REINVENTING URBAN AGRICULTURE IN ALGERIAN URBAN POLICIES: STAKEHOLDERS’ VISIONS AND OPERATIONAL STRATEGY

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ABSTRACT

Climate change and rapid urban growth are driving an increased demand for global resources, exacerbating environmental challenges. Addressing these issues necessitates the implementation of diverse strategies across various scales. Urban agriculture emerges as a potential solution to foster the resilience of urban entities. However, in the Mediterranean region, notably in Algeria, urban agriculture remains inadequately addressed in public policies, with agricultural plots in cities often earmarked as land reserves for future urban development.

This study aimed to assess the perspective of urban actors in Annaba regarding urban agriculture and to identify and map agricultural activities within the city, with the goal of integrating them into urban policy frameworks. Interviews were conducted with decision-makers and farmers, complemented by spatial analysis.

Findings revealed that although there is interest in urban agriculture, it is not effectively integrated into institutional and legal frameworks. Despite modest agricultural production primarily for self-consumption, urban agriculture projects hold potential for adoption in Algerian cities, offering a pathway towards enhancing urban sustainability.

Keywords: GIS, Surveys, Urban agriculture, Urban planning, Urban stakeholders

Introduction

The escalating urban population has propelled urban areas to the forefront as the primary consumers of global resources and the principal generators of environmental challenges (Purvis et al., 2022). Urbanisation has led to the dispersion of agricultural land, environmental degradation, emissions of pollutants, stress on residents, and threats to biodiversity (Liu et al., 2011; Mori & Christodoulou, 2012; Botzat et al., 2016), thus exacerbating the negative impacts associated with urbanisation. Importantly, these impacts transcend local boundaries and persist over both space and time (Kyoi, 2023).

To alleviate the adverse environmental effects of urbanisation and enhance urban sustainability, urban agriculture emerges as a recommended solution endorsed by international and scientific organisations (FAO, 2018) (Kyoi, 2023).
2023). Its promotion constitutes a pivotal strategy for attaining the Millennium Development Goals (Mougeot, 2005).

The concept of urban agriculture represents the convergence of societal, ecological, and design considerations. It encapsulates a discourse on reintegrating food production into the urban fabric, thereby fostering the creation of healthier neighbourhoods and environments (Philips, 2013).

Indeed, when integrated as an additional component of the urban landscape, urban agriculture can significantly enhance the city’s resilience to various challenges (De Zeeuw et al., 2011; Kapucu et al., 2021). Research suggests that urban agriculture can contribute to improving the urban microclimate, promote urban biodiversity, and ameliorate the living conditions of urban residents (Dubbeling, 2009) by lessening the vulnerability of specific urban demographics (Smit et al., 2006). Furthermore, by cultivating fresh produce in close proximity to cities, urban farming holds promise for reducing energy consumption and greenhouse gas emissions (Orsini et al., 2013).

Recent deliberations among experts in architecture, urban planning, and landscape design have sparked discussions regarding the potential integration of agriculture into urban environments, fostering more fertile landscapes. This departure from the traditional notion of a ‘sterile city’, which has historically characterised the relationship between urban areas and agriculture over the past century (Cavin, 2012), introduces novel concepts such as Bhatt and Farah’s (2010) notion of a transformable landscape or Viljoen and Bohn (2014) concept of a continuously productive urban landscape. These architectural propositions offer innovative approaches for incorporating fruit and vegetable cultivation within urban settings.

Several researchers (Armanda et al., 2019; Aciksoz et al., 2021) have scrutinized current production and distribution networks alongside the financial benefits of urban agriculture; (Hosseinpour et al., 2022). Additionally, the interrelationship between preserving agricultural land and improving quality of life has been underscored (Reyburn, 2002; Audate et al., 2021; Kirby et al., 2021; Mead et al., 2021; Shi, 2021; Hassan et al., 2022).

However, there persists institutional resistance to incorporate urban agriculture into urban master plans (Drescher, 2001; Cissé et al., 2005). This reluctance is evident in Mediterranean regions, both in the North and the South, where the cultivation of virtuous connections between cities and agriculture is being addressed through public initiatives. This endeavour aims to reimagine urban planning, revitalise and diversify agricultural functions, or at the very least, explore sustainable modes of their interaction (Valette & Philifert, 2014).

In Algeria, within the two urban planning documents, namely the Master Plan for Architecture and Urban Planning (PDAU) and the Land Use Plan (POS), agriculture is predominantly viewed through the lens of preservation. Agricultural parcels within urban areas are designated as public or private land reserves with an indefinite period before urbanisation (Paoli et al., 2017; Boudemagh, 2021). Nonetheless, in the Algiers strategic plan, agriculture is underscored within the green plan as a pivotal project for 2035 (Bouzekri et al., 2021).

In urban areas, urban agriculture typically occupies vacant private or public land. It evolves in an ad hoc, peripheral manner, often lacking systematic planning and design. Consequently, it is commonly viewed by both citizens and decision-makers as a marginal activity (Boudjenouia et al., 2008).

We posit that urban agriculture in Algerian cities could undergo a revival by identifying existing activities often overlooked by planners and public authorities. This may serve as a catalyst for integrating agricultural initiatives into

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1 Executive Decree No. 91-177 of May 28, 1991, amended and supplemented, laying down the procedures for the preparation and approval of the Urban Development Master Plan (P.D.A.U) (Plan Directeur D’Aménagement et d’Urbanisme).

2 Executive Decree No. 91-178 of May 28, 1991, amended and supplemented, laying down the procedures for the preparation and approval of the Land Use Plan (P.O.S) (Plan d’Occupation des Sols).
planning documents. An illustrative case is Annaba, Algeria’s fourth-largest city and one of the nation’s major urban centres. Situated in the northeast, it stretches along a coastline spanning over 16 kilometres. In this context, we aim to investigate the status of urban agriculture in Annaba. Does it currently exist? What are the perspectives of agricultural and urban stakeholders? And what strategies could be employed to reimagine it?

After outlining our research domain, we will analyse the position of urban agriculture in local policies by gathering input from stakeholders involved in agriculture and the urban environment. We propose employing interactive cartography as a strategy for revitalising the connection between the city and agriculture in Annaba.

Methods

Case study: city of Annaba

Our study was carried out in the town of Annaba, the fourth largest town in Algeria and among the nation’s largest urban centres. Positioned in the northeastern sector of the nation, it fronts the sea along a 16-kilometre expanse of coastline (Figure 1). Renowned as the preeminent industrial hub in the eastern precinct, its urban jurisdiction spans in excess of 50 square kilometres. As per the 2020 General Population and Housing Census (RGPH), Annaba sustains an urban populace of 263,650 inhabitants, yielding a population density of 424 individuals per square kilometre.

This territory is mainly composed of alluvial land of fluvial and lagoon-marine origin with a high agro-pedological value and may be used to cultivate a variety of crops (PDAU Annaba, 2008). With a Mediterranean climate characterised by temperate and humid winters and varying rainfall between 600 and 800 mm, and hot and dry summers, watered by numerous rivers, the area presents a fertile soil that is favourable to agricultural production.

Although economic activities have increasingly gravitated towards the tertiary sector in recent years, the Annaba region still harbours significant agricultural facets. Notably, agriculture comprises 8.20% of the region’s establishments (PDAU Annaba, 2008). However, the uncontrolled urban expansion within the Annaba metropolitan area has exerted substantial pressure on agricultural domains, precipitating adverse consequences. The proliferation of
built-up areas has surged markedly, encompassing an estimated surface area of 444.87 hectares, equivalent to approximately 50 hectares annually (Djakjak et al., 2021). As delineated in a (2021) study by Saouli, Benhassine and Oularbi, the interlude between 2000 and 2017 witnessed a 2.366% reduction in vegetation cover, corresponding to a depletion of 20.38 square kilometres. This situation threatens the sustainability of agricultural land, including productive and profitable land.

The principal catalysts propelling contemporary urbanisation encompass population expansion, heightened rates of immigration, and rural-to-urban migration, phenomena pervasive in Annaba as well as across other Algerian urban centres (Rouag-Saffidine & Hacini-Chikh, 2009). Subsequent to the unveiling of the Constantine plan in 1958, the Annaba region underwent a comprehensive restructuring, affording precedence to the port and the El Hadjar steelworks. This strategic emphasis precipitated profound alteration in the city's physical landscape commencing from 1962 onward (Fenet-Rieutord, 2016).

The observed demographic upsurge, attributed to both natural population expansion and substantial rural-to-urban migration, is thus, predominantly intertwined with economic factors (Rouag-Saffidine & Hacini-Chikh, 2009). Evidently, the municipality's ascension in prominence stemmed from a marked augmentation in industrial employment between 1962 and 1978. For instance, during the 1966 national demographic survey, the province boasted a populace of 311,000. This figure nearly doubled to 605,000, as per the 1982 national projections (Fenet-Rieutord, 2016).

The town's population has experienced a 42% increase since 1962, marked by a significant surge in migration between 1970 and 1973, during which a considerable workforce relocated to Annaba. This influx, promptly joined by their respective families, constituted the principal catalyst driving the town's metamorphosis. Concurrently, Annaba's housing inventory, already strained since the War of Independence, proved inadequate to absorb the influx of new residents. Consequently, the urban crisis escalated, precipitating a profound transformation in spatial utilisation patterns (Fenet-Rieutord, 2016).

In 2004, the wilaya of Annaba encompassed an area of 1,412 km², marking a substantial increase from its area of less than 10 km² in 1959 and 15 km² in 1970 (PDAU). The population of the wilaya, recorded as 540,000 in the RGPH 1998 and 630,000 according to statistical projections from RGPH 2008 (Table 1), has since escalated to 793,172 (RGPH 2020) (Rouag-Saffidine & Hacini-Chikh, 2009).

<table>
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<tbody>
<tr>
<td>Annaba</td>
<td>453.9</td>
<td>521</td>
<td>540</td>
<td>583</td>
<td>625</td>
<td>663</td>
</tr>
</tbody>
</table>

In the realm of urban development and planning, Annaba's inaugural Master Plan for Architecture and Urban Planning (PDAU) was enacted in 1997 (Acidi & Kouadria, 2012). However, it succumbed to evolving circumstances, prompting its initial revision in 2001, followed by a subsequent overhaul in 2008. Operating as an inter-municipal framework, the PDAU encompasses the adjacent communes of El-Bouni, El-Hadjar, Ain Berda, Barrehal, and Chetaibi, in addition to the commune of Annaba. Its implementation has spurred the formulation of 20 land-use plans (P.O.S), serving as the foundational components of the town planning regulatory framework. These plans facilitate and accompany the urban trajectory (Chachour, 2022).

However, consistent with patterns observed nationwide, these plans have adhered to the principles of traditional urban planning schemes (PUD). Such regulatory zoning frameworks juxtapose the urbanised or slated-for-urbanisation areas (SU and SAU) with predominantly agricultural natural zones (SNU). Notably, the potential linkages between these
spaces remain largely unaddressed (Paoli et al., 2017).

It is imperative to highlight that the PDAU for the city of Annaba advocated for the revitalisation of the agricultural sector in alignment with the national agricultural development plans (PNDA), instituted at the national level since September 2000. These plans entail two primary objectives: the modernisation and enhancement of agricultural and livestock enterprises, and the preservation and expansion of natural areas. However, it is noteworthy that these programs exclusively target agricultural areas situated within the rural zones of the intermunicipal region.

**Interviews and analysis process**

The investigation of urban agriculture requires observation of productive natural zones within and adjacent to the urban environment. The identification of various agricultural practices within a conurbation unveils the multiplicity of stakeholders influencing these territories (Nahmias & Le Caro, 2012).

As an integral component of this study, interviews were conducted with key institutional stakeholders responsible for formulating and executing urban development strategies in the municipality of Annaba, alongside engagements with farmers operating within the city’s urban periphery.

**Interviews with stakeholders in charge of urban planning**

Semi-structured interviews were conducted between June 27, 2022, and January 3, 2023, with representatives from seven key public institutions deeply involved in the implementation of Annaba city’s urban planning frameworks: the Master Plan for Architecture and Urban Planning (PDAU) and the Land Use Plan (POS). These institutions encompassed the Chamber of Agriculture, the Department of Urban Planning and Architecture, the Municipality of Annaba, the Land Agency, the Department of Public Works, the Hydraulic Department, and the URBAN Annaba urban planning study office.

Through these interviews, we endeavour to achieve our research objectives, which are outlined as follows: (1) to discern the perspectives of relevant stakeholders within the urban milieu concerning the integration of urban agriculture, and (2) to delineate the pivotal determinants impeding the incorporation of urban agriculture within the city’s developmental frameworks, namely the Master Plan for Architecture and Urban Planning and Land Use Plan (PDAU and POS), wherein it persists primarily as earmarked territory for urbanisation.

The interviews were carried out in a face-to-face format, with an average duration of approximately one hour each. They adopted an open-ended approach, affording interviewees complete autonomy in responding to the posed inquiries. However, to structure these interviews effectively, a thematic framework was devised, comprising three primary categories. This framework served as a roadmap, guiding the discourse towards specific aspects pertinent to each predefined theme: (1) the delineation of urban agriculture; (2) the identification and assessment of existing agricultural land within the urban periphery; and (3) the appraisal of the feasibility of integrating urban agriculture as a component of urban planning.

The discussed subjects encompassed an exploration of the urban potential of urban agriculture (UA), an assessment of the comprehension level of UA among urban stakeholders, an evaluation of its viability from the vantage point of these stakeholders, and various other intricacies and nuances elucidated throughout the discourse.

**Interviews with farmers**

Following multiple field excursions accompanied by the Annaba agricultural subdivision, we successfully pinpointed agricultural plots situated within the urban confines. A total of 14 such plots were identified (Figure 2). These parcels constitute individual agricultural holdings (EAI), forming part of the State’s private domain and allocated to private individuals pursuant to law 87-19 of December 18, 1987 (Ali, 2011). Their surface areas range between 1 hectare and 10 hectares and are situated in the districts of Oued Forcha, Sidi Aïssa, and Séraïdi Road (4th km) in Annaba.
Subsequently, semi-structured interviews were undertaken with operators of individual agricultural holdings (EAI). These interviews cantered around three key themes: (1) a historical examination delving into the origins and typology of the farms, (2) an exploration of the crop varieties cultivated and the yield from gardens, including assessments of satisfaction rates and plot productivity, and (3) an investigation into the constraints encountered by these operators.

A descriptive analysis of the obtained results was conducted, wherein graphical and tabular representations were generated to facilitate a comprehensive understanding of the data. These representations will be meticulously presented and expounded upon in the subsequent results section of the article.

**Mapping Urban Agriculture**

For the cartographic representation conducted through QGIS software (version 3.24.3), we amalgamated field-collected data with foundational maps sourced from the Annaba land register, the master plan for development and urban planning, and OpenStreetMap. Georeferencing the Master Plan for Architecture and Urban Planning (PDAU) of Annaba in the WGS 84 UTM ellipsoid within zone 32 North was imperative to align it with the study area and Google Satellite images for compatibility with QGIS.

Subsequently, we enhanced the base maps from OpenStreetMap by integrating high-resolution satellite images from Google Earth and SAS Planet software, supplemented by field surveys and PDAU data. Digitisation ensued based on these images to produce updated maps. Priorly captured GPS coordinates, organised in an Excel spreadsheet, were imported into QGIS to precisely locate agricultural plots.

Following this, an attribute table for these plots was established, showcasing their primary characteristics. Ultimately, leveraging this table, GIS operations were employed to generate final characteristic maps of the agri-urban farms.

**Results**

*The position of Urban Agriculture in local policy frameworks: Actors perspective*

Urban agriculture encompasses a spectrum of criteria for its definition, including its geographical placement, functional roles within urban environments, and its integration within broader urban development initiatives. Yet,
our empirical findings suggest a conspicuous dearth of comprehensive understanding in this domain. Through interviews conducted (Figure 3), it became apparent that institutional stakeholders predominantly delineate urban agriculture based solely on its proximity to the urbanisation perimeter delineated by the Annaba PDAU. Regrettably, considerations regarding its potential functions within the urban landscape are notably absent from their conceptualisations.

All respondents (100%) unequivocally identified vegetable gardens in interstitial urban spaces as the predominant manifestation of urban agriculture. Conversely, only (57.14%) of respondents considered production on building rooftops or balconies as urban agriculture, with an even lower recognition rate for urban farms, standing at (28.57%). The notion of livestock farming as a viable urban agricultural pursuit was completely dismissed, mainly due to spatial constraints and concerns regarding its detrimental impact on urban infrastructure and amenities.

Regarding the characterisation of urban agricultural activity within Annaba, interviewees acknowledged the presence of urban gardening practices (85.71%) while expressing reservations regarding its significance and productivity (71.42%). Notably, they highlighted that the existing spaces allocated for such activities largely predate the city's expansion and are now earmarked for new residential developments due to their minimal or negligible contribution to the city's developmental agenda.

The primary location identified by urban stakeholders, with a unanimous agreement rate of (100%), for hosting such spaces is the foothills of Mount Edough, followed by the town's entrance, cited by (80%) of respondents. According to 83.33% of our respondents, these areas are perceived as already designated for urban development in the PDAU document, while an additional (66.67%) of respondents consider them as protected areas. This consensus reinforces the institutional actors' vision concerning the intended utilisation of these plots, which have negligible prospects of being regarded as integral components of the urban landscape for urban agricultural activities.

Nevertheless, urban stakeholders within the city appear to endorse the notion of potentially integrating Urban Agriculture (UA) into the urban planning process, with an acceptability rate of (83.34%). Furthermore, they perceive UA as a prospective element in the city's development, particularly in environmental (100%), social (60%), and to a lesser extent, economic (20%) dimensions.

UA is acknowledged as a means to bolster biodiversity in the urban environment (83.33%), facilitating the incorporation of green spaces into the city (100%). Additionally, it is seen as a mechanism to leverage urban voids (50%), thereby fostering the transition towards a more resilient and sustainable urban framework.

According to these stakeholders, however, several factors hinder the incorporation of urban agriculture into the planning process. Foremost among these is the functionalist zoning framework mandated by Law 90-29 of 1 December 1990 and its accompanying decrees. This framework segregates urbanised or earmarked urbanisation spaces (SU and SAU) from predominantly agricultural natural spaces (SNU), effectively compartmentalizing them. There is a consensus among opinions that planning instruments in Algeria are inflexible and have proven ineffective in the sustainable and efficient management of urban space.

Other factors were pinpointed by the interviewed stakeholders, including the urbanisation pressure primarily stemming from emergency housing programs initiated by public authorities (85.71%), the high cost and scarcity of urban land (71.43%), the undivided nature of private land ownership (57.14%), and limited access to water (42.86%).

Conversely, stakeholders proposed potential solutions for integrating UA into urban planning, advocating for the incorporation of urban agriculture as a component of city planning (85.71%) through requisite reforms to urban planning documents.
The position of Urban Agriculture: Farmers perspective

Regarding the existing farms situated within the urban perimeter, they fall under the State’s private domain. These farms, formerly categorised as individual farms (EAI), are awaiting regularisation as concessions under the agricultural policy law of 2008.

The uncertainty surrounding the tenure status of these lands has raised concerns among the farmers, the majority of whom are retired individuals aged between 60 and 70, predominantly male (Table 2). Farming serves as their primary occupation and a supplementary source of income. Motivated by the economic advantages associated with farming, these individuals boast extensive experience in the field, often inheriting their agricultural expertise from previous generations. Their focus lies on enhancing production and food quality. Despite their limited awareness of environmental concerns, these farmers adhere to ecological farming practices, abstaining entirely from the use of pesticides and chemical products.

Table 2. Farmers Profile

<table>
<thead>
<tr>
<th>Gardener's profile</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>2</td>
<td>14,29%</td>
</tr>
<tr>
<td>Men</td>
<td>12</td>
<td>85,71%</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>4</td>
<td>28,57%</td>
</tr>
<tr>
<td>Independent worker</td>
<td>1</td>
<td>7,14%</td>
</tr>
<tr>
<td>Retired</td>
<td>9</td>
<td>64,28%</td>
</tr>
</tbody>
</table>
In terms of crop diversity and yields, our findings reveal a range of food product typologies encompassing both arboriculture and vegetable gardening. Arboricultural pursuits encompass an array of tree crops including bananas, pomegranates, figs, almonds, walnuts, citrus fruits, grapes, prickly pears, medlars, and olives. Conversely, vegetable gardening predominantly focuses on seasonal vegetable crops such as potatoes, beans, onions, peas, artichokes, and lettuce.

Given the strong preference of the Algerian population for vegetable consumption, particularly potatoes, agricultural production exhibits a notable concentration on these crops. Additionally, it’s noteworthy that certain types of fruit, contingent upon their seasonal availability, are also favoured by growers.

According to the conclusions illustrated in the figure above (Figure 4), it is possible to observe the presence of uncultivated plots of land on five of the fourteen farms identified. These vacant plots signify a lack of active agricultural production on the respective land, suggesting a trajectory towards urbanisation incentivised by public authorities.

Approximately 43% of farmers are engaged in livestock farming, with varying typologies characterizing these activities based on the types of animals reared, as well as the practices and techniques employed, such as beekeeping (83.33%), poultry farming (16.66%), and cattle farming (33.33%). These agricultural pursuits encompass the production of honey, eggs, milk, poultry, and cattle, each offering distinct advantages in terms of yield and product quality.

It is noteworthy, however, that these products are primarily intended for personal consumption rather than commercial sale. This trend primarily stems from the absence of dedicated local markets for locally produced goods, coupled with the relatively limited production

<table>
<thead>
<tr>
<th>Gardener's profile</th>
<th>Number</th>
<th>Percentage (%)</th>
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</thead>
<tbody>
<tr>
<td>Educationnal level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No level</td>
<td>3</td>
<td>21.43%</td>
</tr>
<tr>
<td>Primary</td>
<td>8</td>
<td>57.14%</td>
</tr>
<tr>
<td>Secondary school</td>
<td>3</td>
<td>21%</td>
</tr>
<tr>
<td>High school</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>University</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-45</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>46-65</td>
<td>10</td>
<td>71.42%</td>
</tr>
<tr>
<td>&gt;65</td>
<td>4</td>
<td>28.57%</td>
</tr>
</tbody>
</table>

Figure 4. Type of cultures

[Image of a bar graph showing the distribution of type of cultures]
quantities from the plots. The products that are occasionally sold in limited quantities to local consumers include livestock products such as honey, milk, and eggs, as well as olive oil for those cultivating arboriculture on their plots. Market garden produce is exclusively reserved for the farmers' own consumption.

The surveyed farmers expressed a favourable acceptance towards the yields from their agricultural plots, with a notably high satisfaction rate (85.71% falling within the categories of ‘satisfied’ and ‘extremely satisfied’). This contentment primarily arises from the sufficient quantity of produce obtained, which effectively contributes to alleviating food expenses within their households.

However, despite this satisfaction, the farmers expressed apprehensions regarding the sustainability of their agricultural activities. They perceive challenges arising from the city’s proximity, making compromises with urbanisation difficult and the inevitable consumption of agricultural land (92.86%). Furthermore, concerns were raised regarding water scarcity and the implications of urban policies implemented in the region (Figure 5).

**Mapping Urban Agriculture**

Drawing upon insights gleaned from interviews with institutional stakeholders and farmers, we have developed an interactive GIS web map detailing the attributes of each farm. Each identified parcel encompasses details regarding its legal status, area, type of production, supplementary activities (livestock farming), as well as the destination of the cultivated products (Figure 6).

This dynamic mapping tool and modernisation of land resource management represent tangible and incontrovertible instruments for enhancing the planning of future projects and achieving efficient, optimal urban space planning (Sirima, 2021). By facilitating access to digitised information for authorities, this approach could underpin the formulation of innovative implementation and design strategies that incorporate the agricultural facets of the city.
Discussion

According to Aubry (2013), the food-related roles of urban agriculture are on the rise across various regions, encompassing both southern and northern countries. However, the progression of urban agriculture is subject to disparate economic and spatial contexts between the Northern and Southern regions, as underscored by Serra da Cruz et al. (2021). European nations, in particular, confront pronounced challenges pertaining to healthy nutrition and climate change, thereby bolstering the expansion of urban agriculture through various modalities such as urban farms and agri-parks, exemplified by the Baix Llobregat Agricultural Park in Barcelona, Spain (Berenguer & Carril, 2008), and Mas Nouguier in Montpellier, France (Scheromm & Jarrige, 2020), alongside initiatives like rooftop agriculture. Conversely, African countries, especially southern Africa, have witnessed more modest and often involuntary ventures into urban agriculture, driven by imperatives of food security, augmented household incomes, and the dearth of employment opportunities (Da Cruz et al., 2021).

Moreover, urban agriculture (UA) knowledge has reached an advanced stage in European countries, with the incorporation of this practice as a strategic urban intervention to mitigate the impacts of global change and food insecurity being adequately acknowledged and developed. However, African nations, notably those in North Africa such as Algeria, Tunisia, and Morocco, remain in the nascent phases of recognizing UA as a distinct activity. Consequently, urban agriculture in these regions continues to grapple with a deficit in awareness and mainstream adoption, as noted by Saied et al. (2022).

Indeed, despite interviews conducted with municipal planners in Annaba revealing a vested interest in urban agriculture among public authorities, there was a concurrent acknowledgment of their limited expertise in this domain. Moreover, these authorities highlighted their restricted comprehension regarding urban agriculture, primarily defining it solely based on its geographical proximity to the city. However, they neglected to consider its functional aspects and integration within the urban framework, crucial elements for delineating its urban character, as elucidated by Nahmias and Le Caro (2012).
Table 3. Limiting Factors to the Development of Urban Agriculture

<table>
<thead>
<tr>
<th>Variables</th>
<th>Observation</th>
</tr>
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<tbody>
<tr>
<td>Crop diversification</td>
<td>Crop production is restricted to market gardening of local vegetables and fruit and to a specific selection of fruit trees.</td>
</tr>
<tr>
<td>Marketing</td>
<td>A predominance of production for own consumption, which limits its contribution to urban food security.</td>
</tr>
<tr>
<td>Juridical status</td>
<td>The plots remain unregulated and informal from a legal point of view.</td>
</tr>
<tr>
<td>Surface</td>
<td>The surface area remains relatively small, mainly due to the limited space available and the constraints imposed by urban expansion.</td>
</tr>
<tr>
<td>Workforce</td>
<td>Each plot is farmed by a maximum of 3 to 4 individuals, generally family members living on site.</td>
</tr>
<tr>
<td>Irrigation</td>
<td>No irrigation problems are encountered due to the proximity of the river, which runs along the western side of the town.</td>
</tr>
<tr>
<td>Yields</td>
<td>Although yields are appreciated by farmers, they are still insufficient to make a significant contribution to urban food security, and in economic terms, their lack of market orientation limits their impact.</td>
</tr>
</tbody>
</table>

Furthermore, the meager yields, diminutive scale of existing farms, and their limited number render urban agriculture inconsequential in the eyes of these stakeholders (Table 3), often relegating it to an inevitable reservoir for urban expansion, mirroring trends observed in neighbouring nations such as Morocco and Tunisia (Valette & Philifert, 2014; Dugué et al., 2015). Our findings thus corroborate the insights gleaned from studies conducted by Banzo et al., in (2016), which underscore the abandonment of agricultural pursuits by urban actors, who accentuate its drawbacks while disregarding its potential multifaceted benefits, notably in environmental spheres.

Nevertheless, notwithstanding the scant attention accorded to urban agriculture by institutional actors, it appears to garner support as a prospective facet within the urban planning framework of Algerian cities, notably as a strategy geared towards sustainability and urban resilience. This endorsement encompasses endeavours aimed at preserving biological diversity, sustaining soil health, enhancing landscape diversity, and fostering the vibrancy of urban spaces (Banzo et al., 2016).

Agricultural production threatened by urbanisation, yet Poised with Opportunities.

The farms studied, albeit limited in number, unveiled favourable environmental attributes, notably expansive green areas adorned with meticulously tended trees, constituting a significant asset for the city in terms of air quality enhancement and biodiversity preservation.

This observation underscores the feasibility of urban agriculture notwithstanding prevailing circumstances, presenting avenues for urban agricultural initiatives. The discernible disjunction between theoretical frameworks and practical implementation, as elucidated by this study, further accentuates the need for alignment between conceptual instruments and on-ground realities.

However, the ambiguous legal status of these farms, coupled with a limited focus on diversified production primarily geared towards self-consumption and the oversight of these areas by planning mechanisms, renders them vulnerable to urbanisation pressures. Consequently, there is a looming risk of their conversion into urban development projects, as evidenced by prior research conducted by Scheromm, Perrin, Soulard, (2014) and Dugué et al., (2015). Our study unveils that these agricultural parcels are coveted by various urban entities due to their strategic positioning.

The dichotomy between the loss/sustainability of urban agriculture is highlighted by the findings of this investigation, highlighting the imperative and urgency of interventions aimed at safeguarding these areas, which have thus far withstood urban encroachment and are already earmarked for future urbanisation in the Annaba PDAU.
Diverging contexts and converging motives at international level.

Urban stakeholders identified urban planning instruments as a prominent hindrance to the viability of any sustainable agricultural scheme within the city, vehemently attributing the deficiency to the absence of reform in urban practices, notably evident at the level of two primary urban planning instruments, the Master Plan for Architecture and Urban Planning (PDAU) and Land Use Plan (POS), which are currently under scrutiny and deemed largely dysfunctional.

Current public policies inadequately confront the challenge posed by urban agriculture (Banzo et al., 2016). Agricultural zones within urban regions are frequently earmarked as future construction sites, representing vacant spaces within the cityscape (Boudjenouia et al., 2008). The legislation established to protect and preserve agricultural land is frequently disregarded, with emphasis instead placed on housing and the social facets of sustainability (Perrin, 2015; Bousmaha & Boulkaibet, 2019).

The 2008 revision of Annaba’s Master Plan for Architecture and Urban Planning (PDAU) reinforces these observations and highlights the inadequacy and deficiency of PDAU planning concerning spatial development, especially regarding agricultural land, which paradoxically accelerates land artificialisation (Paoli et al., 2017). The emergence of the agricultural dilemma in urban locales is indeed shaped by public policies, although its entirety is not dictated solely by them (Banzo et al., 2016). These insights were substantiated by our survey findings and the outcomes elucidated in this study.

Despite variances in contexts and rationales underlying urban agriculture development in northern and southern Mediterranean countries, there exist shared constraints. A holistic framework is imperative to address nuances specific to urban agriculture forms and practices, facilitating spatial management and urban planning decisions. This framework aims to integrate agriculture as a supplementary activity to urban endeavours. Municipal and inter-municipal urban plans, such as Algeria’s Pdau and Pos, France’s SCOT (Schéma de Cohérence Territoriale) and PLU (Plan Local d'Urbanisme), Spain’s PGOU (Plan General de Ordenación Urbana), and Morocco’s SDAU (Schéma Directeur d’Aménagement et d’Urbanisme), serve to safeguard agricultural land. Nevertheless, their static nature precludes accommodating the intricacies of diverse agricultural forms and their associated dynamics (Sanz Sanz et al., 2017).

Accordingly, the sustainability of urban agriculture can only be achieved through a comprehensive approach that includes all the different issues (Bouzekri et al., 2021). Over the long term, the relentless pace of urbanisation, compounded by land scarcity, poses significant challenges to its viability. Sustained viability hinges upon the implementation of spatial regulation strategies and the integration of agriculture into urban development plans that acknowledge its distinctiveness and multifaceted societal contributions (Jarrige et al., 2003).

We posit that the outcome, manifested as an interactive GIS map delineating each farm’s characteristics, presents prospects for future agricultural urban planning within the city and facilitates the identification of high-quality productive spaces across other communes and provinces.

Remote sensing data and geographic information systems represent increasingly revolutionary tools now accessible to urban planners and stakeholders. They hold particular relevance for planning and decision support, as well as for land reserve management (Sposito, 2010), enabling the monitoring and management of changes in land use (Boultit, 2018). These technologies furnish adaptive and dynamic cartography capable of seamlessly adapting to the perpetual evolution of society (Sposito, 2010; Houle lou et al., 2022).

The notion of recognising GIS as a potent decision-making instrument is not novel and traces its origins back to the 1970s; however, recent advancements have significantly expanded the scope of these tools (Guay, 2016).

In our scenario, conflicts pertaining to land and natural resource utilisation rank among the most prevalent challenges in urban settings. Consequently, our proposition to craft an interactive GIS map delineating and elucidating the characteristics of agricultural parcels within the territory of Annaba arises as a
A concise document summarising the utilisation of urban geographical space, which has been largely overlooked by the authorities. This endeavour is grounded in the outcomes of interviews conducted with institutional stakeholders and farmers. This adaptive cartography, tailored specifically for Annaba’s directional agricultural services, endeavours to depart from conventional methodologies that these services have historically employed to survey and identify land for preservation purposes. Rather, it aims to furnish a foundational framework for the formulation and execution of an urban planning strategy that assimilates the potential interconnections between the city and its agricultural expanse in Annaba.

Indeed, the empirical data collected in the field and insights gleaned from interviews, coupled with the digitalisation of this data, could constitute an informative repository concerning the state of urban agriculture within the Annaba region. It is imperative to highlight that the prospective alliances that may emerge necessitate consideration at elevated echelons of urban planning, extending to a national scale. This proposed tool for public action is regarded as an alternative to current zoning and town planning regulations, which are deemed inadequate in preserving the agricultural vocation. While securing land status is necessary, it alone proves insufficient for sustaining urban agriculture. However, these provisions can align with each municipality’s agricultural project, akin to the characterisations of agricultural units conducted by Sanz, Napoléone and Hubert, in (2017).

Consequently, the process of identifying UA (Urban Agriculture) sites in urban areas facilitates the analysis and mapping of the coexistence of diverse social and technical agricultural forms within the city. This method enables public action to be directed towards understanding their production systems, characteristics, and contributions, thereby facilitating their integration.

Adopting this approach across all cities would enable the identification of each city’s agricultural potential and maximise the utilisation of these resources. This, in turn, could orient public action towards promoting local food systems, fostering an operational framework for food planning. Moreover, this adaptive mapping can aid public authorities in formulating agricultural strategies congruent with Algeria’s recent ministerial policy changes.

**Conclusion**

Our research embarked on the inquiry of how to reimage urban agriculture within the urban planning framework of Algerian cities. To address this, we chose to identify and assess these spaces, presenting them as pivotal considerations for future urban planning endeavours. This involved scrutinizing existing data on farms in Annaba through statistical methodologies to delineate their susceptibility to urbanisation and strategies for preservation. Concurrently, we engaged local stakeholders via surveys to glean insights into urban farming practices and requisites.

The culmination of these analyses yielded recommendations aimed at fostering the integration of urban agriculture into forthcoming urban planning initiatives. Furthermore, it facilitated the development of a GIS delineating the existing urban farms in Annaba, revealing incongruences between documented plans and ground realities. Additionally, it unveiled a considerable level of acceptance towards urban agriculture in Algerian cities, despite its previous neglect.

These findings underscore the efficacy of an urban agricultural strategy, a venture that holds promise in light of prevailing national and global challenges such as food insecurity and climate change. Moving forward, our research advocates for a subsequent phase focused on identifying the capacity of urban areas and interstitial spaces to accommodate future agricultural activities. This initiative promises a more efficacious and adaptable approach to integrating urban agriculture into Algerian urban policies.

**References**


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