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SUSTAINABLE SPATIAL PLANNING FOR URBAN EXPANSION IN THE WEST BANK 2023-2050[1]

PLANIFICACIÓN ESPACIAL SOSTENIBLE PARA LA EXPANSIÓN URBANA EN CISJORDANIA 2023-2050

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Las ciudades palestinas, independientemente de su pequeño tamaño, se enfrentan a una alta densidad de población y a un rápido crecimiento demográfico debido a la falta de control sobre el territorio como consecuencia de las restricciones impuestas por la ocupación israelí. En consecuencia, los palestinos deben utilizar todos los modelos de desarrollo urbano disponibles dentro de los límites de la ciudad para dar cabida a la creciente población. Esto implica la expansión de los barrios residenciales en todas las direcciones y el desarrollo de las tierras menos explotadas. El presente artículo examina la necesidad de los palestinos de Cisjordania de expandirse urbanísticamente en función del crecimiento natural y la disponibilidad de tierras, teniendo en cuenta el desarrollo urbano sostenible que mejora la calidad de las zonas espaciales mediante una planificación sostenible y un sistema medioambiental integrado, así como las restricciones políticas basadas en dos escenarios: el primero (2023-2030) considera la planificación bajo las restricciones de la ocupación israelí; el segundo (2030-2050) prevé la planificación con plena soberanía sobre las tierras de Cisjordania siguiendo las fronteras de 1967. El artículo describe un modelo para evaluar la idoneidad del terreno para la expansión y el desarrollo urbanos, y para construir nuevas ciudades utilizando sistemas de información geográfica. Este enfoque garantiza un desarrollo equilibrado y mejora el plan general de desarrollo urbano espacial de Cisjordania, rodeando nuevos emplazamientos urbanos, zonas y otras características vitales.

Palabras clave: planificación espacial, idoneidad del suelo, desarrollo urbano, zonas residenciales

Palestinian cities, regardless of their small size, struggle with high population density and fast population growth due to a lack of control over the land because of the Israeli occupation constraints. Accordingly, Palestinians must use all the available urban development models within city limits to accommodate the growing population. This involves expanding residential neighborhoods in all directions and developing the least developed lands. This paper examines the need of the Palestinians in the West Bank for urban expansion based on natural growth and the availability of land, taking into consideration sustainable urban development that enhances the quality of spatial areas through sustainable planning and an integrated environmental system, as well as the political constraints based on two scenarios: the first (2023-2030) considers planning under Israeli occupation restrictions; the second (2030-2050) envisages planning with full sovereignty over the lands of the West Bank following the 1967 borders. The paper outlines a model to assess land suitability for urban expansion and development, and to build new cities using Geographic Information Systems. This approach guarantees a balanced development and improves the overall spatial urban development plan for the West Bank, circling new city sites, areas, and other vital features.

Keywords: spatial planning, land suitability, urban development, residential areas

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I. INTRODUCTION AND THEORETICAL FRAMEWORK

Existing cities struggle to meet their residents' needs due to rapid population growth, overcrowding, and other challenges. These challenges include inadequate infrastructure for public services, high unemployment rates, limited transportation facilities, and frequent traffic accidents. On an international level, many countries, especially those in the developing world, address urban problems by expanding communities within their administrative borders or the boundaries of urban areas or by proposing the creation of new urban areas. Despite ongoing efforts to build homes and communities, the need for familiar tools to ensure sustainability in urban development projects underscores the need for a solid approach to guide urban planning. However, planning for future urban development is essential to achieving sustainable communities, and this is the primary goal pursued by all countries. Many research studies, including several case studies worldwide, have demonstrated the effectiveness of the land-use suitability analysis approach as a powerful strategic tool for making comprehensive decisions in urban development planning through Geographic Information System (GIS) analysis (Chen, 2016).

Researchers have studied how land suitability for development is affected in war zones, such as in Lebanon. Al-Ghorayeb et al. (2023) analyzed the Nabatiyeh region, which was affected by the 2006 war in Lebanon. This paper showed how post-conflict rebuilding and the influx of Syrian refugees have increased unplanned urbanization and rendered land unsuitable for sustainable development. The authors stressed that political instability and weak governance structures have made urban expansion management less effective. On the other hand, Ekleel and Tariq (2025) discussed the case in Afghanistan. They stressed that the ongoing war has displaced many people, leading to informal settlements on unsuitable land around Kabul. The authors identified the need for data-driven allocation to find places for displaced people and to return refugees to safe, sustainable areas. Dutta (2012) has also discussed this issue, addressing Lucknow's peri-urban growth in India, using fuzzy-AHP integrated with GIS, and arguing that unregulated urban expansion, driven by conflict and socio-political conditions, has led to land-use conflicts and environmental degradation. The paper examines how weak planning and the lack of sustainable land-use and urban planning lead to sprawl that fails to follow master planning. Meanwhile, Abdo et al. (2025) assessed land suitability in Syria's Tartous governorate, using GIS to compile environmental, physical, and infrastructure factors. The paper identified only a limited number of highly suitable areas due to steep slopes, fault lines, and vegetation restrictions. The authors concluded that, in post-conflict situations, displacement and informal displacement resulting from war are concentrated on marginal, less suitable lands.

In Kenya, Younes et al. (2022) focused on how wars in neighboring countries, such as Somalia and South Sudan, created large refugee flows, putting significant pressure on Kenyan land resources. This paper used a Hybrid GIS and fuzzy AHP approach to evaluate suitable land for new refugee camps, considering geographical, infrastructural, and environmental factors to reduce risks, such as flooding and overpopulation, in unstable areas. Another study by Omar and Raheem (2016) examines how long-lasting warfare, political instability, and sanctions affected settlement patterns in Kirkuk, Iraq. This paper used GIS and multi-criteria decision analysis (MCDA) to assess post-war land suitability. The authors explain that, after years of war, security and social factors reshaped settlement suitability more than physical land attributes.

The discussed papers and the cases they present illustrate the different challenges in urban development. The cases analyzing land-use suitability in war zones highlighted how war and instability influence land suitability by reshaping demographic pressures, settlement patterns, and land-use decisions, as demonstrated through GIS-based spatial analysis. These papers are essential for demonstrating that land suitability is crucial to urban expansion and development, and that Palestinians in the West Bank should consider it.

According to the National Urban Policy Document in Palestine [NUPDP] (Ministry of Local Government [MoLG], 2023), 77% of Palestinians live in urban areas. 71% in the West Bank (WB) and 87% in the Gaza Strip (GS), mainly in Areas A and B. An additional 8% of the population lives in refugee camps that are characterized by high levels of informality and are considered urban in nature, which makes the actual urban population in the occupied Palestinian territory about 85%. The remaining 15% live in rural areas referred to as Area C (MoLG, 2023).

This reality is placing increasing pressure on land, infrastructure, and resources, especially amid steady urban growth driven by high population growth rates and spatially concentrated development, with limited space for expansion. The percentage of available land for expansion and development in the WB was found to be 75% of the total area, excluding constraints from the protection plan. However, when considering the constraints imposed by the Israeli occupation on land use, which are represented by Israeli colonies, military bases, the separation wall, and bypass roads, the percentage of land available for use drops to about 38% of the WB's Area (MoLG, 2023).

Despite restrictions, several research studies have been conducted to assess the potential for urban expansion in Palestine. In this vein, Jabba's master's thesis focuses on identifying areas for new residential development, primarily undertaken by developers and governmental planning agencies (Jabba, 1997). In the GS, the study identifies new locations for residential development and presents an implementation program that uses various planning methods to develop the most suitable locations. Rabayah (2006), on the other hand, conducted a study on urban expansion driven by population growth and its effects on land-use and land-cover changes in the Bethlehem district to develop a regional land-use planning framework. AbuSada and Thawaba (2011), in their study, sought to classify sustainable areas for accommodating urban development in Ramallah, relieving pressure on the city center, and providing housing for young families seeking improved living conditions; they applied GIS to identify 13 potential sites based on detailed criteria. In the second phase, a multicriteria analysis was used to assess these sites using different indicators,

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integrating stakeholder and public input. Afterward, considering over 20 variables, a site was chosen as the most sustainable location for establishing a suburban center within the study area. Raddad's work in the southern Jerusalem Region of Palestine aimed to define the most suitable areas for urban development under conditions of political instability. Integrated with GIS, the study employs the MCE approach to identify potential areas for urban development (Raddad, 2016).

In another study, Ghodieh (2020) looked in greater depth at the urban expansion in the WB from 1997 to 2016 under the political constraints imposed by the Israeli occupation. He aimed to examine urban expansion patterns using high-resolution aerial photos and satellite imagery. His research focused on the geographic and political implications of urban expansion, particularly in Area C, which is under Israeli occupation and control. He addressed how the lack of Palestinian planning in Area C resulted in encroachment on agricultural lands and the emergence of social and economic issues, finding that the Israeli occupation had imposed significant restrictions and challenges on Palestinians before and limited Palestinian urban expansion before and after the Oslo Accords (Ghodieh, 2020).

Therefore, the result and the basis for this paper were the absence of sustainable spatial planning research on urban expansion at the level of the WB-Palestine as a whole, rather than at the regional level, both with and without Israeli political constraints. The primary objectives focus on achieving population balance, reducing significant population density gaps, mitigating the effects of random, unregulated development, and developing new cities to accommodate population growth and the expected return of displaced persons. The selection of the proposed sites for new cities considered sustainability principles, and the locations were chosen accordingly. Urban expansion and new urban areas in the WB offer an alternative to some of the complexities of urban growth, requiring a shift from random urban growth to planned urbanization. Addressing the legal and policy frameworks connected to spatial planning is vital for future Palestinian development, particularly given population increases and the predictable return of displaced Palestinians to the WB after 2030. These reflections highlight the significance of understanding the urban development process and the necessity of an inclusive strategy—Palestinian urban development policies that guarantee resilience, implying sustainability and future growth.

II. CASE STUDY

This study will be conducted in the WB, Palestine, which covers an area of around 5,860 km^2. The WB region has 11 governorates (Figure 1). According to the Palestinian Central Bureau of Statistics (PCBS), the WB's population reached 3,250,000 individuals in 2023, with a natural population growth rate of 2.1%. Politically, the Oslo Interim Agreement of 1995 divided the WB into three areas. First, Area "C" covers about 61% of the WB and remains totally under the control of the Israeli occupation in terms of urban planning (urban development); Palestinians face restrictions in construction as licenses for construction are rarely given to them. Second, Area

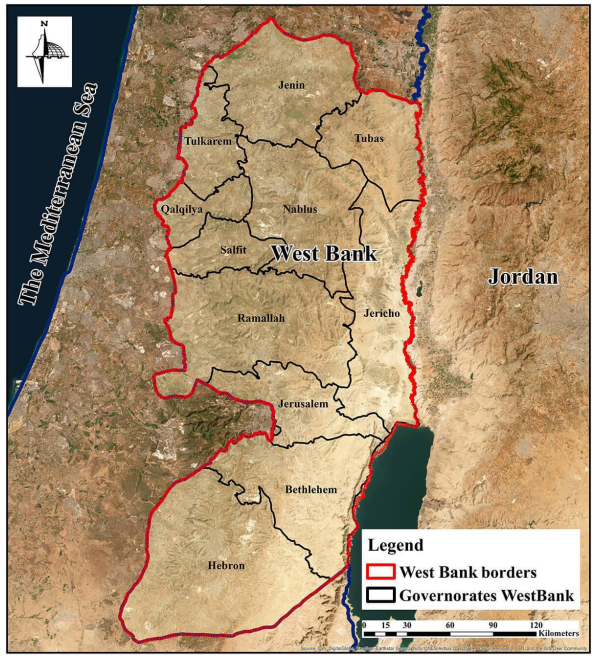

Figure 1. West Bank (WB). Source: Authors' dataset (MoLG, 2022).

"B" comprises around 21% of the WB. While its security falls under Israeli occupation control, administrative and urban planning authority stays with the Palestinian Authority. Finally, Area A covers about 18% of the WB and is under the Palestinian Authority's complete administrative, urban planning, and security control. Inside Hebron, the "H1" area is under Palestinian sovereignty administratively, whereas the "H2" area is under the security control of the Israeli occupation. In Jerusalem, "J1" is the segment of the Jerusalem Governorate that was forcibly annexed by the Israeli military occupation after its occupation of the West Bank in 1967.

The number of Israeli colonies in the WB will be 151 by the end of 2022 (PCBS 2022), (Applied Research Institute- Jerusalem [ARIJ], 2023). The largest colonies by area are found in the Jerusalem, Ramallah, and Al-Bireh governorates. Colonies cover an area of 198 km^2, representing 3.5% of the total WB area. Nevertheless, their influence extends beyond their physical boundaries, impacting an area of 537 km^2. The existence of these colonies enforces vital restrictions and burdens on Palestinian communities, delimiting their freedom of movement and urban development. Consequently, these colonies have negative impacts on both urban and economic development for the Palestinians (Figure 2). Table 1 summarizes the built-up areas of Palestinian cities and colonies, and the distribution of colonies across the governorates of the WB.

In addition to the political constraints in the WB, natural constraints must be considered in urban development and

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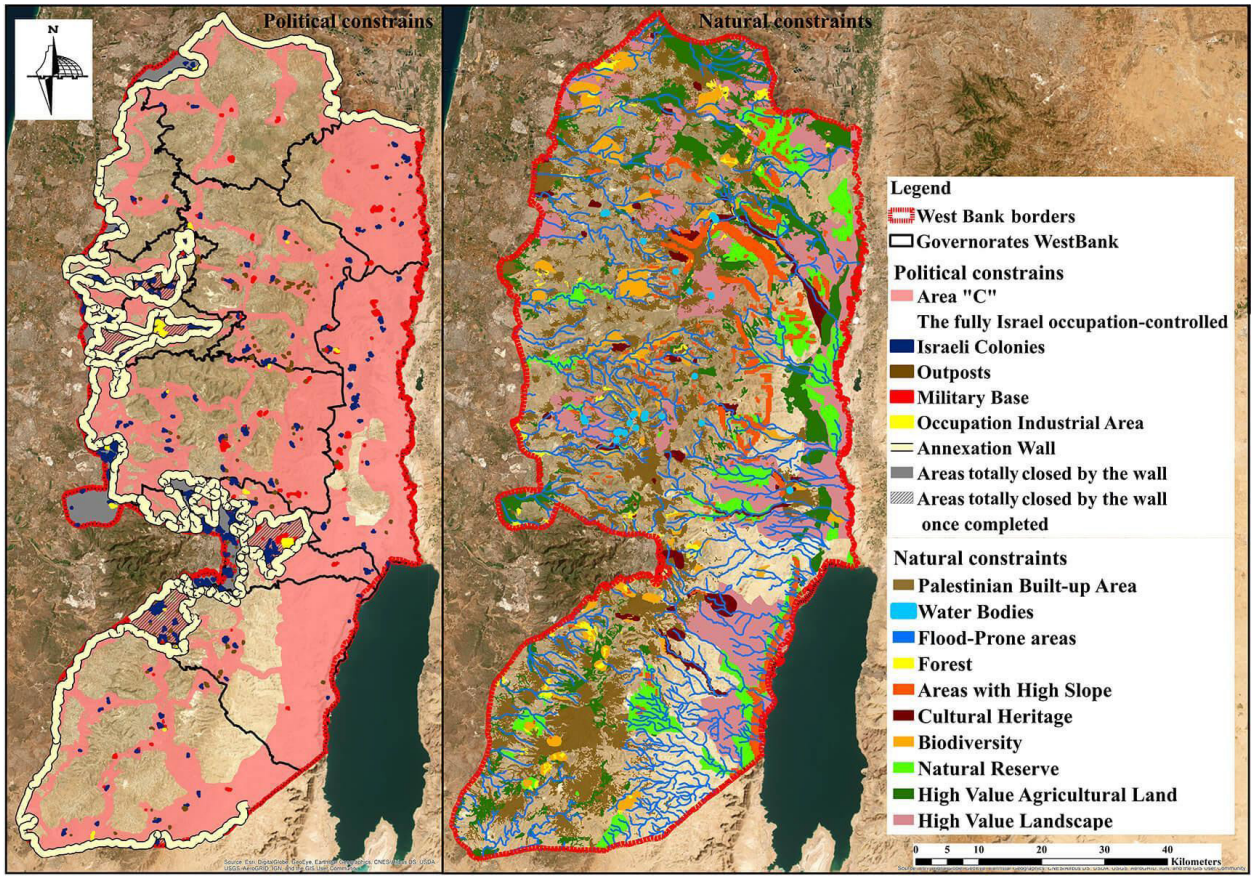

Figure 2. Political and Natural constraints. Source: Authors' dataset (MoLG, 2022).

Governorate	No of Palestinian communities	Governorate area	Palestinian Built-up area (km²)	Colonies area (km²)	No of colonies	Areas confiscated by the annexation wall (km²)
Jenin	84	583.7	88.65	3.55	5	34.9
Tubas	22	408.7	22.5	8.46	7	2.7
Tulkarem	38	246.5	49.34	2.56	3	17.8
Nablus	67	598.5	84.22	21.98	13	-
Qalqilia	34	165.3	21.67	9.92	8	25.3
Salfit	20	204.4	19.5	12.91	13	20.9
Ramallah and Al-Bireh	80	855.2	100.24	28.19	26	85.9
Jericho	13	592.9	29.7	23.27	17	-
Jerusalem	29	349.4	58.9	34.77	26	87.7
Bethlehem	51	655.4	53.32	16.72	13	7.6
Hebron	118	1000	230.77	13.12	20	12.8

Table 1. Built-up areas and colonies in the WB by Governorate. Source: ARIJ (2023), PCBS (2022).

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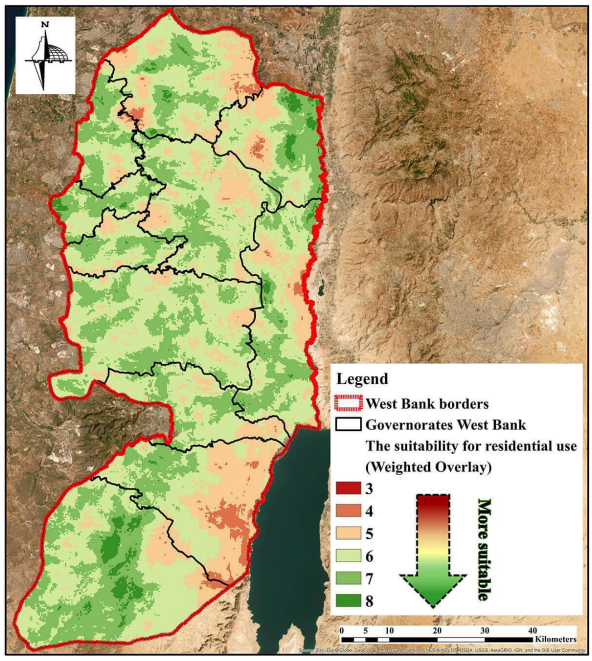

Figure 3. Land suitability for residential use. Source: Authors' dataset (MoLG, 2022).

expansion. One significant natural constraint is the protection plan, encompassing factors such as high agricultural land value, medium agricultural land value, forests, natural reserves, biodiversity, water sensitivity, springs, and underground water. Additionally, areas with high slopes (topography) are highlighted in Figure 3.

Therefore, due to constraints in the WB and with a focus on envisioning future urban development over the next few years, this paper outlines a vision based on the political-strategic framework provided by the Palestinian Prime Minister's Office for the National Spatial Plan (NSP) 2050. In this assumption, two scenarios for spatial development in the WB were proposed as follows:

1- First Scenario: Spatial development with the Israeli occupation constraints for 2023 to-2030.
2- Second Scenario: Planning based on full sovereignty over the WB lands following the 1967 borders, without Israeli occupation constraints for (2030 to 2050).

Population projections were calculated for the WB for the two scenarios in 2030 and 2050 for each Palestinian community (Table 2). The displaced Palestinians around the world, numbering 1.5 million, will return and be received by 2050, with 90% (1,350,000) distributed in the WB and 10% (350,000) in the GS. In the WB, they will be distributed in governorates in specific proportions. Then, the areas required for expansion were calculated in each target year for each cluster, considering the classification of clusters in terms of urban areas, main cities, rural areas, etc., in order to preserve the rural character and agricultural lands in rural areas; thus, the expansion is proportionate (Table 3). The classification of population centers and their definitions, along with the per capita share (population density) proposed for each, is based on a group of Palestinian experts and planners, as illustrated in Table 4.

After population projections were calculated, future areas and needs were calculated based on the per capita share of population increase between periods (Table 3).

Governorate	Population in 2017	Built-up area (km²)	Built-up area Percentage by Governorate area	Population density (individual/ km²)	Population projection in 2030	Population projection in 2050
Jenin	314,866	88.65	15.18%	3551.7	411,044	1,230,024
Tubas	60,927	22.5	5.5%	2707.8	79,538	238,011
Tulkarem	186,760	49.34	20%	3785.1	243,807	729,578
Nablus	388,321	84.22	14.07%	4610.7	506,936	1,516,976
Qalqilia	112,400	21.67	13.1%	5186.8	146,733	439,091
Salfit	75,444	19.5	9.5%	3868.9	98,489	294,722
Ramallah and Al-Bireh	328,861	100.24	11.72%	3280.7	429,314	1,284,696
Jericho	50,002	29.7	5.01%	1683.5	65,275	195,333
Jerusalem	435,753	58.9	16.85%	7398.1	568,857	1,702,269
Bethlehem	217,400	53.32	8.13%	4077.2	283,806	849,273
Hebron	711,223	230.77	23%	3081.9	928,471	2,778,393
West Bank	2,881,957	758.81	13%	3797.9	3,762,270	11,258,366

Table 2. Population, population density, built-up area, and population projection (2030-2050) in the WB Governorates. Source: PCBS (2019), prepared by the authors

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Governorate	Area needed for expansion (km2) 2030	Area needed for expansion (km2) 2050
Jenin	27.08	133.00
Tubas	6.85	23.03
Tulkarem	15.07	72.00
Nablus	25.72	140.44
Qalqilia	6.62	45.74
Salfit	6.00	33.00
Ramallah and Al-Bireh	30.62	135.20
Jericho	9.00	17.00
Jerusalem	9.80	151.00
Bethlehem	16.30	86.03
Hebron	68.31	368.23
Total	221.37	1204.67

Table 3. Areas needed for expansion in the WB according to each Governorate for 2023-2040-2050. Source: MoLG (2022).

Classification of Population Centers	Necessary Population Density (m^2/ individual)
West Bank	
Central city in the governorate	115
Urban area (1): (population greater than 25,000 but less than 50,000)	155
Urban areas (2): (population greater than 10,000 but less than 25,000)	180
Rural communities: (population greater than 1,000 but less than 10,000)	230
Small communities: (population less than 1,000 people)	300
Refugee camps	75

Table 4. Approved classifications of population centers and the per capita share of each. Source: MoLG (2022).

III. METHODOLOGY

The previous section focused on the spatial reality in the WB, outlining the political and natural constraints and their geographical distribution that affect the capability of urban expansion. This paper develops a descriptive, scientific, and empirical analytical methodology to determine land suitability for urban development from 2023 to 2050, utilizing a GIS tool.

As illustrated in Figure 4, the GIS erase tool was used to determine available areas for urban expansion by removing areas representing these constraints from the total area of the WB. This step was carried out in two scenarios: First, removing both natural and political constraints to identify the areas available for expansion under the Israeli occupation, and second, removing only the natural constraints to identify the areas available for expansion in the absence of Israeli occupation. Second, we examine the potential of WB communities to expand in both scenarios. For this purpose, the WB communities and their population centers were defined and mapped. Then, the GIS intersect tool was used to overlay the available areas from the first stage with community boundaries, indicating the expansion areas for each community. After this, a demographic analysis was conducted to compare the areas each community needs based on population forecasts and per capita shares with the areas it actually has. This indicates whether communities can meet their future needs, have some areas that are covered but not enough, or cannot expand at all. Third, for land suitability

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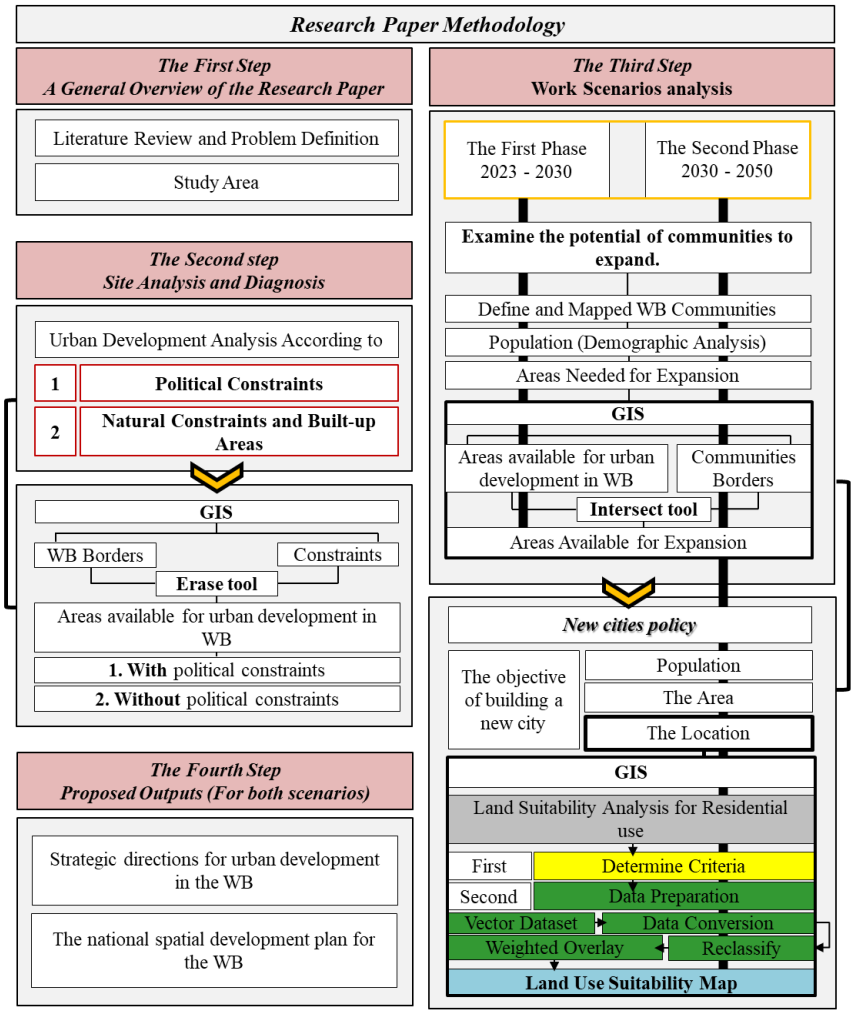

Figure 4. Research Methodology. Source: Prepared by the authors.

analysis (residential), a land suitability model was used. Initially, special criteria were determined for residential areas, and each criterion was weighted according to its importance. After the criteria were established, each criterion was classified according to its required and essential elements, with the total weights summing to 100%. The (Weighted Overlay) tool was applied using GIS.

Table 5 shows the Criteria that must be available in residential areas, the weight of each criterion according to importance, and the Map that expresses this criterion. The criterion itself was classified from (1-10), so that (10) expresses the good classification that should be provided in the land, and (1) expresses the bad classification that is to be avoided in residential areas.

A model regarding the suitability of the land for residential use was developed. Initially, we prepared the necessary data based on the specified criteria. Euclidean distance and multiple ring buffer tools were used to calculate and define distances relative to specific features, which is important for determining proximity in areas where specific criteria depend on the remoteness from these layers. The Topo to raster tool was used to convert topographic data into a DEM, which was then used to calculate slope. After that, we converted the data into layers that can be compared using the Feature to Raster tool, which converts vector data to raster format, as suitability analysis (reclassify and weighted overlay) is typically done in raster format. Then, the reclassification tool was used to convert raw values into suitability classes, which enable consistent evaluation and comparison across different criteria layers. Finally, the weighted

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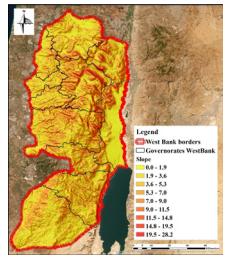
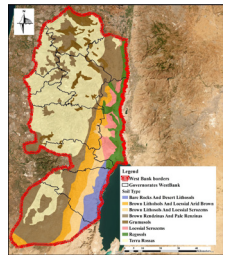
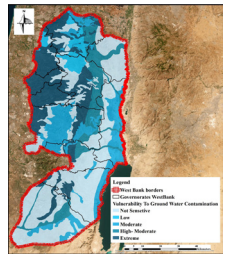
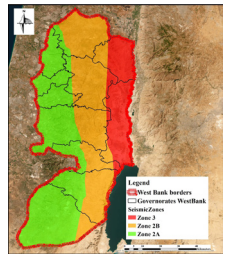
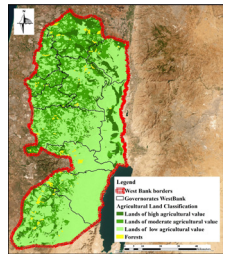
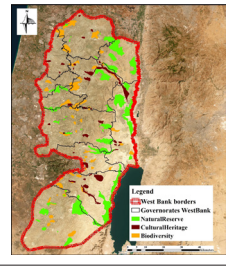
Criterion	Sub criteria	classification	Layer used	Weight	Map
The slope of the land must be easy for construction, so that it does not exceed 5-10%.	0-5 %	9	Contour	10%	
	5-10 %	7			
	10-15 %	5			
	15-20 %	3			
	> 20%	1			
The land must contain soil suitable for construction, such as rocky soil.	Sand loamy	9	Soil Classification	8%	
	loamy	7			
	Clay loamy	5			
	clay	3			
The area must be low in sensitivity to water.	Extreme	1	Water sensitivity	6%	
	High-Mod	3			
	Mod	5			
	Low	7			
	Not Sensitive	9			
The seismic value of zone A2 or B2.	2A	9	Seismic area	6%	
	2B	7			
	3	3			
The site must be on low-value agricultural lands.	Low Agricultural Value	9	Agriculture classification	9%	
	Medium Agricultural Value	7			
	High Agricultural Value	3			
	Forest	1			
The site must be 500 meters or more away from nature reserves, biodiversity areas, and important historical areas	0-500 m	1	Nature reserve, Biodiversity, Cultural Heritage	9%	
	500-1000 m	3			
	1000-1500 m	5			
	1500-2000 m	7			
	> 2000 m	9			

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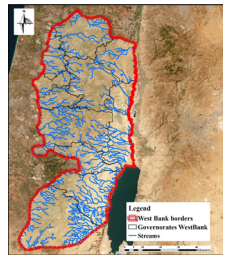
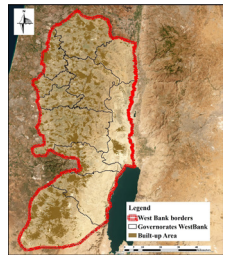
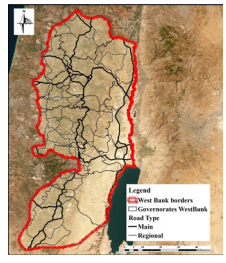
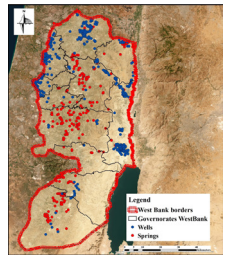
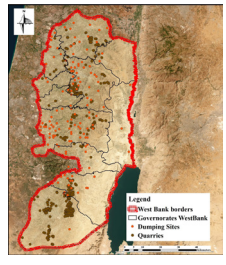
The site must be at least 500 meters from the valleys.	0-500 m	1	Streams	8%	
	500-1000 m	3			
	1000-1500 m	5			
	1500-2000 m	7			
	> 2000 m	9			
The site must be close to population centers, within 1000 meters.	1000-0 m	9	Built-up area	12%	
	1000-2000 m	7			
	2000-3000 m	5			
	3000-4000m	3			
	> 4000 m	1			
The location must be close to streets, at a distance of no less than 150 meters.	0-150 m	9	Road Network	12%	
	150-300 m	7			
	300-450 m	5			
	450-600 m	3			
	> 600 m	1			
The site must be close to water sources, within 1000 meters.	0-1000 m	9	Springs & Wells	10%	
	1000-2000 m	7			
	2000-3000 m	5			
	3000-4000 m	3			
	> 4000 m	1			
The site must be at least 5000 meters from sources of pollution and disturbance.	0-5000 m	1	Quarries & Landfills	10%	
	5000-6000 m	3			
	6000-7000 m	5			
	7000-8000 m	7			
	> 8000 m	9			

Table 5. Criteria for residential areas. Source: Prepared by the authors.

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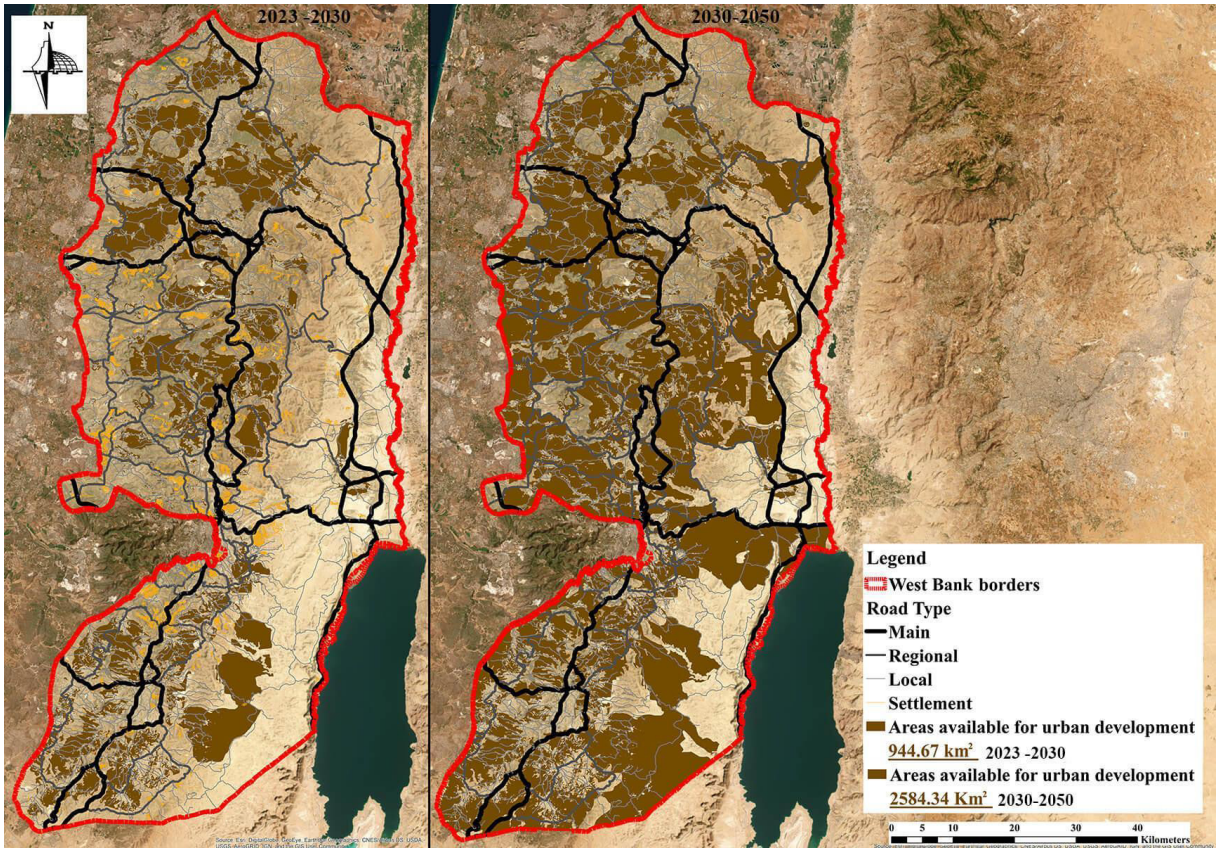

Figure 5. Areas available for urban development with and without political constraints. Source: Author's dataset (MoLG, 2022).

overlay tool was used to assign weights to each criterion based on its importance and to combine them into a suitability map. Figure 3 shows that areas with low suitability received a value of (3,4), areas with moderate suitability received a value of (5), and areas with high suitability for residential use received a value of (6,7,8).

Fourth, the strategies for the two scenarios were based on communities that cannot expand and those that can. Finally, areas for expansion in the two scenarios are clarified, recognizing that the second scenario may provide sufficient land for new cities to address communities that cannot handle growth. The new cities policy is planned based on the number of people it should host, the required area, and a suitable location.

It must be noted that the spatial plan is a regional plan, not a master plan; it does not directly affect local people. Its reflections and implications are at the policy level, not at the local level. Fieldwork is impossible in 70% of the WB, where these areas are indicated as colonies, Area C, where Palestinians are not allowed to go. Moreover, as mentioned earlier, fieldwork is not needed for this level of planning.

IV. RESULTS AND DISCUSSION

Before analyzing the two scenarios, it is important to clarify the theoretical concepts behind this study. Sustainability goes beyond environmental protection to include the long-term ability of Palestinian urban systems to function effectively under political constraints, limited access to land and resources, and spatial fragmentation. Therefore, sustainable urban development in Palestine means flexibility and resilience – planning that enables communities to adapt to constraints, preserve agricultural and environmental assets, and manage land and natural resources efficiently despite external pressures.

On the other hand, urban expansion does not only indicate the physical growth of built-up areas, but also a complex spatial process driven by demographic pressure, mobility restrictions, and imbalanced land management. In the WB, expansion commonly occurred as a reactive, uncoordinated response to population needs rather than as part of an integrated spatial vision. As a result, this led to the fragmentation of agricultural

Communities	Classification	Pop. No 2017	Pop forecast 2030	Pop. Increase 2050	Per capita share (m2/individual)	major cities such as Tulkarm, Qalqilya, and Jenin	Area available for expansion (km2)	Gap (km2)	Ability to expand	Built-up area (km2)	Building area (km2)
Nablus city	Main city	156,906	204,834	47,928	135.9	6.5	2.6	4	No	21	3.5
Balata	Refugee camp	14,635	19,105	4,470	18.7	0.1	0	0.1	No	0.3	0.2
Old Asker	Refugee camp	6,537	8,534	1,997	20.4	0.04	0	0.04	No	0.1	0.1
New Asker	Refugee camp	4,767	6,223	1,456	15.4	0.02	0	0.02	No	0.1	0.1
'Ain Beit el-ma'	Refugee camp	3,588	4,684	1,096	16.0	0.02	0	0.02	No	0.1	0.02
Salem	Within Urban area	6,266	8,180	1,914	189.3	0.4	0.3	0.1	No	1.1	0.2
Dei el-Hatab	Within Urban area	2,838	3,705	867	202.0	0.2	0.6	-	Yes		
Azmout	Within Urban area	3,440	4,491	1,051	202.8	0.2	0.7	-	Yes		
Roujeeb	Within Urban area	5,964	7,786	1,822	237.1	0.4	0.00003	0.4	No	1.4	0.2
Kafr Qalil	Within Urban area	3,029	3,954	925	216.0	0.2	0.02	0.2	No	0.7	0.1
Till	Within Urban area	5,162	6,739	1,577	310.3	0.5	4.0	-	Yes		
Beit Wazan	Within Urban area	1,312	1,713	401	355.3	0.1	0.8	-	Yes		
Beit Iba	Within Urban area	4,079	5,325	1,246	462.2	0.6	1.3	-	Yes		
Zawata	Within Urban area	2,537	3,312	775	280.7	0.2	0.2	-	Yes		
Qusain	Within Urban area	2,251	2,939	688	412.5	0.3	1.7	-	Yes		
Der Sharaf	Within Urban area	2,949	2,850	901	500.6	0.5	0.8	-	Yes		
Iraq Burin	Within Urban area	1,008	1,316	308	361.6	0.1	2.0	-	Yes		
Total						10	15	-	Yes		
Beit Hasan	Rural area	1,599	2,087	488	359.5	0.2	0.5				
En-Nasarieh	Rural area	1,889	2,466	577	465.4	0.3	0.2	0.1	No	0.9	0.1
Bathan	Rural area	3,171	4,140	969	391.0	0.4	3.0	-	Yes		
Taluza	Rural area	2,795	3,649	854	322.2	0.3	7.6	-	Yes		
Assera el-shamalieh	Rural area	8,813	11,505	2,692	369.3	1.0	6.2	-	Yes		

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Communities	Classification	Pop. No 2017	Pop forecast 2030	Pop. Increase 2050	Per capita share (m2/individual)	major cities such as Tulkarm, Qalqilya, and Jenin	Area available for expansion (km2)	Gap (km2)	Ability to expand	Built-up area (km2)	Building area (km2)
Yasid	Rural area	2,505	3,270	765	415.3	0.3	8.0	-	Yes		
Beit Imrin	Rural area	3,323	4,338	1,015	264.4	0.3	6.2	-	Yes		
Burqa	Rural area	4,152	5,420	1,268	250.4	0.3	6.8	-	Yes		
Sebastia	Rural area	3,205	4,184	979	289.8	0.3	0.8	-	Yes		
An-Naqura	Rural area	1,786	2,332	546	308.3	0.2	0.03	0.2	No	0.6	0.1
Bazaria	Rural area	2,794	3,647	853	286.1	0.2	3.9	-	Yes		
Beit Dajan	Rural area	4,460	5,822	1,362	300.8	0.4	1.4	-	Yes		
Jamaein	Rural area	7,436	9,707	2,271	341.1	0.8	5.3	-			
ʻAwarta	Rural area	7,054	9,209	2,155	221.3	0.5	0.00002	0.5	No	1.6	0.2
ʻAqraba	Rural area	10,024	13,086	3,062	340.2	1.0	4.5	-			
Zeita Jamaein	Rural area	2,740	3,577	837	462.0	0.4	4.2	-			
Osarin	Rural area	2,053	2,680	627	219.2	0.1	0.03	0.1	No	0.5	0.1
Horeesh	Rural area	1,541	2,012	471	351.3	0.2	3.9	-	Yes		
Majdal Bani Fadel	Rural area	2,907	3,795	888	257.7	0.2	0.4	-	Yes		
Qusra	Rural area	5,418	7,073	1,655	332.1	0.5	2.5	-	Yes		
Douma	Rural area	2,674	3,491	817	326.8	0.3	0.2	0.1	No	0.9	0.1
Qabalan	Rural area	8,195	10,698	2,503	302.6	0.8	3.4	-	Yes		
Yutma	Rural area	3,363	4,390	1,027	267.8	0.3	0.2	0.1	No	0.9	0.1
Sawieh	Rural area	2,761	3,604	843	310.2	0.3	0.4	-	Yes		
Telfeet	Rural area	3,591	4,688	1,097	268.8	0.3	3.7	-	Yes		
Qaruit	Rural area	2,560	3,342	782	239.9	0.2	1.0	-	Yes		
Loban al-Sharqieh	Rural area	2,640	3,446	806	332.8	0.3	2.5	-	Yes		
Odala	Rural area	1,566	2,044	478	372.1	0.2	0.003	0.2	No	0.6	0.05
Huwarra	Rural area	2,844	3,713	869	282.1	0.3	1.1	-			
Madama	Rural area	6,659	8,693	2,034	334.2	0.7	1.1	-			
ʻAinabuos	Rural area	2,092	2,731	639	203.2	0.1	1.5	-			
Assera el-qiblieh	Rural area	2,891	3,774	883	253.3	0.2	1.9	-			
Oureef	Rural area	2,935	3,832	897	Built-up	0.2	1.4	-			
Beit Fourik	Urban community	13,477	17,594	4,117	235.0	1.0	4.4	-			
Beita	Urban community	11,682	15,250	3,568	350.4	1.3	0.6	0.7	No	4.1	0.4
Nisf Jbeel	Small community area	471	615	144	267.9	0.04	0.02	0.02	No	0.1	0.02

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Communities	Classification	Pop. No 2017	Pop forecast 2030	Pop. Increase 2050	Per capita share (m2/individual)	major cities such as Tulkarm, Qalqilya, and Jenin	Area available for expansion (km2)	Gap (km2)	Ability to expand	Built-up area (km2)	Building area (km2)
Ijnesnia	Small community area	585	764	179	360.8	0.1	0.04	-			
'Aqrabanieh	Small community area	939	1226	287	598.4	0.2	2.0	-			
'Ain shibli	Small community area	313	409	96	319.7	0.03	0.0002	0.03	No	0.1	0.01
Froush Beit Dajan	Small community area	723	944	221	918.6	0.2	0	0.2	No	0.7	0.03
Alrajman	Small community area	0	0	-	-	-	0	-			
Yanun	Small community area	92	120	28	1254.1	0.04	0.5	-	Yes		
Tell el-Khashabeh	Small community area	107	140	33	902.6	0.03	0	0.03	No	0.1	0.004
Jaloud	Small community area	743	970	227	412.7	0.1	3.4	-	Yes		
'Amouria	Small community area	371	484	113	592.4	0.1	1.4	-	Yes		
Za'tara	Small community area	63	82	19	51.9	0.001	0	0.001	No	0.003	0.001

Table 6. Analyzing the ability of communities in Nablus governorate to expand. Source: Authors using MoLG (2022).

lands and open spaces and to challenges in regional coherent planning.

Combining the two concepts — sustainability and urban expansion — within the framework of land suitability analysis enables a balanced, evidence-based planning approach. Through GIS-based modeling, LSA identifies areas that can support urban expansion while reducing environmental and spatial conflicts. Within this context, it serves as a strategic tool to ensure spatial justice, direct development to the most suitable and least restrictive areas, and strengthen resilience under occupation and restrictive governance.

The land suitability model calculates the available area for community expansion under the two scenarios.

First scenario (2023-2030)

Considering geopolitical and natural constraints, the available areas for urban expansion in this scenario amount to

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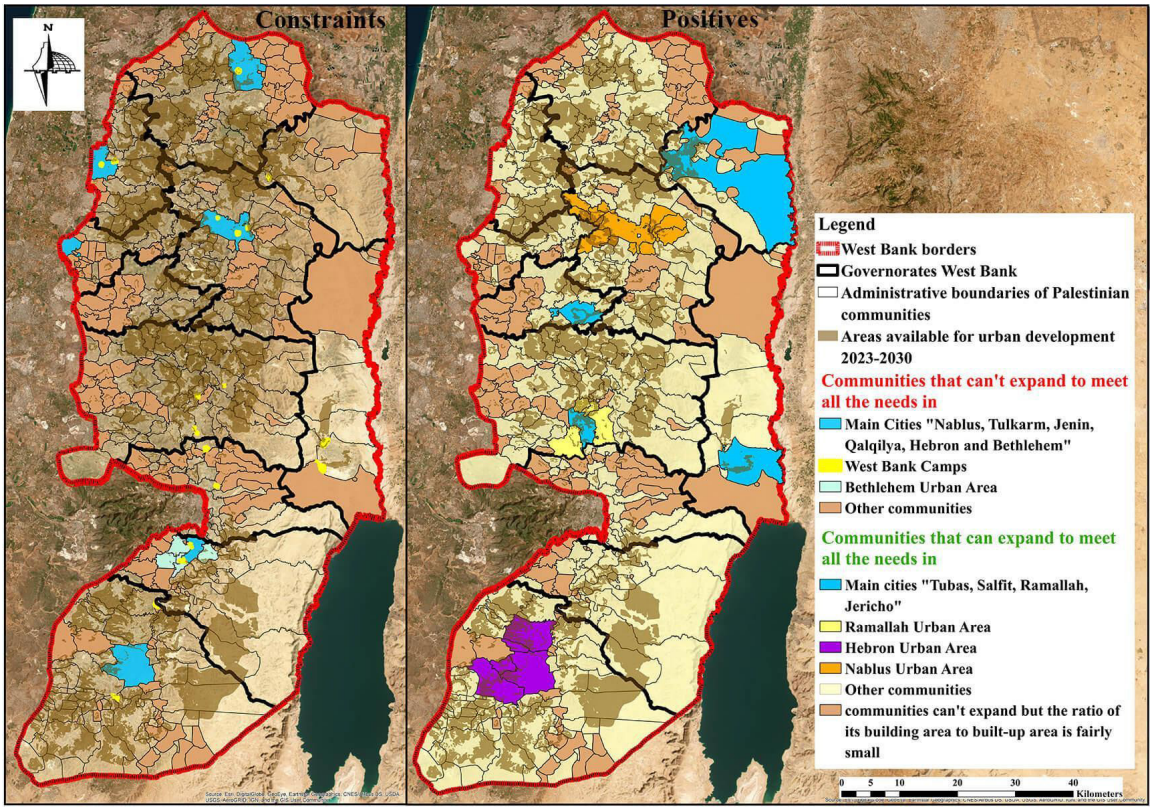

Figure 6. The constraints of the urban development in the WB in the First Scenario (2023-2030). Source: Author's dataset (MoLG, 2022).

approximately 944.67 km^2 (Figure 5). This paper focuses on the Nablus governorate as an illustrative example to analyze the communities' capacity for expansion (Table 6). The analysis of the remaining governorates in the WB follows the same methodology applied to Nablus.

Results of analysis in the First Scenario (2023-2030):

The challenges were represented in areas that were difficult to expand, that is, communities that could not expand to meet all needs, as Table 7 and Figure 6 explain.

Notably, some major cities, such as Tulkarm, Qalqilya, and Jenin, face restrictions on expansion, with residents often buying land outside the city's administrative borders. This trend is exemplified in Tables 8, Table 9, Table 10 and Table 11, which show both the migration forms and the communities' capacity to attract these residents and meet the needs of these cities. Figure 6 summarizes the satisfactory features of urban development in the WB under the First Scenario (2023-2030).

Governorate	The number of communities that are unable to expand in a way that meets all needs
Jenin	49
Tubas	9
Tulkarem	10
Nablus	21
Qalqilia	22
Salfit	9
Ramallah and Al-Bireh	6
Jericho	28
Jerusalem	20
Bethlehem	28
Hebron	26

Table 7. Number of communities unable to expand in the WB Governorates. Source: Prepared by the authors.

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Community	Bethlehem urban area (km^2)	Hindaza (km^2)	Janata (km^2)	Wadi Rahal (km^2)	Total (km^2)
Area needed for expansion	5.7	0.8	0.2	0.5	7.2
Area available for expansion	1.0	3.0	1.6	2.2	7.8

Table 8. Capacity of the Hindaza/Janata and Wadi Rahal areas to cover the needs of areas within the greater Bethlehem urban area. Source: Prepared by the authors.

Community	Jenin and its refugee camp (km^2)	Burqin (km^2)	Total (km^2)
Area needed for expansion	5.0	0.6	5.6
Area available for expansion	4.2	5.4	9.6

Table 9. Capacity of the Buqin areas to cover the needs of areas within Jenin and its refugee camp. Source: Prepared by the authors.

Community	Qalqilia city (km^2)	Jaious (km^2)	Seer (km^2)	Total (km^2)
Area needed for expansion	2.2	0.3	0.1	2.6
Area available for expansion	0	2.0	2.1	4.1

Table 10. Capacity of the Jaious and Seer areas to cover the needs of areas within Qalqilia. Source: Prepared by the authors.

Community	Tulkraem city (km^2)	Kafr al-Labad (km^2)	Iktaba (km^2)	Total (km^2)
Area needed for expansion	5.1	0.3	0.3	5.7
Area available for expansion	1.0	4.7	1.1	6.8

Table 11. Capacity of the Kafr al-Labad/Iktaba areas to cover the needs of areas within Tulkraem. Source: Prepared by the authors.

- Residents of areas within the greater Bethlehem urban area headed to Hindaza/Janata/Wadi Rahal
- Residents of areas within Jenin headed out to Burqin
- Residents of areas within Qalqilia headed out to Jaious/Seer
- Residents of areas within Tulkraem headed out to Kafr al-Labad/Iktaba

Strategic directions for urban development in the WB, First Scenario (2023-2030)

In the First Scenario, policies for urban development have been articulated as follows: First, to allow for the intensification of construction and infill development inside major urban areas while keeping their existing urban form and typology. Second, to promote expansion within master plans and the intensification of construction in built-up areas of communities, given constraints on urban expansion, especially where there is a substantial difference between the building area and the total built-up area. Third, it aims to enable urban area expansion in Bethlehem, Qalqilya, and Tulkarm beyond their administrative borders. Finally, part of the city of Sama Qarantal is allocated to provide the needs of communities in the Jericho Governorate that face limitations in urban expansion, totaling 1.63 km^2. Figure 7 shows the spatial development of WB under the First Scenario.

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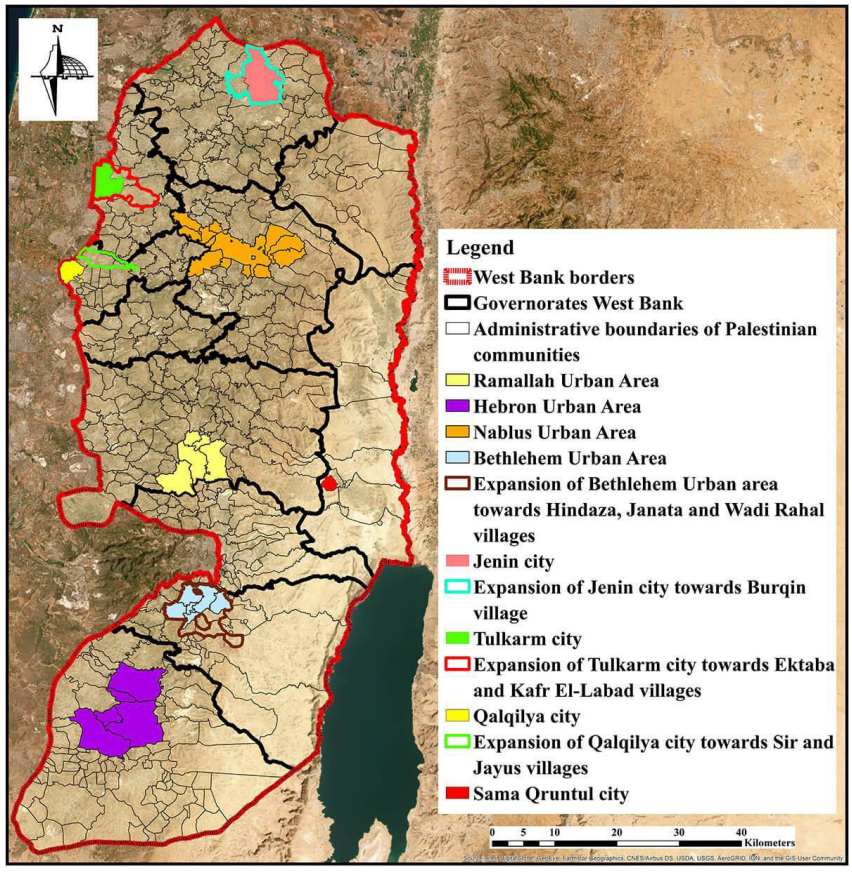

Figure 7. The Spatial Development for the WB, First Scenario (2023-2030). Source: Author's dataset (MoLG, 2022).

Governorate	Number of colonies	Colonies Area (km2)	Colonies Built-up area (km2)	Area left unused (dunum)		
				Total Area (Built-up area km2)	For Urban development (km2)	For Protection plan (km2)
Jenin	5	3.6	1.5	2.1	2.1	0
Tubas	7	8.5	1.8	6.7	0	6.7
Tulkarem	3	2.6	1.1	1.5	1.5	0
Nablus	13	22	4.4	18	8.2	9.8
Qalqilia	8	10	5.9	4.1	4.1	0
Salfit	13	13	8	5	2.1	2.9
Ramallah and Al-Bireh	26	28	13	15	1	14
Jericho	17	23	5.3	18	0	18
Jerusalem	26	35	20	15	11	4
Bethlehem	13	17	8.0	9	4	5
Hebron	20	13	4.8	8.2	0.7	7.5
Total	151	176	74	103	35	68

Table 12. The residential colonies and how to reuse them. Source: Prepared by the authors.

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Governorate	Number of colonies/tourists	Area (km²) (For urban dev.)	Number of colonies/ industrial	Area (km²) (to be used as an industrial area)	Number of military posts	Area (km²) (For urban dev)
Jenin	0	-	1	0.3	6	1.0
Tubas	0	-	-	-	11	2.2
Tulkarem	0	-	1	0.2	1	0.04
Nablus	0	-	1	0.04	6	0.8
Qalqilia	0	-	4	0.8	3	0.3
Salfit	0	-	4	3.4	3	0.08
Ramallah and Al-Bireh	2	2.9	4	0.5	10	2.8
Jericho	3	2.5	1	0.1	27	4.0
Jerusalem	2	0.2	3	5.4	14	5.3
Bethlehem	2	0.3	2	0.04	2	0.1
Hebron	0	-	4	0.4	10	1.0
Total	9	5.9	25	11	93	18

Table 13. The touristic, industrial colonies, and military posts, and how to reuse them. Source: ARIJ 2023.

Second scenario (2030-2050)

This scenario is framed under the hypothesis of full sovereignty over the 1967 borders of the WB, free from geopolitical restrictions (Figure 5). However, it considers the protection plans and the existing built-up areas (Table 12). The analysis is based on two key assumptions: first, the return of displaced Palestinians; and second, the removal of illegal colonies in accordance with United Nations resolutions. Consequently, these colonies are studied by area within each governorate to identify potential reuse in the context of future Palestinian urban development (Table 13).

In this scenario, there is potential for expansion in the main cities of Tubas and Salfit, as well as in major urban areas such as Nablus, Ramallah, Jerusalem, Bethlehem, and Hebron. These areas can grow in ways that accommodate the needs of the main cities and the nearby regions within the major urban areas. However, challenges and constraints hinder the expansion of the main cities—Tulkarm, Jenin, and Qalqilya—so that they meet all requirements.

Considering this scenario, the total area for development and expansion is 2584.34 km². Considering that 221.15 km² has already been used for urban development in the first scenario, 2363.19 km² remains for development in this setting. This contains the addition of 67,298 km² of colonies to the National Protection Plan, with 11,209 km² selected for industrial areas. Therefore, the available area for urban expansion in the WB is 2,284.68 km². Of this, 131.67 km² of the colonies will be proposed for urban development in cities unable to expand under the first scenario. However, in the second scenario, cities such as Jenin, Tulkarm, and Qalqilya will have the opportunity to expand within their respective governorates' borders. Thus, the total area available for urban development is 2,153.01 km². Consequently, the vital and available areas for expansion were calculated for each community (Table 14).

Spatial plan for the WB 2023-2050

Our earlier analysis shows that the expansion of all major cities, including major urban areas, must meet essential needs. An exception to this trend is observed in Salfit and Tubas.

Subsequently, there is an urgent need to establish new cities to ease the strain on existing urban centers and accommodate population growth during this phase. Table 15 briefly summarizes the required spaces, as determined by our earlier analysis.

Before determining the locations of the cities, their functions, the distribution of their areas, and the number of residents therein, the main functional centers of the existing cities in the governorates were determined based on the nature of the resources available in each governorate in order to help us determine the functions of the new cities. Afterward, the areas needed and population numbers were distributed to the new specialized cities with different, non-traditional functions in the WB, as shown in Table 16 below:

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Communities	Classification	Pop. No 2030	Pop forecast 2050	Pop. Increase (2030-2050)	Per capita share (m2/ individual)	Area necessary for expansion (km^2)	Area available for expansion (km^2)	Gap (km^2)	Ability to expand
Jenin	Main city	65,153	194,966	129,813	115	15	0.1	14.9	No
Tubas	Main city	27,977	83,72	55,743	115	6.4	74	-	Yes
Tulkarem	Main city	84,244	252,094	167,85	115	19	1.2	17.8	No
Nablus	Main city	204,834	612,953	408,119	115	47			
Salem	Within Urban area	8,18	24,478	16,298	135	2.2			
Dei el-Hatab	Within Urban area	3,705	11,087	7,382	135	1.0			
Azmout	Within Urban area	4,491	13,438	8,947	135	1.2			
Roujeeb	Within Urban area	7,786	23,298	15,512	135	2.1			
Kafr Qalil	Within Urban area	3,954	11,833	7,879	135	1.1			
Till	Within Urban area	6,739	20,165	13,426	135	1.8			
Beit Wazan	Within Urban area	1,713	5,125	3,412	135	0.5			
Beit Iba	Within Urban area	5,325	15,935	10,61	135	1.4			
Zawata	Within Urban area	3,312	9,911	6,599	135	0.9			
Qusain	Within Urban area	2,939	8,794	5,855	135	0.8			
Der Sharaf	Within Urban area	3,85	11,52	7,67	135	1.0			
Iraq Burin	Within Urban area	1,316	3,938	2,622	135	0.4			
Total						61	31	30	No
Salfit	Main city	14,244	42,624	28,38	115	3.3	9.2	-	Yes
Ramallah	Main city	50,91	152,346	101,436	115	12			
Al-Bireh	Main city	60,018	179,601	119,583	135	16			
Beitonya	Within Urban area	34,73	103,929	69,199	135	9.3			
Surda	Within Urban area	1,708	5,11	3,402	135	0.5			
Abu Qash	Within Urban area	2,92	8,739	5,819	135	0.8			
Total						39	30	9	No
Jericho	Main city	27,294	81,675	54,381	115	6.3	1.8	4.5	No
Jerusalem (communities within urban area)	Main city	365,83	1,094,723	728,893	115	84	72	12	No
Bethlehem	Main city	37,324	111,691	74,367	115	8.6			
Beit Jala	Within Urban area	17,603	52,675	35,072	135	4.7			
Beit Sahour	Within Urban area	17,338	51,882	34,544	135	4.7			
Al-Dawha	Within Urban area	16,647	49,816	33,169	135	4.5			
Al-Khader	Within Urban area	15,613	46,722	31,109	135	4.2			
Artas		7,5	22,443	14,943	135	2.0			
Total						29	19	10	No

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Communities	Classification	Pop. No 2030	Pop forecast 2050	Pop. Increase (2030-2050)	Per capita share (m2/ individual)	Area necessary for expansion (km^2)	Area available for expansion (km^2)	Gap (km^2)	Ability to expand
Hebron	Main city	260,742	780,256	519,514	115	60			
Doura	Within Urban area	51,012	152,649	101,637	130	13			
Halhul	Within Urban area	35,054	104,898	69,844	130	9.1			
Tafouh	Within Urban area	20,49	61,314	40,824	130	5.3			
Beit Kahel	Within Urban area	11,516	34,46	22,944	130	3			
Total						90	41	49	No
Qalqilia	Main city	67,47	201,9	134,43	115	15	1.3	14	No

Table 14. Expansion capacity analysis for the second scenario (2030-2050). Source: Spatial plan for the WB 2050. Prepared by the authors.

Governorate	Population Number	Spaces (area) needed (km2)
Jenin	92,986	10.7
Tulkarem	120,232	13.8
Nablus	264,380	30.4
Qalqilia	96,293	11.1
Ramallah and Al-Bireh	74,426	8.6
Jericho	38,908	4.5
Jerusalem	104,348	12
Bethlehem	87,709	10.1
Hebron	428,661	49.3

Table 15. The extent of the need for new cities by governorate and population numbers. Source: Prepared by the authors.

New City Location	Area (km^2)	Population no.
Ramallah	10	86,600
Jenin	7	60,901
Tubas	25	217,391
Jerusalem	8.5	73,913
Jericho	5	43,256
Bethlehem	10	87,709
Hebron	9	78,261
Hebron	40	350,400

Table 16. Characteristics, function, area, population, and location of new cities in the WB. Source: Prepared by the authors.

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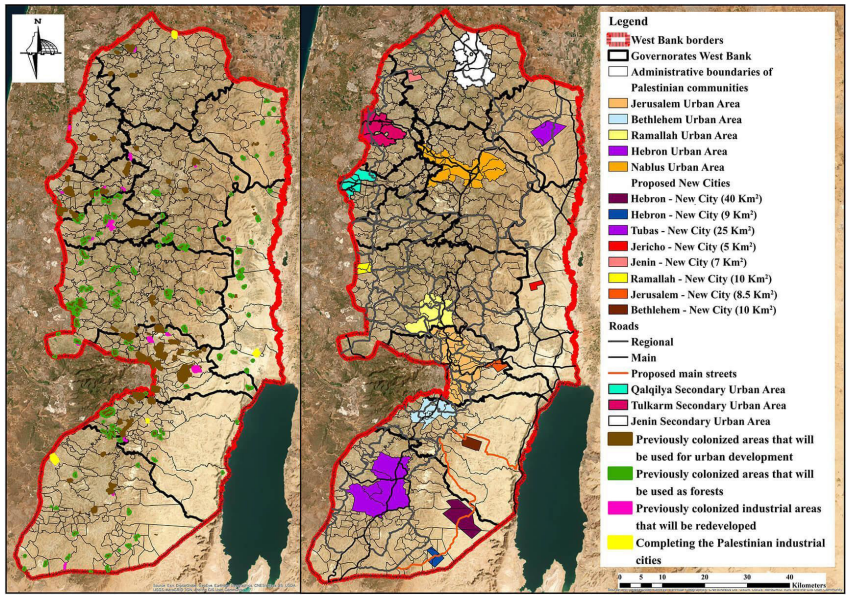

Figure 8. The National Spatial Development Plan for the WB 2050, Second Scenario (2030-2050). Source: Author's dataset (MoLG, 2022).

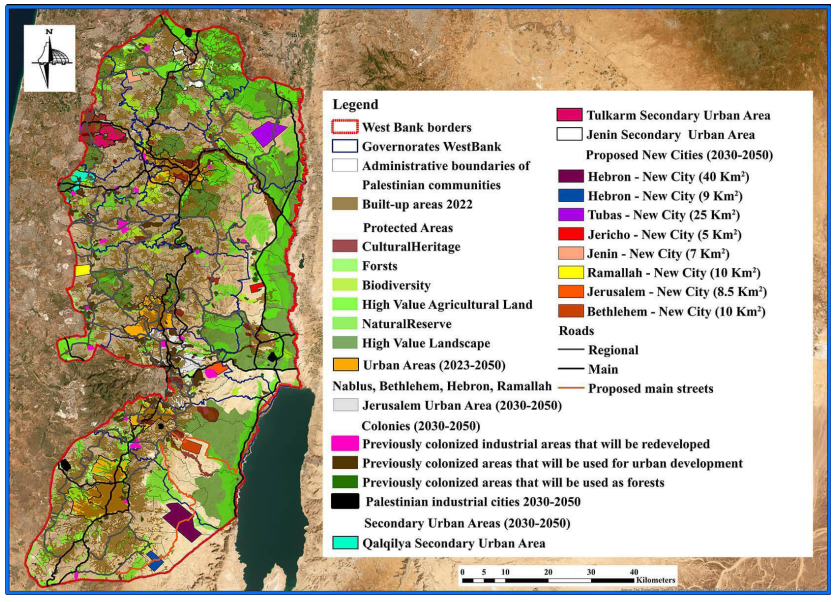

Figure 9. The outcome of the national spatial development plan for the WB 23/50. Source: Author's dataset (MoLG, 2022).

These results were reflected in the areas available for expansion, as shown in the maps below. Based on this, the appropriate sites for the new cities were chosen to ensure access, appropriate slope, and land use suited to each city's specific function. Strategic directions for the urban development sector for the Second Phase (2040-2050): Completion of available space areas in major urban areas, establishing new secondary urban centers (Qalqilia, Tulkarm, Jenin), and a change in construction style, especially in major urban areas (Figure 8). Thus, the National Spatial Development Plan for the WB 20/50 was prepared after specialized cities were identified and their locations were selected (Figure 9).

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V. CONCLUSION

The limited availability of land, the rapidly growing population of Palestine, and the ongoing political constraints have led to uncontrolled urban expansion across the WB. This paper shows that spatial planning supported by LSA provides a structured pathway towards sustainable urban development even under severe constraints. By integrating environmental, political, and demographic variables using GIS, the proposed NSP demonstrates the potential to achieve more balanced growth, strengthen urban-rural linkages, and ensure the long-term sustainability of Palestinian urban areas.

In addition, this paper demonstrates how LSA can serve as an effective decision-making tool in complex, conflict-affected contexts. In Palestine, which faces significant constraints in land governance and access, LSA enables planners to identify potential expansion areas, optimize limited resources, and advocate for spatial justice using data-driven evidence. Also, the approach provides a foundation for adaptive planning, allowing national and local institutions to respond flexibly to environmental and demographic changes.

Furthermore, the proposed framework opens promising opportunities for future implementation. Land suitability models can guide human interventions and planning for refugee resettlement, while also providing insights for policy dialogues on land management and environmental conservation. Integrating LSA with environmental indicators, such as ecosystem conservation and infrastructure efficiency, can enhance its role in advancing sustainable development goals in fragile political environments.

Finally, this paper emphasizes that sustainable urban expansion in Palestine requires not only the removal of political constraints but also the establishment of integrated governance mechanisms that combine scientific analysis, participatory planning, and a long-term spatial vision. By integrating the LSA into national and local planning systems, the Palestinian authorities can build a more inclusive and resilient urban future —one that turns spatial constraints into strategic opportunities for sustainable development.

VI. AUTHOR CONTRIBUTION CRediT

Conceptualization, IK; Data Curation, IK+AA; Formal Analysis, IK+ZZ; Funding Acquisition, N/A; Research, IK+ZZ+AA; Methodology, IK; Project Management, IK+ZZ; Resources, IK+AA; Software. IK; Supervision, ZZ; Validation, IK+ZZ; Visualization, IK; Writing - original draft, IK+ZZ; Writing - review and editing, ZZ+IK; Writing - revision and editing, IK+ZZ.

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