



The Impact of Urban Expansion in Saidia on Urban Forests: A Case Study of Tazgrarte Forest

Adil Akallouch^{1*}, Souad Tannouch Bennani², Mohamed Hamjik², Hossain Boudilab³, Aziz Mahjoub⁴

¹Department of Geomatics and Strategic Planning, Devantec Ingenierie, Rabat, Morocco

²Department of Geography, Faculty of Letters and Human Sciences Dhar El Mahrez, Sidi Mohamed Ben Abdellah University, Fez, Morocco

³Center for Historical and Environmental Studies, Royal Institute of Amazigh Culture, Rabat, Morocco

⁴Department of Geography, Faculty of Letters and Human Sciences Ben M'sik, Hassan II University, Casablanca, Morocco

Email: *adil.akallouch@gmail.com

How to cite this paper: Akallouch, A., Bennani, S.T., Hamjik, M., Boudilab, H. and Mahjoub, A. (2025) The Impact of Urban Expansion in Saidia on Urban Forests: A Case Study of Tazgrarte Forest. *Open Access Library Journal*, **12**: e12956.
<https://doi.org/10.4236/oalib.1112956>

Received: January 13, 2025

Accepted: February 22, 2025

Published: February 25, 2025

Copyright © 2025 by author(s) and Open Access Library Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

As of 2005, the city of Saidia has undergone substantial urban expansion, which has led to the Tazgrarte Forest, a major urban green space, not just for the citizens but also for tourists alike, to decline in urban forests. In this regard, this research aims to assess the differences in the forest cover of Tazgrarte Forest from the period of 2005-2025, concentrating on the impact of urban expansion at three critical points in time: 2005, 2015 and 2025. Forested area reduction and urban growth dynamics were examined using satellite images and Geographic Information Systems (GISs). The conclusions reveal that uncontrolled urban sprawl has been principally responsible for the growth of space deserts, which does not bode well for the environment and the existing ecological balance. On the basis of these results, we seek the program of reconstruction for the Tazgrarte Forest within the broader context of a sustainable urban development strategy that aims to preserve and enhance the few remaining metabolisms of the city.

Subject Areas

Urbanization, Conservation, Biodiversity

Keywords

Urban Forests, Urban Expansion, Tazgrarte Forest, Saidia, Development

1. Introduction

Over the past two decades, Saidia, a city renowned for its touristic appeal, has

undergone substantial urban expansion. This growth is part of a broader trend affecting many Moroccan cities as they evolve into urban centers. The rapid development has significantly encroached upon natural areas, particularly urban forests such as Tazgrarte Forest, which are crucial for the ecological and social health of urban environments. Urban forests enhance the quality of life by providing essential ecosystem services, including air purification, noise reduction, and moderation of urban heat islands, thus contributing positively to urban health and well-being [1].

The case of Saidia is particularly illustrative of the broader impacts of unchecked urban sprawl on urban green spaces. As the city has expanded, Tazgrarte Forest has seen a marked decline in its area and ecological health, raising concerns about the sustainability of urban growth and its compatibility with environmental conservation. This decline is mirrored in global studies, which have consistently highlighted the tension between urban development and ecological preservation. For instance, research by Zhou and Wang (2011) [2] demonstrates how urbanization often leads to a decrease in green space, with significant implications for biodiversity and the quality of urban environments.

Moreover, the integration of green spaces like Tazgrarte Forest into the urban fabric is not just about conserving patches of nature but about understanding their role in enhancing urban resilience. Forests in urban settings help filter pollutants, provide recreational spaces, stabilize urban climates, and support biodiversity, which, in turn, benefits the whole city [3]. The ongoing reduction of such spaces due to urban encroachment could lead to a significant loss of these benefits, stressing the need for strategic urban planning that incorporates green infrastructure as a fundamental component of urban development.

This study aims to provide a comprehensive analysis of the environmental impacts associated with the urban expansion in Saidia on Tazgrarte Forest from 2005 to 2025. Utilizing satellite imagery, ecological data, and urban growth models, this research will explore the dynamics of forest cover reduction and its implications for urban sustainability. The goal is to offer actionable insights and recommendations for urban planning that prioritizes green space preservation and sustainable development, ensuring that cities like Saidia can grow without sacrificing their natural assets and the myriad benefits they provide.

2. Methodology

The methodology chosen for the current analysis of the effects of urban expansion on Tazgrarte Forest in Saidia seeks to examine both the spatial and the temporal processes of urbanization and its impacts on urban forest cover. This investigation will be relative and contextual, which is why it requires an integrated and multi-causal approach while focusing on the fragmentation of the urban forest. A combination of remote sensing, Geographic Information Systems (GISs), and ecological analysis will be used. These are the particular steps and methods that have been followed in the work.

2.1. Remote Sensing Data Acquisition and GIS Mapping and Analysis

Satellite images have been obtained from sources such as Landsat 7 and 8, and Sentinel, which include Sentinel 2 MSI. This was done with the intention of monitoring changes in land use over the period of 2005 to 2025. The images were pre-processed, which included the correction of the atmosphere using Sentinel-2 Toolbox alongside geometric correction to make sure the images were aligned with the ground reference points. Various changes in vegetation were studied with the help of the Normalized Difference Vegetation Index (NDVI) which quantifies the loss in forest cover and the dynamics of urban expansion.

ArcGIS, which is a geographic information system software, was used for the spatial analysis of the historical maps. This enabled the user to compare the previous land use to the newest maps in order to discern where the most urban development has occurred with regard to forest cover. Land use classification was done by the supervised classification method, which is the random forest algorithm, the results of which were cross validated with the ground data collected during the surveys. The method of the confusion matrix was utilized to determine the accuracy level of the classification, achieving an overall accuracy of 89% and a Kappa coefficient of 0.85, both of which are indicators of high credibility of the classification.

2.2. Field Surveys

Ground truthing through field surveys will be conducted to verify the data obtained from satellite images. This step is crucial for assessing the actual condition of the forest and the biodiversity it supports.

2.3. Ecological Impact Assessment

An ecological impact assessment will be carried out to evaluate the consequences of urban expansion on the forest's ecosystem. This includes studying biodiversity, the health of flora and fauna, and ecosystem services like carbon sequestration and temperature regulation.

2.4. Stakeholder Interviews

Interviews with local government officials, urban planners, and community members will be conducted to gather qualitative data on the perceived impacts of urban expansion and the value attributed to the forest. This will also help in understanding the effectiveness of existing policies and the community's engagement in forest conservation.

2.5. Data Integration and Analysis

All collected data will be integrated into a comprehensive analysis to understand the broader impacts of urban expansion. Statistical tools and spatial analysis techniques will be employed to interpret the data and identify patterns and trends.

2.6. Recommendations and Policy Implications

Based on the results, recommendations will be done on how sustainable consideration for urban planning and forest management can be achieved. This will serve to strengthen policy initiatives and urban development frameworks towards an environmentally friendly focus.

This methodology guarantees a more effective approach towards the complex patterns that exist between urban expansion and forest ecosystems. Particular emphasis will be placed on easing the impacts of these processes on urban planning, management, and growth in a manner that maintains and improves the provision of urban greening.

3. Results and Discussion

In recent decades, Saidia has transformed from a quiet town into one of Morocco's most prominent tourist destinations. This transformation was driven by large-scale development projects such as the "Fadesa" project, which included the construction of multiple residential units and the development of infrastructure. This attracted both Moroccan expatriates and tourists, significantly boosting the local economy. According to data from the High Commission for Planning, the population of Saidia grew from 3338 in 2004 to 10,514 in 2024 [4], reflecting significant demographic growth that has placed immense pressure on the city's natural resources, particularly its forests (shown as **Figure 1**).

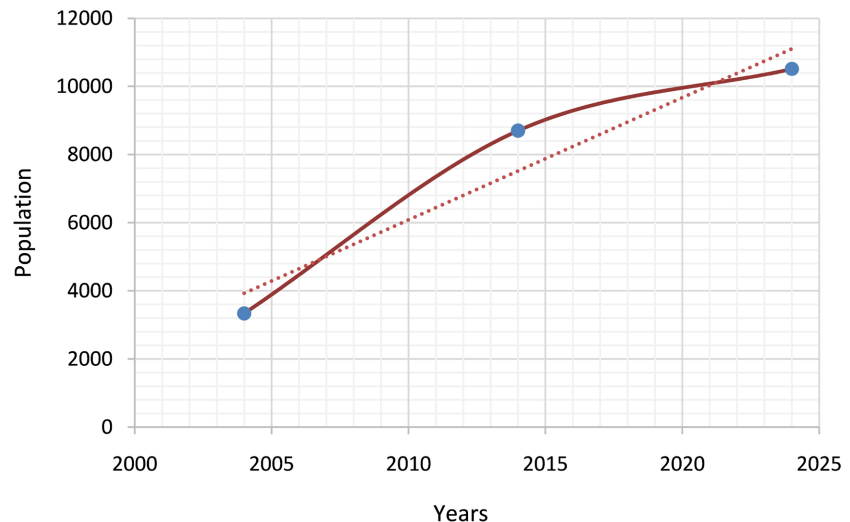


Figure 1. The development of the population of Saidia between the years 2004 and 2024. (source: General Population and Housing Census for the Years 2004, 2014 and 2024)

3.1. Impact on Tazgrarte Forest

Analysis of satellite images from the years 2005, 2015, and 2025 reveals a significant reduction in the area of Tazgrarte Forest, from 80 hectares in 2005 to just 20 hectares by 2025 (shown as **Figure 2**). This represents a dramatic 75% decrease in forest cover over two decades, highlighting the alarming pace of urban encroachment

on green spaces. This reduction is not only a result of direct land conversion for residential and commercial purposes but also of the indirect pressures caused by infrastructure expansion, such as road networks and tourist facilities that accompany urban growth.



Figure 2. Changes in the forest cover of the city of Saidia, marked as (A) for 2005, (B) for 2015, and (C) for 2025. Source: Google Earth satellite image.

The sharp decline in forest areas is a clear indicator of the profound negative impact of urban expansion on local ecosystems. Forests, particularly in urban environments, play a critical role in providing ecosystem services. As emphasized by Tyrväinen *et al.* (2005) [5], urban forests contribute significantly to air purification by filtering pollutants and particulate matter, thereby improving air quality, which is essential for public health in densely populated areas. Additionally, these forests help regulate local temperatures by providing shade and reducing the urban heat island effect, a phenomenon where cities become significantly warmer than their surrounding rural areas due to human activities and reduced vegetation [6].

Moreover, the loss of green spaces such as Tazgrarte Forest exacerbates other environmental challenges, including soil erosion and reduced water retention capacity. Without adequate forest cover, the soil becomes more vulnerable to erosion during heavy rainfall, potentially leading to sedimentation in nearby water bodies. This can have further ecological consequences, such as affecting aquatic habitats in the Moulouya estuary, an area already recognized for its rich biodiversity under the Ramsar Convention [7]. Reduced forest cover also diminishes the city's ability to manage stormwater runoff effectively, increasing the risk of urban flooding,

especially during peak rainy seasons.

Furthermore, the loss of Tazgrarte Forest impacts biodiversity, as it disrupts the habitats of numerous plant and animal species. Urban forests provide critical shelter, food sources, and breeding grounds for wildlife, many of which are integral to maintaining the ecological balance. Studies on urban biodiversity have shown that green spaces, even within urban areas, can support a surprisingly high level of species richness if properly conserved [8]. The reduction in Tazgrarte Forest threatens not only local flora and fauna but also migratory species that rely on this habitat during their seasonal movements.

In addition to the ecological consequences, the loss of such a major portion of the forest hinders the social and recreational benefit it offers to surrounding populations as well as tourists. Much as Tazgrarte Forest, urban green spaces are important in providing a possibility for outdoor activities as well as fostering community integration that contributes towards both mental and physical well-being. The urban forest thus elevates the living standards for the people in Saidia and enhances Saidia's attractiveness to visitors who love nature.

Still, the causes of urbanization and deforestation in Saidia go beyond just the population increase and tourism. There has been a rapid social diversity due to high internal migration resulting in the city being one of the major tourist centers which has increased the need for shelter and infrastructural improvements. Economically, the expansion is just a reflection of policies in place, for example, urban policies looking for higher and faster economic gain. Cutting down the trees without caring about the environment further development in areas like Tazgrarte Forest reflects the absence of proper zoning strategies. These factors indicate the strong requirement for development plans, which include infrastructure changes without harming the environment.

This problem is not limited to Saidia. Other Moroccan cities are facing similar challenges like Tangier. For instance, because of urbanization, there has been a drastic reduction in the area of the Rmilat Forest in Tangier which has had comparable environmental impacts such as loss of biodiversity and heightened urban heat island effects. In Saidia, however, these distinguishing elements bring the issue even further, especially the fact that it is very close to the Moulouya estuary which is an important ecological zone, and the level of dependence on the green spaces for tourism. These peculiarities make Saidia an interesting subject when studying the relationship of uncontrolled urban growth and environmental protection in cities dependent on tourism.

In this regard, it is evident that conserving what is left of Tazgrarte Forest is not only an environmental issue. It is also social as well as an economic one. Decision makers as well as urban designers in the region must formulate appropriate and efficient urban policies that will not only promote economic growth, but also make allowance for the maintenance of green spaces within the city's development agenda. Let us hope that improved zones, planting of trees, and establishment of greenbelts will prevent further destruction and help to restore some of the lost ecosystem

services.

3.2. Social and Environmental Considerations

The social and psychological importance of urban forests cannot be overstated, as they provide a vital connection between urban residents and nature in increasingly dense urban environments (Konijnendijk *et al.*, 2013) [8], emphasize that green spaces are more than just aesthetic elements; they play a critical role in enhancing mental health and overall well-being by offering places for relaxation, exercise, and social interaction. Studies have shown that access to urban green spaces can reduce stress, improve mood, and even decrease the risk of certain mental health disorders, particularly in fast-paced urban settings where stress levels are typically higher [8]. These benefits are particularly relevant in cities like Saidia, which experience rapid urbanization, as the availability of well-maintained natural spaces can serve as an essential counterbalance to the pressures of urban life.

Moreover, urban forests are key to fostering a sense of community. They offer shared spaces where residents can gather for recreational activities, cultural events, or simply to enjoy the outdoors. Such environments can enhance social cohesion by encouraging interaction among diverse groups, strengthening the social fabric of urban neighborhoods. In tourist destinations like Saidia, green spaces are also significant for their ability to attract visitors seeking relaxation and nature-based experiences. Well-preserved forests and parks add to the city's appeal, increasing its competitiveness as a tourist destination and supporting the local economy.

Given these wide-ranging benefits, the urgent need to reconsider urban expansion policies in Saidia to include measures for environmental protection and the enhancement of green spaces is clear. Failing to do so risks not only further environmental degradation but also a decline in the overall quality of life for residents and the city's attractiveness to tourists. Local governments and urban planners must adopt a holistic approach to urban development, integrating environmental, social, and economic considerations into their strategies. This includes enforcing stricter regulations on land use, promoting sustainable construction practices, and investing in the rehabilitation and maintenance of existing green spaces.

Furthermore, involving local communities in the planning and management of urban green spaces can foster a greater sense of ownership and responsibility toward these natural resources. Community-based initiatives such as tree-planting programs, environmental education, and clean-up campaigns can enhance public awareness and engagement, ensuring the long-term sustainability of urban forests. By preserving and expanding green spaces, Saidia can promote a more balanced urban environment, supporting both ecological integrity and the well-being of its growing population.

4. Proposals and Suggested Project

According to the results and analyses of this work, it is clear that there is no time to lose in order to save and restore Tazgrarte Forest, taking into account the growth

of Saïdia in urban development. In fast-growing cities, urban sprawl is an inevitable phenomenon. However, the impact of urban sprawl on the environment can be alleviated by focusing on measures that are more environmentally friendly. Forthcoming are strategic priorities outlined to achieve coordination between urban growth and environmental protection.

4.1. Adoption of Sustainable Urban Planning Policies

Local authorities must implement stricter urban planning regulations that prioritize the preservation of green spaces. This includes establishing zoning laws that restrict construction in ecologically sensitive areas such as forests and wetlands. Additionally, the creation of green corridors connecting urban forests to other natural areas would contribute to maintaining ecological balance and biodiversity [9]. Sustainable urban planning ensures that while cities continue to grow, they do so without compromising natural ecosystems. In the case of Saïdia, preserving Tazgrarte Forest as a green belt is crucial for regulating local climate and maintaining urban biodiversity [10].

4.2. Development of Tazgrarte Forest as an Eco-Resort

In an effort to craft a design project that would secure what is left of the forest and

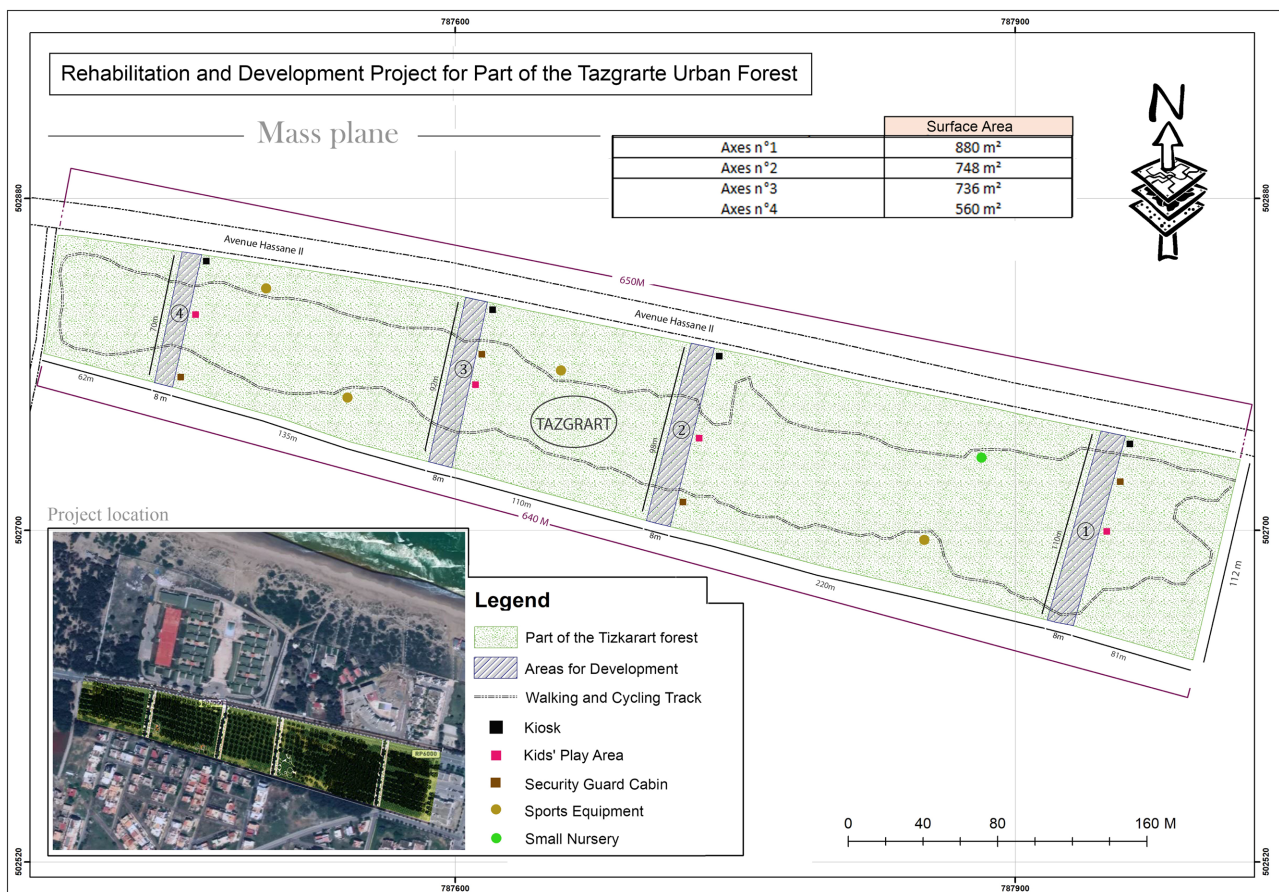


Figure 3. Components of the project for the development and equipment of a part of the urban forest Tazkarrart in the city of Saïdia.

stimulate socio-economic development, our team has designed this project and submitted it to the municipality. We suggest the construction of this section of the forest that is situated close to the residential blocks as a portion of the overall remaining forest area (Figure 3). The project with preliminary cost estimations of 3 million dirhams or say 300,000 US dollars is aimed at setting up a recreational with ecological focus for the locals and tourists. This eco resort will include eco friendly trails, picnic spots, birdwatching observation decks, and environment education zones [11].

Figure 4 illustrates the conceptual design of the proposed project for Tazgrarte Forest which has been developed by our group and approved by the local municipality. The proposal sets out the transformation of the degraded forest into a sustainable eco-resort. Various stakeholders, including governmental agencies, NGOs and private investors, will be sought to fund the project to ensure successful implementation and long-term maintenance. The aim of this project is to create a space that is multifunctional in nature, which provides recreation, a venue for outdoor sports and leisure, promotes environmental education and at the same time contributes to public health and tourism [12].



Figure 4. The general concept for the proposed development of a part of the Tazgrarte Forest in Saidaia.

4.3. Promotion of Eco-Tourism

Given Saidaia's strategic location near the Moulouya estuary, a region recognized for its biodiversity under the Ramsar Convention and the MedWet Coast initiative, eco-tourism presents an opportunity to both conserve the environment and boost the local economy [13]. Once developed into a sustainable eco-resort, Tazgrarte Forest can serve as a major attraction for eco-tourists who seek natural experiences while also learning about the region's unique flora and fauna. Promoting eco-tourism will not only help protect the remaining forest but also create jobs and generate

income for the local population, thus linking conservation with socio-economic benefits [14] [15].

4.4. Community Engagement and Awareness Campaigns

Raising public awareness about the importance of preserving urban forests is essential for long-term sustainability. Local communities should be actively involved in conservation efforts through programs such as tree planting, clean-up drives, and educational activities in the forest. Engaging local schools and civic organizations in these initiatives can foster a culture of environmental stewardship. Furthermore, such programs can encourage residents to take pride in their natural heritage, promoting a stronger connection between people and their environment.

4.5. Establishment of Monitoring and Evaluation Mechanisms

To ensure the long-term success of conservation efforts, it is essential to establish a monitoring and evaluation system. This system would track changes in forest cover, biodiversity, and visitor impact, providing data-driven insights for adaptive management [16] [17]. Periodic assessments will help identify risks and areas for improvement, ensuring that the eco-resort remains a viable ecological and recreational space. Regular reporting and transparent communication with stakeholders will be key to sustaining community support and securing future funding [18].

5. Conclusions

This research concerns itself with showing the contours of the urban expansion problems affecting the environment of Tazgrarte's Forest in Saidia. The last two decades of uncontrolled urban expansion have led to a dramatic change in forest cover, which in fact threatens the biodiversity and ecosystem balance of the city along with the social and tourism value of the forest.

The results indicate that the negative repercussions of urbanization can be alleviated by insisting on planned urban development, which encompasses maintaining open spaces and green covers. Planning goes hand in hand with constraining the sensitive ecological areas through zoning regulations and fostering green belt community conservation activities. Practical action that should also be taken includes reforestation and the establishment of greenbelts for some of the forest's lost ecological functions.

Meeting these objectives necessitates a strong political will, active participation from the public, collaboration between different parties, and putting synergies with environmentally friendly organizations along with local businesses into the vision of the city. So, somehow, the public awareness, alongside with reasonable plans for the city, Saidia, can be an example for other cities that are facing similar problems. Being friendly to natural assets like the Tazgrarte forest is crucial for the quality of life of the people. Everyone wants the city to be an appealing, tourist-friendly destination for many years to come.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Escobedo, F.J., Kroeger, T. and Wagner, J.E. (2011) Urban Forests and Pollution Mitigation: Analyzing Ecosystem Services and Disservices. *Environmental Pollution*, **159**, 2078-2087. <https://doi.org/10.1016/j.envpol.2011.01.010>
- [2] Zhou, X. and Wang, Y. (2011) Spatial-Temporal Dynamics of Urban Green Space in Response to Rapid Urbanization and Greening Policies. *Landscape and Urban Planning*, **100**, 268-277. <https://doi.org/10.1016/j.landurbplan.2010.12.013>
- [3] Jim, C.Y. and Chen, W.Y. (2006) Perception and Attitude of Residents toward Urban Green Spaces in Guangzhou (China). *Environmental Management*, **38**, 338-349. <https://doi.org/10.1007/s00267-005-0166-6>
- [4] General Population and Housing Census Reports for the Years 2004, 2014 and 2024. https://www.hcp.ma/Recensement-general-RGPH_r518.html
- [5] Tyrväinen, L., Pauleit, S., Seeland, K. and de Vries, S. (2005) Benefits of Urban Green Space for Improving Urban Climate Conditions. *Urban Forestry & Urban Greening*, **4**, 133-149.
- [6] Tekken, V. and Kropp, J.P. (2015) Sustainable Water Management—Perspectives for Tourism Development in North-Eastern Morocco. *Tourism Management Perspectives*, **16**, 325-334. <https://doi.org/10.1016/j.tmp.2015.09.001>
- [7] Boumeaza, T., Sbai, A., Salmon, M., Benata, M. and Ozer, A. (2010) Impacts écologiques des aménagements touristiques sur le littoral de Saïdia, Maroc Oriental. *Méditerranée*, **115**, 94-102. <https://doi.org/10.4000/mediterranee.4888>
- [8] Konijnendijk, C.C., Annerstedt, M., Nielsen, A.B. and Maruthaveeran, S. (2013) Benefits of Urban Parks: A Systematic Review of the Evidence. *IFPRA World*, **42**, 678-692. <https://publications.slu.se/?file=publ/show&id=54128>
- [9] Aronson, J., Blignaut, J.N. and de Groot, R. (2017) Restoration of Natural Capital: Science, Business, and Practice. *Restoration Ecology*, **25**, 905-912. <https://books.google.co.ma/books>
- [10] McDonald, R.I., Marcotullio, P.J. and Güneralp, B. (2020) Urban Growth and the Geography of the Urbanization Process. *Global Environmental Change*, **62**, 102-118.
- [11] Soga, M. and Gaston, K.J. (2016) Extinction of Experience: The Loss of Human-Nature Interactions. *Frontiers in Ecology and the Environment*, **14**, 94-101. <https://doi.org/10.1002/fee.1225>
- [12] Ward Thompson, C. (2013) Activity, Exercise and the Planning and Design of Outdoor Spaces. *Journal of Environmental Psychology*, **34**, 79-96. <https://doi.org/10.1016/j.jenvp.2013.01.003>
- [13] Bouma, J.A. and van Beukering, P.J.H. (2015) Ecosystem Services: From Concept to Practice. In: Bouma, J.A. and van Beukering, P.J.H., Eds., *Ecosystem Services*, Cambridge University Press, 3-22. <https://doi.org/10.1017/cbo9781107477612.002>
- [14] Martinez, R.C. (2015) The Role of Government Policies in Promoting Tourism in Saïdia. *International Journal of Tourism Policy*, **28**, 167-182. <https://www.inderscience.com/jhome.php?jcode=ijtp>
- [15] Stronza, A.L., Hunt, C.A. and Fitzgerald, L.A. (2019) Ecotourism for Conservation? *Annual Review of Environment and Resources*, **44**, 229-253. <https://doi.org/10.1146/annurev-environ-101718-033046>

- [16] Miller, J.R. and Hobbs, R.J. (2007) Habitat Restoration—Do We Know What We're Doing? *Restoration Ecology*, **15**, 382-390.
<https://doi.org/10.1111/j.1526-100x.2007.00234.x>
- [17] Jabareen, Y.R. (2006) Sustainable Urban Forms: Their Typologies, Models, and Concepts. *Journal of Planning Education and Research*, **26**, 38-52.
<https://doi.org/10.1177/0739456x05285119>
- [18] Sbai, A. and Boumazza, T. (2018) Urban Expansion and Its Environmental Effects in Moroccan Cities. *Journal of Geographic Sciences*, **15**, 250-265.