GLL
Geomatics, Landmanagement and Landscape No. 3 • 2024, 153–171

ISSN 2300-1496 http://dx.doi.org/10.15576/GLL/2024.3.10

Research paper

Received: 7.04.2024
Accepted: 12.08.2024
Published: 15.10.2024

Urban dynamics and socio-spatial transformations of housing in Djelfa City, Algeria

Hamza Bendechou[1,✉] 0009-0003-7884-5417
Ahmed Akakba[1]
Mohammed Issam Kalla[1]
Abderrahmane Ben Salem Hachi[2]

[1] Laboratory of Natural Hazards and Spatial Planning (LRNAT), Department of Geography and Territorial Planning, Earth and Universe Sciences Institute, University of Batna 2
[2] Department of Earth and Universe Sciences, Faculty of Natural and Life Sciences, University of Djelfa
✉ Corresponding author: bendechou@gmail.com

Summary

This study examines the socio-spatial transformations of Djelfa, Algeria in the contexts of its urbanization from 1990 to 2024, focusing on the transition from extended to nuclear family structures and from monocentric to polycentric urban forms. Utilizing a mixed-methods approach, including interviews, questionnaires, observations, and data analysis with 200 participants, the research outlines the adaptation of housing and urban space to meet the needs of Djelfa's growing population. Key findings highlight a dramatic demographic shift marked by a 75.6% increase in population, a reduction in average household size from 6.3 to 4.1, and a 150% surge in the number of households. This demographic expansion has spurred extensive urban expansion, effectively doubling the built-up area and necessitating the development of sub-centres of the city to mitigate pressure on the primary city center (CC). This evolution underscores Djelfa's progression towards a polycentric urban model, reflecting broader urban space decentralization and diversification trends to improve accessibility and reduce congestion. The study contributes to the understanding of complex effects that urbanization has on social and spatial structures in the Global South, highlighting the critical interplay between demographic shifts, urban planning, and social restructuring. Advocating for strategic, inclusive urban planning and policy-making, the research underscores the importance of addressing the diverse needs of rapidly urbanizing populations, offering invaluable insights into sustainable urban management practices applicable to similar urban scenarios worldwide.

Keywords

urbanization • urban form • demographic shift • family structure • urban planning • Djelfa

1. Introduction

Urbanization is a global phenomenon that has attracted significant attention from scholars and policymakers due to its profound and multifaceted implications for the socio-spatial fabric of cities worldwide. In the heart of Algeria, the city of Djelfa is a striking example of how urbanization can dramatically reshape the landscape and alter the lifestyle patterns of its inhabitants. The city's rapid urban growth is not an isolated occurrence but a reflection of broader trends affecting urban centres globally. These trends illustrate the complex interplay between demographic expansion, urban planning, and social restructuring, presenting unique challenges and opportunities for sustainable development [Ayambire et al. 2019].

The history of Djelfa provides a rich case study for examining the subtleties of urban growth and its repercussions. This growth encapsulates the challenges of managing urban sprawl, accommodating the needs of a burgeoning population, and preserving cultural and architectural heritage, all while striving for economic and social sustainability. As Djelfa evolves, it faces the tensions and possibilities inherent in urbanization processes worldwide, turning it into a pertinent subject for in-depth analysis [Angel and Blei 2015, Madani et al. 2002].

This study investigates the core of urban transformations in Djelfa in order to uncover the intricate dynamics governing the city's socio-spatial changes. By examining how Djelfa's urbanization mirrors global trends and impacts local social and spatial arrangements, the research seeks to understand better the role of urbanization in shaping contemporary cities. The study mainly focuses on the socio-spatial transformation of housing in Djelfa, a critical aspect that influences its residents' quality of life and well-being. Through a comprehensive analysis of Djelfa's urban development patterns, family systems, and spatial organisation, this research aims to shed light on the broader implications of urban growth for city planning, policy-making, and the sustainable development of urban spaces [Boussouf 2000, Damba et al. 2019].

The significance of this research lies in its potential to inform and guide urban development strategies in Djelfa and other similar urban contexts facing the challenges of rapid urbanization. By identifying the factors driving socio-spatial changes and evaluating their impacts on urban life, the study aspires to contribute valuable insights into effective urban planning and policy-making that can foster sustainable, inclusive, and resilient urban environments [Danso-Wiredu and Poku 2020, Mcloyd 1990].

Despite a wealth of studies on urbanization, the specific socio-spatial transformations of housing in the context of Djelfa remain to be explored. This gap is particularly evident in understanding how rapid urbanization of Djelfa affetcs its social structures, particularly the transition from extended to nuclear family systems [Mcloyd 1990], and its spatial structures, such as the evolution from monocentric to polycentric urban

forms [Angel and Blei 2015]. This study addresses this gap, highlighting the relevance and need to explore these dynamics in the unique urban context of Djelfa.

The research has three main objectives: first, to assess the impact of urbanization on family structures in Djelfa, particularly the shift towards nuclear families; second, to understand how these social changes influence the spatial organisation of the city; and third, to evaluate the implications of these socio-spatial transformations for urban planning and policy-making in Djelfa. These objectives guide the study toward a comprehensive analysis of the interrelations between urban growth and socio-spatial dynamics.

Given the exploratory nature of this study, no specific hypothesis is advanced. Instead, it proposes to investigate the multiple impacts of urbanization on Djelfa's housing and urban structure. It hypothesises that rapid urban growth is a critical driver of the observed socio-spatial transformations, leading to significant changes in family systems and urban form [Damba et al. 2019].

This research is important as it contributes to knowledge on the effects of urbanization on the developing cities. Focusing on Djelfa, the study offers insights into the specific socio-spatial challenges and opportunities faced by rapidly urbanizing areas in North Africa. The findings aim to inform sustainable urban development strategies that accommodate changing family structures and spatial organisations, thus enhancing the quality of life for Djelfa's residents [Boussouf 2000].

This article is structured as follows: the section following the introduction outlines the methodology, including data collection and analysis techniques employed in the study. The subsequent section presents the results, shedding light on the socio-spatial transformations in Djelfa. These results follow an interpretation of the findings against the existing literature and urban theory. The article concludes with a summary of the study's contributions to urban studies, policy implications, and suggestions for future research.

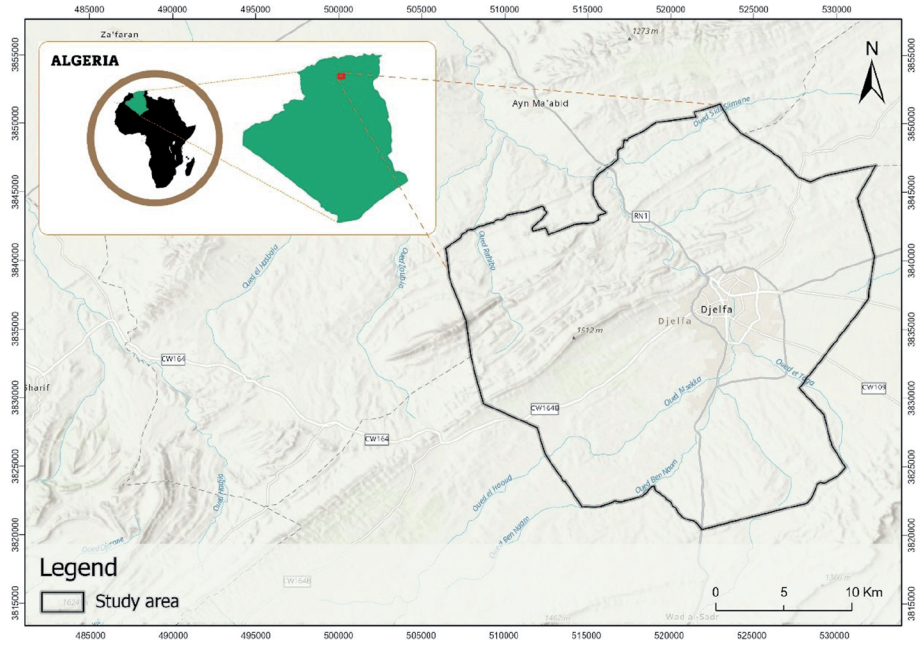
2. Study area

This research focuses on Djelfa, the capital of Djelfa Province in northern Algeria, situated approximately 300 kilometres south of the national capital. Geographically positioned between latitudes 34°31' and 34°48' north and longitudes 3°4' and 3°21' east, Djelfa covers an area of 542.17 square kilometres. The region has a semi-arid climate, experiencing average annual precipitation between 200 and 500 millimetres. Weather pattern is characterised by hot, semi-arid summers with maximum temperatures reaching 33°C and cold, subtropical winters where temperatures can drop below freezing. The terrain is predominantly plateau, with altitudes ranging from 900 to 1400 meters above sea level (D.P.S.B. 2020) (Fig. 1).

3. Materials and methods

Our methodology is designed to thoroughly examine the socio-spatial changes in housing in Djelfa using a comprehensive and integrated approach. This methodology combines structured interviews with key stakeholders, including urban planning experts, local

government officials, and long-term residents, to gather qualitative insights. Detailed questionnaires were distributed to a representative sample of residents to collect quantitative data on housing characteristics and urban experiences. Systematic observations were made within the city to capture real-time socio-spatial dynamics. Additionally, expert input from urban planning and development specialists was incorporated to enrich the analysis and interpretation of the data. Furthermore, Landsat TM/OLI remote sensing imagery was used to analyze land use and land cover changes over time, providing a detailed view of Djelfa's urban expansion and transformations. This multifaceted methodology allows for a holistic analysis of Djelfa's unique urban context, offering a comprehensive view of the socio-spatial transformations taking place.



Source: Authors' own study

Fig. 1. A map of Djelfa City

3.1. Primary data collection

Using the GeoPoll sampling approach, a type of Stratified Random Sampling, our study meticulously reflected Djelfa's demographic diversity with a targeted sample of 200, achieving an 84% response rate from 168 participants aged over 18, who live in the city for over two decades, ensuring representation at a 90% confidence level, 10% confidence interval, and 0.5 standard deviation. Supported by the findings of Lee and Park [2015] and Nanjundeswaraswamy and Divakar [2021], this method was chosen for its efficacy in uncertain sampling frames and the importance of meticulous sample size planning.

Further qualitative insights were gathered through structured interviews with citizens, officials, and stakeholders, coupled with cross-sectional surveys among long-term city centre residents, guided by Creswell and Creswell [2017] qualitative research framework. These were complemented by field observations of urban life in Djelfa and key informant interviews with urban planning and development experts, drawing on Kumar [2012] for a detailed examination of the socio-economic impacts and sustainable practices of urbanization, highlighting the critical role of firsthand observation and expert input in understanding urban dynamics, as emphasised by Gehl [2011].

To gain in-depth qualitative insights, we conducted a total of 30 structured interviews with various stakeholders in Djelfa. The interviewees included:

a. Urban Planning Experts (5 interviews): These professionals from the Physical Planning Department and Development Planning Department provided insights into urbanization processes and planning strategies in Djelfa. Their expertise included urban development, land use planning, and infrastructure projects.
b. Local Government Officials (10 interviews): Officials from the Land Use and Spatial Planning Authority and Djelfa Municipality shared information on policy implementation, regulatory challenges, and urban management practices. They provided valuable data on urban governance and policy impacts.
c. Community Leaders and Residents (15 interviews): Long-term residents and community leaders from various neighborhoods discussed the socio-economic impacts of urbanization, changes in housing patterns, and community dynamics. They included members of local associations and long-term residents with over 20 years of living experience in the city center.

These interviews were crucial for collecting qualitative data that complemented the quantitative survey, providing a comprehensive understanding of the socio-spatial transformations in Djelfa.

3.2. Secondary data collection

The study was augmented by integrating secondary sources, such as government reports, census data, and historical documents, with primary data in order to provide context for Djelfa's urban evolution. Our analysis was enriched by data from the National Office of Statistics (ONS), Djelfa Municipality monographs, the Directorate of Urban Planning, Architecture, and Construction for Djelfa [DUC Djelfa 2024], Report on the State of the Construction Sector, and other relevant publications.

3.3. Data interpretation and visualization

In analysing Djelfa's urban data, we applied GIS for mapping alongside other tools for pattern recognition, and comparative and qualitative analyses to uncover urban trends and relationships. Additionally, we used Landsat satellite images to observe land use changes and urban expansion, providing a comprehensive view of the city's development

over time. This method allowed us to create detailed maps with the help of ArcGIS software, highlighting urban growth patterns. Excel 2021 enabled the creation of charts and graphs, improving the visual representation of data. Such approach constructs narratives of Djelfa's urban evolution that inform data-driven urban planning and policy decisions.

3.4. Framework and design for urban dynamics survey

Our Djelfa study used a detailed survey to understand the city's urban dynamics. Designed with precision and sensitivity to culture, the questionnaire mixed qualitative and quantitative questions to capture the essence of the city and identify urban trends. It explored various topics, including housing history, family demographics, housing characteristics, and socio-spatial dynamics, to gain insights into residents' experiences and perceptions of urban change. It also addressed urban infrastructure, planning, housing transformation, and the impact of policies on community life. Participants shared personal stories, offering a comprehensive view of Djelfa's urban development and residents' interactions.

The survey questionnaire consisted of 45 questions covering a comprehensive range of topics:

a. Urban Housing History: Historical changes in housing, major urban development phases, factors influencing housing changes, and significant events impacting housing.
b. Family and Demographic Information: Number of households, ages of family members, occupation and income levels, housing history, reasons for moving, and duration of residence.
c. Housing Characteristics: Total and built area of current housing, number of rooms, age of the house, available amenities, type and architectural style of housing, changes made since moving in, and quality and satisfaction with housing facilities.
d. Socio-Spatial Dynamics: Social interactions within neighborhoods, effects of housing changes on social dynamics, community ties, and demographic changes in neighborhoods.
e. Urban Infrastructure and Planning: Perceptions of infrastructural development, effectiveness of urban planning, impact of urban planning on housing, and the role of public spaces.
f. Housing Transformation: Views on socio-spatial transformation, impact on personal and family life, benefits and challenges of housing transformation, and suggestions for improvements.
g. Comparative Analysis: Comparison of housing conditions in different parts of Djelfa and perceived inequalities in housing.
h. Policy and Governance: Influence of urban policies on housing transformation, effectiveness of government interventions, suggestions for policy improvements, and community involvement in housing decisions.

i. Additional Comments: Personal experiences and additional insights regarding housing in Djelfa.

These comprehensive questions were designed to gather detailed insights into the socio-spatial transformations in Djelfa, ensuring a thorough understanding of the urban dynamics at play.

3.5. Methodology for Satellite Image Analysis

This study utilized the Landsat TM/OLI data for remote sensing imagery. Specifically, we employed the Landsat 5 TM for the years 1990 and 2005 and the Landsat 8 OLI for the year 2024 due to their relevance in Land Use and Land Cover (LULC) analysis, as detailed in Table 1. These images facilitate the identification of land use and land cover transitions [Midekisa et al. 2017], and were used to analyze changes in land use. To clarify, classification was conducted for three individual years within the specified period [Feng et al. 2020, Rawat and Kumar 2015], which avoided any implication of a continuous annual study.

Table 1. Landsat image collections used for classification

Year	Satellite	Sensor	RBG composite bands	Spatial resolution	Period of collection
1990	Landsat	5-TM	3-4-5	30 m	01/01/90–31/12/90
2005	Landsat	5-TM	3-4-5	30 m	01/01/05–31/12/05
2024	Landsat	8-OLI	4-5-6	30 m	01/01/24–31/12/24
TM Thematic Mapper, OLI Operational Land Image					

Source: USGS

4. Results and discussion

4.1. Urbanization's impact on Djelfa's social structure

The significant urban growth of Djelfa, Algeria, indicated by a 67.9% increase in population from 2005 to 2024, reflects the global urbanization trends in developing cities, as determined by many studies [Ayambire et al. 2019, Farai et al. 2020, Karg et al. 2019, Tagnan et al. 2022]. These trends were also accounted for by Africa's urban growth rates [Karg et al. 2019]. This increase, presented in Table 2 [ONS 2024], is attributed to Djelfa being a hub for high-order services that attracts migrants from regions, like Biskra, Batna, Alger, and Blida, with better socio-economic opportunities. This influx, emphasising Djelfa's role as a growth pole, stresses the existing infrastructure and services [Damba et al. 2019], indicating significant socio-economic and cultural shifts within Djelfa's urban landscape over the decade.

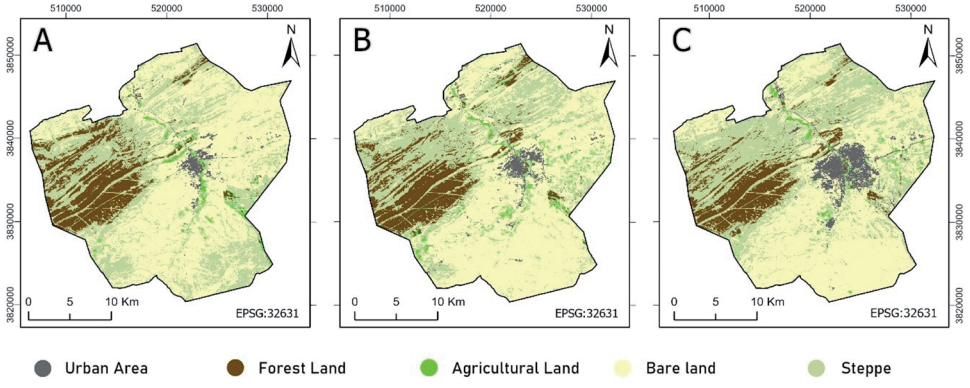
Table 2. Population and housing trends over census years

Year	Population	Rural/Urban proportion		Housing stock
		Rural	Urban	
1966	50,885	*	*	2643
1977	92,426	*	*	6933
1987	150,205	*	*	9728
1998	210,267	*	*	15,783
2005	288,228	96272.92 (19%)	409995.08 (81%)	50,637
2024	506,168	*	506168 (100%)	75,955

Source: ONS [2011], DUC Djelfa [2024]

* – not available.

Urbanization has a significant impact on lifestyles and living standards, enhancing economic opportunities and attracting migration – it is a key driver of Djelfa's population growth. The 2024 census revealed that 11% of Djelfa's residents are immigrants, which puts pressure on the city's infrastructure due to the uneven distribution of services [ONS 2011, DUC Djelfa 2024]. The shift from 81% urban population in 2005 to 100% in 2024 indicates a move towards urban settlement, intensifying land use and potentially overexploiting natural resources. This transition, documented in Table 3 and Figure 2, highlights the transformation of rural areas to urban spaces, as studies by Ocholla-Ayayo [2000], Rosenlund [2019], and Karg et al. [2019] indicate discussing the effect of urbanization on socioeconomic structures and land utilization.



Source: Authors' own study

Fig. 2. Djelfa land use and cover evolution (A) 1990, (B) 2005 and (C) 2024

Table 3. Shifts in Djelfa's land use and cover ratios (1990, 2005, and 2024)

LULC unit	1990		2005		2024	
	Area [Ha]	Area [%]	Area [Ha]	Area [%]	Area [Ha]	Area [%]
Urban Area	924.09	1.75	1405.12	2.66	2742.30	5.20
Forest Land	6174.25	11.70	6128.76	11.61	5344.06	10.12
Agricultural Land	768.25	1.46	1051.47	1.99	547.05	1.04
Bare land	27944.39	52.94	28632.48	54.24	24976.58	47.32
Steppe	16974.66	32.16	15567.96	29.49	19175.79	36.33
Total	52785.64	100.00	52785.79	100.00	52785.79	100.00

Source: Authors' own study

This study revisits Ashley's [2019] concept of social structure through the lens of family systems, individual preferences, and housing within Djelfa, using changes in average household size and the number of households in 2005 and 2024 as indicators [ONS 2011, DUC Djelfa 2024]. It found a significant shift from extended to nuclear family systems, with the average household size decreasing from 6.3 to 4.1 – a 35% drop – and the number of households increasing by 150% from 50,637 to 75,955, reflecting an evolving social structure towards privacy and spatial reorganization. This shift is detailed in the survey results and Table 4, highlighting privacy (50%), improved financial status (32%), and congestion (27%) as key drivers, alongside an inverse relationship between population growth and household size, all of which point to a broader trend of urban social transformation.

Table 4. Factors driving the departure from xtended family model

Reasons	Percentage
Privacy	50
Improved financial status	32.28
Congestion	27.39
Family problems	15.92
Others	10.25

Source: Authors' own study

Privacy concerns, improved financial status, and family problems have emerged as significant factors influencing the shift from extended to nuclear family models in Djelfa. Privacy issues led 50% of respondents to leave their extended families – they were often

compounded by household congestion [Tagnan et al. 2022, Danso-Wiredu and Poku 2020]. Financial independence has facilitated this transition for 32% of individuals, enabling them to establish separate residences and signalling economic growth within Djelfa that affects residential decisions and social structures [Patterson 2002, Yakubu et al. 2014]. Additionally, 16% respondends mentioned escaping domestic violence and family disputes as reasons for moving, highlighting the adverse effects the extended family can have on personal well-being, and contributing to the global trend towards nuclear households [Danso-Wiredu and Poku 2020, Tagnan et al. 2022]. These shifts emphasize the complex interplay between socio-economic factors and family dynamics in urban settings. Table 5, based on the survey from January 2024, points to diverse motivations for the shift towards nuclear families in Djelfa, including personal and economic factors. Reasons like marriage and the achievement of homeownership also indicate the complex interplay of personal and socio-economic influences on family structure changes.

Table 5. Additional reasons for the departure from extended family structures

Reasons	Percentage
*	80.5
Death of my father	2.5
I got married	3.7
Marriage	5.6
My son built a house and relocated me	2.5
My son built a new house there for me	2.5
The pride of owning a house	2.5
Total	100.0

Source: Authors' own study

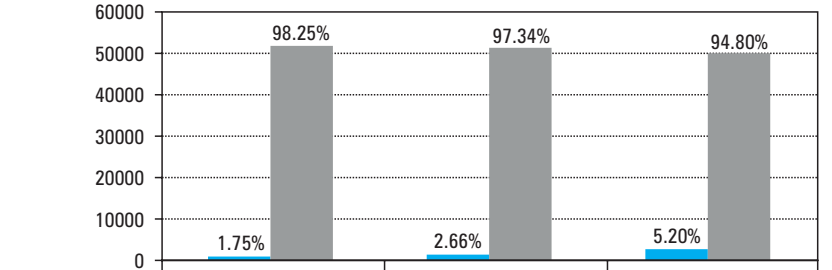
4.2. Urbanization's impact on Djelfa's spatial structure

Inspired by fundamental research, our study on the effects of Djelfa's urbanization on spatial structure illustrates the dynamic relationship between urban growth and social changes from 1990 to 2024. Anas et al. [1998] initially defined spatial structure as the distinct pattern of human activity across space, a concept further elaborated by Liu et al. [2021] and Angel and Blei [2015], who emphasized the distribution model of residences and workplaces interconnected by commuting flows.

This study thoroughly examines the dynamic urban transformation of Djelfa, Algeria, in the context of escalating urbanization from 1990 to 2024. The analysis reveals a sharp 75.6% increase in population, from 288,228 to 506,168 residents, and a fundamental shift in living patterns from extended to nuclear family structures, with the average household size reduced from 6.3 to 4.1. Additionally, the study notes

a 150% increase in the number of households and a significant expansion of the built-up area, effectively doubling its footprint. These changes mark a transition towards a polycentric urban model, emphasizing the critical need for innovative, sustainable urban planning approaches to manage and capitalize on such growth adeptly.

The evolution of Djelfa's urban landscape underscores the complex interplay between demographic trends and urban planning, highlighting the implications for social structures and the city's spatial organization. The number of households increased from 35,408 in 2005 to 89,011 in 2024, with the built-up area growing from 1.75% to 5.20% of the total land area. This progression demonstrates the profound impact of urbanization on the spatial and social structure of Djelfa, as illustrated by the extensive data analysis and visual representation in Figure 3.

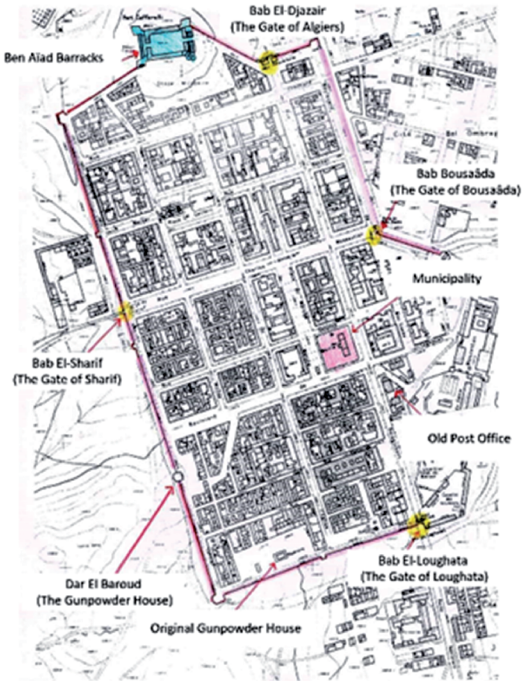


	1990	2005	2024
built-up	924,09	1405,12	2742,3
non built-up	51861,55	51380,67	50043,48

Source: Authors' own study

Fig. 3. Djelfa land cover analysis chart

The literature indicates that urbanization, particularly in the global south, is leading to considerable urban expansion, with cities extending beyond their original boundaries and jurisdictions [Brandful and Nsomah 2017, Hisham et al. 2019]. This expansion, especially on the periphery and in rural areas that serve as the city's food basket, has significantly contributed to the urban sprawl in Djelfa, adversely affecting steppe areas, natural reserves, agricultural lands, and ecologically sensitive areas. The rate of Djelfa's expansion from 1990 to 2024 is documented in Table 3 [Djelfa Assembly 2022]. Urban spatial structure, which concerns the distribution of significant activity areas such as residential and commercial zones within a city [Angel and Blei 2015], was examined through a comparative analysis using structure plans from 2005 and 2024, with the 1970 structure plan serving as the baseline (Figures 4 and 5). Djelfa, once a secondary city, showed a monocentric spatial structure with all significant activities clustered around a CC, closely linked to transport hubs and residential areas, which facilitates access to goods, services, and workplaces [Angel and Blei 2015]. Such layout, which prevailed from 1970 to 2005, positioned the CC as the hub for all major regional activities.



Source: DUC Djelfa [2024]

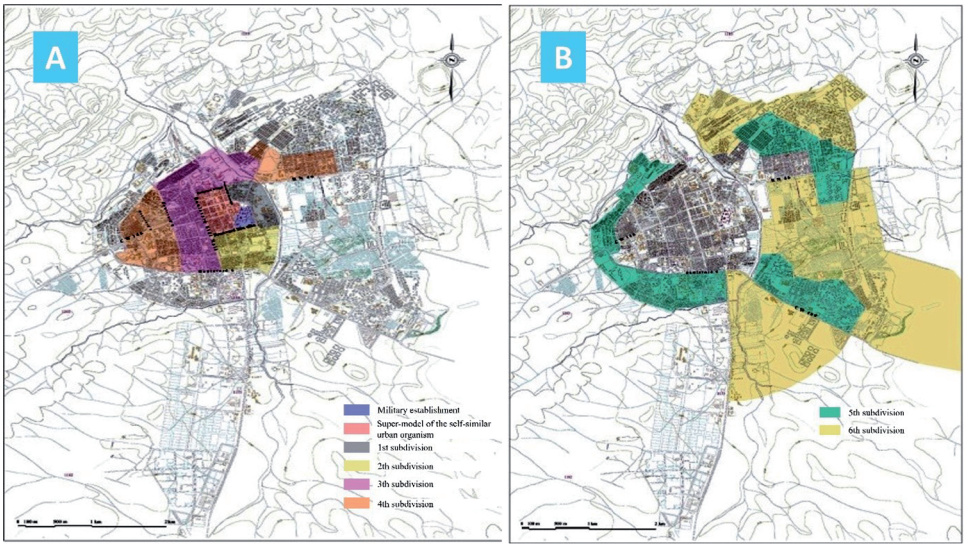
Fig. 4. Initial boundary layout of Djelfacity in 1970

According to the results presented in Table 6, as of 2005, a significant majority of Djelfa's population, i.e. 75.9%, resided within 3 km of the city centre, reflecting its traditional structure with a strong emphasis on the extended family system as family members usually lived in compound houses near the CC. Meanwhile, 24.1% of the population resided beyond 3 km diameter of the CC. The study also found that the average travel time from residential areas to the CC was 21 minutes, which confirmed the community's inclination to dwell near the CC to maximize access to its services [Angel and Blei 2015]. Figure 5 further illustrates the spatial structure of Djelfa from 1970 to 2005, visually depicting the evolution of the city's layout and the distribution of residences about the CC.

Table 6. Distance from homes to CC for respondents (2005)

Distance from CC	Per cent
Close to the CC, within 3 km	75.9
Far from CC, beyond 3 km	24.1
Total	100.0

Source: Authors' own study



Source: DUC Djelfa [2024]

Fig. 5. Structure lan of Djelfa's spatial development from (A) 1990 to (B) 2005

The study highlights a significant shift in residential patterns in Djelfa, with 61% of respondents moving their homes after 2005, diverging from the earlier trend (75.9% lived within 3 km of the city's centre). Notably, 91.5% of these individuals now reside more than 3 km from the CC, with only 8.5% moving to locations closer to it, as detailed in Table 7. This transition has increased the average travel time to the CC from 21 minutes in 2005 to 34 minutes, reflecting the broader effects of urban expansion on commuting times. This phenomenon is confirmed by the studies of Acheampong [2020], Amponsah et al. [2015], Mensah et al. [2021), Puplampu and Boafo [2021], Zhou and Chen [2018], which suggest that extended commuting time has become characteristic of urban expansion, indicating a substantial change in the social and spatial structure of Djelfa.

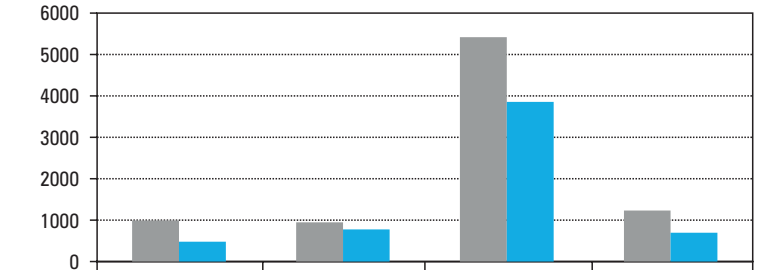
Table 7. Distance from homes of the respondents to CC (2024)

Distance from CC	Per cent
Close to the CC, within 3 km	8.5
Far from CC, beyond 3 km	91.5
Total	100.0

Source: Authors' own study

In response to Djelfa's urbanization challenges and the resultant socio-spatial changes, city authorities developed a 20-year development structure plan to accommo-

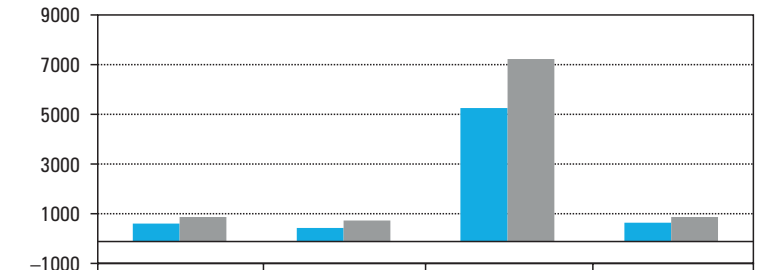
date urban pressures through space reorganisation, especially around the city's centre. This plan is designed to redistribute key activities to various strategic points in order to alleviate congestion by balancing population distribution and making services more accessible [Li 2020]. Such strategic shifts align with urban trends around the world – developing countries evolve from dispersed, monocentric models to polycentric ones, enhancing equitable access to services and opportunities [Liu et al. 2021]. Traffic congestion, a critical issue in Djelfa's CC, was highlighted by a detailed traffic count showing a significant imbalance between vehicle inflows and outflows during peak hours, underlining the urgent need for spatial reorganisation to manage traffic effectively. This scenario of high traffic and human congestion supports Takyi's [2016] findings on the persistence of congestion in areas of concentrated services and Cobbinah and Amoako's [2012] argument that urban expansion often leads to increased traffic generation. Figures 6 and 7 provide a breakdown of the traffic counts, illustrating the extent of congestion and informing the city's planning strategies.



	Motorcycle	Tricycle	Cars	Heavy vehicles
in	995	955	5422	1235
out	487	783	3862	699

Source: Authors' own study

Fig. 6. Traffic counts in the morning (7–10 AM)

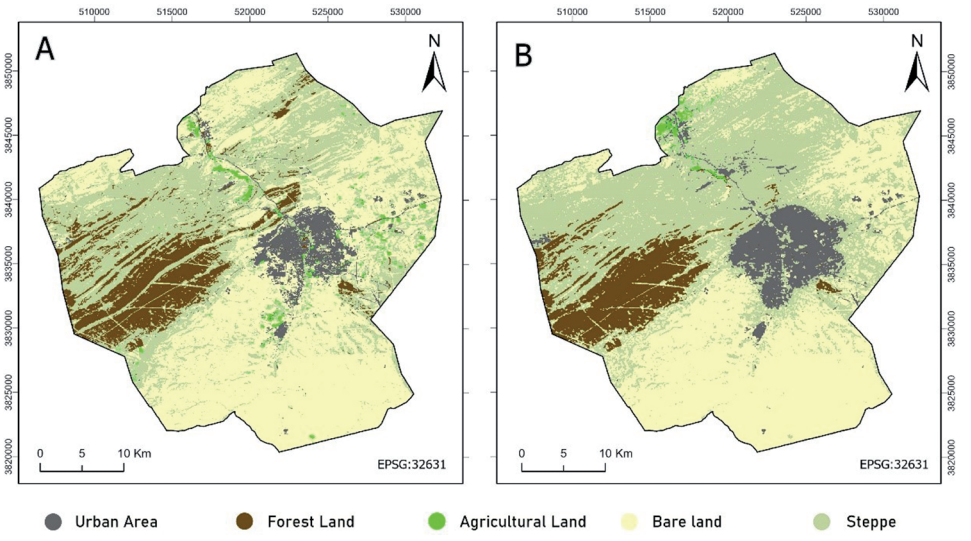


	Motorcycle	Tricycle	Cars	Heavy vehicles
in	834	627	6124	862
out	1133	963	8354	1132

Source: Authors' own study

Fig. 7. Traffic counts in the evening (4–7 PM)

In Djelfa, strategic urban development initiatives, including the creation of new neighborhoods and the expansion of its suburbs, have been instrumental in transforming the city into a polycentric spatial structure. A new centre approximately 9 km west of the primary CC has been designated to alleviate congestion and improve service accessibility to the further Djelfa districts, Ain Maabed municipality, and surrounding areas. Complementary developments include a new railway station on the city's outskirts at Moudjbara, an expanded industrial park 15 km to the north, and a new public transport terminal at Massoudi, 13 km to the south-west of the primary CC. These initiatives aim to distribute economic opportunities more equitably across the city, and reduce vehicle and human congestion. Takyi [2016] emphasizes the importance of redistributing opportunities to achieve equitable geographic access. Angel and Blei [2015] describe this evolution towards a polycentric spatial structure, with multiple centres across the city concentrating on workplaces and services, as evident in the development of the Alamraoui sub-district and the Pole of Barabih sub-district. Figures 8 and 9 illustrate land use changes and congestion patterns, respectively, providing a comprehensive overview of Djelfa's urban dynamics and the impact of these strategic developments on the spatial organisation and congestion management of the city.



Source: Authors' own study, 2024

Fig. 8. Djelfa land use and cover evolution (A) 2024, (B) 2035

4.3. Interrelations between the social and spatial structures in Djelfa

The analysis demonstrates a direct correlation between the evolving social and spatial structures of Djelfa, transitioning from a monocentric model in 2005 to a polycentric one by 2024. This transition was driven by significant demographic changes, including

a 75.6% population increase (from 288,228 to 506,168), a reduction in average household size by 2.2 persons (from 6.3 to 4.1), and a 150% increase in the number of households (from 50,637 to 75,955). Thus, the city achieved a complete urbanization, with its entire population residing in urban settings. These changes resulted in a considerable urban expansion, increasing the built-up area from 2.66% to 5.2%, necessitating the development of additional sub-CCs. This shift is confrimed by the subject literature discussing the adaptation of the social structures to urbanization [Danso-wired and Poku 2020, de la Sablonnière and Taylor 2020, Ocholla-Ayayo 2000, Tagnan et al. 2022], and similarly, the evolution of the spatial structures to accommodate in both social structures and the urbanization process [Agyemang et al. 2019, Boahen et al. 2020, Li 2020]. This interplay between social and spatial dynamics in Djelfa underscores the complex nature of urban development and its impact on planning and structure of the city.

Source: Authors' own study

Fig. 9. Congestion in Djelfa CC

5. Conclusion

Reflecting on the findings of this comprehensive analysis, it becomes evident that Djelfa's urban evolution, driven by significant demographic shifts and spatial reconfigurations, requires a strategic, forward-thinking approach to urban planning. The move towards polycentric urban development, coupled with the growing need for accessible housing, infrastructure improvements, and increased community involvement, makes it imperative to address the multifaceted challenges of urban expansion. This study contributes to the academic debate on urban transformation and offers practical insights for policymakers and urban planners seeking for sustainable and inclusive urban environments.

Further research should focus on the most promising research areas, such as sustainable infrastructure development and effective public transportation systems, in order to manage urban sprawl. More studies are needed to explore the socio-economic

impacts of urbanization on marginalized communities in Djelfa. This research faced limitations in data availability and the scope of socio-economic variables. Future studies should aim to include a more diverse set of variables and longer timeframes to capture the full impact of urbanization.

By viewing urbanization through the lens of opportunity, this research aligns with broader metropolitan studies and argues for a nuanced, strategic response to urban growth. The analysis here sets a foundation for ongoing inquiry into the socio-spatial dynamics of urbanization, urging continued exploration and adaptation to ensure resilient, livable urban futures.

References

Acheampong R.A. 2020. Extended commuting in urban Ghana: Issues of travel time and worker well-being. Urban Studies, 57(1), 101–118. https://doi.org/10.1177/0042098019853663

Agyemang K.J., Boahen E., Li W. 2020. The spatial structure evolution of China's urban agglomerations and its impact on regional economic development. Land Use Policy, 94, 104512.

Amponsah O. et al. 2015. Assessing low-quality water use policy framework: A case study from Ghana. Resources, Conservation and Recycling, 97, 1–15. https://doi.org/10.1016/j.resconrec.2015.01.009

Anas A., Arnott R., Small K.A. 1998. The dynamics of urban sprawl. The Journal of Urban Economics, 42(3), 354–384.

Angel S., Blei A.M. 2015. The dynamics of urban sprawl: Assessing global cities' spatial and temporal growth patterns. Urban Studies Journal, 52(8), 1359–1379. https://doi.org/10.1177/0042098015577332

Ayambire R.A., Danso-Wiredu E.Y., Karg H., Tagnan A.S. 2019. Urbanization and its impact on socio-economic growth in developing regions. GeoJournal, 84(1), 165–184. https://doi.org/10.1007/s10708-018-9912-y

Boahen E., Agyemang K.J., Li W. 2020. The spatial structure evolution of China's urban agglomerations and its impact on regional economic development. Land Use Policy, 94, 104512.

Boussouf A. 2000. Housing policies and urban dynamics: Case study of Djelfa, Algeria. Journal of Urban Planning and Development, 126(3), 123–142. https://doi.org/10.1061/(ASCE)0733-9488(2000)126:3(123)

Brandful C.O., Nsomah J.N. 2017. Urban expansion and its effects on the livelihoods of rural communities in the global south. Urban Studies, 54(7), 1665–1680.

Cobbinah P.B., Amoako C. 2012. Urban sprawl and the loss of peri-urban land in Kumasi, Ghana. International Journal of Sustainable Development & World Ecology, 19(5), 442–455.

Creswell J.W., Creswell J.D. 2017. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Sage Publications.

Damba C., Patterson K., Li Z. 2019. Urban sprawl and the challenges for urban planning: Evidence from the periphery of Tamale, Ghana. Journal of African Real Estate Research, 4(1), 63–84. https://www.afrer.org/journal/volume4/issue1

Directorate of Urban Planning, Architecture, and Construction for Djelfa. 2024. Report on the State of the Construction Sector.

Djelfa Assembly. 2022. Urban planning and development strategy for Djelfa City 2020–2040. City of Djelfa Urban Planning Documents.

D.P.S.B. 2020. Monograph of the Wilaya of Djelfa. Department of Budget Programming and Monitoring, 3–11.

Farai S., Demeterio J.P. 2020. Urban growth and development in Africa: Trends and challenges. African Studies Review, 63(1), 190–212.

Feng Y., Lei Z., Tong X., Gao C., Chen S., Wang J., Wang S. 2020. Spatially-explicit modeling and intensity analysis of China's land use change 2000–2050. Journal of Environmental Management, 263 (November 2019), 110407. https://doi.org/10.1016/j.jenvman.2020.110407

Gehl J. 2011. Life Between Buildings: Using Public Space. Island Press.

Hisham B., Mahdi S., El-Hadi H. 2019. The impact of urban sprawl on the peri-urban areas of North African cities: A case study of Tripoli, Libya. Journal of Urban Management, 8(2), 224–235.

Karg H., Hologa R., Schlesinger D., Drescher A., Kranjac-Berisavljevic G. 2019. Urbanization and agricultural land loss in the peri-urban areas of Accra, Ghana. Land Use Policy, 81, 584–593.

Kumar R. 2012. Research Methodology: A Step-by-Step Guide for Beginners. Sage Publications.

Lee K., Park H. 2021. Strategic Urban Investments: The Path to Resilience and Inclusivity. International Review of Urban Development, 7(2), 156–172.

Li Z. 2020. Towards concentration and decentralisation: The evolution of the urban spatial structure of Chinese cities, 2001–2016. Computers, Environment, and Urban Systems, 80 (March 2019), 101425. https://doi.org/10.1016/j.compenvurbsys.2019.101425

Liu X., Heilig G.K., Chen J., Heino M. 2021. Urbanization and its environmental effects in Shanghai, China. Urban Climate, 31, 100537.

Madani K. et al. 2002. Water management in Algeria for drought conditions and future needs. Hydrological Sciences Journal, 47(S1), S29–S40.

Mcloyd V.C. 1990. The impact of economic hardship on Black families and children: Psychological distress, parenting, and socioemotional development. Child Development, 61(2), 311–346.

Mensah C.A., Amponsah O., Opoku A., Ahadzie D.K., Takyi S.A. 2021. Urban sprawl and the challenges for sustainable urban development in Accra, Ghana. Journal of Urban Planning and Development, 147(1), 05020028. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000620

Midekisa A., Holl F., Savory D.J., Andrade-Pacheco R., Gething P.W., Bennett A., Sturrock H.J. W. 2017. Mapping land cover change over continental Africa using Landsat and Google Earth Engine cloud computing. PLoS One, 12(9), 1–15. https://doi.org/10.1371/journal.pone.0184926

Nanjundeswaraswamy T.S., Divakar C.G. 2021. Performance appraisal systems in higher education: An overview. Journal of Educational Review, 4(3), 417–429.

National Office of Statistics (ONS). 2011. L'armature Urbaine RGPH 2008 – Collections Statistiques N° 163/2011 [The Urban Framework RGPH 2008 – Statistics Collections N° 163/2011]. 220.

Ocholla-Ayayo A.B.C. 2000. Traditional ideology and ethics among the southern Luo. University of California Press.

Puplampu B.B., Boafo K.A. 2021. Traffic congestion in urban areas: Understanding the traffic jamming phenomenon in Accra, Ghana. Cities, 108, 102992. https://doi.org/10.1016/j.cities.2020.102992

Rawat J.S., Kumar M. 2015. Monitoring land use/cover change using remote sensing and GIS techniques: A case study of Hawalbagh Block, District Almora, Uttarakhand, India. Egyptian Journal of Remote Sensing and Space Science, 18(1), 77–84. https://doi.org/10.1016/j.ejrs.2015.02.002

Rosenlund L. 2019. Urban lifestyle changes and the process of urbanization. Social Indicators Research, 142(3), 897–915.

Tagnan H., Zoungrana T., Ouedraogo A. 2022. Urbanization and the transition from extended to nuclear families in West African cities. Urban Studies, 59(3), 640–656.

Takyi S.A. 2016. The effects of urban sprawl on peripheral agricultural lands in Kumasi, Ghana. Land Use Policy, 59, 472–485. https://doi.org/10.1016/j.landusepol.2016.09.022

Zhou Y., Chen X. 2018. The impact of urbanization-related land use land cover and urban morphology changes on the urban heat island phenomenon. Science of the Total Environment, 1467–1476. https://doi.org/10.1016/j.scitotenv.2018.04.091