Recibido: 01-12-2021
Aceptado: 02-08-2022

PLANNING THE RURAL URBAN FRINGE OF SANTA EUFEMIA, CÓRDOBA, ARGENTINA[1]

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA.

EMILIANO JAVIER CAHE [2]
JORGE DANTE DE PRADA [3]

1 Research financed by the PERHID CIN Postgraduate Scholarship

2 Magíster en Ciencias Agropecuarias
Universidad Nacional de Río Cuarto (UNRC), Río Cuarto, Argentina.
Docente-Investigador, Departamento Economía Agraria, Becario Doctoral, Instituto de Investigaciones Sociales, Territoriales y Educativas (ISTE) - Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)
https://orcid.org/0000-0002-2967-2287
ecahe@ayv.unrc.edu.ar

3 Doctor en en Economía Agraria y Recursos
Universidad Nacional de Río Cuarto (UNRC), Río Cuarto, Argentina.
Docente-Investigador, Instituto de Investigaciones Sociales, Territoriales y Educativas (ISTE) - Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)
https://orcid.org/0000-0001-9732-0497
jdeprada@ayv.unrc.edu.ar

DOI: https://doi.org/10.22320/07183607.2022.25.46.03

El objetivo de este artículo es mostrar cómo diseñar y evaluar la visión estratégica territorial de la Franja Urbano Rural (FUR) en la localidad de Santa Eufemia, Córdoba, Argentina. La metodología se basa en un procedimiento multicriterio por fases dirigido al gobierno municipal y los actores que éste involucró. En la fase 1, se identificaron los problemas (oportunidades) y aspiraciones locales mediante entrevistas en profundidad. En la fase 2, se diseñó y valoró un menú de alternativas para dos decisiones estratégicas que emergen de las entrevistas: la regulación hídrica (desagües) y la provisión de alimentos de proximidad. En la fase 3, se relevaron las preferencias de los actores y se evaluaron las alternativas mediante el algoritmo Promethee. Las alternativas elegidas fueron incluidas a la visión de FUR y complementan tres decisiones estructurales (localización de un parque industrial, poblamiento urbano futuro y gestión de residuos). Comparada con las prognosis, dichas alternativas presentan mejor performance, aunque se reconocen algunas limitaciones. Una de ellas reduce 50% los escurrimientos hídricos que potencialmente afectarían a la localidad y otra incrementa la producción de alimentos de proximidad 27%, genera excedentes económicos (12 puestos de trabajo) y minimiza significativamente los riesgos de enfermedades zoonóticas y de contaminación por agroquímicos. Ahora bien, las alternativas requieren más inversiones y un esfuerzo político institucional mayor que la prognosis. Por último, los actores valoraron las alternativas diseñadas junto a las tres dimensiones de la sostenibilidad (criterios de comparación) y acordaron avanzar en una decisión de compromiso sobre la visión de FUR.

Palabras clave: ordenamiento territorial, periurbano, diseño colaborativo, ayuda multicriterio discreta.

This article seeks to show how to design and evaluate the territorial strategic vision of the Rural-Urban Fringe (RUF) in Santa Eufemia, Córdoba, Argentina. The methodology is based on a multi-phase multi-criteria procedure for the municipal government and the actors involved. In phase 1, local problems (opportunities) and aspirations were identified through in-depth interviews. In phase 2, a menu of alternatives was designed and assessed for two strategic decisions that emerged within the interviews, namely, rainwater drainage and local food provision. In phase 3, the actors' preferences were revealed, and the alternatives were evaluated using the Promethee algorithm. The chosen alternatives were included in the RUF vision and complemented three structural decisions (location of an industrial park, future urban settlements, and waste management). Compared with the prognosis, the alternatives chosen, have a better performance, although some limitations are recognized. One of the alternatives reduces the water runoff that could potentially affect the locality by 50%. Another alternative increases local food production by 27%, generating an economic surplus (12 jobs) and significantly minimizing the risks of zoonotic diseases and agrochemical contamination. However, the alternatives require more investment and an increased institutional political effort than in the prognosis. Finally, the actors appreciated the alternatives designed with the three sustainability dimensions (comparison criteria) and agreed to move forward on a compromise decision about the RUF vision.

Keywords: spatial planning, peri-urban, participative design, discrete multi-criteria analysis

REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PÁG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PAG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

I. INTRODUCTION

The Rural-Urban Fringe (RUF) is a synergistic territory for urban and rural development, with a high risk of disintegrating. Disintegration has been associated with the phenomenon of dispersed urban sprawl (Scott *et al.*, 2013; Le Bivic & Melot, 2020) and the loss of complementarity between different land uses and services of the RUF (Gallent, 2006; La Rosa, Geneletti, Spyra, Albert, & Fürst, 2018). In some regions, such as Latin America, the impacts of disintegration are alarming (Inostroza, 2017). For example, in the south of Córdoba, Argentina, the growth of 69 urbanized areas was scattered and, among the other effects recorded, it was three times greater than the population increase between 2001-2018 (Cahe & de Prada, 2022)

To minimize disintegration and appraise the services of the RUF, territorial planning received increased attention. The RUF was assessed to develop green belts, agricultural parks, and to reserve areas for future urban development in England (Gallent, 2006), to facilitate the mixed and complementary use of land in Sweden (Hedblom, Andersson & Borgström, 2017), to regulate the water cycle in Mexico (Nanninga *et al*., 2012), and/or to mark off local productive areas in Argentina (Zulaica & Ferraro, 2013; Hermida, 2015)

Different planning approaches have been used in this sphere. Scenario planning was used in South Africa to manage new urban developments on the RUF (Cash, 2014), collaborative planning was used to resolve conflicts on dispersed urbanizations in Peru (Haller, 2017), and territorial planning was considered to support the urban-rural spatial balance in the urban fringes of two regions of Italy (Cattivelli, 2021), and to identify areas of conflict with productive potential near La Plata, Argentina (Baldini, Marasas, Tittonell & Drozd, 2022).

Participatory and collaborative approaches have demonstrated a better performance to start the planning process (e.g., they help to identify problems for actors and possible solutions), although they are limited and methodologically imprecise. In that sense, Nanninga *et al*. (2012) used participatory planning and combined it with scenarios to improve the understanding of the study addressed. Scenario planning seems to overcome this situation for specific RUF issues (future urban settlement, drains, transport), but the methods that consider stakeholder interactions are reduced (Geneletti, La Rosa, Spyra & Cortinovis, 2017). This has triggered the use of methods such as land use planning (LUP) (Gómez Orea, 2008) and the integration of approaches such as LUP and ecosystem services (Gallent, 2006; Scott *et al*., 2013), geographic information systems and multicriteria decision analysis (de Prada *et al*., 2017; Boggia *et al*., 2018) to explore planning opportunities, bring together actors, and support decisions. However, LUP plan preparation times are rarely pragmatic for political timeframes and need innovative approaches to link RUF services with the needs of each case addressed.

This article shows a phase-based multicriteria procedure (PMP) to design and evaluate the vision of the RUF of Santa Eufemia, Córdoba, Argentina. The hypothesis behind this research is that there is at least one vision of RUF that can synergistically integrate local aspirations and needs with the services of this territory, and overcome the trend. Along these lines, an online PMP for planning the RUF is laid out here, showing how stakeholder involvement helps to identify relevant issues for the local agenda.

II. THEORETICAL FRAMEWORK

The Rural-Urban Fringe (RUF) is a transitional territory between the urban and the rural with multiple services. The RUF can be a territory to locate a future urban settlement (Le Bivic & Melot, 2020), for the supply of essential goods and services for the population (e.g. fruit and vegetable food production) (Boccolini & Giobellina, 2018), as well as to promote local economic growth with new industrial and commercial areas (Cattivelli, 2021). In the same way, it can constitute a territory to hierarchize ecosystem services, and amenities (Baró, Gómez-Baggethun & Haase, 2017), and to strengthen the regulation processes of the water, air, and nutrients cycle (e.g. waste, effluent) from human activities.

The academic field has recognized the RUF as a territory, differentiated from the urban and rural, that requires planning (La Rosa *et al*., 2018). Planning of the RUF is recent and regions such as Europe, the USA, Canada, and China are more advanced in the development and application of planning approaches (Geneletti *et al*, 2017). The authors propose a new planning approach, called sustainable planning, which is related to the spatial distribution of the RUF's land and human activities. The approach incorporates sociological and sustainability principles, which help to align the aspirations of the actors who take part in the planning process, and encourage thinking about a long-term territorial vision.

The design of the vision is the starting point of territorial planning and, for this, there are three different approaches. A group of authors designs the visions (Envisioning design system) by generating different images of the landscape from virtual reality or geographic information systems (GIS) (Stock, Bishop & Green, 2007).

Figure 1. Location of Santa Eufemia, Córdoba, Argentina. Note: (33°1130S; 63°1730 O). Source: Preparation by the author.

Others use territorial foresight to structure the objectives and strategy into long-term thinking (Vargas-Lama & Osorio-Vera, 2020). Finally, some use phase-based procedures and discrete multicriteria methods with the participation of the actors to choose the vision (de Prada *et al*., 2017). This work extends the phase-based multicriteria procedure and interacts virtually and face-to-face with the actors to plan the vision of the RUF as a space with its own identity.

III. METHODOLOGY

The study area is a town of 2,700 inhabitants in the south of Córdoba, Argentina (Figure 1). The design of the RUF vision was developed in three phases through face-to-face and online interactions – the result of the Pandemic *SARS-Cov-2* (de Prada *et al*., 2017). These are explained below.

Identification of problems and aspirations

In the first phase, local problems and, gradually, the aspirations of the actors were identified using a snowball method (Otzen & Manterola, 2017). Using Quantum Gis, historical images from Google Earth, and direct observations, a geographic information system (GIS) was built to quantify the evolution of urban sprawl and services (activities and land use) present in the RUF. 14 semi-structured face-to-face interviews were conducted (Díaz-Bravo, Torruco-García, Martínez-Hernández & Varela-Ruiz, 2013), with differentiated protocols for authorities (Intendent, Government secretary, President of the Council, and Councilors) and important local actors (professionals, agricultural and livestock producers, and representatives of social organizations). Eleven interviews were individual, and three in groups, and lasted 35 minutes on average.

Alternative planning visions

The second phase specifically considered planning the vision of the RUF. Work was done to define the surface area and territorial limits. Interactions with the actors took place online, in five meetings using Meet®. In the first meeting, the importance of the RUF was discussed and the actors defined the limits of this territory (Figure 3). The limits considered were administrative falling under the management of the government. In the second meeting, possible solutions to the problems identified in the interviews were discussed, considering the flow of goods and services of the RUF.

In the following three meetings, progress was made in the design of the local runoff and drainage water regulation service and the local food supply service as a solution to two main local problems. For the water regulation service, rural and urban sub-basins were digitized to analyze the runoff and water infrastructure. The curve number (CN) method was used (USDA-SCS, 1968) to dimension the

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PÁG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PAG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

maximum runoff of each sub-basin considering a design rainfall of 125 mm and a frequency of 1/25 years. In the GIS, the existing drainage network was designed together with drainage alternatives and soil and water conservation practices in rural areas. Meanwhile, for the local food supply service, three productive modules of one hectare per module were designed, located on vacant (unused) lots owned by the municipality. Module 1 integrates lettuce and tomato horticultural crop systems; Module 2, peach and orange fruit plantations, and; Module 3, sheep, pigs, and dual-purpose (egg and meat) poultry farming.

To make the alternatives comparable, comparison criteria were identified for each sustainability dimension. In the case of the water regulation service, two environmental criteria were developed: maximum flow (m^3 $second^{-1}$) and flood-health risks. The first one considers the aggregate value of the estimated runoff for each sub-basin and is used in relative terms to facilitate the decision. The second qualitatively indicates the physical-health hazards of handling runoff. An economic criterion, investment ($), was also considered, which measures the financial efforts needed for the land volumes to be moved and the meters of canals to be built in each alternative based on data published in the Argentinean Ministry of the Interior, Public Works and Housing.

In the case of the local food supply service, two economic criteria were considered, equivalent annual net present value (EANPV, $ $year^{-1}$) and investment ($), prepared from a private benefit-cost analysis (BCA) of the productive modules, following de Prada *et al*. (2014). An environmental qualitative criterion was also added here, health risk or bad odors. Meanwhile, for both services (Regulation and Supply), a social criterion was considered, Institutional Political Effort (IPE), which indicates the behavioral changes of the government and the community needed to develop either alternative.

Evaluation and selection of the Rural-Urban Fringe vision

In the third phase, the alternatives were evaluated together with local authorities and actors, in two online workshops. The PROMETHEE method was used (Brans & Mareschal, 2005), to rank the alternatives and guide the policy recommendation. The participants' preferences were assessed individually, using a scale of 0 to 10. Preferences with values equal to 0 remove the criterion; 1 indicates that the criterion is unimportant and 10, that the criterion is very important. The common preference function was used for qualitative criteria and the linear function for quantitative criteria. The indifference and absolute preference index values were 10% and 90%, respectively. Finally, a sensitivity analysis was performed considering values of 30% - 70% and 40% - 60%, respectively.

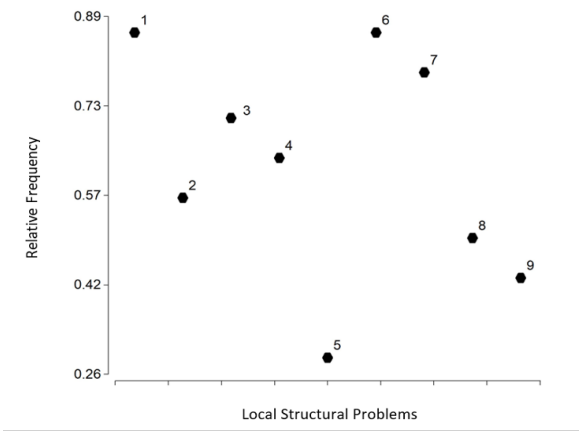

Figure 2. Frequency of structural problems in Santa Eufemia, 2020. Note: 1= Risk of flooding and collapse of storm drains; 2=Lack of local employment; 3=Lack of sewers; 4=High water tables; 5= Clandestine landfills; 6= Spread of zoonotic diseases and loose domestic animals; 7=Contamination from agrochemical applications; 8=Air pollution, bad odors; 9= Lack of green spaces. Source: Preparation by the author.

IV. RESULTS

The results of the interviews showed the perception of nine local structural problems (Figure 2). More than 80% of the interviewees mentioned as the main problems, the risk of flooding and collapse of storm drains; the spread of zoonotic diseases - loose domestic animals, and contamination by agrochemicals. 70% and 60% of respondents cite problems of a lack of sewer services and a high water table, respectively. And less than 50% list problems such as lack of employment; clandestine landfills; bad odors from local industries, and the need for green-recreational areas. In general, the interviewees associate these problems with dysfunctions of the rural-urban space and limited governance. In 8 out of 14 interviews, possible solutions emerged, such as: "create a green belt"; "do afforestation to prevent contamination by agrochemicals"; "if we add forest, we improve the environment too".

Vision of the Rural-Urban Strip

The aspirations of the actors to solve the problems of flood risk and storm drain collapse and the spread of zoonotic diseases and loose domestic animals guided the design of the vision. Through an agreement between the actors, the administrative limits of the RUF were set, and, out of the three proposals analyzed, an area of 625 ha was considered. Figure 3 shows the 2040 territorial vision of

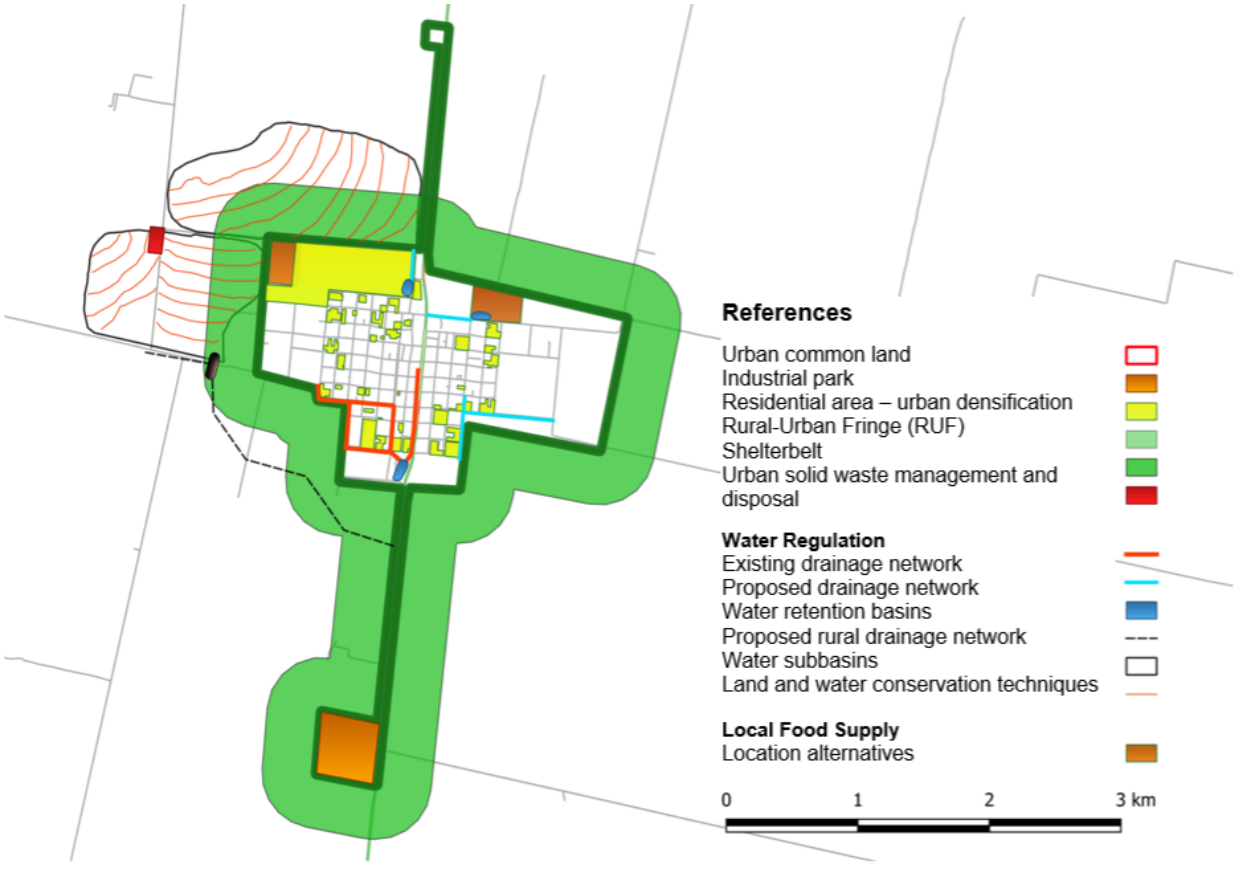

Figure 3. Vision of the Rural-Urban Strip, Santa Eufemia 2040.

the RUF of Santa Eufemia. The vision comprises five strategic structural decisions. Initially, the government addressed the location of an industrial park, the future urban settlement, and solid waste management (de Prada *et al*., 2017). Second, the water infrastructure services (runoff and drain regulations) and the local supply areas, were planned.

Water infrastructure alternatives

For this point, five alternatives were designed for the risk of flooding and collapse of storm drains issue. Alternative 1 considers the trend of the current situation and the drainage network is designed only for new residential areas. Meanwhile, alternatives 2 to 5 propose integrated runoff management (Figure 4). Alternative 2 adds 4.2 km of drainage channels to evacuate surplus water from the most compromised urban and peri-urban areas, as well as a retention basin. Alternative 3 improves the distribution of 3.3 km of drainage channels. Alternative 4, similar to 3, requires 3.8 km of drainage channels and proposes the use of runoff in a forestry area (60 ha). And Alternative 5 incorporates soil and water conservation techniques in rural subbasins west and northwest of Santa Eufemia, which reduces interventions in the drainage network (2.1 km of canals).

Selecting some of the alternatives *a priori*, revealed certain compromises between the actors (Table 1). Alternative 1, although it does not solve the problem, keeps the flood risk high, requires less investment, and less institutional political effort. In contrast, alternatives 4 and 5 reduce the levels of maximum runoff (better environmental performance) but need greater economic and political efforts to build public works, as well as motivate a change in the behavior of agricultural producers towards water conservation at a farm level.

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PÁG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PÁG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

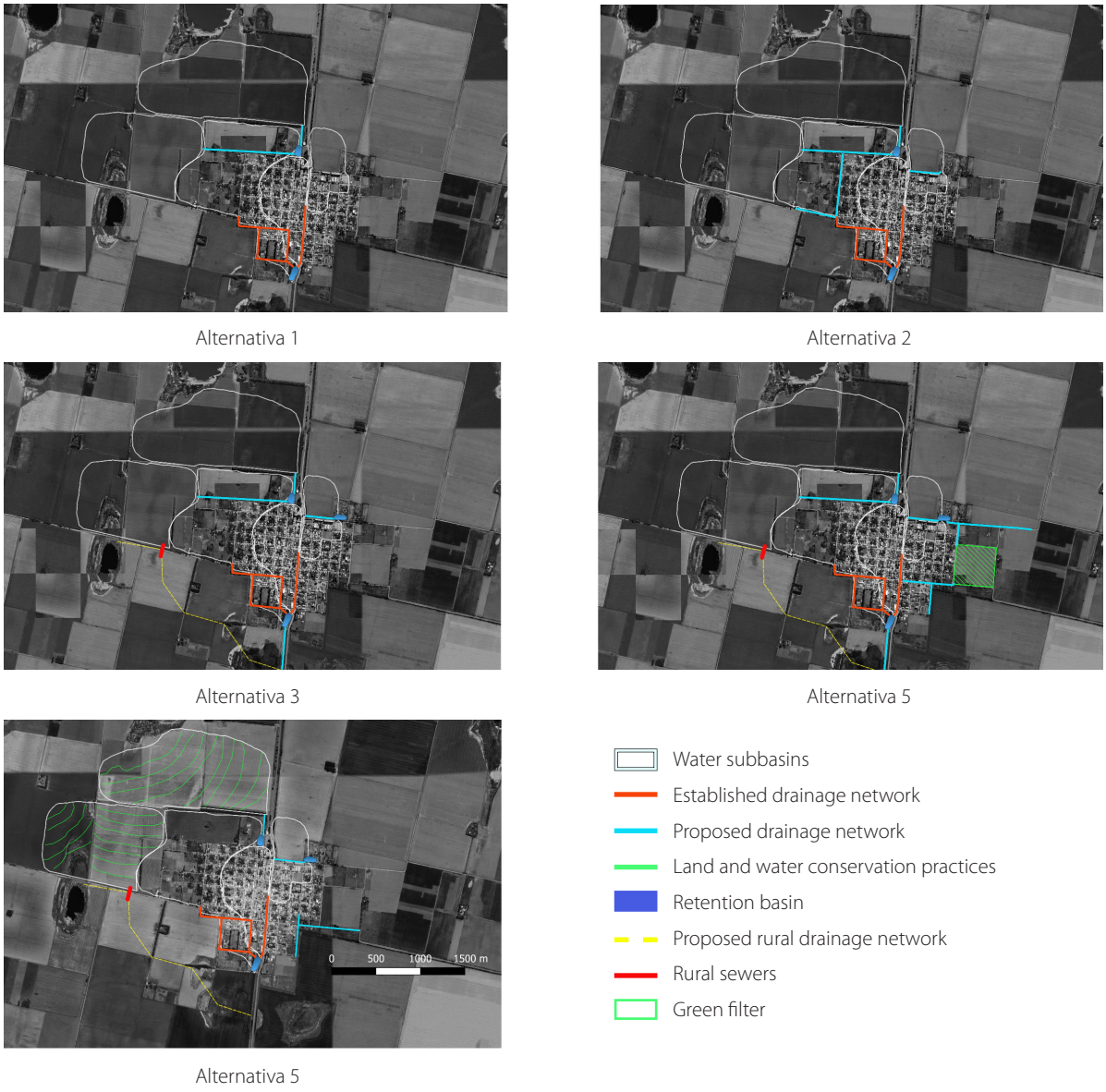

Figure 4. Water infrastructure alternatives. Source: Preparation by the author.

The actors' preferences evaluate the four criteria used as "important", although with some differences in magnitude (Table 2). The flood risks criterion has higher preferences on average and captures the essence of the problem. In order of importance, it is followed by the maximum flow criterion, which captures the problem quantitively. Meanwhile, the IPE criterion had a lower assessment and a marked dispersion, possibly due to differences in the perception of the actors who have Government responsibilities versus civil society representatives. The Investment criterion is evidenced as "important" for the participants and as "intermediate" between IPE and the criteria that capture the essence of the problem.

Based on the preferences of the actors, alternative 5 and alternative 3 turned out to be promising for hierarchizing the water regulation service, and a superior one in terms of strengths and weaknesses did not emerge in the individual analysis. In the analysis by participants, alternative 5 shows fewer weaknesses (Table 2), while in the strengths,

	C1	C2	C3	C4
Alternative_1	4.276.078	58	High	Low
Alternative_2	9.184.890	39	Medium	High
Alternative_3	8.737.282	35	Medium	Medium
Alternative_4	11.551.412	29	Low	High
Alternative_5	7.813.452	25	Very Low	Very High
Objective	minimize	minimize	minimize	minimize

Table 1. Multicriteria matrix: Water infrastructure alternatives by criteria. Source: Preparation by the author.
Note: C1: Investment ($); C2: Maximum Flow (m3 s-1); C3: Flood-Health Risks; C4: Institutional political effort (IPE).

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PÁG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

Participant	C1	C2	C3	C4	Strength	Weakness
I	6	8	5	5	A2	A5
II	6	8	10	5	A3	A5
III	9	8	10	10	A1	A5
IV	9	7	8	6	A2	A5
V	8	9	10	9	A2	A5
VI	8	8	10	9	A2	A5
Average	7,7	8,0	8,8	7,3	A2	A5
Standard deviation	1,4	0,6	2,0	2,3		

Table 2. Individual preferences by criterion, water infrastructure alternatives. Source: Preparation by the author.
Note: C1: Investment ($); C2: Maximum Flow (m3 s-1); C3: Flood-Health Risks; C4: Institutional political effort (IPE).

Alternative 2 has a greater frequency. After the individual reflection, the participants agreed on Alternative 5 followed by Alternative 3 as the best options. Alternative 5 has a better performance to solve the structural problem, while the economic effort is evaluated as "intermediate" and demands more institutional political effort (IPE).

Local food supply alternatives

The supply alternatives guided the search for solutions to the spread of zoonotic diseases and to improve local food production. Currently, there are 11 family producers scattered over 1.5 hectares to the west of the town. The actors together explored five underutilized spaces on the RUF (Figure 5) and combined the productive modules as follows. Alternative 1 considers the 11 producers adjusted to the legal framework[4]. Alternative 2, located to the northwest, is made up of two hectares with 1 horticultural module and 1 animal module. Alternative 3, located to the west, comprises five hectares with 2 horticultural modules, 2 animal modules, and 1 fruit module. Alternative 4, located to the west and north, is made up of six hectares with 3 horticultural modules, 2 animal modules, and 1 fruit module. Finally, alternative 5, located to the north, comprises three hectares with 1 horticultural module, 1 animal module, and 1 fruit module.

The alternatives had differences from one another (Table 3). Alternative 1 maintains the current operation and

4 Argentine Food Code (Law 18.284, Decree 815/99); Animal health according to SENASA: (Law 27.233); Organic, ecological and/or biological production SENASA (Law 25.127/99); Phytosanitary management (Provincial Law 9164).

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PÁG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

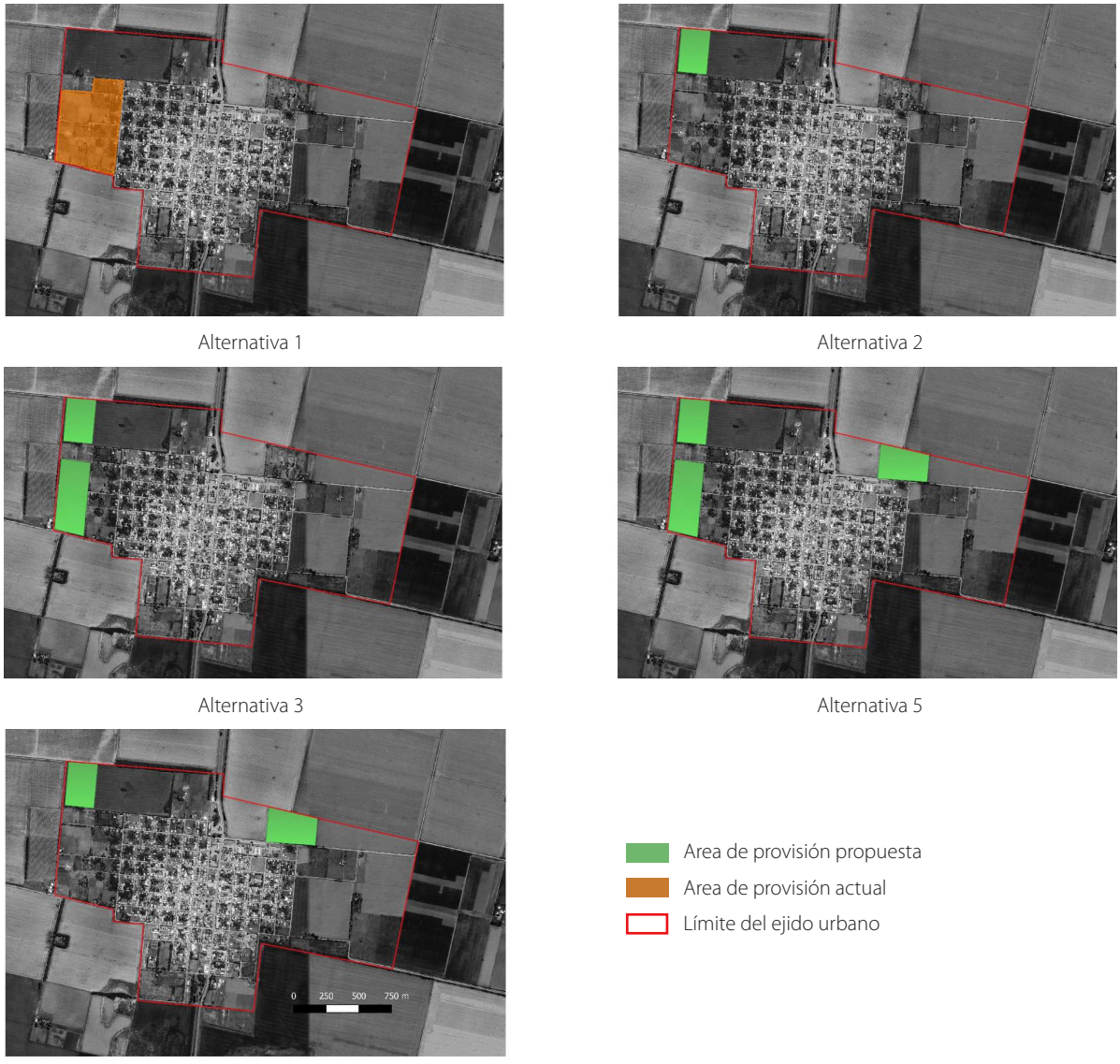

Figure 5. Location of local production. Source: Preparation by the author.

evidences local discontent with the means of production. It shows poor economic and environmental performance, contributes minimally to economic growth (lower EANPV), and retains environmental risks for the urban population. The health risks and bad odors criterion helps to detect these shortcomings. The only advantage it has is that of a lower IPE because it keeps the *status quo*.

On the contrary, alternatives 4 and 5 show adequate behavior in the economic and environmental dimensions. Both triple the economic surplus (EANPV) of alternative 1 and also exceed it environmentally. The same alternatives are located far from the residential area and areas where they can potentially contribute to the regulation and use of surplus rainfall. However, both require more investment and demand more IPE than Alternative _1

The participants' preferences show that all four criteria are important (Table 4). The highest rated criterion, with maximum score and no dispersion, was health risks and bad odors. This finding highlights the potential of a qualitative criterion for

	C1	C2	C3	C4
Alternative_1	1.975.785	441.528	Medium	High
Alternative_2	2.652.288	590.492	Low	Medium
Alternative_3	6.804.522	1.278.597	High	Medium
Alternative_4	7.872.600	1.574.738	High	Low
Alternative_5	4.367.136	688.105	Medium	Low
Objective	minimize	minimize	minimize	minimize

Table 3. Multicriteria matrix: Local food supply alternatives. Source: Author's elaboration.
Note: C1: Investment ($); C2: Equivalent annual net present value, EANPV ($ year-1); C3: Institutional political effort (IPE); C4: Health risks and bad odors.

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PÁG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

Participant	C1	C2	C3	C4	Strength	Weakness
I	7	7	9	10	A4	A5
II	6	8	8	10	A4	A5
III	5	8	10	10	A4	A5
IV	8	8	9	10	A1	A4
V	8	6	8	10	A4	A4
VI	7	7	8	10	A4	A5
Average	6,8	7,3	8,7	10,0	A4	A5
Standard deviation	1,2	0,8	0,8	-		

Table 4. Individual preferences by criterion, Supply Alternatives. Source: Preparation by the author.
Note: C1: Investment ($); C2: Equivalent annual net present value, EANPV ($ year-1); C3: Institutional political effort (IPE); C4: Health risks and bad odors.

political decision-making. The IPE and EANPV criteria reached intermediate preferences. Meanwhile, the investment criterion was the least valued, although with greater dispersion in their preferences.

Based on the preferences of the actors, alternative 5 was chosen to rank the local supply services. This has fewer weaknesses for all participants and, in terms of its strengths, it was surpassed by Alternative 4. The participants agreed that Alternative 5 is the best followed by alternative 4. In environmental terms, alternative 5 minimizes the health risk. Economically, alternative 5 generates 55% more economic surpluses than Alternative 1. And, in the social field, it has a greater IPE.

V. DISCUSSION

The availability of RUF-oriented planning approaches is scarce. Four years ago, Geneletti *et al.* (2017) mentioned this limitation, which still persists (Cattivelli, 2021; Žlender, 2021). The PMP (de Prada *et al.*, 2017) is used in this work as a regulatory planning approach to design the vision of the RUF and include local aspirations in successive online and face-to-face interactions.

There are several multicriteria methods (Barba-Romero, 1996), some of which have been used to support RUF decisions. The AHP (Analytic Hierarchy Process) method was used together with GIS to evaluate land use (Liu *et al.*, 2007), manage groundwater (Jesiya & Gopinath, 2020), and analyze territorial policies for local productive areas (Baldini *et al.*, 2022). Here, the PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluation) over-classification method was applied as in the territorial planning works (de Prada *et al.*, 2017) and urban waste management planning (Cahe & de Prada, 2019), as it allows communication with and between actors, and significantly facilitates their participation from the design of alternatives to the selection of relevant criteria and other interventions (determining the objectives, weighing their

importance, and establishing preference and indifference thresholds).

Finally, qualitative criteria have the potential to guide the decision of the actors and are quick to build. Londoño Cadavid and Ando (2013) describe the flooding risk criterion (in basements, or gardens) as the most preferred. In this study, maximum preferences were also obtained for a similar criterion, Flood–health risk. And, in fact, the qualitative criteria of the environmental and social dimension, achieved more preferences and helped to guide the political decision. This same situation was identified by Smith, Meerow, and Turner (2021) and Liu *et al*. (2007)

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PAG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607

VI. CONCLUSIONS.

This work shows a phase-based multicriteria procedure to plan the vision of the rural-urban fringe (RUF) of Santa Eufemia, Córdoba, Argentina. According to interviews with authorities and actors, the risk of floods - collapse of storm drains, and the spread of zoonotic diseases – loose animals, constitute the main structural problems of the locality. Respectively, these problems were considered to prioritize the water regulation and food supply services of the RUF. For the regulation service, five alternatives were designed that recondition the existing drainage network, create a new network, and vary in their scope. For the local supply service, five alternatives were also designed that integrate new productive management and locations. To distinguish between alternatives, four comparison criteria were developed for each service, covering the different sustainability dimensions. Meanwhile, to survey the preferences and evaluate the alternatives, online workshops were held and the PROMETHEE multicriteria method was used.

Concerning both services, alternatives emerged that overcome the current handling and help the authorities to create an agenda for the RUF. In the case of the regulation service, an alternative was identified that greatly reduces potential water runoff and minimizes the risks of temporary flooding. The alternative requires intermediate investment, needs a high government effort, and the actors are aligned to materialize it. In the case of the supply service, an alternative emerged that showed a better overall performance to solve the spread of zoonotic diseases issue that improves the technical capabilities of local production. In addition, the alternative generates economic surpluses and proposes to synergistically locate new local productions within the urban area.

Finally, the research presented has two limitations to be considered in future works. Firstly, the vision of the RUF is prepared as the first content of the territorial plan, without considering the design of the strategy and the action plan for the local political agenda. Secondly, the designs of the regulation and supply services addressed are considered as a first approximation based on primary field data and secondary data that require precision.

VII. BIBLIOGRAPHIC REFERENCES

Baldini, C., Marasas, M. E., Tittonell, P. y Drozd, A. A. (2022). Urban, periurban and horticultural landscapes – Conflict and sustainable planning in La Plata district, Argentina. *Land Use Policy*, *117*, 106-120. DOI: https://doi.org/10.1016/j.landusepol.2022.106120

Barba-Romero, S. (1996). *Manual para la toma de decisiones multicriterio*. Santiago de Chile: ILPES.

Baró, F., Gómez-Baggethun, E. y Haase, D. (2017). Ecosystem service bundles along the urban-rural gradient: Insights for landscape planning and management. *Ecosystem Services*, *24*, 147-159. DOI: https://doi.org/10.1016/j.ecoser.2017.02.021

Boccolini, S. M. y Giobellina, B. (2018). Reconstrucción histórica del territorio periurbano de producción hortícola de Córdoba, Argentina (1573-1900). *Eutopía. Revista De Desarrollo Económico Territorial*, (14), 83-110. DOI: https://doi.org/10.17141/eutopia.14.2018.3577

Boggia, A., Massei, G., Pace, E., Rocchi, L., Paolotti, L. y Attard, M. (2018). Spatial multicriteria analysis for sustainability assessment: A new model for decision making. *Land Use Policy*, *71*, 281-292. DOI: https://doi.org/10.1016/j.landusepol.2017.11.036

Brans, J.P. y Mareschal, B. (2005). Promethee methods. En J. Figueira, S. Greco y M. Ehrgott (Eds.), *Multiple criteria decision analysis: state of the art surveys* (pp. 163-196). Boston Springer.

Cahe, E. y de Prada, J. (2019). Análisis Multicriterio y Selección de Propuestas de Gestión de Residuos Sólidos Urbanos. *Revista Iberoamericana de Economía Ecológica*, *29*, 53-56.

Cahe, E. y de Prada, J. (2022). Evolución de la expansión urbana y riesgos para la agricultura de proximidad en el sur de Córdoba, Argentina. *EURE - Revista de Estudios Urbano Regionales*, *48*(144), 1-21. DOI: https://doi.org/10.7764/EURE.48.144.11

Cash, C. (2014). Towards achieving resilience at the rural–urban fringe: the case of Jamestown. En *South Africa Urban Forum*, *25*, (pp. 125-141). Springer. DOI: https://doi.org/10.1007/s12132-013-9204-2

Cattivelli, V. (2021). Planning peri-urban areas at regional level: The experience of Lombardy and Emilia-Romagna (Italy). *Land Use Policy*, *103*, 105282. DOI: https://doi.org/10.1016/j.landusepol.2021.105282

De Prada, J. D., Degioanni, A., Cisneros, J. M., Gil, H. A., Plevich, J. O., Chilano, Y., … y Cantero G., A. (2014). Análisis multicriterio y selección interactiva del uso agrario de aguas residuales tratadas, Adelia María, Córdoba. *European Scientific Journal*, *10*(2) 419-441. DOI: https://doi.org/10.19044/esj.2014.v10n2p%p

De Prada, J., Degioanni, A., Cantero, A., Tello, D., Gil, H., Cahe, E., … y Pereyra, C. (2017). Procedimiento multicriterio en fases para la construcción de la visión territorial local. Aplicación en la localidad de Santa Eufemia, Córdoba, Argentina. *Revista Argentina de Economía Agraria*, *17*(1), 6-30. Recuperado de https://raea.com.ar/revistaaaea_arg/article/view/23

Díaz-Bravo, L., Torruco-García, U., Martínez-Hernández, M. y Varela-Ruiz, M. (2013). La entrevista, recurso flexible y dinámico. *Investigación en Educación Médica*, *2*, 162-167.

Gallent, N. (2006). The Rural–Urban fringe: A new priority for planning policy? *Planning Practice & Research*, *21*(3), 383-393. DOI: https://doi.org/10.1080/02697450601090872

Geneletti, D., La Rosa, D., Spyra, M. y Cortinovis, C. (2017). A review of approaches and challenges for sustainable planning in urban peripheries. *Landscape and Urban Planning*, *165*, 231-243. DOI: https://doi.org/10.1016/j.landurbplan.2017.01.013

Gómez Orea, D. (2008). *Ordenación territorial*. 2da Edición. Madrid: Mundi Prensa.

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

Hermida, G. C. (2015). Agroforesteria periurbana una opción para la producción sustentable en los alrededores de Buenos Aires. *Revista Scientia Agroalimentaria, 2*, 7-17. Recuperado de http://revistas.ut.edu.co/index.php/scientiaagro/article/view/740

Inostroza, L. (2017). Informal urban development in Latin American urban peripheries. Spatial assessment in Bogotá, Lima and Santiago de Chile. *Landscape and Urban Planning, 165*, 267-279. DOI: https://doi.org/10.1016/j.landurbplan.2016.03.021

Jesiya, N. P. y Gopinath, G. (2020). A fuzzy based MCDM–GIS framework to evaluate groundwater potential index for sustainable groundwater management - A case study in an urban-periurban ensemble, southern India. *Groundwater for Sustainable Development, 11*. DOI: https://doi.org/10.1016/j.gsd.2020.100466

La Rosa, D., Geneletti, D., Spyra, M., Albert, C. y Fürst, C. (2018). Sustainable Planning for Peri-urban Landscapes. En Perera, A., Peterson, U., Pastur, G. y Iverson, L. (Eds.). *Ecosystem Services from Forest Landscapes* (pp, 89-126). Cham: Springer. DOI: https://doi.org/10.1007/978-3-319-74515-2_5

Le Bivic, C. y Melot, R. (2020). Scheduling urbanization in rural municipalities: Local practices in land-use planning on the fringes of the Paris region. *Land Use Policy*, *99*, 105040. DOI: https://doi.org/10.1016/j.landusepol.2020.105040

Liu, Y., Lv, X., Qin, X., Guo, H., Yu, Y., Wang, J. y Mao, G. (2007). An integrated GIS-based analysis system for land-use management of lake areas in urban fringe. *Landscape and Urban Planning*, *82*(4), 233-246. DOI: https://doi.org/10.1016/j.landurbplan.2007.02.012

Londoño Cadavid, C. y Ando, A. W. (2013). Valuing preferences over stormwater management outcomes including improved hydrologic function. *Water Resources Research*, *49*(7), 4114-4125. DOI: https://doi.org/10.1002/wrcr.20317

Nanninga, T. A., Bisschops, I., López, E., Martínez-Ruiz, J. L., Murillo, D., Essl, L. y Starkl, M. (2012). Discussion on Sustainable Water Technologies for Peri-Urban Areas of Mexico City: Balancing Urbanization and Environmental Conservation. *Water*, *4*(3), 739-758. DOI: http://dx.doi.org/ https://www.mdpi.com/2073-4441/4/3/739

Otzen, T. y Manterola, C. (2017). Técnicas de muestreo sobre una población a estudio. *International Journal of Morphology, 35*, 227-232.

Scott, A. J., Carter, C., Reed, M. R., Larkham, P., Adams, D., Morton, N., … y Coles, R. (2013). Disintegrated development at the rural–urban fringe: Re-connecting spatial planning theory and practice. *Progress in Planning*, *83*. DOI: https://doi.org/10.1016/j.progress.2012.09.001

Smith, J. P., Meerow, S. y Turner, B. L. (2021). Planning urban community gardens strategically through multicriteria decision analysis. *Urban Forestry & Urban Greening, 58*, 126897. DOI: https://doi.org/10.1016/j.ufug.2020.126897

Stock, C., Bishop, I. D. y Green, R. (2007). Exploring landscape changes using an envisioning system in rural community workshops. *Landscape and Urban Planning*, *79*(3), 229-239. DOI: https://doi.org/10.1016/j.landurbplan.2006.02.010

USDA-SCS (1968). *A Method for Estimating Volume and Rate of Runoff in Small Watershed*. Washington, D.C.: USDA Soil Conservation Service.

Vargas-Lama, F. y Osorio-Vera, F.-J. (2020). The Territorial Foresight for the construction of shared visions and mechanisms to minimize social conflicts: The case of Latin America. *Futures*, *123*. DOI: https://doi.org/10.1016/j.futures.2020.102625

Žlender, V. (2021). Characterisation of peri-urban landscape based on the views and attitudes of different actors. *Land Use Policy*, *101*. DOI: https://doi.org/10.1016/j.landusepol.2020.105181

Zulaica, L. y Ferraro, R. (2013). Lineamientos para el ordenamiento del periurbano de la ciudad de Mar del Plata (Argentina), a partir de la definición de sistemas territoriales. *Geografía em questao, 6*(1), 202-230. DOI: https://doi.org/10.48075/geoq.v6i1.6731.

PLANIFICACIÓN DE LA FRANJA URBANO RURAL DE SANTA EUFEMIA, CÓRDOBA, ARGENTINA
EMILIANO JAVIER CAHE, JORGE DANTE DE PRADA
REVISTA URBANO Nº 46 / NOVIEMBRE 2022-ABRIL 2023
PÁG. 30 - 41
ISSN 0717 - 3997 / 0718 - 3607