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Papers

Between ”soils” and “lands”: etnopedology, rural settlements and participatory processes

Entre “solos” e “terras”: Etnopedologia, assentamentos rurais e processos participativos

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Resumo
A atividade de produção agrícola tem presença pequena, mas de importância expressiva na região Metropolitana de Porto Alegre (RMPA). Esta importância tem motivado a busca por formas de consolidação desta atividade, principalmente a agricultura familiar. Com o objetivo de avaliar as características dos solos, relacionando-os as percepções e avaliações dos agricultores locais, dois assentamentos da RMPA foram visitados, e lotes de moradia e produção familiar escolhidos para este trabalho. Foram utilizados recursos de entrevista semiestruturada, caminhamento e escolha de algumas glebas para amostragem e observação dos solos. Os resultados mostraram que estes solos têm limitações ao uso, como textura arenosa, baixa fertilidade natural e drenagem restrita em algumas áreas. Os assentados conseguem distinguir estas características, e para isto foi importante a comparação com os solos de suas localidades de origem. Este público demonstrou maior familiaridade com abordagens no campo, evidenciando serem estas as formas mais produtivas de diálogo com técnicos e pesquisadores. Foi percebida a identidade entre várias observações do público, e critérios e atributos técnico-científicos utilizados em levantamentos e avalição de aptidão de uso das terras, mostrando a aproximação entre estas diferentes formas de saber, e viabilizando trabalhos no sentido de planejamento de sistemas de produção sustentáveis, de forma participativa

Palavras-chave: agroecologia; etnopedolgia; diagnostico participativo.

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Abstract
The presence of agricultural production in the metropolitan region of Porto Alegre (MRPA) is small but quite significant. This importance has prompted the search for ways of consolidating such activity, especially family farming. With the aim of evaluating soil characteristics and relating them to the perceptions and appraisal of the local farmers, two settlements in the MRPA were visited, where areas of housing and family production were chosen for this study. Resources, such as semi-structured interviews, hiking and the selection of tracts of farmland for soil sampling and monitoring were used. The results showed that the soils have some limitations on use, such as the sandy texture, low natural fertility and, in some areas, restricted drainage. Local settlers can distinguish between these characteristics, and to do this, a comparison with the soils of their places of origin was important. The people displayed greater familiarity with field-based approaches, showing these to be the most productive forms of dialogue with technicians and researchers. Similarities were noted between several observations made by the public and the criteria and technical and scientific attributes used in surveys and in evaluating land suitability, showing a correspondence between these different forms of learning, and making it feasible to plan sustainable production systems on a participatory basis.
Keywords: agroecology; ethnopedolgia; participatory diagnosis.

Introduction

The metropolitan region of Porto Alegre (MRPA) began its formation linked to agricultural activity. Colonisation of the region saw the predominance of cattle ranches and the production of jerky for trade, with the beginning of the 20th century seeing areas of capitalist rice production beginning to gain importance (DUVOISIN, 2008). Currently the MRPA is the most densely populated area of the State of Rio Grande do Sul, concentrating 37.7% of the total population of it, more than 4 million inhabitants (SEPLAN, 2016). These data indicate a growing process of population concentration, with implications for aspects of infrastructure, and reflecting in the quality of life. On the other hand, there are several agrarian reform settlements; according to the Agricultural Census of 2006 (IBGE, 2010), Porto Alegre has 294 farming establishments belonging to individual producers, occupying around 5,600 ha. There are, therefore,

significant vacant urban areas and spaces characterised as rural environment (IBGE, 2010; GRANDO & MIGUEL, 2002). Despite a series of interruptions, action has been taken towards overcoming the problems generated by the growing urbanisation. As such, a part of these efforts can be recognised in the redirection of agricultural activity, especially considering the potential of family farming in relation to social and productive inclusion. To family farming is reputed not only the capacity to adapt to different contexts, but also a significant contribution to food production, which has a positive impact on food and nutritional security in rural and urban communities (MDA, 2009; SCHNEIDER, 2003).

The formation of settlements within the process of Agrarian Reform at a national level aims to promote, among other things, the democratisation of land ownership, the production of basic foodstuffs and the generation of work and income (INCRA, 2011). Another aspect to be considered is that many studies find positive changes in the socioeconomic dynamics of regions or municipalities that start to rely on rural settlements and, in part, also in the socio-economic conditions and quality of life of the settlers (ALVES & SILVEIRA, 2008). According to COPTEC (2011), among the 34 municipalities that make up the MRPA, there are rural settlements (Federal or State) in six municipalities, involving around 1,100 families (Box 1).

However, settling families alone does not guarantee that they will remain, nor does it contribute to the region, and it is necessary to establish diagnostic and planning activities to consolidate these initiatives. As such, there has been much criticism of the vertical and exogenous planning processes, resulting in various approaches that include the participation of the communities involved in these actions (VERDEJO, 2006; GOMES and VILELA, 2004). The need to seek production systems adapted to the local reality, with respect to environmental, economic, social and cultural

conditions and possibilities, has led to the development of different approaches in diagnosing and evaluating the use of natural resources.

Box 1. Rural agrarian reform settlements in the Metropolitan Region of Porto Alegre
Source: Adapted from COPTEC (2011)

Municipality	Settlement	Number of families
Capela de Santana	São José	15
Eldorado do Sul	Faz. S. Pedro	103
	Apolônio de Carvalho	72
	Colônia Nonoaiense	13
	Integração Gaúcha	74
	Padre Josimo	24
	Belo Monte	95
	Lanceiros Negros	7
Guaíba	Dezenove de Setembro	36
Montenegro	Vinte e Dois de Novembro	20
Nova Santa Rita	Itapui/Meridional	68
	Capela	101
	Sino	13
	Santa Rita de Cassia II	101
Viamão	Viamão-Filhos de Sepé	375
TOTAL		**1117**

The present work aimed to evaluate, on a participatory basis, aspects of natural resources, with emphasis on the soils, in rural settlements of the MRPA. Moreover, we wanted to gain knowledge of the experiences, perceptions, evaluations and criteria for land use and management of the settlers at their places of work, as a way of increasing understanding of the logic and organisation of the activities implemented by the family farmers.

Methodology

Characteristics of the physical environment

The region covered by the municipalities of the MRPA corresponds to coordinates 29°20' S and 30°40' S, and 50°20' and 52°10' W. It is located within the Pampa biome, and comprises two distinct topographies: lower, gently undulating terrain and the slopes of the Crystalline shield (HASENACK, 2008; CPRM, 2008). It is inserted in transitions between the main physiographic regions of Rio Grande do Sul, such as the Southeastern Mountains and the Central Depression (southwest); the Central Depression in transition with the lower slopes of the Northeastern Mountains (north), and the Coastal Plain, to the east. As classified by the Köppen System, the climate in these regions is type ‘Cfa’ (a humid subtropical climate with no drought), with an annual precipitation of between 1100 and 1700 mm. The representative soils are respectively the classes of Planosols, Gleysols and Organosols in the areas of floodplain, and Red-Yellow Argisols, Haplic Cambisols and Litholic Neosols in the areas of gently rolling and rolling terrain in the Central Depression and the Southern-Riograndense Shield (STRECK *et al.*, 2008). In general, there are limitations on land use due to the low natural fertility, with problems of erosion, drainage and flooding in several areas. Low-lying fields characterise the floodplains, which are areas that flood during certain periods of the year, making the soils suitable for growing irrigated rice.

Characterization of study models

This study was carried out so as to give value to the protagonism of the farmers and their families, relating the technical and scientific approach to the observations, perceptions and appraisals made by the farmers, and arising from their daily experience and work on the land. In this way, an attempt was made to lay the foundations for an ethnopedological approach (ALVES *et al.*, 2005, ARAÚJO *et al.*, 2013).

Contact was made with the leaders of social movements and technicians from the Cooperative for the Provision of Technical Services (COPTEC), which operates in the settlements. Action was set up for the settlements ‘Santa Rita de Cássia II’ (SRC), in the municipality of Nova Santa Rita, and ‘São Pedro’ (SPE), in the municipality of Eldorado do Sul.

The São Pedro settlement, established in 1986, has a total area of around 2,250 ha, with 100 families that have settled there (COPTEC, 2011). In the settlement, the work was more specifically carried out with an organic-production group (based on agroecology), with the presence of 7 families belonging to different areas of the settlement. Production was basically olericulture and fruit farming, and attempted to follow a management based on agroecology. It should be noted, however, that this mode of production was still at various levels of consolidation, characterising, in a general way, a system in transition or implementation (CAMARGO, 2007).

The settlement at Santa Rita de Cassia II has a total size of approximately 1,660 ha, where 103 families have settled (INCRA, 2009). The areas of floodplain are occupied by rice production in group-production systems, bringing together eight to ten families per group. The ‘high’ areas, with well-drained soils, are mainly used for olericulture. Many settlers have a part of their land in each region, where the higher land is reserved for housing, and the larger area is in the lowlands. Other families have ‘complete’ plots, usually in an area of transition between the high and low regions. In this settlement, the work was carried out with ten families or plots where olericulture in agroecological production systems predominated. In both settlements, characteristics such as region of origin and the choice of a certain production system helped to define groups within the set of settled families (MIRANDA, 2007).

Methodology

Initial meetings were set up in the settlements, where the main idea was to promote awareness of participation in the study, as well as to carry out an initial study to collect impressions of the proposed theme (a diagnosis of the natural resources and their influence on the life and work of the families). The profile of the participants at these meetings, which would eventually constitute the ‘target public’ in each settlement, showed a certain homogeneity with respect to history, current activities and perspectives, and it was possible to define the meetings as those of a ‘focus group’ (MINAYO, 2010).

The reports made by the participants were reinforced, using diagrams and drawings elaborated by them, where the representatives of each geographical sector depicted its principal aspects, such as the location of schools and other social facilities, the location of the plots, and the spatial distribution of land features and land use, characterising the method of participatory mapping (CHAMBERS, 1992). Right from the beginning, it was possible to feel an interest and willingness to participate in the project.

In the second phase, the work was developed on the settlers’ plots. During that time, after a quick meeting with the settlers, COPTEC technicians, university professors and students, the work was carried out in each plot. Wherever possible, this stage included an initial, brief, semi-structured interview (VERDEJO, 2006; MINAYO, 2010), involving some key questions, but allowing the families to highlight aspects that were most important to themselves, such as their origin, experience (in their places of origin and after entering the settlement) and difficulties encountered, as well as such aspects related to work and production as land use and work organisation. After this, a walk was taken around the plot, observing the areas of greatest interest to the farmer in relation to a diagnosis of the characteristics and quality of the soil, in a procedure similar to that defined as a ‘transect walk’ (CHAMBERS, 1992). On these tracts of land (usually

two to four per plot), observations on soil characteristics were made by way of a brief morphological description of the representative profile (SANTOS *et al.*, 2005), in an attempt to fit it into a class defined by a taxonomic system (Embrapa, 2013), in addition to evaluating, in a participative way, some aspects of the limitations and problems, and management practices for overcoming and/or coexisting with them (RESENDE *et al.*, 2002). At the same time, soil samples were collected from the 0 to 20 cm layer for an analysis of the main physical and chemical attributes.

The activity carried out in the plots counted on the participation of the team implementing the project, representatives of the family settled in the plot, other settlers belonging to the working group, and, in some cases, technicians connected with COPTEC. This helped to enrich the dialogue, exchange ideas and approximate the local and technical-scientific learning. The total from the two working settlements were 17 lots and 38 worked lots, with collections of soil samples and observations of the soil profiles at 16 points. Olericulture was the main activity in the sampled areas (21 tracts), where crop, meadow or pasture, and fruit-orchard activities were also important (around five tracts each).

Finally, a schedule was drawn up for the subsequent stages of the work, with emphasis on the team returning to the settlement with the results of the analyses in order to allow the data to be evaluated.

Results and Discussion

Land use and soil characteristics

From the chemical point of view, the results of the analyses showed that they depended on the history of land use and management in the areas. Olericulture, under the production system employed, had an impact on such

attributes as pH, and the organic matter and phosphorus content (Table 1). The greatest values for pH and phosphorus content can be seen in the tracts used for vegetable crops (olericulture), due to the large addition of organic fertilisers every two or three production cycles; on the other hand, due to the ready decomposition of the material and the sandy texture of the soils, the organic matter content remains low (GEBRIM *et al.*, 2010; REIS *et al.*, 2014).

Table 1. Distribution of the number of tracts by reference class, as per CQFS (2004), for soil chemical attributes

	pH			OM			P		
Land use	Hi. to Vhi.	Med.	Low to vlow	Hi. to Vhi.	Med.	Low to vlow	Hi. to Vhi.	Med.	Low to vlow
Vegetables	15	2	4	0	0	21	19	0	2
Others*	3	6	5	0	2	12	4	2	8

Hi: high; Vhi; very high; med: medium; vlow: very low. OM: organic matter content; P: phosphorus content
*pasture, fruits, crops.
Source: The Author, 2018

The characteristics of the soils in the settlements under study derive mainly from the lithology and relief. The following should be noted: the occurrence of deep soils; a tendency for textural change along the soil profile, generally from a depth of 30 to 50 cm; and the colouration, which varies from red to greyish according to the natural drainage of the soil and is in turn conditioned by the relief (KAMPF & CURI, 2012).

These aspects, directly related to usability and susceptibility to degradation, were immediately recognised by the settlers upon their arrival at the sites. The origin of the settlers had a great influence on this, the majority of whom came from the plateau to the north of the state, where the geology, formed from basaltic material, is reflected in soils of a clayey texture and a high iron oxide content, influencing such properties as soil aggregation and nutritional potential for the cultivated plants.

Similarity and strangeness: local perceptions and learning

Concern about the quality of the soil and natural resources, and even the quality of life, is expressed in the choice of production systems based on agroecology. However, a variation can be seen among producers in relation to the level reached within the transition process, most of whom are in the stage of input substitution (GLIESSMANN, 2009).

At the first meeting at SPE, a few reports showed the difficulty of adapting to this new situation, in relation to the natural soil resource: "*sandy soil, especially in the lower areas, different from our region, which was fertile land*." The attempt to reproduce in the settlement the production system from the place of origin was a further obstacle. Another settler, coming from the North, sums up the original idea of the settlers, when planning to use the land for large areas of crops: “*poor man’s appetite, rich man's ideas*” (*barriga de pobre, cabeça de rico)*. The soil granulometry (clay, silt and sand content) has been systematically included by the farmers as one of the most noticeable attributes, and it is a primary characteristic for defining land-use potential and systems for preparing and cultivating the crops. This is more marked when the farmer's experience includes work in areas of varying textures, which allows the resulting differences in soil properties to be seen (FINATO *et al*, 2015).

Similar observations were noticed in SRC. At the first general meeting, the farmers reported a few general aspects of soil texture and morphology, associating this with the original quality of the soil: “*The soil is weak, there are a few centimetres of sand, and then it becomes a ‘tabatinga’*.” In this case, the term "*tabatinga*" characterises the increase in clay at depth, giving a harder consistency to the soil, which is characteristic of the floodplain soils in the region, the Planosols (EMBRAPA, 2013). Perceiving soil characteristics led one settler to mention a class established by the technical-scientific system, when comparing the lands of the settlement with

his place of origin, the “Upper Uruguay” (*Alto Uruguai*): "*there we had fallow land, the Latossols. Here it is more diversified, there are Latosols, but there is also sandy soil, more sand than earth. This is a problem because of erosion.*" It is interesting to note that in this case, an observation is being made based on the characteristics of soil morphological (homogeneity of the soil in its different sections, a reddish coloration, great depth) which usually characterise the taxonomic class of the Latosols (EMBRAPA, 2013; STRECK *et al.* al., 2008). The region where the SRC is inserted does not present this class of soil, however, the similarity of the soils in a few areas of this settlement with the Latosols of the Upper Uruguay, led the farmer to make the comparison, which displays logic from the technical and cognitive points of view.

Initially, we noted that a sandy texture was more likely to be attributed to the floodplain soils, but the experience of daily work in areas of ‘*coxilhas*’ (smoothly rolling relief) also led to more accurate observations about this characteristic: “*People think that it is different from down there, but there is also a lot of sand. Only it's drier.*” This remark shows another very important attribute. Although not mentioned so much, colour in this case is a feature associated by one settler with the differences between the types of soil and environment in his plot: “*up here, the earth is redder*”.

Other attributes of both the soil and the environment are also highlighted in observations by the settlers. As the settlement has a large area under restricted drainage, a few phenomena concerning the dynamics of elements are recognised: “*Sometimes you can see yellow rust, which seems to be pesticide residue. Part of the fertiliser is lost; the water pulls the fat downwards.*” In areas of flat or smoothly rolling relief, where drainage is somewhat restricted, reference is made to the occurrence of concretions in the form of ‘pellets’ or ‘pebbles’. In a plot at SPE, this material can be seen in larger volumes of up to 30 cm in diameter: "*there are stones scattered all over the land*". Although a specific analysis was not made to characterise

and define the origin of these features, it is quite plausible that they originate from iron concretions through pedogenetic processes of reduction, oxidation and cumulative precipitation in the form of iron oxides (KAMPF & CURI, 2012; MIGUEL *et al*., 2013).

It is easy to notice the concern of the settlers with the degradation of the soil and natural resources as being the result of a history of intensive land use under a system of conventional production before the settlement was formed. The observations and experience of the farmers, together with the technical assistance, lead to certain choices for soil preparation and management as well as crop cultivation. For example, the choice to use ground cover is explained by a settler: “*straw breaks up and leaves fat in the earth; if you don’t put down straw, you will have to do 3 or 4 times more weeding*.”

It was thus possible to see that the set of observations, perceptions and knowledge of the settlers, in relation to the available natural resources and their most appropriate use, combines the experience acquired over a long period of working and coexisting with the land, its systematisation and interpretation, and the measures and practices chosen for its management, in order to establish sustainable forms of production. The ability to understand these characteristics in a multidimensional way should be noted, integrating technical, economic, social and cultural aspects, which is implicit in the criteria used in defining land use and management. Barrera Bassols & Zinck (2003) identify this set of perceptions as ‘corpus’, referring to the knowledge gained by local farmers through work, observation and learning, and ‘praxis’, consisting of land-use and management options, and their implementation.

The relationships between forms of learning: reflections and projections

From the roadmap outlined together with the settlers, the final stage of the work consisted of meetings to evaluate the results of the soil characteristics, and of the complete project. At that time, different situations characterised this stage in each of the settlements. In SPE, based on the results of the soil analysis, a meeting was held to discuss the results, as well as an evaluation of carrying out the project in its entirety. The meeting was prepared based on the preparation of visual material to be shown to the set of participants and to technicians from COPTEC, seeking to raise the issue of more-effective participation on the part of the public. Individual reports were also handed out, where for each soil attribute (clay content, pH, organic matter and nutrient content, among others), the levels were classified as being ‘very low’ to ‘very high’, as per CFQS (2004).

The technicians noticed greater difficulty in stimulating a more participative attitude towards the analyses and evaluating the results, unlike in field activities, where the group of settlers is more secure in its observations. The mention of soil types ("*stony soil, coloured soil, small stones on top and earth below*") is more easily related to problems and limitations than are analytical results.

Despite these problems, some points proved to be interesting, allowing group reflection: “*we use a lot of organic fertiliser, but organic matter is still low*.” The technicians involved with production in the settlement also displayed concern over environmental aspects: “*we have to be careful with the heavy metals, zinc and copper*.”The observations and evaluations made at this meeting served to make some changes in the dynamics of the evaluation meeting in CRS. Right from the start, the use of more-dynamic visual resources was tried, where the settlers could also participate, including adding observations or items that they considered pertinent. Thus, a flip chart was used. The approach sought not to give so

much priority to the results of the soil analysis, but to general observations that could be verified by the settlers. Among the points discussed, the characteristic of soil drainage was again highlighted: “*We live on an island, in winter the soil suffers from an excess of water, in the summer it’s very hard and dry*.” Despite a few problems and the need for changes in the production system, the settlers repeated their satisfaction with the adoption of greater production diversity and practices based on agroecological production systems: “*When we arrived at the settlement, monocrops had done away with the birds, but now they're coming back*.” It was important to realise, however, that for the work carried out to bring real profit to the target audience, participation of the technical staff is essential to advise the settlers, as well as facilitate ways of continuing the work. More-detailed criteria for evaluating soil quality, as well as planning forms of management within the adopted production systems, are topics that can be approached in furthering the work, as well as a greater appreciation of field activities, an environment of greater familiarity with the practices and routines of the farmers, and a larger degree of association between the analytical results and the direct observations made jointly by the technicians and farmers.

Final Considerations

The soils in the settlements have characteristics that involve limitations and the need for conservation practices, such as a sandy texture, variations in granulometry throughout the profile and restricted drainage. According to past and recent use and management, the chemical attributes on the surface have already undergone important changes;

The perceptions of the settlers concerning characteristics of the land in the settlements, enriched by their origins in other regions, allowed comparisons that facilitate characterisation of the soil, as well as criteria for adopting usage and management practices;

Greater identification and empowerment of the settlers in observing and evaluating the soil occured when the activities and discussions were carried out directly in the field. This illustrates the need for experience and to adapt approaches and procedures on the part of the implementing group;

There is a similarity between the perceptions and evaluations of the local farmers and the attributes and characteristics used as criteria in the scientific and technical analysis, especially regarding physical and morphological attributes related to soil formation and land suitability. This reinforces the prospect of work, evaluation and participatory planning in defining production systems.

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