1)	11. Planted Yerba Mate System in Shaded Land
				(1)	12. Planted Yerba Mate System in Open Land
			Yes	(1)	13. Planted Yerba Mate System in Open Land with Crops

Source: Marques (2014)

* *Potreiro* is a local term for perennial pastureland used for unconfined grazing

(1) FCI not evaluated as it only refers to forest vegetation physiognomies.

The *descriptive indicators* which help to portray the different landscapes were: the significance of the Yerba Mate systems for the farmer; the management practices; and their agricultural suitability. The first two were obtained on the basis of the interview scripts and the agricultural suitability was based on the work of Ramalho Filho and Pereira (1999).

3 The Yerba Mate landscapes

Chart 2 presents a succinct characterization of the 13 YMLUs identified.

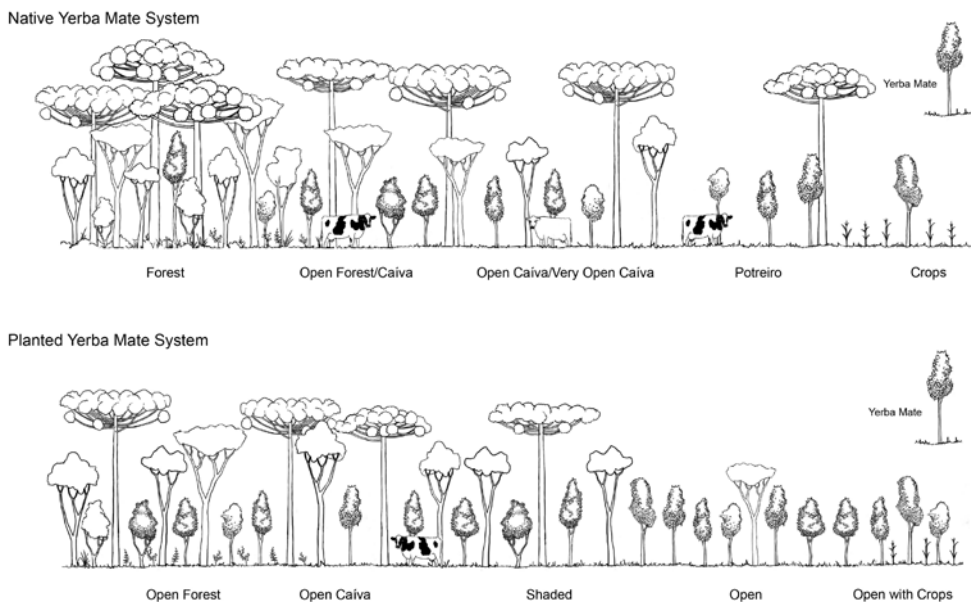
Chart 2 – General description of the Yerba Mate Landscape Units (YMLUs) identified in the Northern Plateau of Santa Catarina.

YLYs	General Description
1. Yerba Mate Systems in Forest	Characterized by the presence of more well-conserved forest vegetation cover, free from the constant presence of animals.
2. Yerba Mate Systems in Open Forest	Forest vegetation cover more open due to anthropic activity, presence of native Yerba Mate systems, free from the constant presence of animals.
3. Yerba Mate Systems in Caíva	Relatively well preserved forest vegetation cover, presence of native Yerba Mate systems, constant presence of animals, presence of pasture on the forest floor.
4. Yerba Mate Systems in Open Caíva	Forest vegetation cover far more open due to anthropic activity, presence of native Yerba Mate systems, constant presence of animals, ground dominated by pasture in most of the area.
5. Yerba Mate Systems in Very Open Caíva	Forest vegetation cover very open due to anthropic activity, in transition to becoming <i>potreiro</i> , native Yerba Mate systems, constant presence of animals, pasture predominant in most of the area.
6. Planted Yerba Mate Systems in Open Forest	Open vegetation with very dense systems of Yerba Mate and more than 50% of the production stemming from planted Yerba Mate, free from the constant presence of animals.
7. Planted Yerba Mate Systems in Open Caíva	Open <i>Caíva</i> with very dense systems of Yerba Mate and more than 50% of the production stemming from planted Yerba Mate, constant presence of animals..
8. Open Native Yerba Mate Systems - <i>Potreiro</i>	Perennial pastures (<i>Potreiro</i>) with significant presence of Yerba Mate, native Yerba Mate systems, sparsely distributed trees in the whole area but not representing more than the initial stage of forest regeneration.
9. Open Native Yerba Mate Systems – Deforested	Yerba Mate systems in areas where most of the other trees have been removed to favor the Yerba Mate, presence of some remaining trees but not classifiable as a forest formation, free from the constant presence of animals.
10. Open Native Yerba Mate Systems – Crops	Area of annual crop production but with a significant presence of native Yerba Mate.
11. Planted Yerba Mate Systems in Shaded land	Yerba Mate plantation with the presence of other trees but not sufficient to be classifiable as a forest formation
12. Planted Yerba Mate Systems in Open Land	Yerba Mate plantation, monoculture on open land or in orchards, occasional presence of sparsely distributed trees, associated to annual crops.
13. Planted Yerba Mate Systems in Open Land with crops	Yerba Mate plantation, monoculture on open land or in orchards, associated to annual crops

Source: Marques (2014)

Two of the most important characteristics for classifying Yerba Mate landscapes have to do with the valuation of the Mate itself, namely, whether the Yerba Mate systems constitute a forest landscape or a non-forest one and whether they are native systems or have been planted. Figure 2 represents the general profiles of the YMLUs of both native and planted Yerba Mate systems with the forest cover gradually diminishing from left to right.

Figure 2 – Profiles of the Landscape Units of both native and planted Yerba Mate Systems.



Source: Marques (2014)

Caívas are the most commonly found YMLUs with three categories of native types (YMLUs 3, 4 and 5), in a total of 30 situations and representing 45.45% of the number of YMLUs; they occupy 64.11% of the areas and contribute 45.29% of the production embraced by the research. If YMLU 7 (Yerba Mate Systems Planted in Open Caíva) are included then the percentage of YMLUs represented goes up to 48.48%, occupying 66.25% of the area and contributing 55.43 % of the production. That result underscores the importance of that kind of landscape in the Yerba Mate production of the PNC and consequently, the importance of livestock raising associated to the Yerba Mate systems.

The YMLUs classified as forest formations (YMLUs 1, 2, 3, 4, 5, 6 and 7) represent a total of 46 situations and 69.70% of the total number of YMLUs; they occupy 77.58% of the area and contribute 69.38% of the production embraced by the study, confirming the importance of Yerba Mate production in forested environments of the PNC.

Those YMLUs in which the Yerba Mate is native (1, 2, 3, 4, 5, 8, 9, 10), represent a total of 49 situations, representing 74.25% of the number of YMLUs, occupy 91.89% of the area and contribute 65.28% of the production embraced by the study, confirming the importance of native Yerba Mate production in the PNC.

4 The significance of Yerba Mate: between economic and cultural aspects

In regard to its production and importance, all the interviewed farmers agreed that Yerba Mate had lost a lot of its economic importance to the community due to the fall in production, which was a reality in 58% of the properties surveyed and affects 85% of the Native Yerba Mate systems. According to the farmers, the situation is due to: the conversion of the Yerba Mate areas into cropland; excessive presence of bovine livestock; aging of the existing plants without any renewal; and harvesting being done at the wrong time or in inadequate ways.

That drop in Yerba Mate production means that currently 50% of the families surveyed by the research produce up to 5,000 kg a year and only in 20% of the properties surveyed does that represent more than 20% of their gross income. On the other hand, 30% of the surveyed properties had a gross income from Yerba Mate of more than R\$ 6,000.00 (six thousand reals) a year (considering prices in June 2012). That amounts to almost one official minimum salary a month and, furthermore, in 33% of the properties it corresponds to over 10% of the total annual gross income which leads us think that the Yerba Mate is of considerable economic importance, at the very least to those 33% of the families.

Chayanov (1985) points out that family production does not set priority on making a profit but, instead, on satisfying the family's needs and ensuring its reproduction, endeavoring to strike a balance between work and consumption and based on a very different logic than the capitalist one.

In that perspective, even if the Yerba Mate does not generate monetary amounts that are significant in relation to the total gross income, the amounts do constitute what 72% of the families consider to be an important reserve; a kind of savings that can be used for investment or to face emergencies or to pay off debts. Furthermore, in some situations it is possible to finance crop farming and the purchase of machinery and equipment using the income from the Yerba Mate.

The declarations of two of the farmers illustrate this last situation:

With the money from the Yerba Mate I was able to pay the Pronafinho (Farmer 07).

The last time I bought limestone I used the money from the Yerba Mate (Farmer 04).

Wanderlei (2009) considers that agricultural activities based on 'agricultural modernization' models lead farmers to become dependent on external inputs, technology and financing, thereby raising production costs and placing their continued presence in

the rural environment in jeopardy. The Yerba Mate activity, especially when it involves native systems, being managed, as it is, practically without the use of fertilizers or mechanization, effectively counters those problems insofar as it does not require cash outlays or the need to employ labor, and, regardless of climatic conditions, it 'always produces', constituting a stabilizing element for the rural properties.

It is in fact an activity totally adapted to family agriculture strategies designed to reduce risks, satisfy the family's need to ensure its reproduction; two of family farmers' main concerns in regard to maintaining their existence in the rural environment (CHAYANOV, 1985; ABRAMOVAY, 1992; WANDERLEY, 2009).

Carneiro and Maluf (2005) state that in family-based agriculture the farming activity fulfils a role that goes far beyond its economic significance because it is related to a lifestyle, to maintaining social bonds and to sustaining cultural manifestations that guarantee the density of the social fabric in certain rural localities. It would seem that it is precisely in that perspective that the Yerba Mate activity is inserted in the PNC.

In that regard, 83% of the farmers declared that they really liked working with Yerba Mate, showing that is an enjoyable activity that instills a strong affection. As for the reasons for such enjoyment, the most outstanding motive cited was the aspect of tradition as 53% of the farmers have been engaged in the activity since their childhood days, showing that it is something that has been passed down from generation to generation.

Sahlins (1976) considers that in human actions there is always a practical reason and another that is symbolic or meaningful and that man lives in a material world but in accordance with a scheme of meanings that he has created for himself. Brandenburg (1999; 2002) thinks that family farmers combine subjectivity with rationality when they develop their activities not latching on to an economic-instrumental rationality alone but taking into consideration more subjective needs and feelings related to their ways of life and life projects. In that light, that 'liking' to work with Yerba Mate and its insertion in local tradition may well be decisive for the continuity and/or the expansion of the Yerba Mate activity.

In that context, the high value set on the Yerba Mate environment is important given that 77% of the interviewees stated in reply to the specific question that they 'like the environment of the Yerba Mate systems' or 'feel good' when they are in the Yerba Mate areas or 'like to walk' in the Yerba Mate systems. In other words, the farmers set a high value on the Yerba Mate landscape, in most cases a forest environment, and that it gives them a pleasant feeling, usually of tranquility.

I like to work with Yerba Mate because it means being in the forest;
it is good, one feels good and it is what I like most (Farmer 16).

It is worth remembering that Tuan (1980) considers that there is a relationship of affection between a person and the place he inhabits marked by his experience in it and his way of viewing the environment and it is all the more significant in rural communities. In that regard, the Yerba Mate systems constitute a landscape that is pleasing and meaningful for the farmers.

The study data verified the important fact that the Yerba Mate systems are associated to other uses that are valuable for generating income or for consumption such as raising livestock and the production of firewood, pine nuts, honey and others. Maluf et al. (2000) report that auto-consumption of production is a risk reduction strategy family farmers adopt as a kind of protection against uncertainties and the oscillations of market prices for their products.

Thus it can be considered that the importance attributed to Yerba Mate is not only due to considerable monetary amounts it produces but especially because it is a low-risk activity requiring little investment or labor and, furthermore, it is associated to landscapes susceptible to various forms of land use, constituting a stabilizing element in the property capable of generating resources in forested areas while at the same time being an activity that is a pleasure for farmers and is strongly linked to cultural aspects.

5 Yerba Mate: use and conservation landscapes

The Yerba Mate systems are important for the conservation of remaining systems of Araucaria Forest in the region. The interviewees' properties have 42% of their areas occupied by native forest vegetation and 68% of the farmers engage in harvesting Yerba Mate leaves and do so in more than half their forested areas.

Most of the farmers produce either entirely native Yerba Mate (68%) or produce from both native and planted Yerba Mate systems (13%). When referring to native Yerba Mate systems it must be made clear that there has been human intervention in promoting the presence of Yerba Mate in the landscape so that the so-called 'native' Yerba Mate did not come about through the action of nature alone but instead through the action of nature assisted by farmers' management of them. In the case of Yerba Mate systems in forested areas, whenever there is no management of them, the forest vegetation regenerates and advances and the farmers cease to harvest the leaves. Thus it must be concluded that the native Yerba Mate systems are essentially landscapes that have been modified or fostered; cultural landscapes which nevertheless have the important function of environmental conservation given that the original native forest vegetation remains in place.

The farmers face the dilemma as to whether to open up the forest to enable greater production or maintain a more consistent forest vegetation cover which results in a more stable environment and produces the best quality Yerba Mate leaves. In that regard, the environmental legislation in force helps to curb the impetus to further opening of the forest where Yerba Mate is present.

There is a notable presence in the Yerba Mate areas of the two arboreal species most threatened with extinction in the Araucaria Forest formations, namely the Araucaria itself (*Araucaria angustifolia*) and the Imbuia (*Ocotea porosa*) (BRASIL, 2008). Araucaria is present in 93% of the landscapes and Imbuia in 68%. As was to be expected, the threatened species are concentrated in the areas of closed forest cover, that is, in the forests and Caívas. It is worth observing that those species were more frequent in the areas of Caíva, that is, where there was the presence of livestock, than in forested areas free from the presence of animals.

According to the studies Reis et al. (2018) conducted in the region, it can safely be stated that the Yerba Mate systems in forest areas are of fundamental importance to the conservation of the threatened species in landscapes with *Araucaria* present, especially due to the different management methods applied, which result in mosaics of vegetation with different demographic structures and consequently different genetic structures too. In that sense, conservation is not based on maintaining the existing germplasm alone because the genetic variability that this kind of conservation maintains also makes it possible to maintain biodiversity by means of evolutionary processes.

The concern most of the farmers expressed regarding the management of livestock had to do with excessive overpopulating of the areas with animals which they considered to be the main cause of the degradation of the Yerba Mate systems. It is therefore important to underscore that in fact, in spite of the problems livestock raising can cause for the Yerba Mate formations and even for the regeneration of the forest as a whole, it is thanks to the presence of animals associated to the management of Yerba Mate systems that the majority of the forested landscapes in the region exist at all (MARQUES, 2014). Accordingly, strategies to improve Yerba Mate production and conserve the remaining systems of forest vegetation in the PNC must take into account the presence of livestock-raising activities.

During the field trips it was evident that the Yerba Mate activity is very efficient in conserving both soil and water because there were practically no signs of erosion in the Yerba Mate areas as there is little or no movement of the soil or the vegetation cover that protects the soil from the impact of drops and that fosters the infiltration of the water. There was some evidence of erosion, however, in the Yerba Mate systems planted in open areas.

The use of chemical fertilizers was entirely absent in 100% of the situations, meaning that the activity is close to being classifiable as organic production. However there was significant use of agricultural pesticides (insecticides and herbicides) in the Yerba Mate areas involving 45% of the farmers, 31.8% of the landscapes, 15.4% of the area and 41.9% of the production. The higher percentages of pesticide use are more associated to production volumes than to areas, indicating that use of agricultural pesticides is mainly present in areas of intensive production, that is, in the areas of planted Yerba Mate on open land.

An analysis of pesticide use shows that it is far less frequent in the forested YMLUs with native vegetation (Forests and Caívas); agricultural pesticide use only occurs in 9.7% of those landscapes, 9.7% of the area and 24.6% of the production. Thus it can be stated that 75.4% of the production coming from forested areas with native Yerba Mate is entirely free from any kind of toxic chemical.

At the other extreme, where use is intensive, that is in the areas where the Yerba Mate systems are shaded or planted in open land, agricultural pesticides are applied in 91.6% of the landscapes, which is equivalent to 77% of the area and 90.2% of the production. That was only to be expected because they are non-forested areas subject to intensive use and therefore ecologically more fragile and more susceptible to the attacks of pests and the presence of invasive plant species.

There is ample evidence of that association between planting on open land and the proliferation of pests in the scientific literature. Iede and Machado (1989) pointed out how the destruction of native forests, the expansion of the planted areas, the formation of single species plantations and the management of the native Yerba Mate systems as if they were a single species crops caused the appearance of a series of insect pests in the Yerba Mate systems.

Contrary to what one might expect, most (65%) of the native Yerba Mate forests are in areas with great suitability for agriculture and 21% in areas with fair suitability so that there is considerable pressure to convert them into crop lands. The presence of Yerba Mate is cited as being one of the main reasons for not proceeding with that conversion in 80% of the cases and in 55% of them mention is made of the importance of combining different forms of forest use (timber, firewood and Yerba Mate) with cattle raising.

Here it is important to comment how, on the one hand, the environmental legislation in force contributes towards avoiding the felling of the forests but, on the other, it practically makes any kind of forest landscape management impossible. 83% of the farmers interviewed considered that the legislation hampers the management of Yerba Mate extraction.

Many people preserve; my own father, next door, doesn't want to hear any talk about disturbing the forest, but there are many others who only want to destroy it [...] If it were not for the law there would be no more forest [...] only they should allow those who preserve the forest to make use of it [...] the way things are, it is those who preserve it who are penalized (Farmer 15).

The above citation reveals the existence of a socio-environmental conflict which, according to Acselrad (2004), arises when social groups with different modes of appropriating, using and attributing meaning to the territory are involved and at least one of the groups is threatened with the discontinuation of its own particular social forms of appropriating its environment. Thus on the one hand we have farmers conserving the forest by means of using it while on the other, the population at large, represented by the State's inspection and enforcement institutions, suppresses that use by means of legal and punitive instruments. In such cases there is clearly a conflict, as Souza, Baggio and Corona (2010) have described, when the State forbids the farmer to carry out those activities that he has traditionally undertaken and does so without offering social, economic, or even, we could say, technical conditions that would make it feasible to undertake other differentiated practices that would enable the property to align itself with the environmental legislation.

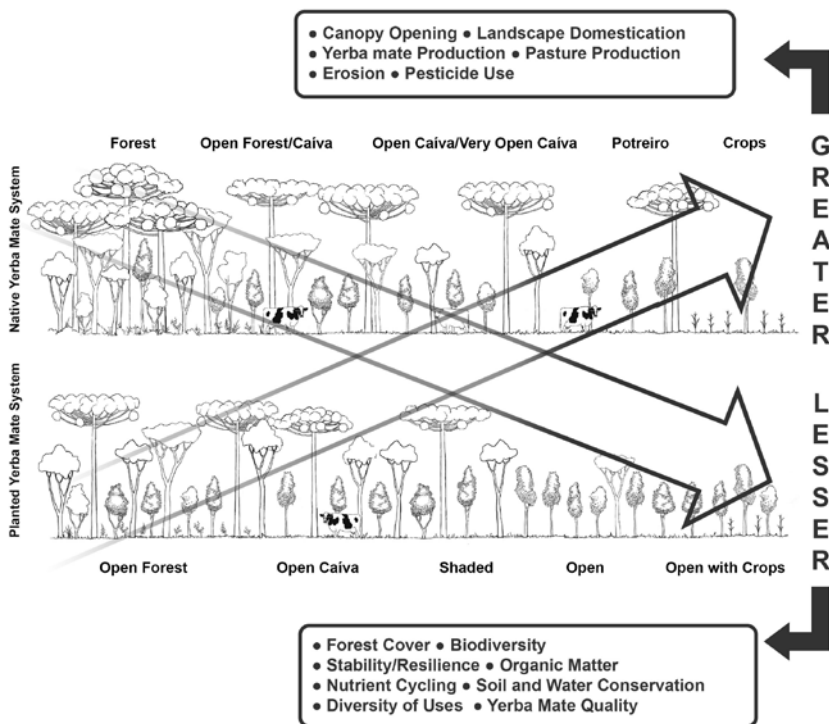
Forests are increasingly seen as generators of value and benefits in addition to their direct production function (BERKES; DAVIDSON-HUNT, 2006). However, the legal restriction on the use of forests, imposed without offering any form of legalized management alternatives, and the non-payment for environmental or ecosystem services generated make many farmers lose interest in maintaining the standing forest (SIMISKI; FANTINI,

2007). In the view of Carneiro and Maluf (2005), the farmer should receive a recompense for the environmental services the conserved forest provides to society.

Thus the feeling of discontent experienced by those PNC farmers who have preserved the forests is quite understandable. However, the way out does not seem to be granting permission to open up more areas but, instead, the development of management systems for Araucaria Forests capable of generating monetary resources from the standing forest, complemented by policies envisaging payment for environmental or ecosystem services, rather than simply vetoing any form of management whatever. It should be borne in mind that, in this case, it has been precisely the use of such areas that has ensured their preservation.

It must be underscored that in both native Yerba Mate landscapes and planted ones, the more the forest cover is diminished, the greater the intensity of domestication of the landscapes the more production of Yerba Mate biomass increases in the light of more intense management practices such as thinning out, clearing fields, applying pesticides and other anthropic interventions that include felling, ploughing, raising livestock and so on; in landscapes with the presence of animals there is an increase in the production of pasture (Figure 3).

Figure 3 – Behavior of some of the properties of Yerba Mate Landscape Units, both native and planted, accompanying diminishing forest vegetation cover.



Source: adapted by the authors of Marques (2014)

On the other hand, with the reduction of forest vegetation cover, there is: a reduction in biodiversity due to the smaller number of plant species and consequently an accompanying reduction in the fauna; a reduction in soil and water conservation capacity due to the greater exposure of the soil surface; a reduction in thermal regulation capacity heightening the risk of frost, drought and other environmental stress phenomena that debilitate the Yerba Mate plants; simplification of the agro-ecosystem, diminishing stability and resilience and making it more susceptible to the attacks of pests, diseases and invading plant species; limitation of the landscape use possibilities, restricting the production of firewood, timber, honey and other products that are important for family consumption on the property; as well as a significant drop in the quality of the Yerba Mate produced.

Accordingly, in general terms, the landscapes with the best levels of forest conservation produce a smaller quantity of Yerba Mate biomass but the product is of a higher quality and has a better level of acceptance in the market. Such landscapes also confer greater stability on the Yerba Mate systems and generate a series of ecosystem services that ought to be remunerated by society at large. The great question involved here is to determine a level of shading or of forest management that is capable of conciliating a good level of biomass production with all the other positive aspects associated to forest vegetation cover.

6 Final considerations

This study of the Yerba Mate formations based on a classification of their landscape units made it possible to identify and characterize various types of Yerba Mate systems present in the PNC together with their significance and their relationship with the environment.

Apart from the fact that it generates significant monetary resources, the Yerba Mate extraction constitutes an activity that produces a reliable income with little investment and it plays an important role as a financial reserve or savings and a stabilizer of the family unit. That being so, it is of great social and economic importance.

The activity of harvesting Yerba Mate is strongly associated to the families' traditions and histories in addition to being an activity that farmers take pleasure in and that endows it with significant social and cultural importance. Furthermore: it contributes to ensuring the conservation of the remaining systems of forest vegetation and of tree species that are under threat of extinction; it enhances the connectivity of forest fragments; and it collaborates in fostering the conservation of soil and water, generating various ecosystem services and allowing for a multiplicity of uses of the forested areas with Yerba Mate vegetation thereby playing an important role in environmental conservation.

Insofar as it contributes to the conservation of the environment and at the same time contributes to social economic and cultural aspects in the lives of the farming families, it can be concluded that the Yerba Mate extraction activity in the PNC is endowed with great importance for socio-environmental conservation. However, the more the forest cover is diminished, even though that may increase production in the short term,

the more the product gradually loses quality and the positive aspects associated to socio-environmental conservation are also lost.

It is also worth stating that the Yerba Mate is one of the most characteristic features of the overall landscape of Santa Catarina's northern plateau, the fruit of a long historical and cultural process of interaction of the local populations with the Yerba Mate environment so that Yerba Mate landscapes can be seen as being veritable cultural landscapes that are characteristic of the region. The process of creating a 'Geographic Identity' which is in course in the region should take good care to attribute a high value to the more well-conserved forest environments with Yerba Mate systems.

In conclusion, the great challenge facing the PNC consists of seeking for a better form of management, with proper legal backing, supported by research and rural extension services together with programs of incentives; a form of management capable of conciliating a significant production of Yerba Mate with all the other desirable social and ecological functions the Yerba Mate systems perform.

References

- ABRAMOVAY, R. **Paradigmas do capitalismo agrário em questão**. São Paulo: HUCITEC /Ed. UNICAMP, 1992.
- ACSELRAD, H. As práticas espaciais and o campo dos conflitos ambientais. In ACSELRAD, H. (ed). **Conflitos ambientais no Brasil**. Rio de Janeiro: Relumbe-Dumará, 2004.
- BARDIN, L. **Análise de conteúdo**. Lisboa: Edições 70, 1977.
- BERKES; F.; DAVIDSON-HUNT, I. J. Biodiversity, traditional management systems and cultural landscapes: examples from the boreal forest of Canada. **International Social Science Journal**, v. 58, n. 187, p. 35-47, 2006.
- BITENCOURT, A. L. V.; KRAUSPENHAR, P. M. Possible prehistoric anthropogenic effect on *Araucaria angustifolia* (Bert.) Kuntze expansion during the late Holocene. **Revista Brasileira de Paleontologia**, v. 9, n. 1, p.109–116, 2006.
- BRANDENBURG, A. **Agricultura familiar, ONGs e desenvolvimento sustentável**. Curitiba: Editora UFPR, 1999.
- _____. Movimento agroecológico: trajetória, contradições e perspectivas. **Desenvolvimento e Meio Ambiente**. Editora UFPR. n. 6. p. 11-28. jul./dez. 2002.
- BRASIL. Ministério do Meio Ambiente. **Instrução normativa nº 6**, de 23 de setembro de 2008. Available at: http://www.mp.ro.gov.br/c/document_library/get_file?uuid=6571fe65-faac-432c-80ad-509df95ec096&groupId=41601 . Consulted on June 20, 2010.
- CARNEIRO, M. J.; MALUF, R. Multifuncionalidade da agricultura Familiar. In: BOTELHO FILHO, F. B (org.). **Agricultura Familiar e Desenvolvimento Territorial – Contribuições ao Debate**. Brasília: UnB, Centro de Estudos Avançados Multidisciplinares, Núcleo de Estudos Avançados. v. 5. n. 17, 2005.

CHAYANOV, A. V. **La organización de la unidad económica campesina**. Buenos Aires: Nueva Visión, 1985.

CLEMENT, C. R. 1492 and the loss of Amazonian crop genetic resources. The relation between domestication and human population decline. **Economic Botany**, 53(2), p. 188-202, 1999.

CENI COELHO, G., Ecosystem services in southern Brazilian agroforestry systems. **Tropical and Subtropical Agro-ecosystems**, v. 20, n. 3, 2017. Available at: <http://www.redalyc.org/articulo.oa?id=93953814004>. Consulted on November 19, 2018.

CORREA, G. et al. Cambona 4: desenvolvimento de uma progênie biclonal de erva-mate em Machadinho, RS. **Embrapa Florestas. Documentos**, v. 224, 2011.

DELPOUX, M. Ecosystema e paisagem. **Métodos em Questão**. n. 07. São Paulo: Instituto de Geografia/USP, 1972.

HANISCH, A. L. ; MARQUES, A. C. ; BONA, L. C. Uso sustentável de áreas de vegetação de caívas e sua relação com os aspectos fisiológicos da produção de leite a pasto. **R.E.V.I. Revista de Estudos do Vale do Iguaçu**, v. 11, p. 129-140, 2008.

IBGE. **Produção da Extração Vegetal e da Silvicultura (PEVS)**. Available at <http://www.sidra.ibge.gov.br/bda/tabela/listabl.asp?z=t&c=289>. Consulted on November 16, 2013.

IEDE, E. T.; MACHADO, D. C. Pragas da erva-mate (*Ilex paraguariensis* St. Hil.) and seu controle. **Boletim de Pesquisa Florestal**, Colombo, v. 18/19, p. 51-60, 1989.

LOPES, N. O. V. **A indicação geográfica como forma de valorização da biodiversidade no planalto norte catarinense**. Dissertation (MSc. in Agro-ecosystems), Universidade Federal de Santa Catarina, Florianópolis, 2011.

LYNCH, O. J. **Whither the people?** Demographic, tenurial, and agricultural aspects of the tropical forestry action plan. Washington, D.C: World Resources Institute, 1990.

MAGALHÃES, M. P. A construção de territórios culturais pelas antigas sociedades amazônicas. **Amazônia: Ciência & Desenvolvimento**. Belém, v. 6, n. 12, p. 69-87 jan./jun. 2011.

MALUF, R. S et al. **Caderno “Segurança Alimentar”**. Fórum social mundial, v. 1, 2000. Available at: http://ag20.cnptia.embrapa.br/Repositorio/seguranca+alimentar_000gvxlxe0q02wx7ha0g934vgwlj72d2.pdf. Consulted on November 20, 2013.

MARQUES, A. C. et al. Florestas Nacionais and desenvolvimento de pesquisas: o manejo da erva-mate (*Ilex paraguariensis* A. St.-Hil.) na Flona de Três Barras/SC. **Biodiversidade Brasileira**, v. 2, n. 2, p. 4-17, 2012.

MARQUES, A. C. **As paisagens do mate e a conservação socioambiental: um estudo junto aos agricultores familiares do planalto norte catarinense**. Thesis (Ph.D. in Environment and Development), Universidade Federal do Paraná, Curitiba, 2014.

MATTOS, A. G. **Caracterização das práticas de manejo e das populações de erva-mate**

(*Ilex paraguariensis* A. Sant. Hil) nativa em exploração no planalto norte catarinense. Dissertation (MSc. in Vegetable Genetic Resources), Universidade Federal de Santa Catarina, Florianópolis, 2011.

_____. **Conservação pelo uso de populações de *Ilex paraguariensis* A. St. Hil, em sistemas extrativistas no planalto norte catarinense.** Tese (Doutorado em Recursos Genéticos Vegetais), Universidade Federal de Santa Catarina, Florianópolis, 2015.

MINAYO, M. C. S. **O desafio do conhecimento** – pesquisa qualitativa em saúde. 12 ed. São Paulo: Hucitec, 2010.

MONTEIRO, C. A. F. **Geossistemas: a história de uma procura.** São Paulo: Contexto, 2000.

NUCCI, J. C.; FÁVERO, O. A.; BIASI, M. Hemerobia nas unidades de paisagem da Floresta Nacional de Ipanema, Iperó/SP: conceito e método. In: IV Congresso Brasileiro de Unidades de Conservação. **Anais Vol 1.** Curitiba: Fundação O Boticário de Proteção à Natureza: Rede Nacional Pró Unidades de Conservação, p. 550-559. 2004.

POSEY, D. Manejo da floresta secundária: capoeiras, campos e cerrados (Kayapo). In: RIBEIRO, D (org). **Suma etnológica brasileira**, vol 1. B. Petrópolis: Vozes. 1987.

RAMALHO FILHO, A. PEREIRA, L. C. **Aptidão agrícola das terras do Brasil:** potencial de terras e análise dos principais métodos de avaliação. Rio de Janeiro: Embrapa Solos, 1999.

REIS, M. S. et al. Management and Conservation of Natural Populations in Atlantic Rain Forest: The Case Study of Palm Heart (*Euterpe edulis* Martius) 1. **Biotropica**, v. 32, n. 4b, p. 894-902, 2000.

REIS, M. S.; LADIO, A. H. Paisajes con Araucarias en Sudamérica: construcciones culturales pre-colombinas y del presente para producción de alimento. In: NAVARRO, V; ESPINOSA, S.(eds). **Memorias de las Jornadas de reflexión acerca de los paisajes culturales de Argentina y Chile, en especial los situados en la región Patagónica.** Rio Gallegos, Argentina: COMOS/UNPA/UMAG. Vol. 1, 224-244. 2012.

REIS, M.S, et al. Domesticated Landscapes in Araucaria Forests, Southern Brazil: A Multispecies Local Conservation-by-Use System. *Frontiers in Ecology and Evolution*. Volume 6, Article 11, February, 2018. Disponível em: <https://www.frontiersin.org/articles/10.3389/fevo.2018.00011/full>. Acesso em 22.set.2018.

ROBERTS, P et al. The deep human prehistory of global tropical forests and its relevance for modern conservation. **Nat. Plants** 3:17093. 2017. doi: 10.1038/nplants.2017.93. Consulted on September 18, 2018.

SAHLINS, E. O. **Cultura e razão prática.** Rio de Janeiro: Zahar, 1976.

SCHMITZ, P. I. Povos indígenas associados à Floresta com Araucária. In: FONSECA, C. R.; et al. (editores). **Floresta com Araucária:** Ecologia, Conservação e Desenvolvimento Sustentável. Holos Editora: Ribeirão Preto, 2009.

SIMINSKI, A.; FANTINI, A. C. Roça-de-toco: uso de recursos florestais and dinâmica da paisagem rural no litoral de Santa Catarina. **Ciência Rural**, 37(3), 690-696, 2007.

SOUZA, A. M. Arranjo produtivo local e Indicação Geográfica: possibilidades para a cadeia produtiva do mate no Planalto Norte Catarinense. In: **SOBER - 48° Congresso da Sociedade Brasileira de Economia, Administração e Sociologia Rural**, Campo Grande, 2010.

SOUZA, A. M. et al. Estudos básicos regionais do Planalto Norte de Santa Catarina. In: DUFLOTH, J.H. et al. (org.). **Estudos básicos regionais de Santa Catarina** (CD) Florianópolis: EPAGRI p. 145-250. 2005.

STEENBOCK, W. **Domesticação de bracatingais**: perspectivas de inclusão social and conservação ambiental. Thesis (Ph.D. in Vegetable Genetic Resources), Universidade Federal de Santa Catarina, Florianópolis, 2009.

STEENBOCK, W. et al. Agroflorestas and sistemas agroflorestais no espaço e no tempo. In: STEENBOCK, W. et al (orgs). **Agrofloresta, ecologia e sociedade**. Curitiba: Kairós, 2013.

TUAN, Y. **Topofilia**: Um estudo da percepção, atitudes e valores do meio ambiente. Trad. Livia de Oliveira, São Paulo: DIFEL, 1980.

VIEIRA, P. F.; WEBER, J. Sociedades, naturezas e desenvolvimento viável. In: **Gestão de recursos naturais renováveis e desenvolvimento**: novos desafios para a pesquisa ambiental. São Paulo, Cortez (2a Ed). 2000.

WANDERLEY, M. N. B. . **O Mundo Rural como um Espaço de vida**. Porto Alegre: Editora da UFRGS, 2009.

ZONNEVELD, I. S. Scope and Concepts of Landscape Ecology as an Emerging Science. In: **Changing Landscapes**: an Ecological Perspective. New York, Spring-Verlag, p 3-30.1990.

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Original Article

YERBA MATE LANDSCAPES: FOREST USE AND SOCIO-ENVIRONMENTAL CONSERVATION

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YERBA MATE LANDSCAPES: FOREST USE AND SOCIO-ENVIRONMENTAL CONSERVATION

Abstract: The Yerba Mate (*Ilex paraguariensis* St. Hil.) is a native arboreal species of forest formations that include the Araucaria Forest and is of considerable socio-economic importance in much of Brazil's southern region. This paper aims to study the different landscapes of the native Yerba Mate systems (NYMS) in the main producing region of native Yerba Mate in the northern plateau region of the State of Santa Catarina, Brazil (*Planalto Norte Catarinense* - PNC) and their relationship to socio-environmental conservation in the context of family farming. Semi-structured interviews were conducted with family farmers and NYMS were evaluated following a specific route. Thirteen types of NYMS Landscape Units were identified as a diagnostic basis for the sustainable management of NYMS and forests. It proved possible to conclude that the Yerba Mate extraction activity is of great importance to socio-environmental conservation in the PNC.

Key-words: Cultural landscape; Family Farming; Native Yerba Mate; Socio-Environmental Conservation.

AS PAISAGENS DA ERVA-MATE: USO DAS FLORESTAS E CONSERVAÇÃO SOCIOAMBIENTAL

Resumo: A erva-mate (*Ilex paraguariensis* St Hil.) é uma espécie arbórea nativa da Floresta com Araucária, de significativa importância econômica and social para grande parte da região sul do Brasil. O objetivo deste trabalho foi estudar as diferentes paisagens dos ervais do Planalto Norte Catarinense (PNC) – principal região produtora de erva-mate nativa de Santa Catarina – and sua relação com a conservação socioambiental, no âmbito da agricultura familiar. Foram realizadas entrevistas semiestruturadas and avaliação de ervais, com base em roteiro específico. Foi possível identificar 13 tipos de unidades de paisagens

dos ervais que constituem uma base diagnóstica para a gestão sustentável dos ervais and florestas. Concluiu-se que a atividade ervateira apresenta grande importância para a conservação socioambiental no PNC.

Palavras-chave: Agricultura familiar; Conservação socioambiental; Erva-mate nativa; Paisagem Cultural.

LOS PAISAJES DEL YERBA MATE: USO DE BOSQUES Y CONSERVACIÓN SOCIOAMBIENTAL

Resumen: La Yerba Mate (*Ilex paraguariensis* St Hil.) es una especie arbórea nativa de la Floresta de Araucaria de significativa importancia económica y social para gran parte de la región sur de Brasil. El objetivo de este trabajo fue estudiar los diferentes paisajes de los Yerba Mateles del Planalto Norte Catarinense (PNC) - principal región productora de Yerba Mate nativa de Santa Catarina - y su relación con la conservación socioambiental, en el ámbito de la agricultura familiar. Se realizaron entrevistas semiestructuradas y evaluación de Yerba Mateles basadas en un itinerario específico. Fue posible identificar 13 tipos de unidades de paisajes de los hierbales que se constituyen en una base diagnóstica para la gestión sostenible de los hierbales y bosques. Se concluye que la actividad Yerba Matetera presenta gran importancia para la conservación socioambiental en el PNC.

Palabras clave: Agricultura familiar; Conservación socioambiental; Yerba Mate nativa; Paisaje cultural.
