D.T2.1.1 Pilot Activity Concepts for thematic working group 1- Pilot region Padova

Concepts of pilot actions on GIS-based models in the individual project regions and pilot sites

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1. Background and objectives

Regional specifications will be taken into account in terms of respecting the development goals from local strategies (see local assessment documents) as well as the distinct functions and benefits of UGS that shall be preserved as part of cultural heritage and identification space. Consequently, the clear definition of motivation for the TWG 1 partners' contributions to the smart GIS model will be supplied by defining local challenges, specific problems, and aspired results. GIS-based solutions particularly aim at the design of semi-automated processes to efficiently identify, analyze, and display phenomena on multiple scale levels. Integrative analyses will be conducted with the help of spatial indicators. In order to profit from public or expert knowledge and facilitate the usability, the tools to be designed should contain interactive elements. The choice of the right indicators, appropriate GIS methods, and application strategies is essential for elaborating durable solutions and preserving regional assets alongside a continuous exchange with the associated stakeholders.

After some theoretical foundations, the core of the model introduces a widespread compilation of indicators that are relevant for an integrative green space assessment. However, this indicator system is not supposed to be complete, but covers five analytic pillars that were identified as most important in the context of TWG 1 activities. It is still open for extensions and adaptations for other users. Furthermore, not all potential indicators will be applied in all pilot sites because an effective assessment needs to take into consideration aspects which may differ in every FUA, e.g. existence and quality of data, individual challenges, or benefits to be preserved. TWG 1 members will pick and test their most suitable indicators with appropriate implementation and communication techniques to tackle their challenges. The experiences from these pilot studies will directly be used to ameliorate the model.

Tackled challenges

Padova Team focussed on environmental indicators analysis and dataset. The Municipality owns or manages only 10% of total green spaces. The main challenge is in fact to achieve a significant share of UGS mapped, engaging efficiently other public authorities (multi level approach) and especially private owners, through a wide participatory process. Another challenge is to define a set of indicators able to compare the specific contribution of different typologies of UGS and forecast the potential impact of specific measure. A further goal is to formalise a policy paper for sustainable management of private and public UGS.

Motivation and aspired results

The Pilot Area has been chosen for several good reasons: it is urgent to preserve it and to put in value such "green triangle" in a consolidated and urbanised settlement scheme; it is strategically located, crossing urbanised and rural contexts, as well as two planned urban Parks, establishing a GI at FUA level; the variety of UGS typologies (biodiversity) and functions (Multifunctionality), will allow an effective assessment of both environmental and socio-economic benefits. The main results concern an enhanced GIS model, a predictive indicators set, a wide participatory process and a Policy Paper.

Starting point

Padova Municipality has a well-developed GIS model, including an App used by competent Dept to update it. This model currently counts a variety of indicators: environmental, green, statistical data and environmental accounting methods. As of today, though, qualitative indicators as well as advanced basic indicators are not included in our GIS model. In fact, assessment of both strategic indicators and class types had to be carried out jointly, in view of a consistent GIS model. One of the major concern, in this respect, was how to make the most out of existing data sets, from the one hand, and be able to ensure a periodical data retrieval to populate new indicators from the other.

2. General implementation strategies

In this chapter, the concrete set of methods is described for each pilot region, which in this case is the set of indicators and the implementation and application process. Each TWG member is supposed to choose an appropriate indicator set from the model to face local challenges and work on one or more predefined thematic pillars. Alongside this thematic perspective, the model supplies many useful approaches for the technical side, too (cf. pursuit of logical and technical paths). In order to document the implementation steps in a harmonized way, a logical structure has been designed where every partner indicates the reference parameter and spatial dimension of each indicator in use as well as the corresponding data, metadata, calculation routines and display options. The choice and communication strategies should be motivated in terms of relevance for the stakeholders, especially regarding community involvement and capacity building directly linking to the project's other TWGs. This applies particularly to the key indicators because of their high analytic, descriptive, and integrative value.

Contribution to testing the model

The Municipality of Padova has chosen the Pilot Area on the basis of the strategic assessment of the current GIS model, in view of its overall enhancement, both in terms of predictive function (what it should be able to forecast) and a comprehensive assessment of UGS in our FUA. As of today, only quantitative indicators are there, hence the contribution of the Pilot Activity will be essential as to 1) new data retrieval 2) further elaboration of composite and key indicators. In particular, Padova team along with both universities involved in the SP, could identify and select advanced indicators to be tested. New Basic indicators have been implemented and in general a more comprehensive UGS classification has been introduced. Four key indicators have been identified: Environmental Index, Economic Index, Recreational Index, and Landascape quality Index. A super key indicator will then provide an overall assessment: the Sustainability Index. Composite indicators were selected in accordance with the four pillars described in the Draft GIS Model document: Maintenance, Sustainability, Attractiveness, and Profitability.

Chosen elements of the model

1. Basic *(basic figures mainly needed for inventory aspects or derivation of composite and key indicators)*:
    - Paved surfaces in green areas by permeability [%]

- Number of herbaceous species (in classes 1-3, 4-10, >10) for UGS [n]
- Meadows in Farming spaces FUGS [%]
- Length of Hedges in Farming spaces [m]/[ha]
- Number of municipal trees by species, age, dendometric values, average cost of managing [n]
- Number of private trees by species, age, dendometric values [n]
- Number of Shrubs in private green areas by species, diameter, height [n]
- Length of Hedges in green areas [m]/UGS [mq]
- Number of farmers markets and Direct-to-consumer point of sales [n]

2. Maintenance *(inventory of UGS types, effort and costs for conservation)*:
   - Density of trees in total, public, municipal, private green areas [n]/ [ha]
   - Tree age distribution based in DBH classes in total municipal and private green areas [%]
3. Sustainability *(supply of natural UGS functions)*:
   - Surface of public/municipal /private green area per capita [mq/person]
   - Number of trees in private UGS and FUGS (farming space included) per capita [mq/person]
   - Share of canopy cover in total, public, municipal, private, agricultural green areas [%]
   - Canopy cover per capita in total, public, municipal, private, agricultural green areas [mq/person]
   - Tree species diversity in municipal UGS
   - Tree species diversity in private UGS (farming space included)
   - Number of herbaceous species in classes 1-3, 4-10, >10 in UGS by properties [n]
   - Share of vegetated area (grass or groundcover) in public UGS, private green areas [%]
   - Average distance between green elements of urban/agricultural landscape (tree-lined streets and paths, shrubs and hedges) [m]
   - Number of farmers' markets and direct-to-consumer point of sales per capita and within a walking or biking distance [n]
   - Share of residents per age groups within distance of 300 m from public green areas [%]
4. Attractiveness *(accessibility, usage and satisfaction with UGS, contribution to liveability and quality of life)*:
   - Surface of municipal playgrounds per capita per specific age-group [mq/inhabitant]
   - Share of public/private green areas accessible for people with disability [% /ha]
5. Profitability
   - Share of uncultivated agricultural surface in total farming space [%]
   - Share of agricultural areas in total, public, municipal and in private spaces [%]
   - Average agricultural patch extension [ha]

Input from the local assessment

Both the conclusions of and SP Contributions to Local Assessment have been strategic for the definition of the Pilot Activity. In the first place, the development a specific tool, including quantitative and qualitative

indicators, reporting both environmental, social and economic value of a variety of urban green spaces. Such tool should have also been able to capture the actual state as well as the transformative potential of UGS. Following this analysis, a new set of indicators has been delivered, as well as a more complete UGS classification, enhancing the GIS currently in use by the Municipality. In second place, the lack of and the difficulties to collect data from privately owned green spaces, motivated the development of an App to be used by a wide range of residents, properly engaged and supported. Finally, it has been highlighted the importance of bringing together different typologies as well as different functions (Multifunctionality) of UGS, in particular the crucial role rural areas may play in urban Green Infrastructure development. With this in mind, the south-west area of the City, including the "Basso Isonzo Park", appeared the most suitable pilot area, connecting different macrosystems: green, blue, cultural heritage City Walls and several functions of Green Spaces, such as rural, recreational, historical.

Role of stakeholder platform

The Municipality of Padova, will implement its pilot in a quite wide and significant area: 21 km2 including the prospective "Basso Isonzo Agri-Urban Park", a so called green triangle connecting the urbanised centre with rural peri-urban areas. In view of the Pilot Action, UGB team set up a new Work Group of associations and business located in the area, with a crucial role. The rationale is twofold: on the one hand, have a more operational set up, on the other establish a permanent intermediate body able to interact both with local authority (the Municipality) and Citizens. To do so, it has been necessary to select a smaller group within the SP acting as catalyzer for other entities operating in the Pilot Area. Capitalising the great efforts of the SP, in the first meetings, to shape the area through the Local Assessment and Baseline Study, it was deemed necessary a more agile platform, preferably composed by stakeholders playing already a significant role in the area. It appeared clearly, in fact, that a successful Pilot Action would have been possible only by providing data of private green areas as well, being the great majority of green surface (more than 80%) in our territory.

Potential interconnection with other project activities

Padova Municipality Pilot Action has multiple connections with both TWG2 and TWG3 models. In particular, concerning community involvement techniques and tools, the Action will continue and reinforce the participatory approach carried out by the Municipality, via its Informambiente-Agenda21 Office, for the establishment of the prospective Basso Isonzo Agri-Park, which grows further and beyond the current Basso Isonzo Park (about 600.000Mq2), with an urban (leisure), rural(productive) and recreational (sports oriented) outlook. As far as TWG3 model, a multi-level approach is essential, since the Municipality directly owns roughly 10% of total UGS, another 8% is owned by Regional/Provincial authorities and 2% falls directly under National control. This being said, the largest share of UGS is private-owned, counting almost 80%, half of which is rural.

Evaluation indicators to measure the success of the activities

- Indicators dataset have been populated as to make the new GIS architecture work properly and, consequently, data retrieval has been ensured by periodical updates (on annual basis).
- Private owned UGS data have been successfully collected and uploaded in the GIS database.
- UGS cadastre is open to public consultation (webgis, citizen use).

- Both Apps (public oriented and professional use oriented) are fully implemented and used to update the database.

3. Procedure and schedule

The most important information regarding upcoming reports that deal with the pilot activities is the suitability of the selected indicators for the defined tasks of the individual project partners. Therefore, within every pilot region, the indicators and their results need to be documented. Depending on the expressiveness/value of the result, the indicators should be assessed as suitable or not suitable for the overall goal. Within this context, it is necessary to document changes within the indicator set along with the reasons why these changes have been required (e.g. adding/changing of indicators if some lacks and needs within the already existing set are discovered during the pilot activities). Regarding technical issues, the derivation procedure also has to be documented in a detailed way in order to make it understandable and reproducible for the other partners in the working group. Also any collaborations with external people or institutions like universities and other research facilities plus their importance and additional value for the pilot actions and the final model need to be mentioned within the reports. As a last point, some evaluation indicators need to be defined and documented (e.g. the success of stakeholder platforms in terms of the number of people attending meetings).

The subsequent description of the pilot activity includes detailed descriptions of the following elements:

- **Description of the pilot activities:** Partners need to deliver an overview of the planned activities including their aim and a short description of the required steps
- **Overall measures planned:** Description of the planned execution of the pilot activities answering the following questions: How will the planned activities be conducted? Who will be involved?
- **Individual steps and timeline:** Tabular overview of individual steps along with a timeline, involved internal and external people, locations, necessity of the steps for the pilot action, and costs
- **Outcomes and interdependencies between the individual steps:** Description of the expected results of the individual steps and how/why they are important for the following tasks
- **Additional details:** Additional information like technical descriptions or more details regarding elements from the draft model chosen for implementation

Overall description and aim of the pilot activity

The outlook of our area resembles a lattice around Padova itself, which is the predominant center, where functions and settlements (including productive) have been concentrating. Despite the great residential enlargement started after WWII, it is still possible to recognise a clear centre (where density is constantly decreasing for people is moving in suburban areas) and the radial development system (typical of Roman "consular" system) alongside the main street infrastructures. Green spaces in between (the so called "green triangles") have thus been reducing, but the forward-looking measures introduced back in the 50s aiming at preserving such triangles to function as GI, could mitigate negative impacts and could partially preserve their liveness despite the constant erosion and fragmentation. However, such rural areas have been basically excluded or separately considered when establishing urban plans. We do think though, they shall now fully play, especially in our Region, their important role in GI planning at FUA level, just as UGS do, also in view of urban regeneration processes. The main objective of the GIS based model and the Pilot Activity is to

identify the ecosystemic value of UGS, using both qualitative and quantitative indicators, allowing a comprehensive assessment of economic, social, environmental benefits for the Community implied in GI. As of today, such indicators may not be found in our planning tools. We need to increase the primary functions of UGS if we are to increase our urban ecosystem resilience as well as rethink planning and management processes aimed to regeneration and multifunctionality.

Planned measures

Padova Pilot has been organised around 4 pillars, contributing to a successful action. The joint elaboration of the GIS model and the Pilot Action has been propaedeutic to a systemic software upgrade, which also represent the very starting point of our Pilot. A second pillar, strictly linked to the previous, concerns the development of dedicated software, namely an APP, designed for different target users: professional or public oriented. A third pillar, concerns the communication and training activities, planned with a twofold goal: to enable targeted users to get acquainted and eventually use in a proper way the new tools developed, on the one hand, to disseminate the work done by the Municipality within UGB project activities and the results both expected and achieved so far, on the other. During this phase, a professional Video Tutorial will be produced and posted on the official UGB webpage (http://www.padovanet.it/informazione/progetto-europeo-ugb-urban-green-belts), clearly explaining how to use the APP in view of the territorial gaming. Besides, the Team will be taking advantage, for dissemination purposes, of two national fairs, the first one held in Padova and the second in Rimini. Two more planned events, the TreesFestival in November, the other, to be defined, in October, will also represent a great opportunity to reach residents in the Pilot Area and promote the initiative. A fourth pillar concerns the joint activity with the well established SP and the new constituted Basso Isonzo work group. The right involvement of both, should ensure a motivated participation to the territorial gaming activity, in fact the core of the Pilot. The territorial gaming, the last pillar, concerns both data acquisition and assessment. During this phase, citizens and SP members will collect data, especially on private owned UGS and trees. The SIT dept. will then analyse and elaborate data.

Individual steps

Activity	Delivery Date	Responsible	Involved people	Place	Costs	Purpose
1. Software upgrade	30/11/2017	Municipality-SIT dept.	SIT personnel	Padova		Integration of new indicators and dataset
1.1 WebApplication (Intranet): management of data collection		Municipality-SIT dept.	SIT personnel	Padova	13000	Integration of new indicators and dataset
1.2 WebGIS (intranet): Spatial representation of new dataset		Municipality-SIT dept.	SIT personnel	Padova		Integration of new indicators and dataset

1.3 Android APP: Municipal-ity/Profes-sional user		Municipality-SIT dept.	SIT personnel	Padova		Integration of new indicators and dataset
2. Software de-velopment	30/11/2017					
2.1 Android APP: Open user		Municipality-SIT dept.	SIT personnel	Padova	10000	Data retrieval
3. SP meetings		Municipality-Informambi-ente/Agenda21 Office/Fonda-zione Lanza	UGB Team/SP	Padova		Activity plan-ning/monitor-ing
3.1 SP meeting (Plenary)	10/10/2017		UGB Team/SP	Padova	500	Activity plan-ning/monitor-ing
3.2 Basso Isonzo Work Group meeting	19/10/2017		UGB Team/SP	Padova	100	Activity plan-ning/monitor-ing
3.3 Basso Isonzo Work Group meeting	02/11/2017		UGB Team/SP	Padova	100	Activity plan-ning/monitor-ing
3.4 SP meeting (Plenary)	12/12/2017		UGB Team/SP	Padova	500	Activity plan-ning/monitor-ing
3.5 Basso Isonzo Work Group meeting	05/02/2018		UGB Team/SP	Padova	100	Activity plan-ning/monitor-ing
3.6 Basso Isonzo Work Group meeting	23/04/2018		UGB Team/SP	Padova	100	Activity plan-ning/monitor-ing
4. Communica-tion/training						
4.1 Flormart Fair	21-23/09/2017	PadovaFiere-Municipality	UGB Team	Padova	1500	Dissemina-tion/commu-nication

4.2 Flyer	30/10/2017	Municipality		Padova	600	Dissemination/communication
4.3 Ad hoc public event	To be defined	Municipality-SP	Citizens/SP	Padova		Dissemination/communication
4.4 Ecomondo Fair	07-10/11/2017	Municipality	UGB Team	Rimini	1500	Dissemination/communication
4.5 TreesFestival	21/11/2017	Legambiente	Citizens/SP	Padova	1000	Dissemination/communication
4.6 Video Tutorial	30/11/2017	Municipality	External expertise	Padova	800	Training
5. Territorial gaming	30/05/2018	Municipality-SIT dept.	Municipality SIT dept.	Padova		Indicators update
5.1 Data acquisition		Municipality-SIT dept.	Municipality SIT dept.	Pilot Area		Indicators update
5.2 Data assessment		Municipality-SIT dept.	Municipality SIT dept.	Pilot Area		Indicators update
6. Reporting/Monitoring		Municipality	UGB Team/SP	Padova		
6.1 Study Visit	21-24/11/2017	UGB Team	Zadar, iSpace	Pilot Area		State of play
6.2 Mid-term Pilot status report	30/12/2017	UGB Team	UGB Team/SP	Padova		
6.3 Pilot evaluation report	30/05/2018	UGB Team	UGB Team/SP	Padova		

Outcomes and interdependencies between individual steps

The workflow, mainly on a chronological axis, has been built upon four pillars, which shall contribute to the achievement of multiple though co-ordinated results: software upgrade, software development, SP meet-

ings, communication and dissemination activities and territorial gaming. Individually, each step has a specific goal, e.g communication and dissemination activities aim at reaching the largest public, providing detailed information about the role and engagement of Padova Municipality in UGB project. Besides, this activity is also functional to motivate residents in the Pilot Area to actively participate in the territorial gaming, aiming at data retrieval, essential for a successful improvement of our current GIS model. Data acquisition will only be possible once the software upgrade and development steps have been finalised; still, SP meetings have been planned during this step to constantly update and involve the Platform in all phases. In this regard, activities have been programmed to functionally interact with one another, enabling multiple positioning towards the final goal: an enhanced GIS model and specific tools for a periodical update of the database.

Annex

	DESCRIPTION			Outcome/ Importance for pilot region/ FUA	METADATA		CALCULATION ROUTINE (if required)		Display/ Implementation (Data Layer, GIS model, Web-Viewer, Script)
	Name of the indicator [analytic elements; unit]	Reference parameter	Spatial dimension		Source	Transferability options	Operation	Derivation procedure	
Basic 1	Population: by sex, age groups, nationality [n]	none	object level	Indicates the Population on civic number (age,sex,nationality) and serves as input for composite indicator S1 S2 S3 S4 S6 S13 S16	Own data collection	FUA level	join by attribute	View age_group,sex from demografhic database group by civic number	GIS Data Layer
Basic 2	Water surfaces by typologies [%]	Extent of Pilot area	object level	serves as input for key analysis: environmental index(landscape quality k1 k4	Own data collection	FUA level	Arithmetic operation & Spatial Join	water [m²] / extent pilot area [m²] * 100	GIS Data Layer
Basic 3	Grey Infrastructure by tipologies and properties [y/n]	none	object level	serves as input for composite indicator S15	Own data collection	FUA level	not required	not required	GIS Data Layer
Basic 4	Distance to Cycle Lanes [m]	none	object level	serves as input for composite indicator (<dist) K3	Own data collection	FUA level	spatial join	Distance from UGS entrance to cycle trails	GIS Data Layer
Basic 5	Distance to pedestrian lanes [m]	none	object level	serves as input for composite indicator (<dist) K3	Own data collection	FUA level	spatial join	Distance from UGS entrance to pedestrian trail	GIS Data Layer
Basic 6	Distance to public transport (efficient stops) [m]	none	object level	serves as input for composite indicator (<dist) K3	Own data collection	FUA level	spatial join	Distance from UGS entrance to public transport	GIS Data Layer
Basic 7	Distance to public parking area) [m]	none	object level	serves as input for composite indicator (<dist) K3	Own data collection	FUA level	spatial join	Distance from UGS entrance to public parking area	GIS Data Layer
Basic 8	Distance to Mobile telephone antennae and high, medium and low voltage lines (n. and position) [m]	none	object level	serves as input for key analysis K1	Own data collection	FUA level	spatial join	Distance from UGS entrance to antenna	GIS Data Layer
Basic 9	Acoustic zoning [n]	none	object level	serves as input for key analysis K1	Own data collection	FUA level	Overlay	value zoning for UGS	GIS Data Layer
Basic 10	Urban Green Spaces by functional typologies [mq]	none	Pilot Area	serves as input for composite indicator A1	Own data collection	FUA level	Arithmetic operation by attribute	not required	GIS Data Layer
Basic 11	Paved surfaces in green areas by permeability [%]	Extent no paved UGS	Pilot Area	serves as input for key analysis K1	Own data collection + LIDAR + Cooperation with University	FUA level	Arithmetic operation	Paved[m²] /(UGS area [m²]-paved[m²])* 100	GIS Data Layer

Basic 12	Number playgrounds UGS [n]	none	Pilot Area	serves as input for key analysis K3	Own data collection	FUA level	spatial join	UGS area typology=playground	GIS Data Layer
Basic 13	Number forniture and equipments for UGS [n]	none	object level	serves as input for key analysis K3	Own data collection	FUA level	spatial join	not required	GIS Data Layer
Basic 14	Number of herbaceous species (in classes 1-3, 4-10, >10) for UGS [n]	none	object level	serves as input for composite indicator S10	Own data collection by Cooperation with Univer-sity by Field survey/Di-rect survey		Arithmetic operation	not required	GIS Data Layer
Basic 15	Meadows in Farming spaces FUGS [%]	Extent of Meadows	object level	serves as input for key analysis K1	Own data collection by Cooperation with Univer-sity by Field survey/Di-rect survey		Arithmetic operation	FUGS area [m²] / Meadows[m²] * 100	GIS Data Layer
Basic 16	Lenght of Hedges in Farming spaces per [ha]	Extent of FUGS	object level	serves as input for key analysis K1	Own data collection by Cooperation with Univer-sity by Field survey/Di-rect survey		Arithmetic operation	Hedges [m] /FUGS area [m²]	GIS Data Layer
Basic 17	Number of municipal trees by species, age, den-dometric values, average cost of managing [n]	none	Pilot Area	serves as input for composite indicator M3 S3 S8	Own data collection	FUA level	Arithmetic operation		GIS Data Layer
Basic 18	Number of private trees by species, age, dendo-metric values [n]	none	Pilot Area	serves as input for composite indicator S4 S9	Own data collection by Cooperation with citizens	FUA level	Arithmetic operation	not required	GIS Data Layer
Basic 19	Trees (Green lines) on street , parterres [y/n]	none	object level	serves as input for composite indicator S7	Own data collection	FUA level	Arithmetic operation	not required	GIS Data Layer
Basic 20	Number of Shrubs in private green areas by spe-cies, diameter, height [n]	none	object level	serves as input for composite indicator M4	Own data collection by Cooperation with citizens	FUA level	Arithmetic operation	not required	GIS Data Layer
Basic 21	Lenght Hedges in green areas [m] / UGS [mq]	Extent of UGS	object level	serves as input for key analysis K1	Own data collection by Cooperation with citizens	FUA level	Arithmetic operation	Hedges [m]/ UGS area [m²]	GIS Data Layer
Basic 22	Number of farmers markets and Direct-to-consu-mer point of sales [n]	none	object level	S14	Own data collection by Field sur-vey/Direct survey	FUA level	Arithmetic operation	not required	GIS Data Layer
Basic 23	Share of cycle lanes in green areas (UGS+FUGS) in total lengh of public and municipal cycle lines (%)	Length cycle lines	Pilot Area	serves as input for key indicator K3	Own data collection	FUA level	Arithmetic operation	Length of cycle lines in UGS [m]/Total lenght of cycle lines[m] * 100	GIS Data Layer
Composite									

Maintenance 1	Share of total, public , municipal, private and agricultural green spaces in total areas (%)	Extent of Pilot area	Pilot Area		Own data collection	FUA level	Arithmetic operation & Spatial Join	(UGS area [m²]+FUGS area [m²]) / Pilot area [m²] * 100	GIS Data Layer
Maintenance 2	Density of trees in total public, municipal, private green areas (n/ha)	Extent of UGS+FUGS	Pilot Area		Own data collection	FUA level	Arithmetic operation & Spatial Join	(public trees[n]+private trees[n])/(UGS[m^2]+FUGS[m^2])	GIS Data Layer
Maintenance 3	Tree age distribution based in DBH classes in total municipal, private green areas (%)	none	Pilot Area		Own data collection by Cooperation with citizens	FUA level	Arithmetic operation & Spatial Join	$F_{(trees)}$=n/N*100 (number trees for DBH class) indicator 17	GIS Data Layer
Maintenance 4	Maintenance level (intensive, standard, extensive) of Municipal green surfaces [%]	Extent of UGS	Pilot Area		Own data collection – UGS attribute	FUA level	Arithmetic operation	$F_{(ugs\ maintenance)}=m^2_n/M^2*100$	GIS Data Layer
Maintenance 5	Multifunctional level of UGS by typology and property [%]	Extent of UGS	Pilot Area		Own data collection – UGS attribute	FUA level	Arithmetic operation	$F_{(ugs\ typology\ :property)}=m^2_n/M^2*100$	GIS Data Layer
Maintenance 6	Share of muncipal green areas by management and typologies [%]	Extent of UGS	Pilot Area		Own data collection – UGS attribute	FUA level	Arithmetic operation	$F_{(ugs\ maintenance:typology)}=m^2_n/M^2*100$	GIS Data Layer
Sustainability 1	Surface of total UGS + FUGS per capita (mq/person)	population	Pilot Area		Own data collection	FUA level	Arithmetic operation & Spatial Join	(UGS area [m²]+FUGS area [m²]) / population[n] by indicator 1	GIS Data Layer
Sustainability 2	Surface of public/municipal /private green area per capita (mq/person)	population	Pilot Area		Own data collection	FUA level	Arithmetic operation & Spatial Join	UGS area [m²] / population[n] by indicator 1	GIS Data Layer
Sustainability 3	Municipal trees per capita (n/person)	population	Pilot Area		Own data collection	FUA level	Arithmetic operation & Spatial Joinbasi	Number municipal trees [n]/inhabitancy [n] (Basic indicator 17/Basic indicator 1)	GIS Data Layer
Sustainability 4	Number of trees in private UGS and FUGS (farming space included) per capita (n/person)	population	Pilot Area		Own data collection by Cooperation with citizens	FUA level	Arithmetic operation & Spatial Join	Number private trees [n]/inhabitancy [n] (basic indicator 18/Basic indicator 1)	GIS Data Layer
Sustainability 5	Share of canopy cover in total, public, municipal, private, agricultural green areas (%)	Extent of Pilot area	Pilot Area		Own data collection + Orthophoto + Lidar	FUA level	Arithmetic operation & Spatial Join	Vegetated area [m²] / Total area of pilot site [m²] * 100	GIS Data Layer
Sustainability 6	Canopy cover per capita in total, public, municipal, private, agricultural green areas (mq per person)	population	Pilot Area		Own data collection + Orthophoto + Lidar by cooperation with University	FUA level	Arithmetic operation & Spatial Join	Vegetated area [m²] / Inhabitancy[n] * 100	GIS Data Layer
Sustainability 7	Share of Street Green lines in total grey infrastructure [%]	grey infrastructure	Pilot Area		Own data collection	FUA level	Arithmetic operation	(Lenght of Street Green lines [m]/Lenght of grey infrastructure [m])* 100 by basic indicator 23	GIS Data Layer
Sustainability 8	Tree species diversity in municipal UGS	none	Pilot Area		Own data collection			Basic indicator 17	GIS Data Layer

Sustainability 9	Tree species diversity in private UGS (farming space included)	none	Pilot Area		Own data collection by Cooperation with citizens	FUA level		basic indicator 18	GIS Data Layer
Sustainability 10	Number of herbaceous species in classes 1-3, 4-10, >10 in UGS by properties	none	Pilot Area		Own data collection by Cooperation with Univer-sity by Field survey/Di-rect survey	FUA level	Arithmetic operation	count(*) from basic indicator 14 by property attribute	GIS Data Layer
Sustainability 11	Share of vegetated area (grass or groundcover) in public UGS, private green areas (%)	Extent of UGS (public+pri-vate)	Pilot Area		Own data collection by Cooperation with Univer-sity by Field survey/Di-rect survey	FUA level		Vegetated area (grass and under-cover) [m²] / UGS area(public+pri-vate) [m²] * 100	GIS Data Layer
Sustainability 12	Average distance between green elements of ur-ban/agricultural landscape (tree-lined streets and paths, shrubs and hedges) (m)	none	Pilot Area		Own data collection by Cooperation with Univer-sity by Field survey/Di-rect survey	FUA level	Arithmetic operation & Spatial Join		GIS Data Layer
Sustainability 13	Areas for certified organic food production per capita (ha per person)	population	Pilot Area			FUA level			GIS Data Layer
Sustainability 14	Number of farmers markets and direct-to-consu-mer point of sales per capita and within a wal-king or biking distance [distance to decide]	population	Pilot Area		Own data collection by Cooperation with Univer-sity by Field survey/Di-rect survey	FUA level	Arithmetic operation & Spatial Join	Number of farmer market and di-rect-to-consumer point of sale [n] / inhabitancy [n]	GIS Data Layer
Sustainability 15	Share of interrupted FUGS and UGS	none	Pilot Area		Own data collection	FUA level	arithmetic operation & Spatial Join & Buffer	% Of green and agricultural areas subjected to interruption by inter-section with railways, highways and tangential areas calculated on a buffer of 5 m on basic indicator 3	GIS Data Layer
Sustainability 16	Share of residents per age groups within dis-tance of 300 m from public green areas [%]	population	Pilot Area		Own data collection	FUA level	arithmetic operation & Spatial Join & Buffer	Number of persons living within distance of 300 m from green areas [n] /total inhabitancy [n]*100 (by indicator 1)	GIS Data Layer
Attractiven-ess 1	Availability level of municipal green areas (%)	Extent of UGS	Pilot Area		Own data collection	FUA level	Arithmetic operation	$F_{(ugs\ availability)}=m^2_n/M^2*100$	GIS Data Layer
Attractiven-ess 2	Surface of municipal playgrounds per capita per specific age-group (mq/inhabitant)	population	Pilot Area		Own data collection	FUA level	Arithmetic operation & Spatial Join	Area of playgrounds [mq]/inha-bitancy [n] (by Indicator 13 indi-cator 1)	GIS Data Layer
Attractiven-ess 3	Share of public/private green areas accessible for people with disability (% n/ha)	Extent of UGS	Pilot Area		Own data collection by	FUA level	Arithmetic operation & Spatial Join	$F_{(ugs\ accessibility)}=m^2_n/M^2*100$	GIS Data Layer

					Field survey/Direct survey				
Attractiveness 5	Density of historical elements of the agrarian landscape (intercropping, farming houses, wells, etc.)				Own data collection by Cooperation with University by Field survey/Direct survey	FUA level			GIS Data Layer
Profitability 1	Share of uncoltivated agricultural surface in total farming space (%)	Extent of FUGS	Pilot Area		Own data collection by Cooperation with University by Field survey/Direct survey	FUA level	Arithmetic operation & Spatial Join	Total uncoltivated agricultural areas [mq]/FUGS area[mq]*100	GIS Data Layer
Profitability 2	Share of agricultural areas in total, public, municipal and in private spaces (%)	Extent of UGS+FUGS	Pilot Area		Own data collection by Cooperation with University by Field survey/Direct survey	FUA level	Arithmetic operation & Spatial Join	Total agricultural areas [mq]/ (UGS[mq]+FUGS[mq])*100	GIS Data Layer
Profitability 3	Average agricultural patch extention (ha)	agricultural patch	Pilot Area		Own data collection by Cooperation with University by Field survey/Direct survey	FUA level	Arithmetic operation & Spatial Join	Total agricultural patch areas[mq]/agricultural patch[n]	GIS Data Layer
Key 1	**Environmental index (da sustainability)**			Integrative analysis based on weighted overlay of specific indicators			Weighted overlay		
Key 2	**Economic index (da profitability/maintenance)**			Integrative analysis based on weighted overlay of specific indicators			Weighted overlay		
Key 3	**Recreational index (da attractiveness/fair supply)**			Integrative analysis based on weighted overlay of specific indicators			Weighted overlay		
Key 4	**Landscape quality index (da attractiveness, profitability, sustainability)**			Integrative analysis based on weighted overlay of specific indicators			Weighted overlay		
Key	**Sustainability index (sintesi dei precedenti)**								