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Urban agriculture and wildlife conservation: a case study from Rosario, Argentina

Strategic Spatial Planning (H02N1a)

Prof. P. Van den Broeck

- Abstract -

"Nowadays, due to exponential population growth and a rural exodus, cities are expanding. Infrastructure is needed to support and feed this growing population. Because of the anthropocentric paradigm, this is often to the detriment of wildlife, whereas it would be possible to create cities that are fulfilling for humans as well as for the rest of the living world. It would even be necessary to allow this cohabitation as biodiversity is an essential element for the resilience of the living world. Urban agriculture allows cities to have a certain food autonomy and improves the quality of life of the inhabitants. The question now is to define if it has the potential to integrate wildlife conservation into urban planning."

Research question: How does the urban agriculture programme in Rosario provide a favourable context for the development of a conservation and development strategy for its wildlife?

Key words: Urban agriculture - Integrated management - Agroecology - Landscape Multifunctionality - Wildlife conservation - Biodiversity - Ecosystem services - Participation

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Introduction

Cities around the world are expanding to accommodate their growing numbers of inhabitants. This phenomenon is most often observed in urban areas where biodiversity is rich. Unfortunately, urbanisation is changing the landscape in which wildlife evolves. This is done through the reduction of spaces, their fragmentation and a modification of the spaces surrounding the different habitats. As a result, more diverse ecosystems are found in less urbanised areas (Nilon et al., 2017).

There are several reasons why efforts should be made to conserve urban wildlife. Firstly, cities can be home to endangered species and support rich biodiversity. Secondly, having spaces that support animal conservation has been shown to improve the well-being of urban residents. Finally, given that the majority of the population lives in urban areas, this is the main way for many people to interact with nature and develop a desire to conserve it and support conservation initiatives (Apfelbeck et al., 2020; Nilon et al., 2017). This illustrates the power of urban planning and design to influence people's understanding, attachment and commitment to biodiversity (Nilon et al., 2017). In many cities, there are not even wildlife impact assessments when a new project is developed. And when they do exist, they usually only delay the gradual decline of individual animal species. This is why it is important to develop the creation of new habitats in land-use planning in addition to the conservation of pre-existing habitats. Hence the importance of integrating biodiversity into urban planning (Apfelbeck et al., 2020).

Urban agriculture could be a potential solution to integrate wildlife into urban planning. To explore this, this paper will analyse a case study in Rosario. This Argentinean city implemented an urban agriculture programme in 2001 following the crisis. Since then, the programme has continued to evolve (FAO, 2014). This paper will attempt to determine to what extent this programme constitutes a favourable context for the establishment of an urban wildlife conservation strategy. This will be discussed in the light of certain aspects that are relevant to the establishment of development and conservation strategies for wildlife.

To this end, a theoretical framework will be established. Before starting the discussion on the case study, it will be followed by a brief history of the urban agriculture programme in Rosario. To conclude the discussion, this report will end with the presentation of some challenges and opportunities for the integration of wildlife in the urban landscape planning of Rosario through the programme.

Conceptual framework

In order to define how the Rosario urban agriculture plan creates a favourable context for the establishment of a wildlife conservation programme, this paper will first establish a conceptual framework. This will then be used to discuss the case study in the light of different aspects combining urban agriculture and urban wildlife conservation.

It will consist of an analysis and explanation of four aspects. The first will be the theory about urban wildlife conservation and the landscape features needed to sustain it. Then the multifunctional aspect necessary for the implementation of a sustainable conservation strategy will be investigated. The third will be the integrated management needed to address this multifunctionality. And the last will be the concept of regenerative agriculture with agroecology.

Urban wildlife conservation

Urban wildlife conservation aims to create and conserve habitats that would otherwise have been used solely for human purposes. Depending on the species, conservation efforts will need to be carried out on larger or smaller scales. Indeed, some species need smaller areas than others or are more or less able to adapt to habitat fragmentation. According to George Hess in the chapter *Integrating Wildlife Conservation into Urban Planning* in the book entitled *Urban Wildlife Conservation: Theory and Practice*, the urban landscape in which wildlife evolves can be defined as follows. Species live in different habitats. These habitats can be mainly made up of 3 elements. The first one consists of *patches* that are fairly homogeneous and distinct from their environment. The second one is *corridors* that can link these different *patches*. Finally, these habitats are included in a *matrix* constituting the dominant habitat in the area. In the case of cities it generally consists of spaces built and occupied by humans.

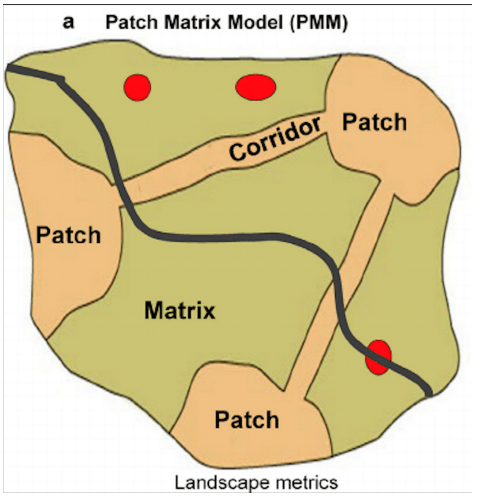

Fig.1 Representation of landscape structure: Patch matrix model (PMM)/ Angela Lausch

The nature of the elements that constitutes a *patch* and its size can influence the development of wildlife. Other elements are also important, such as the nature of the *matrix* surrounding the area. These elements can also interact. For example, larger *patches* are needed to support the same ecosystem in the case of urban densification. In urban areas, open spaces suitable for wildlife development are usually parks with *corridors* of green spaces along the waterways that run through the city (Hess et al., 2014).

Therefore, parks, green spaces and gardens are very important spaces for maintaining biodiversity in urban areas. However, these are gradually disappearing due to urban densification. Hence, as mentioned by Apfelbeck et al. in the article entitled *Designing wildlife-inclusive cities that support human-animal co-existence "approaches are needed that focus on the potential of human-made green spaces for wildlife within the built-up area of cities and that create new habitat opportunities to prevent further loss of urban biodiversity."* (Apfelbeck et al., 2020). Another element that disrupts the mobility and survival of animals between the different patches is the *permeability* between them and thus of the *matrix* which is reduced by urban densification. The cumulative degradation of these factors has an impact on urban wildlife, sometimes leading to the extinction of certain species (Hess et al., 2014). The challenge is to find a way to conserve these habitats by integrating wildlife conservation and development into urban planning.

A *multifunctional planning*

In order to reduce these impacts, there are different approaches to conservation. The first is to compartmentalise between areas for wildlife and areas for human activities, and the second is to find a compromise between the two in the same area. The second approach is more suitable for the urban context due to the lack of space to create areas solely dedicated to wildlife conservation (Hess et al., 2014).

Indeed, biodiversity conservation is often in competition with other land-use priorities. Examples of competing activities in urban areas include mobility, economic growth and housing. In order to effectively integrate wildlife into urban planning, it is necessary to identify and balance the needs of residents and wildlife. This should be done at every stage of project development. The multifunctional aspect of public green infrastructure is important to gain public support for investment in its acquisition and management. In order to find this balance in different urban planning projects, a multidisciplinary governance system operating at different spatial scales is therefore essential (Apfelbeck et al., 2020).

Integrated and multiscalar management

To be able to integrate wildlife into the urban environment, it is necessary to understand who are the actors of urban planing. Depending on the territory, this can be done at different spatial scales or in a more cross-sectional way according to specific objectives.

Today, there are more and more integrated approaches to spatial planning that aim to overcome these sectoral differences. The main objective is to minimise the negative effects often caused by competition between these different sectors in spatial planning. This trend goes hand in hand with more creation of increasingly

multidisciplinary teams in the implementation of different planning projects. In the specific case of biodiversity conservation, this translates into the creation of teams that address not only the needs of humans but also those of wildlife.

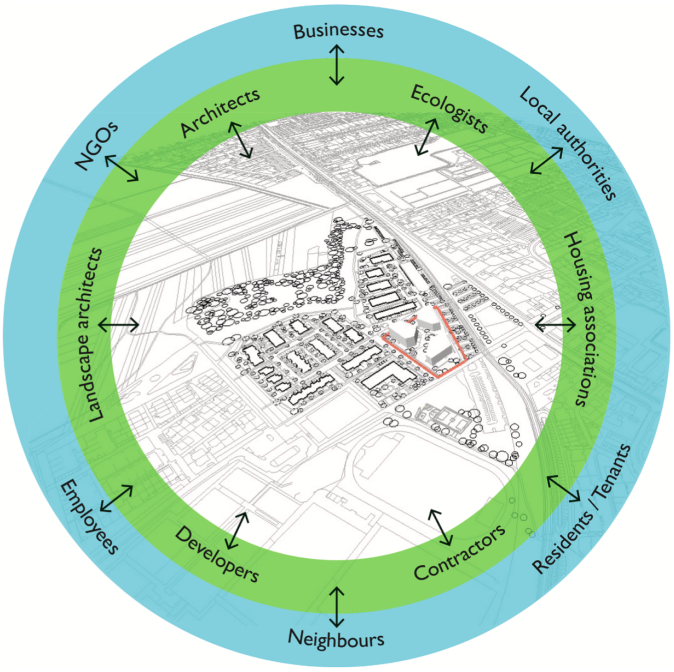

Fig.2 When implementing urban wildlife conservation projects, design teams consisting of architects, landscape architects, developers/builders and ecologists (green circle) jointly develop the project, design and implementation planning. Project stakeholders can be involved in this process (blue circle)./B. Apfelbeck

This allows the creation of wildlife-friendly spaces in urban areas to be systematised instead of isolated, one-off projects (Apfelbeck et al., 2020). This corresponds to the idea of green infrastructure, the fundamental principle of which is based on the creation of ecologically functional green spaces (Hess et al., 2014).

In practice, this translates into the integration of ecologists into multidisciplinary teams from the earliest stages of various urban planning projects (Apfelbeck et al., 2020 ; Hess et al., 2014). This allows for real thinking about spaces in terms of the targeted wildlife and its entire life cycle in addition to human needs (Apfelbeck et al., 2020). As when George Hess mentions green infrastructure, this approach needs to be seen and built as a "*long-term investment in a healthy community that benefits people and nature, and is created with respect for the desires of the community and individual landowners*" (Hess et al., 2014).

Another important element in the implementation of a wildlife conservation project is the involvement of stakeholders who have no formal power over decision-making on urban development design. This ensures that wildlife integration projects take place in different areas of the city, ranging from public parks to private gardens, but also avoids conflicts between humans and animals (Apfelbeck et al., 2020).

Agroecology

As with the implementation of urban planning projects, it is necessary to recognise the multifunctional nature of agriculture and the multiple ecosystem services it can provide. One method of farming that reflects this character is agroecology.

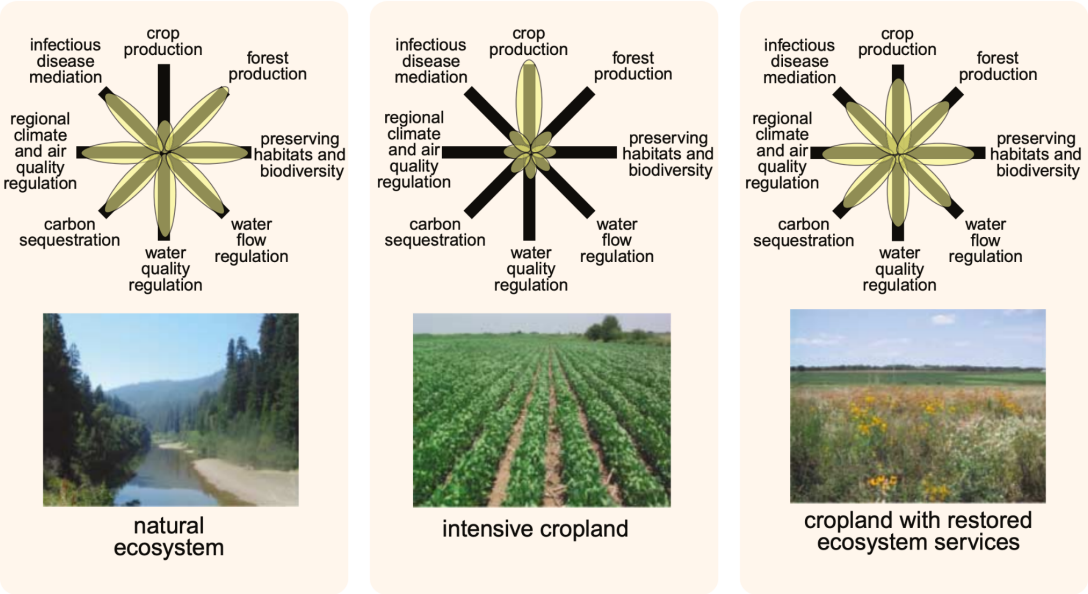

Fig.3 Provision of ecosystem services under different land uses./ J.A. Foley et al.

This discipline has been around for a long time and has given rise to many different schools and practices of agroecology. Nevertheless, most practitioners agree that this discipline seeks to work within a complex context to manage farming systems in a sustainable way. This means that it aims to minimise the effects of agriculture on the environment, or even have a beneficial effect on it, while being attentive to the socio-economic factors in which the project is embedded. This makes it an interdisciplinary science that includes agronomy, ecology and economics, among others (Dalgaard et al., 2001).

When successfully implemented, agroecology can provide a multitude of ecosystem services compared to other monofunctional land uses such as intensive agriculture. As you can see on figure 3, these include resilience to environmental disturbances, carbon sequestration, water quality regulation, etc. (Kremen & Miles, 2012)

Context

Socioeconomic context

The city of Rosario is located in the northeast of Argentina, in the province of Santa Fe, about 300 km from Buenos Aires. It is the third most populous city in Argentina and the most populous city in the province of Santa Fe with an estimated population of almost 1.3 million inhabitants. Under the military dictatorship of the mid-1970s, the city's economy declined sharply due to increasing foreign debt and factors related to international markets. The return to democracy was not enough to manage a return to economic growth. The economic and social crisis, characterised by high unemployment, was aggravated by the arrival of migrants mainly from rural areas north of Rosario (Hardoy & Ruete, 2013).

After the return to democracy in 1983, a candidate of the Radical Civic Union had initiated important changes in Rosario's urban planning, which the socialists later built on by strengthening its social dimension. Since then and until 2019, only socialist mayors have been elected in Rosario; the basis of urban planning and development has always remained the integration of a social dimension. (Almansi, 2009).

Biodiversity and wildlife in Rosario

Vegetation

Human activities have displaced native species, so that the original vegetation has been almost destroyed. There are currently three large natural areas for public use in the city. The Bosque de los Constituyentes, the Parque Regional Sur with and the Deliot legacy. They are among the few places where it is still possible to observe some native species (Municipalidad de Rosario, 2016).

Fauna

Rosario has a relatively diverse fauna, mainly thanks to the Paraná River at the city's border and the rivers that cross it. Indeed, nearly 185 species of fish have been recorded in the river. There are also many species of amphibians and reptiles in the city. Birds are also quite present in the city, thanks to the areas suitable for nesting. The city also has a wide variety of duck species. The most common birds that can be observed daily by the inhabitants are pigeons, sparrows and woodlarks. Regarding mammals, the most emblematic animal present in the territory is the capybara. Otters and weasels can also be observed along the waterways. Some bats have also been observed in Rosario. It

should be noted that the fauna is mainly dominated by the species best adapted to the urban environment and that several species have already become locally extinct (Ibid).

Urbanisation

The urban area covers an area of about 179 square kilometres, of which about 120 are urbanised. It has a total area of green spaces of more than 11 square kilometres, which represents more than 6% of the total area of the territory, divided between parks, squares and other green spaces (Ibid.). About 36% of the territory consisted of vacant spaces in 2014 (FAO, 2014).

Discussion

In Rosario, Argentina, an urban agriculture programme that is still running today was set up during the economic and social crisis of 2001. The way in which this programme was set up and operates today, as well as the creation of cultivated areas in the city, may have potential for the development of a wildlife conservation programme. Indeed, several similarities have been established between Rosario's urban agriculture programme and the literature on different urban wildlife conservation strategies. The remainder of this paper will discuss the different aspects of the Rosario urban agriculture programme in the light of the theoretical framework in order to answer the research question of how the Rosario agriculture programme creates a favourable context for a wildlife conservation and development strategy.

Urban wildlife conservation and development

This section consists of an analysis of the different areas included in the urban agriculture programme in Rosario to determine their potential to be integrated in a conservation or development strategy for wildlife in Rosario.

Initially, the programme aimed to provide seeds and tools to 20 groups in the city to enable them to carry out market gardening activities. However, since such activities require land to be cultivated, a study was conducted by the National University of Rosario on the city's vacant spaces. It determined that approximately 36% of the city's space was vacant. These spaces were mainly made up of land along the river, highways and railway, areas prone to flooding and some greenbelt land that had not been developed due to lack of funding. To allocate this land for market gardening, the mayor approved an ordinance in 2004 allowing it to be quickly allocated for use by residents (FAO,2014).

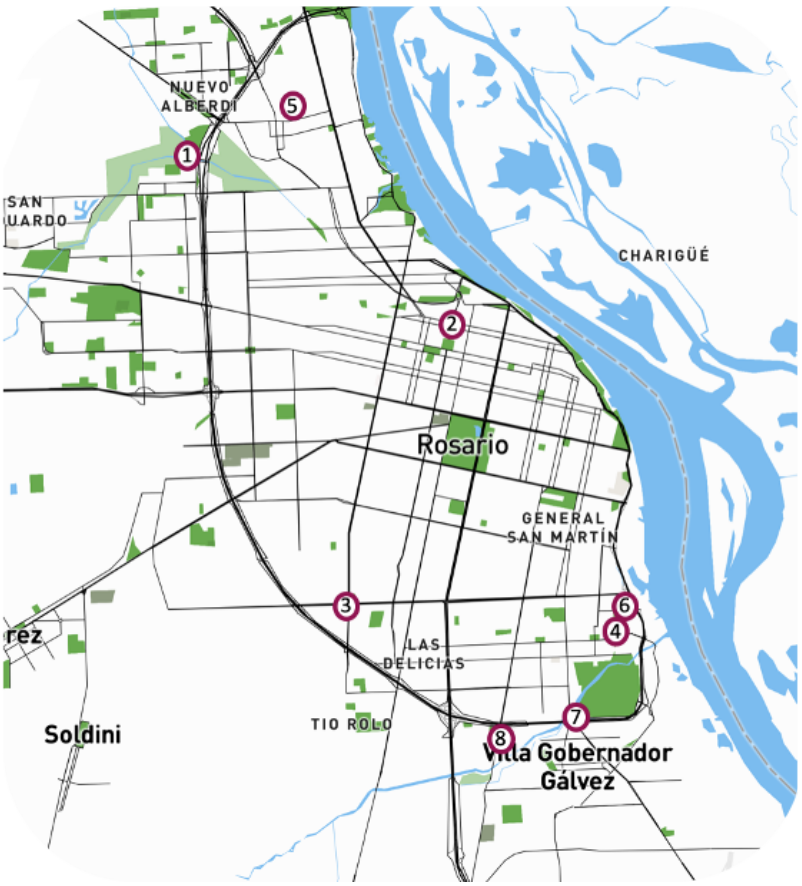

Fig.4 Map of strategic points of the urban agriculture programme in Rosario /(FAO, 2014)

In 2014, the green circuit of the programme consisted of a mix of different areas dedicated to organic farming for a total of about 30 hectares. The smallest cultivable areas called *huertas-jardines* are used for growing medicinal and aromatic plants as well as vegetables to harvest seeds and cut shrubs. There are also two hectares of garden in the north of the city (see figure 4 point 5) along the railway which benefit the surrounding schools as well as residents. As for the plots actually dedicated to professional use, there are several productive two-hectare gardens shared by several market gardeners scattered around the city and used for commercial market gardening. Finally, the largest plots are shared among 5 parks in the city. Many of these plots are on land that was not cultivable due to heavy metals or repeated flooding. Thanks to soil fertilization techniques with compost and residues, the soil has regained its fertility. The plots are also cultivated entirely organically (FAO, 2014).

The diversity of the plots cultivated by their size but also by their surroundings makes these areas ideal candidates for biodiversity conservation. Indeed, the main element to conserve or allow the development of wildlife in an urban environment is to conserve or create a suitable habitat. To do this, the size and nature of the different *patches* as well as the *permeability* of the *matrix* in which they are embedded and the *corridors* that connect them are all necessary elements for the establishment of a

strategy for the maintenance or development of wildlife (Hess et al., 2014). Depending on the nature of the elements that make up the different parcels of the programme, they could fulfil these different functions in the framework of a programme for the conservation or development of biodiversity.

For example, the smaller gardens or *huertas-jardines* can increase the permeability of the *matrix* and enable fauna's mobility. The garden along the railway could act as a corridor. As for the garden parks, these could act as *patches*, especially as they are embedded in larger green spaces. The immediate environment of the different *patches* is also important in order to increase the quality of the habitat for biodiversity conservation (Hess et al., 2014).

These different patches are also cultivated in organic farming. This helps to maintain biodiversity but is not enough. Indeed, a more global approach at the level of the landscape as a whole is necessary to enable the implementation of a successful strategy for the conservation or development of biodiversity (Dalgaard et al., 2001; Bengtsson et al., 2005). A multifunctional approach as in the basic principles of agroecology is among the solutions to achieve this (Kremen & Miles, 2012). Fortunately, it is a principle that is inherent to urban agriculture (Dubbeling et al., 2009). The next section will analyse this aspect in the framework of the Rosario urban agriculture programme.

From multifunctionality to wildlife conservation

According to the principles of agroecology (Dalgaard et al., 2001) and emerging theories on agriculture in a broader sense, it is necessary to link a multitude of aspects that meet the different needs of a multitude of stakeholders when planning the landscape. These include, of course, agricultural production, biodiversity and ecosystem services and economic development. This interdependence is reflected in the need to take these different aspects into account in spatial planning (Estrada-Carmona et al., 2014). The same is true for urban wildlife conservation and development strategies, which rely mainly on the ability to balance the use of green spaces or the use of *patches* between human and wildlife activities (Hess et al., 2014).

In the case of the urban agriculture programme in Rosario, this multifunctionality has developed over time. The programme was basically created to address the crisis of 2001. At that time almost a third of the population of Rosario was unemployed. It was in response to this socio-economic crisis that the municipal government launched the urban agriculture programme in Rosario (FAO, 2014). Then, in addition to addressing the immediate need to generate additional income and food for the population the programme began to diversify the functionality of its urban agriculture (Montiel, 2015).

Indeed, efforts have been invested in several areas. Firstly, with the educational field, the creation of training spaces and the participation of schools. Secondly, there was a will to create social cohesion in addition to promoting economic income with the creation of markets and a label for products from Rosario's urban agriculture as well as events centred around it. Efforts have also been made in the area of ecosystem services, with the introduction of agroecological techniques in the training of market gardeners and the labelling of products as totally organic (FAO, 2014).

This multifunctionality is all the more important in view of the decrease in the number of participants when the unemployment benefit ceased to be conditional on participation in a social activity of which the programme was part of. Indeed, although the programme has enabled some families to make urban agriculture their main means of subsistence or an essential input, urban agriculture in Rosario is not actually perceived as a stable and sufficiently remunerative source of employment, constituting a significant contradiction for the programme (Montiel, 2015).

Nevertheless, if not for the substantial gain in income for all the participants in the programme, it has allowed other services to be provided even if they are more difficult to quantify. Among them is the service to biodiversity and wildlife. This inherent multifunctionality of the programme is one of the foundations of agroecology and wildlife conservation. Therefore, the programme could provide a favourable context for the development of a wildlife conservation strategy.

However, one final element necessary for the establishment of such a strategy will be addressed. This is the need to have an integrated management system for the programme that addresses this need for multifunctionality in a way that best meets the challenges and needs of the different stakeholders in the area, including humans and wildlife. The analysis of the governance and management of the programme will be the last part of the case study discussion.

Integrated planning management to meet multifunctional needs

Nowadays, spatial planning systems integrate the need to address spatial planning in a holistic way by responding to the different needs of the actors in a territory. However, in order to meet this challenge an integrated management of the territory is necessary (cf. class). This is also the case when establishing a wildlife conservation or development strategy (Apfelbeck et al., 2020; Nilon et al., 2017).

To some extent, Rosario's urban agriculture programme can be seen as a good example of integrated spatial management. Indeed, its governance structure involves actors at different spatial scales, from different sectors and from various institutions (see figure) (FAO, 2014).

Such complexity is often necessary in order to best respond to the different needs of the population. In the case of Rosario, this is even more complex given the disparities within the population (Montiel, 2015).

The existence of a network such as this one (see figure 5) has certainly played a key role in the implementation of the urban agriculture programme and participated in the conservation of biodiversity. One example is the access to land and the stabilisation of land use for agriculture, which would not have been possible without coordination between the different actors of the integrated management network (FAO, 2014; Montiel, 2015).

Finally, this integrated network creates a favourable context for a wildlife development and conservation strategy. Indeed, it would be a big step forward towards the integration of wildlife conservation if specialists and advocates were included into the management of the programme. As a result, wildlife interests are represented in spatial planning in order to have a multidisciplinary and multiscalar team capable of meeting the needs of both humans and non-humans.

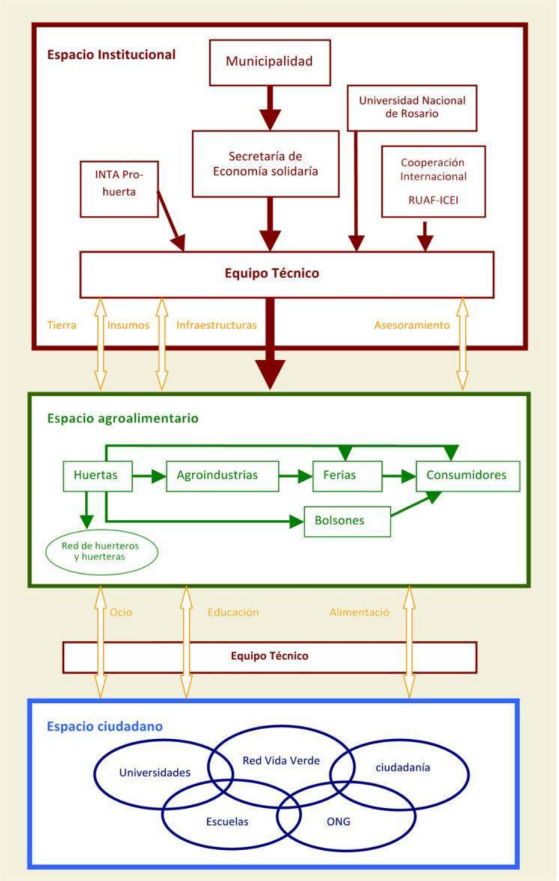

Fig.5 Le réseau du Programme d'Agriculture Urbaine de la ville de Rosario, Argentine/ (Montiel, 2015)

Conclusion

Summary

In conclusion, the urban agriculture programme creates a favourable context for the implementation of a wildlife conservation and development strategy based on a multitude of aspects. Firstly, the programme creates spaces for urban agriculture with high potential for wildlife development and conservation. Due to their different sizes and direct surroundings, they consist of the main elements necessary for the conservation or establishment of spaces for wildlife by creating potential spaces for *patches* and *corridors* and increasing the *permeability* of the city's built-up *matrix*. In addition, by implementing these spaces in the programme, agricultural activity is sustained and ensures that those areas will not host activities to the detriment of local flora and fauna.

This sustainability is also ensured by the inherent multifunctionality of urban agriculture. By meeting the various needs of the different stakeholders in the area, these agricultural areas ensure that they are maintained in the long term. In order to evolve the use of these spaces according to the needs of the different stakeholders, the agriculture programme has an integrated management consisting of a multidisciplinary network operating at different scales of the territory. Which is also a success factor in development and wildlife conservation strategies. The same network would be needed to establish a successful strategy, including ecologists to represent the interests of wildlife in general in urban planning through the programme.

Challenges and opportunities

The urban agriculture programme is a real opportunity to integrate a biodiversity and wildlife conservation dimension into urban planning in Rosario. However, one of the challenges is to find a balance in the use of those spaces that would be dedicated to conservation. To do this, it would be necessary to value biodiversity in the eyes of the different stakeholders and the population. One way could be to develop tourist activities around these spaces, as it is already the case for urban agriculture. Furthermore, there are already many projects and theories studying this alternative model under the name of ecotourism or sustainable tourism that could be used as references for the development of such a project.

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