


## Article

# Are Spatial Planning Objectives Reflected in the Evolution of Urban Landscape Patterns? A Framework for the Evaluation of Spatial Planning Outcomes

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**Abstract:** The evaluation of spatial planning results, or outcomes, has been rather neglected by scholars and practitioners. The causes of this neglect are linked to the characteristics of the planning systems in use or difficulties in quantifying results. To advance the state of the art of outcome evaluation, this paper focuses on assessing the implementation of national spatial planning objectives in urban landscapes through the use of an evaluation framework, which makes use of spatially explicit information. The framework is built around four dimensions, which reflect the main domains of spatial planning: efficient built-up development, conservation of agricultural land, landscape preservation and human perception. Indicators that are capable of capturing landscape changes in both time and space are used to verify the degree of conformance between adopted objectives and actual development patterns. We make use of spatially explicit data, as well as assess whether and where landscape changes occurred, by integrating the framework into a multi-criteria analysis. In the present study, the framework is tested in two study areas located in Switzerland and Romania, while the results are interpreted from the perspective of spatial planning approaches in the two countries. The efficiency and utility of the framework are demonstrated by the ability to provide valuable information that facilitates improvement in the performance of planning processes, such as identifying where the implementation of objectives is less effective, and the domains of affected spatial planning. Our findings indicate that the distance between objectives and outcomes can be attributed to differences in countries' spatial planning approaches, which should also be placed into the wider economic, institutional and legislative context. Our study provides valuable insights for the integration of time series of spatial data into the evaluation procedure.

**Keywords:** planning evaluation; conformance; urban landscape; spatial multi-criteria analysis; Romania; Switzerland

### Highlights:

- We propose a framework to verify conformance between national planning objectives and outcomes
- Planning objectives are partially reflected in land change patterns in test areas within Switzerland and Romania
- Planning strategies have been identified as *anticipate and protect* in Switzerland and *develop and control* in Romania
- The distance between intentions and outcomes is attributed to the planning strategies, along with the overall planning tradition, economic conditions and the legislative context.

## 1. Introduction

Most countries make firm policy statements at the national level about the need to achieve sustainable development. Policy statements for spatial development are often expressed by enacting laws, which become part of spatial planning objectives at the national level [1]. By enacting them, governments ensure that they are binding and apply to all levels of governance that play a role in managing spatial development [2], from national, to regional and local levels. Although objectives are often broad in scope and address holistic concepts, such as sustainable development or quality of life, the expectation is that they will be implemented. In this context, spatial planning objectives become the basis upon which decisions regarding the actions of governments, the private sector and communities are taken.

Indeed, correspondence between intended types of development, as expressed by spatial planning objectives, and actual development is expected [3]. Assessment of the correspondence between planning objectives and planning outcomes has been discussed by scholars as falling under the umbrella of either conformance evaluation or planning process performance evaluation [4]. Conformance evaluation places plans and/or policies at the centre of the evaluation process and seeks evidence of their ability to shape physical development [3,5]. It also implies the use of quantitative methods, which are often spatially explicit [6]. In contrast, planning process performance assumes a broader understanding of planning outcomes (i.e., partnerships, shared agreements, social network and on-the-ground outcomes) [7] and pursues highly qualitative assessments [5]. In our paper, which analyses whether spatial planning objectives at the national level correspond to outcomes on the ground, we refer to *conformance*.

Evaluation procedure plays a key role in the planning cycle, as it helps planners assess the progress made through the implementation of the objectives [8,9]. Hence, it is a means to improve the planning process by providing information for further evidence-based policymaking [10]. Furthermore, evaluation increases the accountability of public institutions and strengthens public confidence in spatial planning decisions [11].

The evaluation of outcomes, defined as the effects on socio-economic and environmental systems (including changes in the landscape patterns) brought about by the planning system and other forces [12], has been rather neglected by scholars and, especially, practitioners [13]. The causes of this neglect include difficulties in quantifying the results, the lack of generally accepted outcome evaluation methodologies [5,14] and the organizational culture within the planning systems, which may or may not recognise the benefits of the evaluation process [11]. As objectives are, at times, not clearly defined or framed in terms of holistic concepts, the evaluation of outcomes becomes a difficult task. Development patterns are not solely influenced by planning practices; thus, any explanation needs to be placed within the broader socio-economic and political context [6]. Even if planning objectives are clearly formulated, it is difficult to establish clear boundaries which delineate the influence of all factors. Moreover, a certain time lag needs to be considered between the moment of planning objectives' adoption and subsequent implementation. Outcome evaluations are either lacking because the planning system is not mature enough to focus on evaluation or intentionally avoided because they may highlight failures in the planning process [14].

Most previous research efforts on outcome evaluations focus on individual planning instruments at the local level [15], such as conformance of development within urban growth boundaries [16,17] or the distance between planning intentions and cities' actual development patterns [18]. Less attention has been paid to developing frameworks suitable for large-scale assessments, such as at the national level. Notable exceptions to the lack of research in this field are the studies by Wong and Watkins [12], who present a methodology for the evaluation of outcomes of national policy statements in England, and Hersperger, Mueller, Knöpfel, Siegfried and Kienast [8] who propose a set of indicators to evaluate landscape planning outcomes based on goals set at the cantonal level. The planning evaluation methodologies developed in both studies make use of indicators to create the link between objectives and positive or negative outcomes. The methodology proposed by Wong and Watkins [12] especially offers useful information on how evaluation at the national level should be performed. Despite the valuable recommendation on technical criteria for indicators' selection, little information is given about the potential application of the proposed framework outside the British context. Hersperger, Mueller, Knöpfel, Siegfried and Kienast [8] stress that planning evaluation should make use of spatially explicit tools to assess whether landscape changes have occurred, as well as determine their spatial distribution.

In order to contribute to the literature on outcome evaluation, this paper focuses on assessing the implementation of national spatial planning objectives in the urban landscape. In particular, we examine the conformance between adopted objectives and observed development patterns. We begin by proposing an indicator-based framework for outcome evaluation. We then explore the integration of the framework into a spatial multi-criteria analysis. Finally, the framework is tested in two study areas in Romania and Switzerland, paying particular attention to understanding the results from the perspective of spatial planning approaches. At the same time, an emphasis is placed on the difference found within the wider economic, institutional and legislative context of the two countries in order to identify the possible influence of these factors on the outcomes.

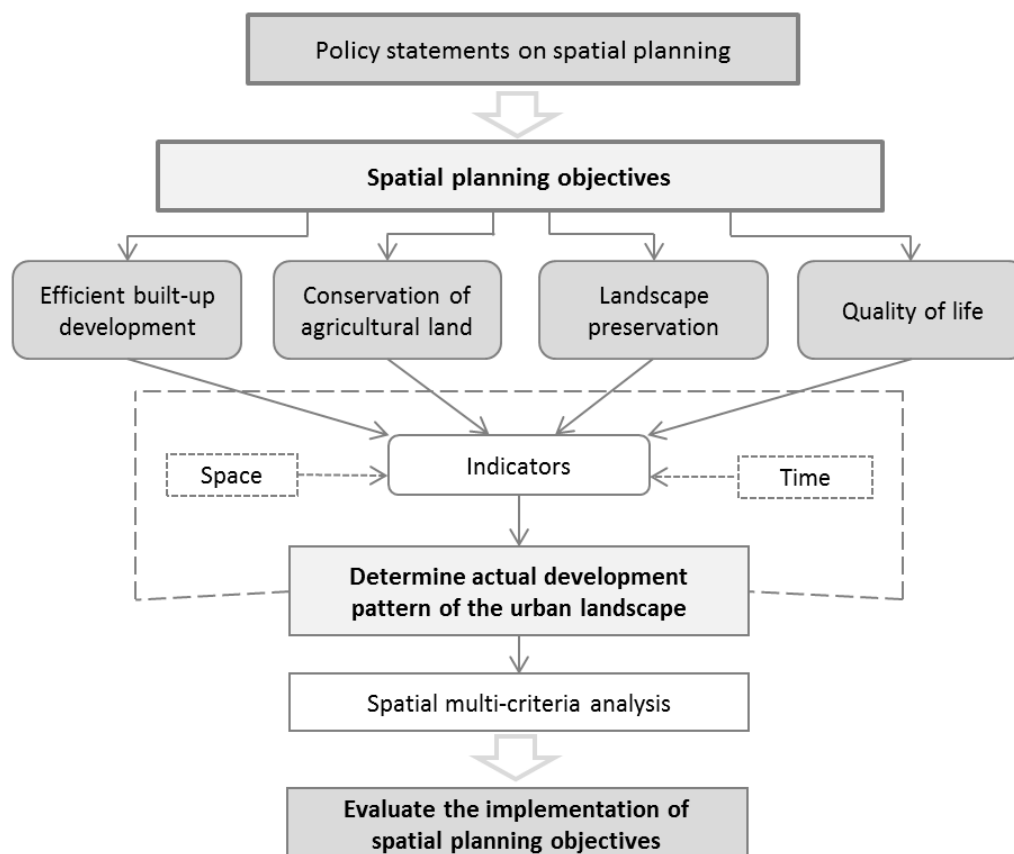
We have selected Switzerland and Romania as study areas because although many similar landscapes occur in both countries, they are at different stages of economic development and have fundamentally different social capital, as well as disparate traditions in policy making. In both countries, the planning objectives set at the national level are expected to guide the elaboration and approval of planning instruments at lower governance levels, particularly with regard to cantonal spatial master plans and municipal land use plans in Switzerland [19], and county development plans and municipal general land-use plans in Romania [20]. However, the two countries have different attitudes towards planning evaluation. In Romania, evaluation procedures implemented over the last two decades have been inconsistent and inconstant [21]. Only recently have studies been conducted to verify the outcomes of the planning process, with a focus on trade-offs between public and private interests in urban planning [22], and policy transfer between countries on flood risk planning [23]. Given the pressure imposed on the planning system by private actors, along with the rather poor coordination between planning levels [24], it is useful to see the extent to which actual results are in conformity with adopted objectives. In contrast, in Switzerland, the evaluation procedure, known as *controlling*, was initiated in the 1990s and has been constantly improved [10]. The analysis of the Swiss case could highlight those aspects that lead to conformance between intentions and development patterns.

To facilitate an understanding and interpretation of the two case studies, a comparative analysis of the Swiss and Romanian planning strategies was conducted through a review of legislative and planning practices. The selected case studies may provide useful insights into how to apply the evaluation framework and interpret the results based on concrete situations. Moreover, findings are expected to improve our knowledge of the relationship between landscape patterns and spatial planning objectives on sustainable development.

## 2. Framework for Evaluating the Implementation of Spatial Planning Objectives

We propose a framework for evaluating the implementation of spatial planning objectives in the urban landscape (Figure 1). The framework has four dimensions, which reflect the main domains of spatial planning: efficient built-up development, conservation of agricultural land, landscape preservation and quality of life. The dimensions were conceptualised based on the national spatial planning objectives of Switzerland and Romania (i.e., stated in the national legislation, as of December 2016), and represent common concerns of spatial planning. We limited their selection to include objectives that have a direct impact on the spatial development patterns in urban areas and could be spatially quantifiable (Table 1).

In order to quantify the outcomes, we made use of indicators as proxy measures of the spatial planning objectives. Technical criteria for indicators' selection were derived from the work by Wong and Watkins (2009) and Hersperger, Mueller, Knöpfel, Siegfried and Kienast [8] on the evaluation of planning outcomes, and Kienast et al. [25] on landscape assessments, as follows: (a) indicators reflect the main domains of spatial planning; (b) they are capable of capturing both spatial patterns and dynamics over time; (c) they represent unique (e.g., uncorrelated) information at the grid/raster level; and (d) each dimension contains no more than two to five indicators to avoid redundancy.



**Figure 1.** Framework for evaluating the implementation of spatial planning objectives.

The *Efficient built-up development* dimension addresses sprawling built-up development in a direct manner, as it has been identified as one of the pressing issues affecting the European urban landscape [26–28]. The differentiation between built-up dynamic indicators (i.e., A1 and A2) was made in order to draw attention to the driving forces behind landscape transformation. The two indicators highlight the capacity of public and private actors to support urban development. Indicator A3. *Changes in fragmentation of the built-up areas* was introduced to evaluate the dispersed pattern of urban expansion.

**Table 1.** Dimensions for the assessment of the degree to which spatial planning objectives are reflected in the actual development pattern.

Dimension	Planning Objectives as Expressed in Spatial Planning Laws	Category of Indicators	Indicators
A. Efficient built-up development	Rational use of land through controlled built-up development (RO <sup>a</sup> ) and restricted land consumption (CH <sup>a</sup> ); orientation towards desired spatial development (CH)	Limit land uptake by built-up development	A1. Built-up development rate due to private initiative A2. Built-up development rate due to public initiative
		Limit scattered built-up development	A3. Changes in fragmentation of built-up areas
B. Conservation of agricultural land	Protection of cultivable land (CH) and conservation of fertile agricultural land (RO)	Reduce loss of agricultural land	B1. Rate of loss of arable land B2. Rate of loss of permanent crops
C. Landscape preservation	Preservation of landscape through maintaining public recreational areas (CH, RO); conservation of natural landscapes and recreational areas (CH)	Conserve natural landscapes and recreational areas	C1. Forest area changes C2. Loss (gain) of public open space <sup>b</sup> C3. Loss (gain) of public green areas <sup>c</sup>
	Elimination of land use conflicts (RO); appropriate location of homes and workplaces (CH); protection of residential areas against pollution (CH)	Avoid land use conflicts	C4. Changes in adjacencies between conflicting land uses <sup>d</sup>
D. Quality of life	Good accessibility of public and leisure facilities (RO, CH); ensure a good human habitat (RO); improve quality of life (RO)	Improve communities' quality of life	D1. Changes in accessibility of nearest recreation areas D2. Changes in share of urban derelict land D3. Changes in landscape diversity

<sup>a</sup> The letters in brackets represent the country where the objective was adopted: CH—Switzerland; RO—Romania; <sup>b</sup> Riverbanks and other small open spaces not considered as urban parks; <sup>c</sup> Urban parks and public gardens; <sup>d</sup> Potentially conflicting land uses considered within the analysis: industrial-residential, derelict land-residential.

The *Conservation of agricultural land* dimension is complementary to the expansion of a built-up area. The two indicators on agricultural land dynamics (i.e., B1 and B2) capture the way in which the diversity of agricultural activities is affected. Moreover, the two indicators can be used to assess which agricultural land uses are more vulnerable to loss, as studies have pointed out that urban expansion affects them differently [29].

The *Landscape preservation* dimension addresses the management of green and open spaces, as well as potentially conflicting land uses. Urban forests and public green spaces are landscape features that provide a wide range of urban ecosystem services, such as climate regulation, heat island reduction [30] and the provision of leisure facilities to the local community [31]. Moreover, their protection is closely related to the sustainability of cities [32]. In urban environments, the presence of open spaces indicates the potential for nature-oriented recreation and increases the perceived naturalness of the landscape [33]. Management and avoidance of potentially conflicting land use adjacencies are important aspects of spatial planning [34]. Cities experiencing a rapid increase in built-up areas are even more exposed to the occurrence of conflicting situations [35].

We considered it necessary to include the *Quality of life* dimension because the way people use and perceive urban landscapes ought to be an important component of spatial planning [36,37]. The role of planning is to increase the quality of landscapes, including ordinary landscapes, where communities carry out their daily activities [38]. The D1 indicator refers to the availability of recreational areas. These areas are connected to nature experiences [39,40] and provide a wide range of psychological and physical health benefits. Indicators D2 and D3 address landscape perception which is evolutionarily determined [41], as they are independent of cultural influences. The presence of derelict land is perceptively associated with desolation and a lack of activity [42], while landscapes that are more diverse receive higher scores in landscape preference ranking [43]. D2 and D3 were chosen because they express the preferences of both residents and experts.

### 3. Integration of the Framework into a Spatial Multi-Criteria Analysis

In this section, we describe the integration of the developed framework (Figure 1) into a spatial multi-criteria analysis. Spatial multi-criteria analysis “transforms and combines geographical data and value judgments (the decision-maker’s preferences) to obtain information for decision making” [44]. It is a method used by spatial planners to help decide which alternatives to implement [45], evaluate the quality of decision-making processes [46] or evaluate the consequences of implementation, such as potential land-use conflicts [47]. As decisions on how development should be performed may involve the management of conflicting goals, multi-criteria analysis has been proven to be a good method for exploring and solving complex problems [45]. In multi-criteria analysis, a criterion expresses the degree of achievement of an objective. Criteria are therefore measurable parameters, whose analysis can be supported by resorting to indicators [48]. For urban areas, these indicators should measure the functional and liveable dimensions of an area [49]. We assigned the criteria of the spatial multi-criteria analysis as defined by the indicators of the framework (Table 1).

#### 3.1. Criteria Weights

To determine the weights of the criteria, we performed a pair-wise comparison using Saaty’s [50] nine-point scale. To assign weights, we addressed the following question: given a pair of criteria, which criterion has been identified in the case studies as having more negative effects on the efficient implementation of spatial planning objectives? For example, when the criteria A1. *Built-up development rate due to private initiative* and A2. *Built-up development rate due to public initiative* were compared, a higher weight was given to the A1 criterion, as studies [51,52] have shown that urban sprawl is mostly triggered by private initiative.

We performed the pair-wise comparison of the criteria within each dimension. We considered this approach appropriate because the dimensions represent different aspects of spatial planning policy. The sum of the weights was set to equal a value of 1 for each of the dimensions.



### 3.2. Calculation and Standardization of Indicators

Indicator values were calculated at the cell level as annual change rates between two moments in time by using Formula (1). An exception was the indicator D1. *Accessibility of nearby recreation areas*, which we considered as distance in metres to the nearby recreation areas in the final year of analysis.

$$\text{Change rate} = \left[ \left( \frac{f_i}{s_i} \right)^{\frac{1}{y}} \right] - 1, \quad (1)$$

where  $f_i$  is the value for the final year in cell  $i$ ,  $s_i$  is the value the start year in cell  $i$ , and  $y$  is the number of years between the two time moments. The change rate calculation takes into consideration the number of years between the two time moments for each country (i.e., nine years for Switzerland and eight years for Romania). In order to allow for computation of change rates, the 0 values corresponding to baseline year (e.g., no built-up in the cells in the baseline year) have been replaced with 0.01.

Indicators A1, A2, B1, B2, C1, C2, C3, D2 take into account the fact that the land cover/land use area changes between the two time moments. Indicator A3 was calculated as a change in the edge density of built-up patches, while indicator C4 was calculated as a change in the length of shared edges between potentially conflicting land uses (i.e., industrial area-residential area, derelict land-residential area). Indicator D1 was calculated based on changes in the Euclidean distance between the cell centre and the nearest public green area. The change in landscape diversity (D3) was determined as change rate in the number of patches within a 500 m radius from each cell centre.

We used a 100 m  $\times$  100 m cell grid to calculate indicator values, as this method has proven to be effective in avoiding redundancy in spatial-based multi-criteria analysis [48]. Moreover, the cell size is reasonable when capturing urban landscape characteristics, including scattered built-up areas.

As the selected indicators have different measurement scales and ranges, they cannot be compared directly. A standardization to a dimensionless value is required. We used mathematical programming [53] to transform the values into percentages. For each indicator in each study area, the worst of all cell values was set to 1 and the best to 100. Accordingly, the lower the values, the greater the difference between planning objectives and outcomes.

The standardised values were calculated using the following formulas:

$$f(Z_i) = \frac{1 - 100}{\max - \min} \times Z_i + \frac{(100 \times \max) - (1 \times \min)}{\max - \min}, \quad (2)$$

when the maximum expresses the worst value, and

$$f(Z_i) = \frac{100 - 1}{\max - \min} \times Z_i + \frac{(1 \times \max) - (100 \times \min)}{\max - \min}, \quad (3)$$

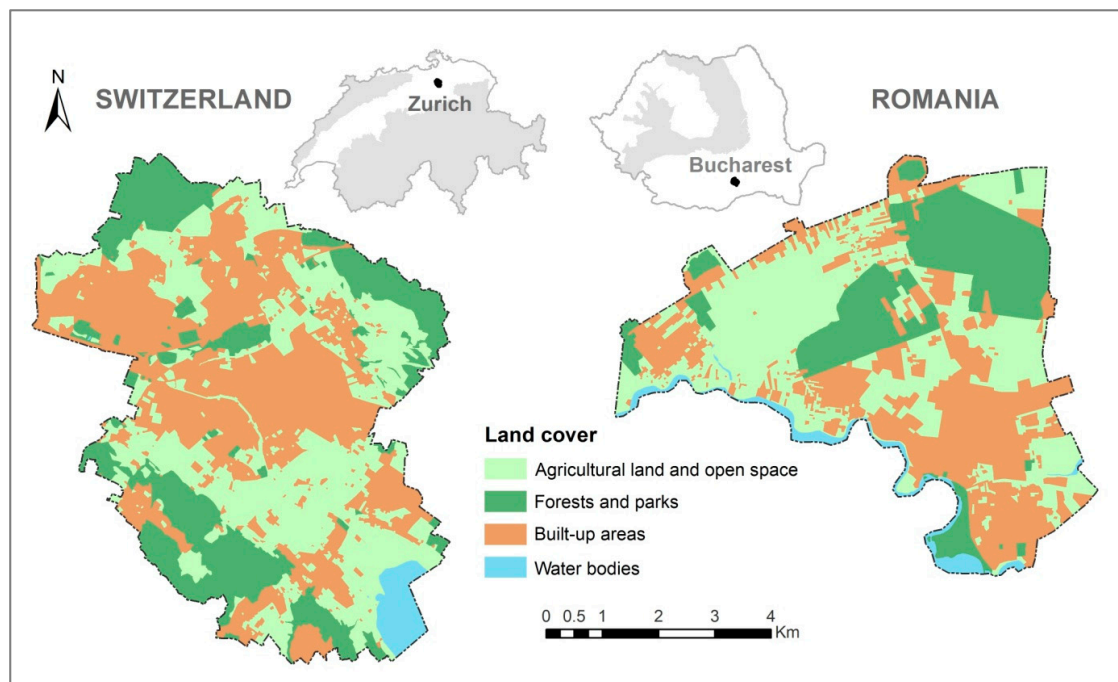
when the minimum expresses the worst value.  $Z_i$  represents the value of a criterion for cell  $i$ ,  $\max$  represents the maximum value for the criterion, and  $\min$  represents the minimum value for the same criterion [47].

## 4. Testing the Proposed Framework

### 4.1. Test Areas and Land Use/Land Cover Data

We screened for potential study areas in which to test the proposed framework, by focusing on common physical features. The common features of case studies should enable generalization [54] and allow for the comparison of results. The following features were taken into consideration: relief, land use, functionality of built-up areas, and presence of public green areas and water bodies. Two cities (Zurich and Bucharest) were chosen, due to their relative importance at the national level and high level of urbanization in the past decade. An area of 42 km<sup>2</sup> was chosen from Zurich's suburbs, while

an area of 33 km<sup>2</sup> was chosen at the periphery of Bucharest, (Figure 2). Boundaries of the study areas corresponded to administrative borders and water bodies.



**Figure 2.** Land cover of study areas in Switzerland (year 2012) and Romania (year 2013).

The analysis period was set so that it could be meaningful in terms of outcome evaluation. It was necessary to take into account changes in spatial planning legislation and a possible time lag between objectives' adoption and implementation, while maintaining similar timeframes for the two countries. Baseline years (2003 for Switzerland, 2005 for Romania) were selected, based on planning legislation stability (i.e., no major planning legislation changes before or after the selected years). Final years (2012 for Switzerland, 2013 for Romania) were chosen to be as close to the present as possible and based on aerial image availability.

Land use/land cover data were obtained at the patch level through a wall-to-wall digitization of QuickBird aerial images provided by Google Earth (spatial resolution: 5 m), representing 2003 and 2012 for Zurich, and 2005 and 2013 for Bucharest. The minimum mapping unit was set to 125 m<sup>2</sup> for both study areas. Land use/land cover data served as the primary source of information for calculating the indicators in Table 1.

The land use/land cover categories were chosen to reflect the spatial planning objectives presented in Table 1 and allow for calculating the indicators. The following land uses classes were digitised: built-up areas (differentiated as industrial, residential and other uses), arable land, permanent crops, forest, public green areas (including urban parks and public gardens), public open spaces (including riverbanks and other small open spaces not classified as urban parks), and derelict land.

Urban land use plans and GIS information on land functions provided by the Canton of Zurich [55] and the Municipality of Bucharest [56] were consulted in order to correctly identify the land uses and their legal status (i.e., private or public land). Additionally, field visits were conducted between January 2014 and December 2015 to validate the digitised land use/land cover data. In the case of Zurich, the online platform containing GIS information was particularly helpful in providing land use data at parcel level. In the case of Bucharest, we mainly made use of urban plans, complemented by field visits.

The derived land use/land cover data were converted into a grid with the cell size of 100 m × 100 m to calculate each of the indicators. For each cell, the following information was recorded: the



number of land use/land cover patches of each land use class, the area of each patch and the edge length of each patch.

#### 4.2. Comparison of Planning Strategies in Romania and Switzerland

We compared Swiss and Romanian planning strategies in order to facilitate an understanding of the results from the test areas. The comparison was conducted by analysing the spatial planning legislation and planning practices of the two countries [20,25,57–59]. Although both countries have common objectives (as outlined in Table 1), information on how planning is performed could provide details regarding the reasons behind the success or failure of the implementation.

### 5. Results

#### 5.1. Results of the Spatial Multi-Criteria Analysis

Within the timeframes under study, built-up areas developed due to private initiatives increased significantly in both study areas, whereas public built-up areas increased slightly in Switzerland but decreased in Romania (Table 2). The fragmentation of built-up areas was rather similar in the two study areas. Both study areas registered a reduction in agricultural land, which was notable given the dramatic loss of arable land in Bucharest as agricultural activities were abandoned. There were no significant changes in forest areas, public open spaces or public green areas. However, there was a significant increase in adjacencies between conflicting land uses in Romania. Accessibility to recreation areas, while higher overall in Switzerland, remained constant in both countries. Derelict land expanded significantly in Bucharest, while the areas were much larger overall than in the Swiss case study. Landscape diversity decreased slightly in Switzerland, but the amount of diversity was still higher than in Romania. Criteria weights were assigned, after a pair-wise comparison, within each dimension. Higher weights were attributed to criteria on the fragmentation of built-up areas, changes in areas of permanent crops and accessibility to recreation areas (Table 3).

The average standardised scores show that there were no large discrepancies between the two study areas (Tables 3 and 4). However, the scores for each of the dimensions and their total value highlight the fact that the implementation of spatial planning objectives in Romania has been less effective than in Switzerland (i.e., indicated by the lower average scores). The higher standard deviation of standardised scores in Romania also indicates the presence of areas with more extreme values (e.g., areas prone to experience situations where actual development patterns are not in conformance with adopted objectives).

**Table 2.** Descriptive statistics for the entire study area.

Analysed Aspect	Measurement Unit	Values for				Corresponding Indicator/Criterion
		Switzerland		Romania		
		2003	2012	2005	2013	
Built-up area due to private initiative	m <sup>2</sup>	3901.548	5809.234	1690.427	4279.347	A1.
Built-up area due to public initiative	m <sup>2</sup>	3096.057	3439.260	2758.007	2218.891	A2.
Fragmentation of built-up patches	Edge density	0.004	0.004	0.003	0.004	A3.
Area of arable land	m <sup>2</sup>	2781.178	2686.142	2503.651	266.024	B1.
Area of permanent crops	m <sup>2</sup>	87.328	83.922	687.418	434.389	B2.
Forest area	m <sup>2</sup>	2009.594	2009.594	1935.586	1917.426	C1.
Area of public open spaces	m <sup>2</sup>	298.839	288.008	61.059	59.538	C2.
Area of public green areas	m <sup>2</sup>	0.000	0.000	147.078	147.078	C3.
Adjacencies between conflicting land uses	m	8.054	8.789	4.590	12.946	C4.
Accessibility of nearest recreation areas	m	190.126	190.126	290.505	290.405	D1.
Area of urban derelict land	m <sup>2</sup>	64.174	35.369	712.648	2568.961	D2.
Landscape diversity	No. of patches	13.139	12.676	9.333	10.366	D3.

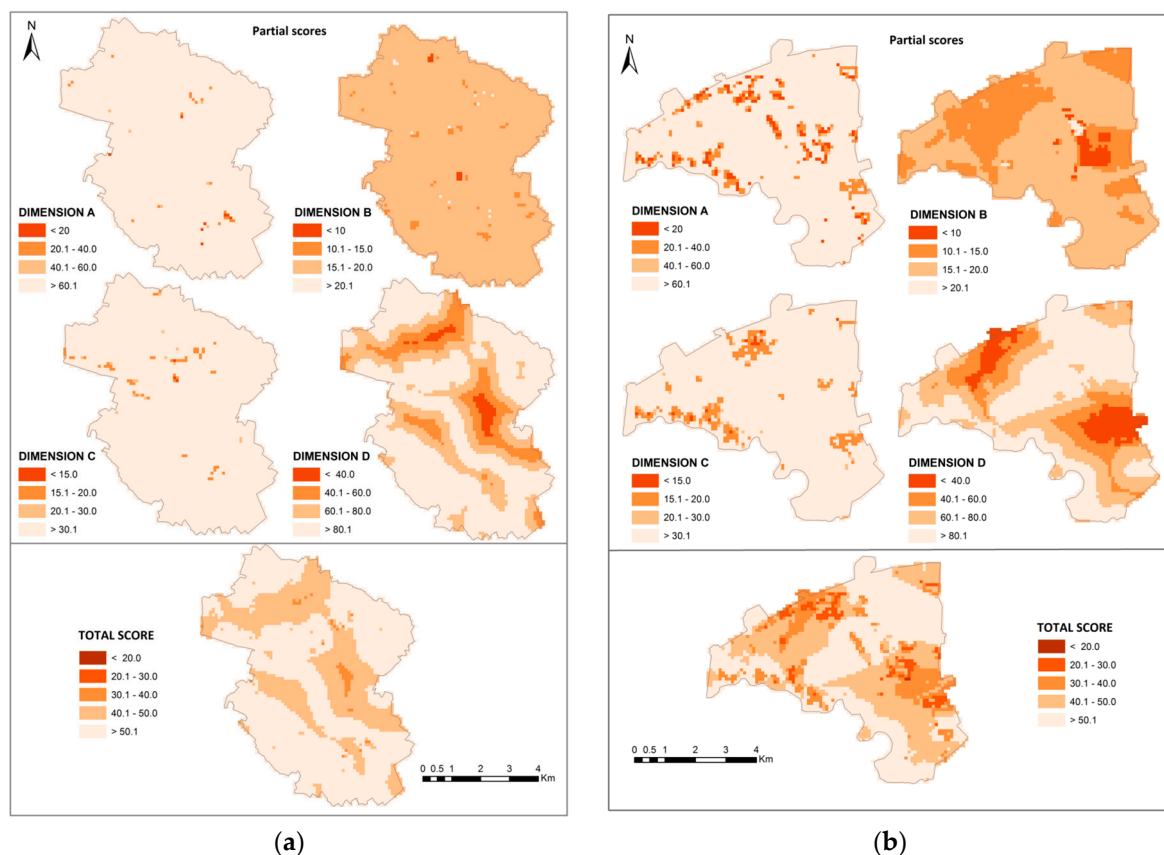
**Table 3.** Descriptive statistics of raw and standardised values (annual change rate) and weight of the criteria within multi-criteria analysis.

Indicator	Worst Situation	Raw Values				Standardised Values				Weight of the Criterion
		Switzerland		Romania		Switzerland		Romania		
		Max. Cell Value	Min. Cell Value	Max. Cell Value	Min. Cell Value	Average of All Cells	Standard Deviation All Cells	Average of All Cells	Standard Deviation All Cells	
A1.	Max.	364.15	−78.45	462.34	−82.21	81.97	4.81	78.99	20.9	0.218
A2.	Max.	364.15	−78.45	462.34	−82.21	82.44	0.12	84.07	8.4	0.091
A3.	Max.	207.01	−67.01	264.01	−72.01	75.78	5.76	72.46	19.55	0.691
B1.	Min.	364.15	−78.45	462.34	−82.21	18.30	1.97	12.01	7.45	0.355
B2.	Min.	364.15	−78.45	462.34	−82.21	18.53	1.41	15.51	3.12	0.645
C1.	Min.	364.15	−78.45	462.34	−82.21	18.51	0.01	15.94	0	0.323
C2.	Min.	364.15	−78.45	462.34	−82.21	18.53	0.01	15.96	1.4	0.108
C3.	Min.	364.15	−78.45	462.34	−82.21	18.54	0.01	15.94	0	0.341
C4.	Max.	190.00	−0.67	2.85	−0.71	73.33	7.66	75.6	15.9	0.228
D1.	Max.	1013.10	0.00	1476.00	0.00	81.42	22.27	80.51	23.51	0.683
D2.	Max.	364.15	−78.45	462.34	−82.21	82.44	4.37	66.14	33.8	0.200
D3.	Min.	4.00	−7.00	20.00	−9.00	58.35	9.95	37.32	11.42	0.117

**Table 4.** Descriptive statistics of standardised scores per dimension.

	Switzerland		Romania	
	Average Score	Standard Deviation	Average Score	Standard Deviation
Dimension A	77.744	4.794	74.947	17.706
Dimension B	18.453	1.146	14.291	3.140
Dimension C	31.148	1.762	29.671	3.668
Dimension D	78.858	15.249	72.458	18.714
TOTAL	51.067	3.981	47.355	7.369

Partial score maps (Figure 3a,b) show, in a spatially explicit manner, the evaluation of the implementation of spatial planning objectives. High scores (light colours) indicate a good fit between policies and outcomes. The efficiency of built-up development was evaluated based on *Dimension A* scores. The results show that the Bucharest study area (Figure 3b) has been highly dynamic in terms of built-up development. Compared to the Swiss study area (Figure 3a), development and fragmentation rates were much higher. The conservation of agricultural land was affected in large compact areas in Bucharest (Figure 3b) and small scattered areas in Zurich (Figure 3a), as indicated by the low scores in *Dimension B*. Landscape preservation has been under pressure in attractive areas near to water bodies and forests in the case of Bucharest (Figure 3b), and in small and dispersed areas in the Swiss study area (Figure 3a), as reflected by the distribution of *Dimension C* scores. The way in which people potentially use and perceive the landscape is reflected in the scores of *Dimension D*. Although the study areas registered both high and low scores, the extent of lower scores was greater in Bucharest.



**Figure 3.** Partial scores for each dimension and the total score for the study area in (a). Switzerland and (b). Romania. The lower the scores (and the lighter the colours), the more development patterns are in conformance with planning objectives. Values can range between 0 and 100.

Total scores reflected the overall conformance with adopted spatial planning objectives. Compared to the Swiss study area, which only exhibited values greater than 30, values of less than 30 and a few cells with values of less than 20 were found in the Bucharest study area. In other words, these lower scores suggest that adopted spatial planning objectives have had less impact on actual urban area development in Romania.

## 5.2. Planning Strategies in Romania and Switzerland

Based on the Ahern's [60] classification of planning strategies, we identify Romania as having a defensive planning strategy, as it seeks to react to the negative effects of spatial development. In contrast, Switzerland has a more protective planning strategy, since planning is used as an instrument to guide or orient development towards a desired spatial pattern. Through its legislative framework and planning practices, Romania promotes development, while trying to control the negative outcomes of urban landscape change. The Romanian planning system attempts to arrest processes such as landscape fragmentation or urban sprawl, rather than to prevent them. A certain difference exists between what the legal framework's aims are (in terms of landscape conservation, urban built-up containment and the preservation of recreational facilities and green areas) and how the legislation is enforced. In contrast, in Switzerland, space is considered to be a limited resource and its efficient management plays a central role in the planning system. Spatial planning aims to foresee urban dynamics and develop strategies to adapt to societal changes. Landscape preservation, urban sprawl prevention and conservation of recreational areas are at the core of the planning system. If we could summarise each of the planning approaches in only two words, for Switzerland, we would choose *anticipate and protect*, whereas for Romania, we would choose *develop and control*.

## 6. Discussion

### 6.1. The Framework to Evaluate the Implementation of Spatial Planning Objectives

The present paper aims to contribute to the literature on the evaluation of planning outcomes, particularly spatial planning objectives set at the national level. In the process, we have developed a framework to evaluate the implementation of objectives with the use of spatially explicit information. The evaluation framework is based on the assumption that spatial planning objectives are expected to guide spatial development in the two countries. This assumption supposes the advantage that it allows for the creation of a link between national spatial planning intentions and their subsequent implementation at lower planning levels (i.e., the local level). Such a link can support assessments on the performance of the planning system. Although spatial planning objectives are set at the national level, their delivery is not the sole responsibility of the central government; rather, it is highly dependent on several factors, including the planning tradition [61], the vertical coordination between planning levels [57] and the interpretation of policy statements by the planning authorities in lower tiers and other stakeholders [12]. In other words, spatial planning assumes a variety of tools, activities and decisions, which seek to give shape to land uses and patterns. However, as we acknowledge that national spatial planning is normally broad in scope (e.g., improving quality of life), it is difficult to identify indicators that capture all aspects covered by one objective. More research is needed to overcome such methodological difficulties and develop accepted methodologies that address planning evaluation from the national to the local level.

The proposed framework and its integration into a spatial multi-criteria analysis allowed us to verify the conformance between adopted objectives and actual development patterns. Since most European countries have adopted similar spatial planning objectives [2], the framework can be used to extend between-states comparisons. Comparisons are suitable for countries that adopt national planning objectives on land use configurations and dynamics. Furthermore, the framework can be downscaled to within-state analyses, for example, of cities or regions.

The indicators were able to capture landscape changes over time and space, as well as reflect both positive and negative aspects of these transformations. Since objectives are mostly expressed in terms of desirable outcomes [62], the use of change indicators helped us to overcome issues related to expressing only positive aspects. In this way, indicators can be better used to track progress made and signal issues regarding policy implementation [8].

The efficiency and utility of the framework was demonstrated by testing it in two study areas. The results provided valuable information that can be used to improve the performance of the planning process, such as locating where implementation of objectives is less effective, and affected domains of spatial planning. The use of the framework may increase planners' accountability during the planning process, while strengthening public confidence in public institutions [63].

For the evaluation procedure to be reliable and valid, certain aspects should be taken into consideration. Using spatially explicit indices to analyse landscape change patterns has proven to be useful, while their integration into a spatial multi-criteria analysis has allowed us to evaluate conformance with desired outcomes. However, researchers and practitioners should be cautious when characterizing landscape functions, as a clear understanding of the relationship between the value of indicators and ecological processes is needed [64].

Planning evaluation could rely on additional measures in order to identify conformance between objectives and outcomes, such as field observations and landscape perception surveys. When applied to larger areas, the framework could imply extensive spatial data collection, which may be conditioned by time, personnel and financial aspects. Moreover, it should be taken into consideration that, within this study, the criteria weights were assigned subjectively, based on the authors' experience and knowledge. To improve this analysis step, further research could include the opinions of planning theoreticians and practitioners or even the public.

## *6.2. Reflection of Spatial Planning Objectives in the Evolution of Urban Landscape Patterns in Romania and Switzerland*

The ensuing paragraphs will focus on the interpretation of the findings for each of the dimensions, based on the identified planning strategy, while also introducing possible causal links between the outcomes and the overall planning context in the two countries.

The scores of the spatial multi-criteria analysis showed that the implementation of spatial planning objectives was more convincing in Switzerland. Observed findings could be explained by the protective planning strategy adopted in Switzerland. In contrast, while the Romanian planning strategy has encouraged development, the planning system has not been very effective at controlling its negative impact. The dissimilarity between the planning approaches of the two countries has also been observed by Tudor et al. [65], who point out that, in Switzerland, land use conflict resolution is more successful due to the focus on economic sustainability and equity among the actors involved, whereas, in Romania, conflict resolution favours landowners and planning regulations are poorly enforced. Although Romania has been characterised as a centralised country, where vertical coordination among planning levels plays an important role [24], the local planning instruments are rather weak at controlling development patterns [57]. This increases the distance between national spatial planning objectives and their subsequent implementation at the lower planning levels. By contrast, strong vertical coordination between planning levels is an important part of the Swiss policy making process [24].

In Switzerland, the efficient expansion of built-up areas and the conservation of agricultural land are considered priorities of the planning system [66], as space is a limited resource. The Romanian planning system is not mature enough [24] to facilitate efficient control of urban sprawl and avoid fragmentation of agricultural land. Romanian national policies on economic development sometimes contradict the objectives of spatial planning [58], with the need to encourage and support the economy possibly overriding land management strategies. Especially in the case of Bucharest, our results are similar to those of Ianoş, Sorensen and Merciu [57], who note that land changes overrun the planning process.

The difference in scores on landscape preservation can be explained by the distinct approaches of Romania and Switzerland regarding landscape planning. Switzerland, which adopted the first law on landscape protection over 40 years ago [67], has recently developed policy documents, such as *Landscape 2020*, to establish its landscape management vision [59]. Landscape planning objectives are further integrated into cantonal comprehensive plans, where specific goals are complemented by thematically organised task sheets, which describe concrete planning tasks [8]. Changes are monitored under the *Swiss Landscape Monitoring Programme*, as they are considered decisive in natural resource management and spatial planning [25]. In contrast, in Romania, landscape protection is closely linked to the ratification of the Landscape Convention in 2002 and the designation of protected areas, which were included in the Natura 2000 Network in 2007. Romania has neither adopted policies that explicitly address landscape protection and management, nor used landscape management plans. Landscape preservation is mainly addressed by environmental impact assessment studies for large-scale development projects.

The areas with low scores in the *Quality of life* dimension in Bucharest are consistent with those identified by Grădinaru, Iojă, Onose, Gavrilidis, Pătru-Stupariu, Kienast and Hersperger [29] as being prone to experience land abandonment, and by Iojă, et al. [68] as having low accessibility to public green areas. In particular, the occurrence of urban derelict land has affected many Romanian cities, driven by institutional changes, urban planning decisions and land speculation [69]. In the Swiss study area, low scores mainly resulted from the fact that recreation areas are located further away from the settlements. However, during the evaluation process, one should take into account that, in Switzerland, the network of trails and roads in agricultural areas are often used for recreational purposes [25].

## 7. Conclusions

We have shown that the framework developed is a powerful evaluation method. The results highlighted the framework's ability to verify the conformance between spatial planning objectives and actual development patterns of the urban landscape. Due to the focus on spatial planning objectives, which are common to most European countries, the framework could easily be applied in both between-states and between-cities outcome evaluations.

The results of the spatial multi-criteria analysis revealed a greater distance between objectives and outcomes for Romania than for Switzerland. These observations were attributed to the planning approaches of the two countries and to the different ways in which they deal with landscape preservation and management. The interpretation of the findings was also placed into the wider institutional and legislative context. Although this study did not discuss other factors that have been documented as influencing development patterns, such as social, cultural and economic forces, planning evaluation studies could benefit from explicitly focusing on the interaction of these factors with planning.

Our study contributes to the current debate on the use of spatially explicit data for the purpose of verifying the degree of conformance between intentions and outcomes. As the volume and detail of available spatially explicit data sets are increasing, future research could focus on methodological advances for the integration of GIS and spatial information into the planning evaluation procedure, with a focus on various landscape scales and time series.

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