Pilot Evaluation Report for the Salzburg FUA

Summary reports on the main outcomes of pilot actions and the lessons learnt within, with an outlook to prospective follow-up actions and potential transfer of the results to other areas within the same FUA and beyond.

Authors: RSA iSPACE Team

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1. Activities and outcomes

1.1 Brief summary

The pilot activities conducted in the Salzburg FUA had three important goals:

1. Assessment of the quality of green
2. Identification of regions with good and poor green space supply
3. Determination of priority zones for different green space functions

The main part of the activities, however, was the testing of indicators and indices for the assessment of green spaces regarding their recreational quality in terms of infrastructural and natural attractiveness. Based on the results, the most important green spaces, but also green areas with potential for enhancement could be detected and the supply green spaces provide for the residents was determined. Additionally, priority zones for different usages like agriculture/forestry and ecology have been defined with the help of an evaluation matrix.
During the activities, representatives of the government of the Federal State of Salzburg were consulted in order to be responsive to their wishes and requirements. The results comprise a series of maps starting with basic information about green in the study area (including e.g. land use classes, degree of greenness per grid cell, and location of protected areas). In further steps, these basic inputs were used for the development of more complex maps displaying the quality of green spaces regarding their value in terms of recreational infrastructure and natural attractiveness.
The main goals defined in the Pilot Activity Concept could be reached, although some adaptations regarding analyzed indicators had to be made. Also some additional suggestions from representatives of the administration of the federal state were included.

1.2 Activities performed – What happened in your pilot action?

Most approaches used during the pilot activities comprise GIS-based methods and visualization techniques. The required data mostly were retrieved from OpenStreetMap and SAGIS (the GI system of the federal state) and stored in a geodatabase.
The focus of the pilot actions lies on two different but interconnected analytical parts. The first one comprises a more scientific assessment of recreational areas and all public green space types. This analytical step is based on a number of indicators that were calculated for every green space. Each indicator is assigned to the indices “nature and scenery”, “properties and infrastructure”, and “accessibility”, which group indicators that give information about the same green space value. Indices can be analyzed independent of each other, but for the purpose of this study they were combined to retrieve an integrated recreational value (for recreational areas) and the green quality/recreational potential (for all public green space types). Both integrated values aim at the assessment of the attractiveness of green for visitors, but with different foci. While the integrated recreational value mostly combines natural characteristics and recreational infrastructure, the green quality mainly is based on natural beauty. The assumption is that green spaces that are not designated for recreation despite a lack of infrastructure for most of these areas still can have a recreational potential resulting from their natural properties. In both cases, the results for each indicator were classified with the help of a normalized 5-stage point system to make them comparable. The indices were retrieved by calculating the weighted mean of the assigned indicators. For each index, the results could be divided into five quality levels from low (1) to high (5).
Table 1 and Table 2 show the indicators and indices that were used for this part of the GIS analysis along with their assigned weights used for index calculation.

	Indicator	Classes and normalization (from 1 to 5)	Weighting
Nature and scenery	Relative relief [m]	0-5 / >5-15 / >15-25 / >25-50 / >50	7,5%
	Presence of a water body [y/n]	no / yes	35%
	Tree cover density [%]	<20, >80-90 / >70-80 / >60-70, >90 / 20-30, >40-60 / >30-40	35%
	Share of biotopes [%]	0 / >0-10 / >10-30 / >30-50 / >50	7,5%
	Share of zones with noise pollution [%]	>30 / >20-30 / >10-20 / >0-10 / 0	7,5%
	Share of protected areas[%]	0 / >0-10 / >10-40 / >40-70 / >70	7,5%
Properties and infrastructure	Area size [ha]	<0.1 / 0.1-0.3 / >0.3-1 / >1-2 / >2	12,5%
	Number of different infrastructural features [n]	0 / 1-3 / 4-6 / 7-9 / >9	25%
	Presence of parks [y/n]	no / yes	12,5%
	Presence of playgrounds [y/n]	no / yes	12,5%
	Presence of sports grounds [y/n]	no / yes	12,5%
	Path density [m/ha]	0 / 1-3 / 4-6 / 7-9 / >9	25%
Accessibility	Size of service area in a walking distance of 400m [km²]	<0.2 / 0.2-0.3 / >0.3-0.4 / >0.4-0.5 / >0.5	50%
	Size of service area in a biking distance of 3500m [km²]	<15 /15-20 / >20-25 / >25-30 / >30	25%
	Number of bus or train stops in a walking distance of 400m [n]	0 / 1-2 / 3-5 / 6-10 / > 10	25%

Table 1: Indicators for the assessment of recreational areas

	Indicator	Classes and normalization (from 1 to 5)	Weighting
Nature and scenery	Relative relief [m]	0-5 / >5-15 / >15-25 / >25-50 / >50	5%
	Presence of a water body [y/n]	no / yes	25%
	Tree cover density [%]	<20, >80-90 / >70-80 / >60-70, >90 / 20-30, >40-60 / >30-40	25%
	Share of biotopes [%]	0 / >0-10 / >10-30 / >30-50 / >50	5%
	Share of zones with noise pollution [%]	>30 / >20-30 / >10-20 / >0-10 / 0	15%
	Share of protected areas[%]	0 / >0-10 / >10-40 / >40-70 / >70	15%
	Land cover [class]	0 / 1-3 / 4-5 / 6-7 / 8-10	5%
	Soil quality [class]	1-2 / 3 / 4	5%
Properties and infrastructure	Area size [ha]	<1 / 1-5 / >5-10 / >10-50 / >50	30%
	Number of different infrastructural features [n]	0 / 1-2 / 3-4 / 5-6 / >6	30%
	Path density [m/ha]	0 / >0-100 / >100-200 / >200-500 / >500	40%
Accessibility	Size of service area in a walking distance of 400m [km^2]	<0.2 / 0.2-0.3 / >0.3-0.4 / >0.4-0.5 / >0.5	50%
	Size of service area in a biking distance of 3500m [km^2]	<15 /15-20 / >20-25 / >25-30 / >30	25%
	Number of bus or train stops in a walking distance of 400m [n]	0 / 1-2 / 3-5 / 6-10 / > 10	25%

Table 2: Indicators for the assessment of all public green spaces

The results for the determination of the integrated recreational value and the green quality/recreational value in each case were determined by calculating the arithmetic mean of the index values. Again, the results were divided into five quality levels from low to high. This analytical step also provides the possibility to calculate a weighted average, but for this study, all inputs were assumed to be of equal importance.
Afterwards, the results were used for a network-based green space supply analysis, which aims at the determination of the highest reachable quality level of green from populated grid cells. This analysis is performed by overlaying a 250x250m population grid with service areas of all recreational areas. Service areas were calculated using three different distance thresholds: 400m (average walking distance for all age groups), 1000m (walking distance for mobile persons), and 3500m (biking distance).

The second part of the GIS analysis is more application-oriented and based on requirements of administrative bodies, but it uses important outcomes of the first part. It also comprises the indicator set mentioned above in an adapted form (cf. Table 3 and Table 4), which was developed in cooperation with representatives from the federal state government.

Recreation and infra-structure	Classes and normalization (from 1 to 5)	Weighting
Sports, playgrounds, pic-nic sites	no / yes	0,3
Path density [m/ha]	0 / >0-200 / >200-400 / >400-800 / >800	0,4
Number of different in-frastructural features	0 / 1-3 / 4-6 / 7-9 / >9	0,3

Table 3: Indicators for the assessment of recreation and infrastructure

Ecology and landscape	Classes and normalization (from 1 to 5)	Weighting
Relative relief (height difference) [m]	0-5 / >5-15 / >15-25 / >25-50 / >50	0,11
Presence of a water body [y/n]	No / yes	0,11
Tree cover density [%]	<20, >80-90 / >70-80 / >60-70, >90 / 20-30, >40-60 / >30-40	0,11
Share of biotopes [%]	0 / >0-10 / >10-30 / >30-50 / >50	0,11
Quality of land cover	Scientific assessment schema	0,11
Share of protected areas [%]	0 / >0-10 / >10-40 / >40-70 / >70	0,11
Share of zones with noise pollution [%]	>30 / >20-30 / >10-20 / >0-10 / 0	0,11
Share of habitat corri-dors [%]	0 / >0-10 / >10-40 / >40-70 / >70	0,11
Share of forests with recreational or welfare function [%]	0 / >0-10 / >10-40 / >40-70 / >70	0,11

Table 4: Indicators for the assessment of ecology and landscape

These inputs again are used for the evaluation of green spaces in terms of their recreational value, but also for more complex analyses. After the assessment of each individual area, connected landscape zones and conflicts of use are determined, while the final part of the GIS analysis aims at the development of a landscape matrix, which is used for the identification of priority areas for different usages. These usages along with the applied criteria for their determination are represented by Table 5. This method is used to detect the main function of grid cells based on the type and the characteristics of green spaces they contain.

Priority areas	Criteria	
	Recreational value	Ecological value
Recreation	Good	Neutral
Natural recreation	Present	Good
(High quality) habitat	Not present	Present (good)
Natural risk prevention	Hazard zones and forest with protective function	
Agriculture and forestry	High soil quality and forest with productive function	

Table 5: Criteria for the determination of a landscape matrix

Feedback regarding the pilot activities and mapped results was given during the 1st National Roundtable (19.04.2018 at the offices of the federal state government), the UGB Synergy Workshop (06.07.2018 at GI_Forum, an annual GIS conference held by the University of Salzburg), and an additional meeting with federal state representatives on 10.10.2018. Also regular contact with representatives from the administration regarding possible additional data and other issues like amendments of the maps took place.

1.3 Outcomes - What are the results?

The outcomes of the performed analyses are represented by a series of maps, which is divided into different parts with increasing complexity. The first part includes maps that provide basic information about population distribution, green space types and their location, degree of greenness, and share of sealed surfaces per grid cell. In the next step, information about ecology is represented by displaying protected areas and green corridors. However, the main part of the series consists of maps displaying calculated results regarding green space qualities, supply, potentials, and conflict zones. The matrix of landscape assessment developed as the final part of the GIS analysis is used to define priority areas based on various types of open spaces differentiated by their main function, e.g. recreation, habitat, and economic use.
On this basis, an interactive tool has been conceptualized together with the authorities of Salzburg State. A prototype that includes an online map and functions for querying grid values of preferable land use will be created as a part of the local roadmap for the use in public administration and planning. It will e.g. provide a supporting function to identify the potential of green spaces, important corridors for ecology, recreation, and economy, but also conflict zones.

The annex includes four maps showing some of the results of our pilot. In Map 1, the location of green spaces with recreational value based on their recreational equipment and infrastructure (e.g. number of different infrastructural features like benches, sports fields, or playgrounds and path density) is displayed. It shows that the city of Salzburg maintains a large number of high quality areas, but also a lack of recreational green spaces in most other municipalities is pointed out. The supply study highlights the lack of recreational areas in the regions with rural characteristics, whereas most residents of the city can access a high quality area within a walking distance of 400m. These outcomes are represented by Map 2, which can be used as a demand-oriented basis for planning.
Map 3 shows a proposal for area delimitation along with possible conflict zones based on the adapted indicator set (cf. table 3 and 4). It can be used to detect connected landscape zones and conflicts of use. Furthermore, the map represents the supply of populated grid cells with high quality recreational areas in a 400m walking distance and ecologically important green with a 1000m buffer as a delimitation to settlement areas. The results show that in many cases the presence of areas with a high natural beauty helps to overcome missing areas with good recreational infrastructure. Also valuable green corridors along rivers and mountains could be detected. Especially the southern part of the city of Salzburg can be described as a best practice example since areas with high recreational quality and areas with a good ecology complement each other. A general conclusion of the pilot is the necessity of a better delimitation of core areas of settlement developments for future planning tasks.

Map 4 finally displays the landscape matrix with different priorities of green. It shows important habitats in the countryside and valuable recreational areas with good infrastructure near settlement cores. Also some valuable recreational areas in rural regions, where natural beauty is the key criterion. Also a good economic value of many forests and agricultural areas could be identified.

1.4 Evaluation – Are you satisfied with the results?

The motivation of the pilot activities was to develop a method that helps to overcome the lack of a common system for green space monitoring and assessment in our study area. We tackled this problem by developing an indicator set as part of the draft model that can be used to evaluate different kinds of green regarding their recreational value, ecological properties, touristic potential, etc. A part of this indicator set consisting of indicators with different complexity as defined in the model have been tested during the pilot phase. In order to meet the requirements for our specific use case, an adapted indicator set based on the draft model had to be developed.

Altogether, the pilot activities can be described as successful because they mainly could be carried out in accordance with the steps listed in the Pilot Activity Concept and administrative bodies have great interest in the results. However, the concept states that the main goal is the evaluation of the recreational quality of recreational areas in terms of attractiveness. This has been enhanced by an additional analysis of the green quality and the recreational potential of all public green in the pilot area because most rural municipalities suffer from a lack of designated recreational areas but still contain other green spaces with potential and recreational usage. Furthermore, an analysis of priority zones for recreation and other green space functions as a part of a landscape matrix and an investigation of conflicting interests have been carried out. The map results will be included in the roadmap also in form of an interactive online map to allow for a flexible assessment and generation of priority scenarios as basis for strategic planning decisions. Due to the extension of the pilot activities, the timeline listed in the concept also has been adapted.

During the pilot, we did not face any major problems. However, one challenge was the adaptation of the indicator set for the analysis of priority areas and zones of conflict, which has been performed with input from representatives of the federal state government. Another challenge in some cases was data availability. Unfortunately, some potentially interesting data like locations of lanterns within green spaces (referring to sense of security) or touristic hotspots are not available for the study area. Therefore, some topics could not be included in the indicator set or had to be adapted. According to the application form, iSPACE does not organize stakeholder platforms, but as already mentioned meetings with state administration members were held, which have been helpful for the development of the map series and the indicator set.

Budget table

Costs description	**Budget line** *(external/ equipment/infrastructure)*	***Status*** *1) performance in progress/ 2) performed but not paid/ 3) performed and paid)*	**Final amount of the costs**
Concept creation, collection of data, analysis, calculation, weighting, visualization, coordination with stakeholders, enhancement of indicators	*Staff Costs*	*Performed and paid*	*51000*
		Total costs:	*51000*

2. Follow-up actions

2.1 What about the future?

The outcomes of the pilot activities have the potential to be used as foundations of decision-making processes regarding green space governance and spatial planning. For this purpose, some additional elements could be included to meet some additional requirements of experts from these domains. The sustainable tools are dynamic indicator systems, the series of maps and the partly interactive web application (first prototype: https://ispacevm54.researchstudio.at/UGB_Landscape_Assessment/), which has all been developed and evaluated in close cooperation with the local authorities and other stakeholders and is used for their governance processes. The option to display landscape corridors and identify conflict zones with preferable land use scenarios is particularly appreciated and used as one guideline for elaborating upcoming regional development programmes. The indicator-based evaluation as baseline method is still flexible for potential adaptions like for example the consideration of a close-to-nature recreational value without ecosystem services as a new index value. In general, the tools allow the integration of diverse additional data sets that can be relevant for certain analytical problems. In terms of settlement development issues, population forecasts and estimated distributions, zoning plans for future land use, or housing densification potentials can be added in order to analyse and secure the long-term supply with green areas of good quality in the future or derive useful actions plans. With regard to conflict zones, the integration of special/seasonal land uses like exploitation grounds, skiing slopes, or commercial/touristic use cases can be taken to account. As a summary, the developed methods and tools give planning experts the possibility to assess landscapes, display evaluation scenarios and derive input for construction and development strategies from local to district to regional scale. The landscape index is a first approach to measure the aesthetic and recreational qualities of suburban green areas and may contribute to the introduction of guideline values for high-quality green supply as part of infrastructural assessments in terms of community benchmarks, certificates or special subsidies. The applied methods in general are well transferable to other regions in the national and international context provided that a wide-ranging spatial data infrastructure is available. The cartographic products require a certain expertise in (web-) mapping and geo-visualisation, but under this conditions are easily reproducible in other regions. Both can foster and supply valuable outcomes for spatial planning and strategic development processes and thus build a bridge between the demands and needs of the residents (community involvement) and the decision making processes of authorities (multi-stakeholder governance). Exemplary showcases to underline this schematic process will be elaborated across the project's thematic working groups and play an important in the Smart Governance Manual.

With the help of stakeholder and synergy workshops but also communication events and initiatives new valuable contacts could be made and established partnerships could be strengthened, which in the future will bring the opportunity for follow-up projects and collaborations. With regard to communication activities the green events established a deeper connection to Municipal Services, particularly the Residents' Service Point of the District of Lehen, as well as valuable contacts to graphic design, marketing and journalism offices. Especially the connections to the local newspaper "Stadtblatt" and the nation-wide newspaper "der Standard" can be of sustainable value not only for RSA iSPACE's research activities but also for bringing consciousness of green qualities and nature conservation to a broad public. As a reaction to the articles, a representative of the civic association "Stadtverein Salzburg" visited our office and uses this channel to disseminate the outcomes of the pilot activities in the FUA of Salzburg. With regard to the scientific discourse we made use of synergy building events and partly the round tables and study visits to strengthen the exchange with our partner University in Salzburg and the Center of Geo-informatics as well as other research institutes, consultation offices and enterprises across Austria and its neighbouring countries (e.g. the urban greening office "GrünStattGrau" in Vienna, or the spatial planning department of the "Hochschule für Technik Rapperswil" in Switzerland). Most important for the dissemination of results and outcomes, however, are the local authorities of the Salzburg State government. Although "official" stakeholder meetings are not scheduled in Salzburg, we conducted several workshops to present and discuss our approaches and solutions with them. The dissemination potential is particularly high since they are the responsible authors for strategic development programmes and recommended actions that have an effect on the long-term development of the whole region and thus have strong connections to all local officials and decision-makers.

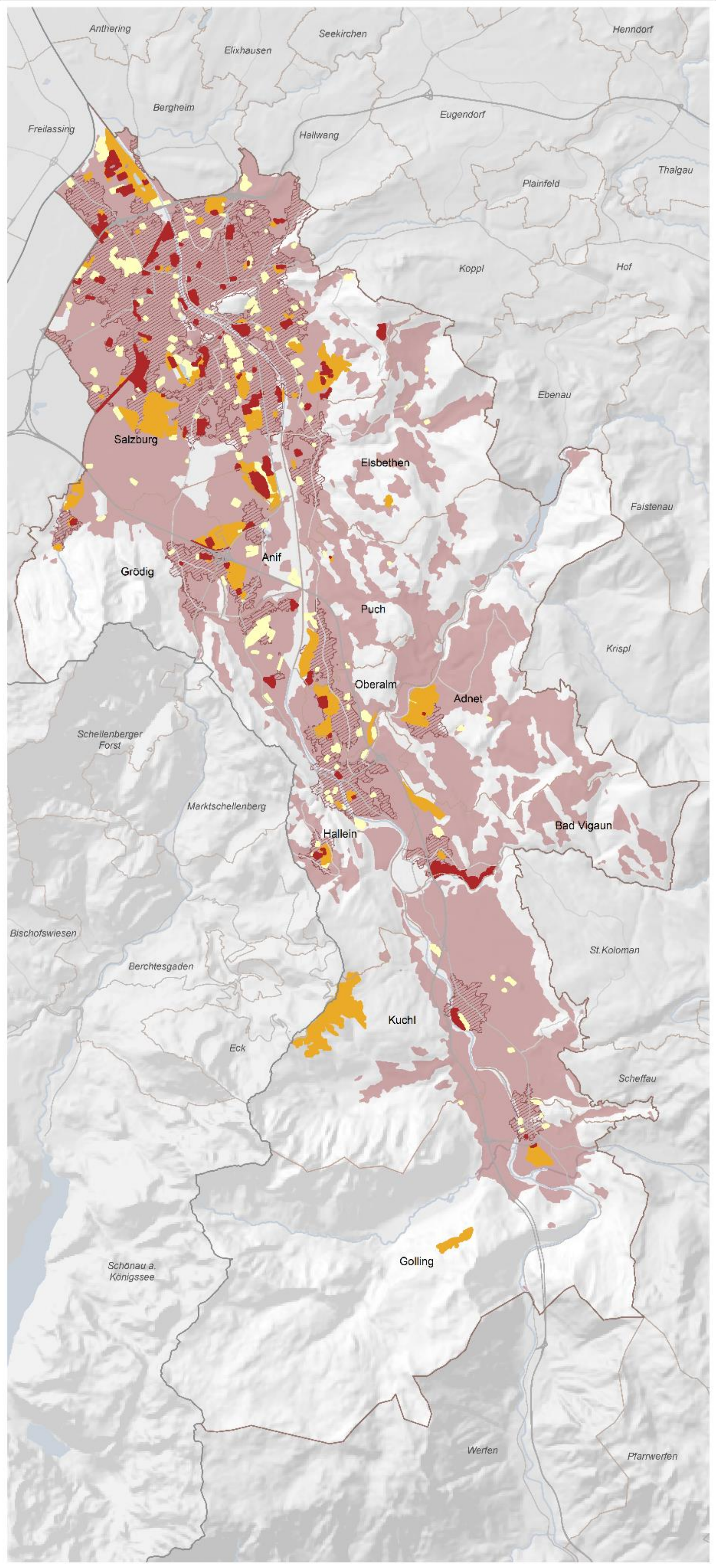
2.2 Lessons learned to upgrade the draft models to “make them smart” – What can be transferred?

During our pilot, we could successfully test the essential part of the model, which is the analytic pillar model and, based on that, the indicator compilation along with its components for the technical application. In the pilot concept we defined the recreational value and green space supply as main analytic goals to be tested with the help of underlying basic and composite information. This concept turned out to be useful, however for non-GIS experts the schematic workflow of the indicator theory and the building process could be difficult. We will upgrade the model with the knowledge that more simplicity and pragmatism in the indicator system design could lead to more constructive results meaning that it often better works out to use few indicators with one target key indicator pointing at one challenge to be solved. In our case, we have defined the two indices “recreation and infrastructure” for the attractiveness pillar and “ecology and landscape” for the sustainability pillar as key indicators with certain benefits in practice. Both key indicators serve as an input for the more complex supply studies and the landscape matrix which basically was triggered by the results of the supply studies and conflict zones. Another amendment would be to highlight the importance of choosing the right spatial scale and reference units (grid cells or polygons) for the indicators which is essential for getting the desired findings.

The indicator compilation defined in the model is generic and cannot be complete but it is, therefore, easily transferable. This means that anybody interested in green space analysis who is familiar with the GIS domain should be able to use it. Of course, always adaptations regarding indicators and key indicators or weights in dependency of analytical goals or data availability have to be made. Furthermore, the analytic pillar model as foundation of the indicator compilation has to be regarded as a framework that can be used as a template to define specifically-targeted indicator systems, but can be enlarged to both, the thematic depth and the horizontal width. We plan to refer to the economic pillar and widen it e.g. by addressing the touristic potential of landscape with (new) indicators in upcoming research and potentially the local roadmap. This flexibility will also be pointed out in the final model.

We will also integrate our and the partners’ experiences with the assessment methodology and technical application to the final model. As TWG leader we want to assess the potential of the model for designing geodata collection, management, analysis, and visualization tools on a transnational level and for using them in the daily routines. Best practice use cases will be presented together with the gained knowledge on how GIS can analyse, assess and measure landscape and thus allow decision support. With regard to the other working groups the use cases can be widened by evaluating demands and needs of the residents as well as potentials and difficulties in green space transformation processes. A good solution then has to be discussed and accepted by the stakeholders to come into implementation. We want to show conceptual workflows as conclusion of the GIS model and hopefully use some jointly elaborated approaches for the roadmap design.

Annex



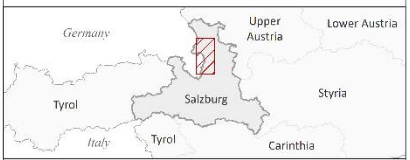
Map 1

Recreational value

Location of green spaces with recreational value differentiated by quality levels based on infrastructural equipment

- High recreational value
- Medium recreational value
- Other zoned recreational areas
- Settlement cores
- Area of permenent settlement

- Bdy Austria-Germany
- Study area
- Municipal bdy (study area)
- Other municipal bdy
- Motorway
- Federal motorway
- State road
- Water



Projection: MGI Austria GK M31

0 2 4 8 km N

Author: Johanna Schmitt, Günter Gruber, Thomas Prinz
Year: 2018
Data sources: BEV, Eurostat, Geoland, LDBV, OSM, SAGIS

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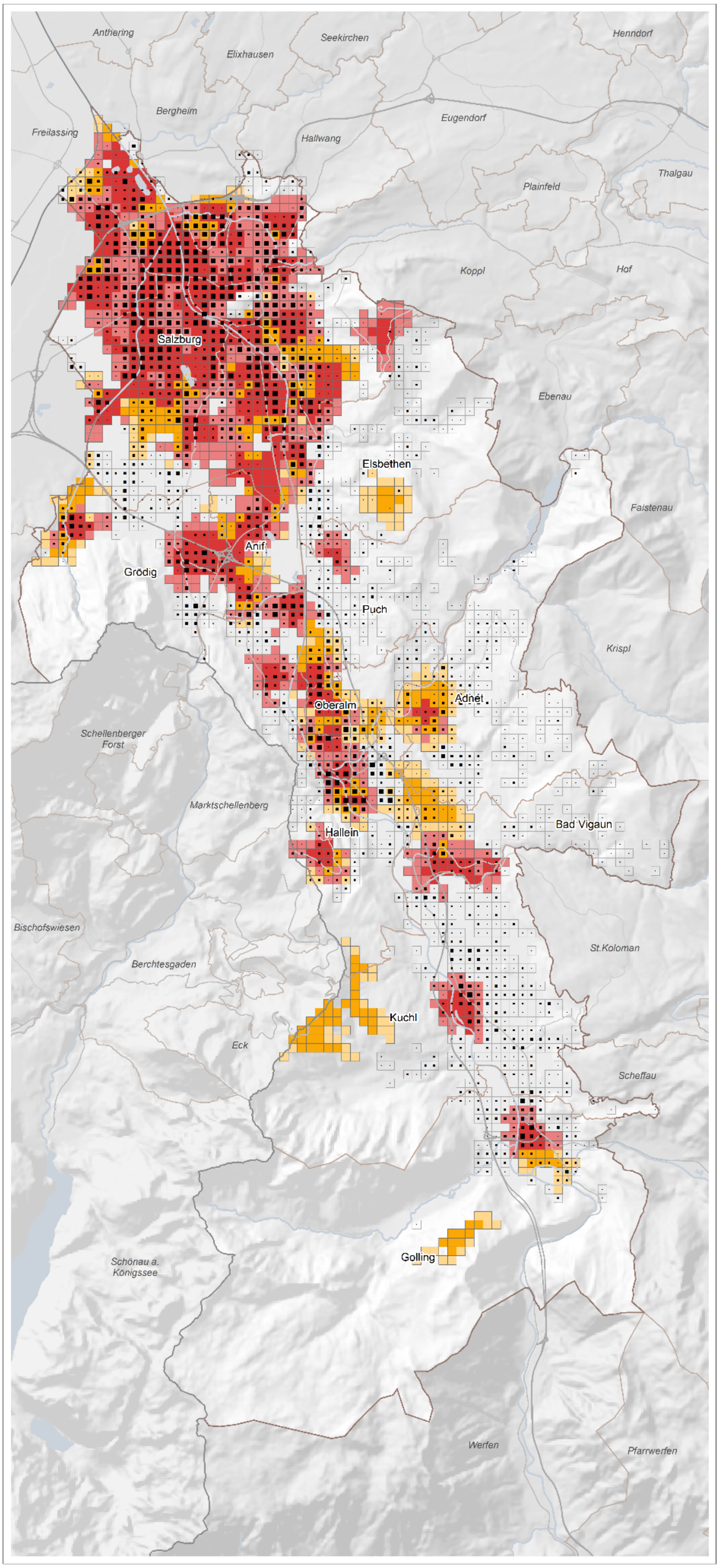

Map 2

Supply with recreational areas of high and medium quality

Supply with recreational areas of high and medium quality per 250m grid cell based on their reachability on the road network

- Good supply (400m walking distance) with areas of high quality
- Medium supply (1km walking distance) with areas of high quality
- Good supply (400m) walking distance) with areas of medium quality
- Medium supply (1km walking distance) with areas of medium quality
- Poor/no supply

Number of inhabitants (1.1.2014)

- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 250
- 251 - 2260

Bdy Austria-Germany	Motorway
Study area	Federal motorway
Municipal bdy (study area)	State road
Other municipal bdy	Water

Projection: MGI Austria GK M31

0 2 4 8 km

N

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Year: 2018

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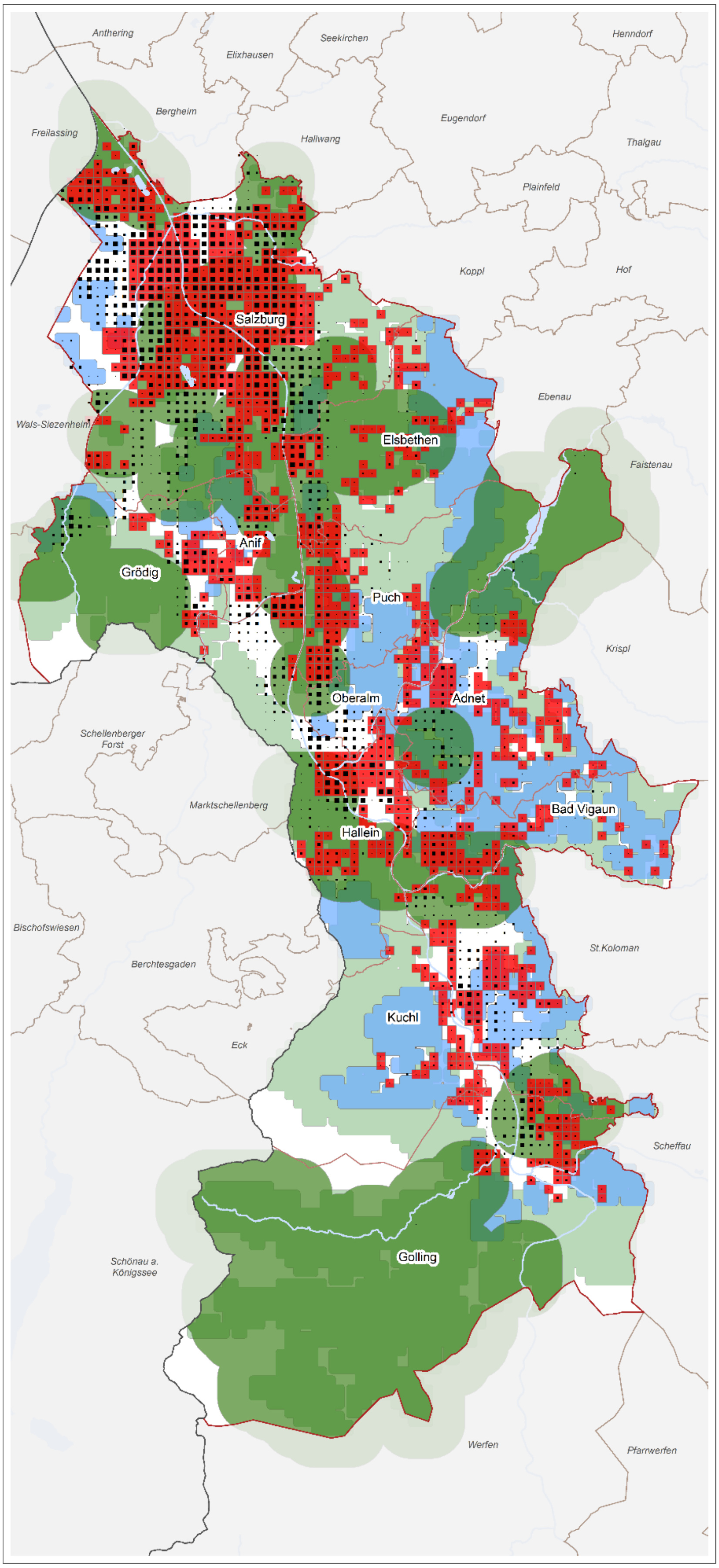
Map 3

Area delimitation and conflict zones



Number of inhabitants (1.1.2014)

- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 250
- 251 - 2260

- High recreational value
- High landscape value
- Agriculture and forestry
- Landscape corridors

- Study area
- Municipal bdy (study area)
- Bdy Austria-Germany
- Other municipal bdy
- Motorway
- Federal motorway
- State road
- Buildings
- Water

Projection: MGI Austria GK M31

0 2 4 8 km

N

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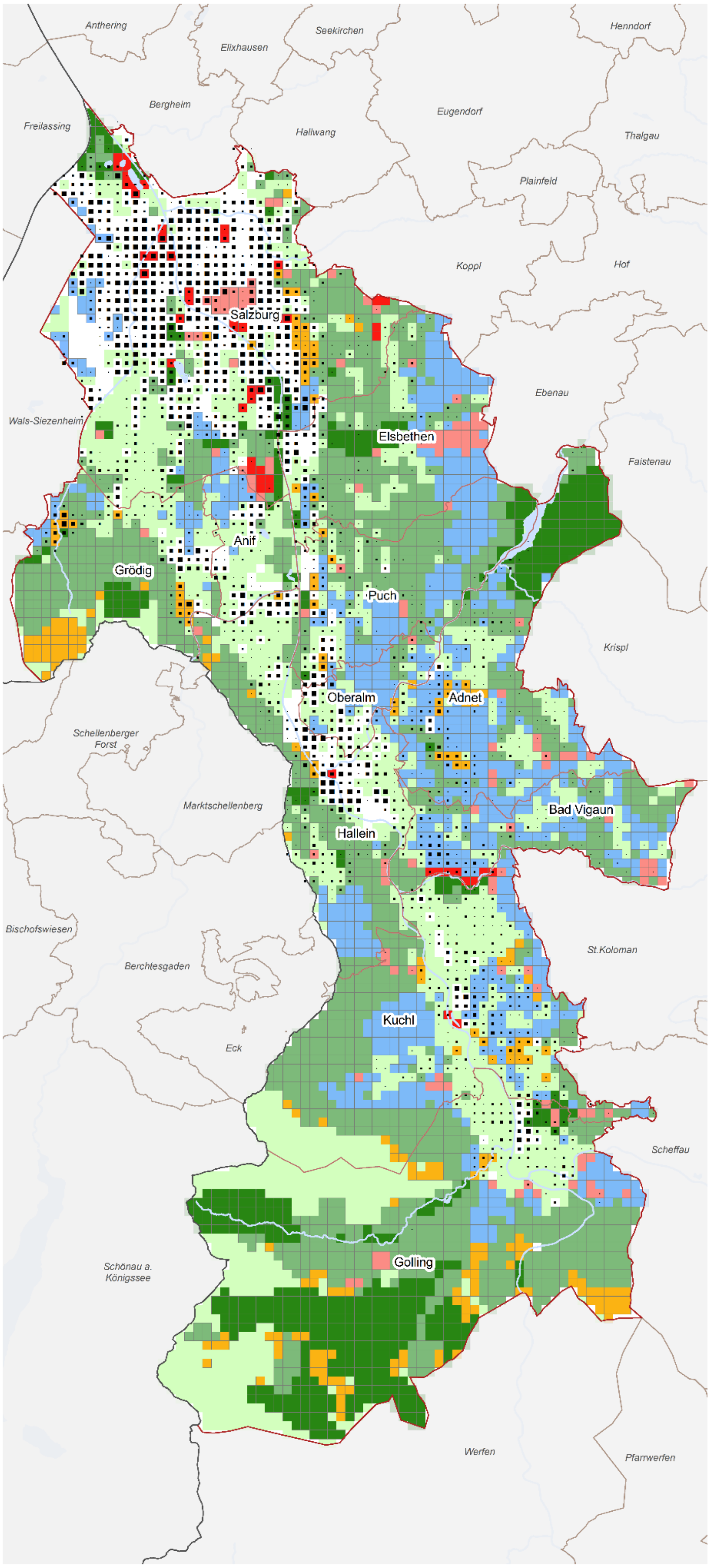
Map 4

Matrix



Number of inhabitants (1.1.2014)

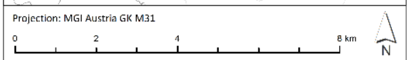
- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 250
- 251 - 2260

Priority areas

- Recreation and leisure
- Recreation and nature
- High quality habitat
- Habitat
- Natural risk prevention
- Economy

- Study area
- Municipal bdy (study area)
- Bdy Austria-Germany
- Other municipal bdy
- Motorway
- Federal motorway
- State road
- Buildings
- Water

Projection: MGI Austria GK M31



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