Implementing Urban Agroecology in Padova

Geovisualization of territorial change: Digital Earth and Participatory GIS
Master joint degree in Sustainable Territorial Development – Climate Change Diversity Cooperation

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Abstract

This project identifies public green spaces in the municipality of Padova that could be converted in community gardens or food forests following agroecological principles. It is composed of three outputs. First, a short report presents and contextualises the map of the potential community gardens and food forests identified in Padova. Their location is determined according to a set of geographical and socio-economic indicators based partly on the academic literature, partly on successful case studies of community gardens and food forests in other European cities. Second, the located areas are reported on the GeoCitizen platform, so that inhabitants of Padova are made aware of the potential of these locations and can contribute to bringing them to life. Third, a story map brings it all together in a visual and engaging way that describes more concretely and deeply how four of the identified public green spaces of Padova could be used for the development of a community garden and a food forest.

1. Context and aims of the project

a) Urban agroecology

Cities are home to increasingly more people. Today, they house 55% of the world's population. This number is expected to rise to 68% by 2050 (UN, 2018). What Europe concerns, it is one of the most urbanised regions of the world with 74% of the population living in cities (ibid.). In this context, urban agriculture - that is the "production of crop and livestock within cities and towns" - has been receiving growing consideration (Zezza & Tasciotti, 2010, p. 265). It is promoted as a means to enhance cities' liveability, sustainability and resilience through the provision of food, of spaces for recreation and social interaction as well as of ecosystem services to the community (Lin, Philpott, Jha & Liere, 2017, p. 159).

Another, more systemic concept, and practice that has been gaining attention is agroecology. Agroecology opposes corporate agriculture harmful to both nature and people and sees small-scale sustainable agriculture to advance social justice (Toledo, 2019). It relies on crop diversity and the harnessing of natural ecosystem processes to eliminate the need for external inputs such as agrochemicals and promote food sovereignty (Altieri & Nicholls, 2020, p. 2). Because it calls for changes in power relations, it can be characterised as a political practice.

Bringing it together, urban agroecology is the implementation of agroecological principles in urban farming. Accordingly, it operates within the same limits as any form of urban gardening, which are defined by the context of land-scarcity that defines urban areas (Tornaghi & Hoekstra, 2017, p. 3). Despite this, agroecological urban farms can be incredibly productive: 10 sqm can produce 200 kg of vegetables per year, which is enough to cover 55 % of the yearly vegetable needs of a family of five (Altieri & Nicholls, 2019, p. 58). This productivity depends not so much on the characteristics of the site where it is implemented, but rather on managing it in line with the three following principles: enhancing soil quality, crop diversification and insect pest regulation. This means that agroecology can thrive even on small and apparently inhospitable surfaces.

However, it is important to note that urban agroecology goes further than urban agriculture, which often lacks an intrinsic political quality (Anderson, 2017, p. 72). Urban agroecology encompasses ecological, social as well as political purposes. It aims not only for the preservation of the land and mutual learning in the respect of cultural diversity, but also for food sovereignty and a just access to resources (Tornaghi & Hoekstra, 2017, p. 3).

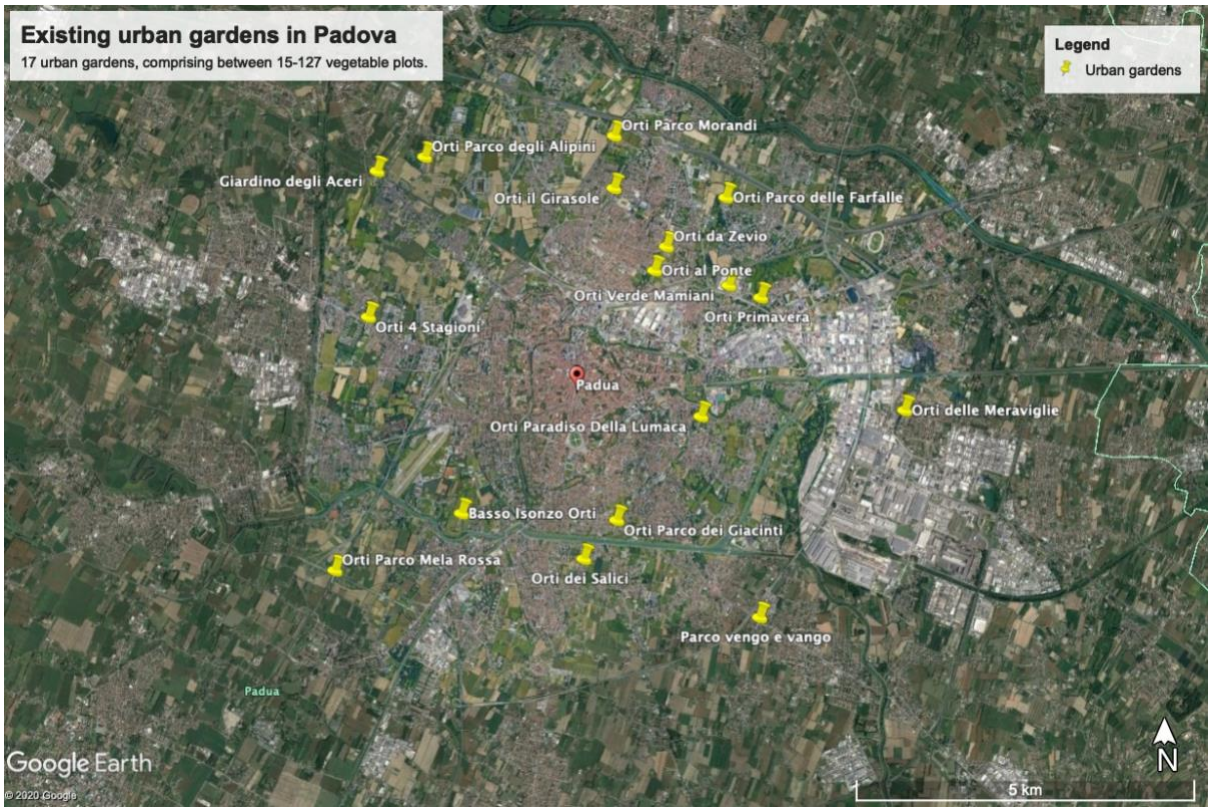
b) Community gardens

Historically, urban gardens emerged as viable food sources during periods of economic stress to assure food security, such as during recessions and periods of War (Burdine & Tylor, 2017). Contemporary community gardens found their root during the First and Second World War in North America, in Europe, for instance in the United Kingdom launched at the time the "Dig for Victory" slogan, to guarantee food safety to the population (Ginn, 2012).

Nowadays, urban community gardens represent one form of urban agriculture to be found in spaces designed, settled, and managed by residents on vacant land. It possibly includes gardens to grow vegetable, play areas. Community gardens are lauded for their capacity to foster diverse communities, engage children and young people in community-oriented projects, and for putting women at the centre of decision-making processes (Yap, 2019, p. 3). They are often located in vulnerable areas and subjected to displacement for commercial use (EPA,2011).

The municipality of Padua has already implemented projects of urban agriculture and community gardens. Referring to the municipality guidelines in the city the public gardens can be used for urban agriculture such as, urban gardens, social gardens, community gardens, therapeutic gardens, and didactic gardens (Comune di Padova, 2019).

Figure 1 Existing urban gardens in Padova. Data of the municipality of Padova



In this context, we seek to underline the importance of allocating more public green areas to community garden options instead of preferring the traditional urban garden use destination. The traditional urban garden (labelled “Orti urbani tradizionali" by the municipality of Padua) indirectly supports an “individualistic” model of gardening assigning the public space to individuals or single families. The community garden option aims to strengthen communities and create resilient communities while giving awareness among communities on topics such as sustainable food production and short food chain suppliers, and solidarity (GreanLeaf Communities, 2012). As stated before, the innovative aspects of community gardens we propose are related to agroecology methods which make it possible to achieve productivity standards while managing the gardens without external chemical output relying on crop biodiversity. In addition, we would like to stress the point of making possible the allocation of green public space among communities through a participatory process coming from inhabitants’ ideas and needs, using geo-participatory tools such as the Geocitizen application which currently works in Padua.

c) Food forests

Another alternative that could be interesting to implement in Padova are food forests. A food forest is a diverse plantation of edible plants that attempts to mimic ecosystems and patterns found in nature. It has the self-sufficient functions of a natural forest while incorporating food plants for human consumption. The result is a semi-natural landscape that requires much less maintenance than row crops, provides habitat for pollinators, insects, and birds, and can accommodate perennial and annual plants. They are composed of several layers of vegetation that extends upwards, downwards, and outwards and occupies all the space (What Is a Food Forest?, 2016).

The food forest is an alternative to more traditional community gardens for engaging citizens. In fact, the composition of food forests awakens a sense of adventure and wonder and is a way of making a wider public aware of its many benefits. Among them is the maintenance of biodiversity by being a shelter for local fauna and flora but also by acting as a genetic bank. In doing so, it also raises the issues of climate and ecosystem degradation and food sovereignty. A food forest also acts as a meeting point and recreates the link between the inhabitants of a neighbourhood (Riolo, 2019).

In the context of global warming, it is also interesting to note that food forests are a very good way to minimize heat islands. Indeed, according to a study on the effects of Land Use/Cover Changes and Urban Forest Configuration on Urban Heat Islands, more varied

forests with more different species, when well selected, would be more efficient than so-called "simple" one-layered forests (Zhang et al., 2017).

d) Why implement it in Padova and where

As previously said, that the Municipality of Padova have urban gardens projects currently underway, we mapped other possible green public space which potentially could become green space benefiting the urban community. Cities are facing environmental challenges, including air and water pollution, heat capture, loss of biodiversity and green areas. In this scenario Community gardens and Food Forest alternatives represent an opportunity to mitigate negative environmental impacts while promoting sustainable agriculture in the urban area. (Heather, 2012)

Community Agriculture and Food Forests are a means to assure food security in many developing countries, implementing the alternatives in a European middle-size city such as Padova would generate advantage as well. The reasons why CA and Food Forest should be taken as a good practice to strengthen and promote within the urban territory of Padova are several. Both the alternatives provide a local source of fresh food, helps to guarantee soil heath and water filtration capacity, reduces neighbourhood waste through composting, and increases surrounding property values. Although the maintenance needed must be ensured constantly by the community, it is estimated to be a low-cost payment. In other words, CA and FF entrench Food Sovereignty patterns while straightening either local biodiversity and micro-climate positive impacts. (EPA, 2011)

In addition, it is demonstrated that being in contact with natural spaces promotes both health and well-being of communities through a balanced diet composed of fruits and vegetable consumption. Gardens can improve economic opportunities by training volunteers and selling or exchanging food. (Victoria Egli, 2016)

Therefore, the implementation of CA and Food Forest in the city of Padova would be suitable to be in building dense neighbourhood and lower-income areas as well. At the same time, the implementation of this kind of project must be integrated with the analytical analysis of the area's quality in terms of geographical features and social-economic aspects which are reported after.

2. Output 1 - Methodology: mapping

a) General considerations

The starting point of the projects was a package of data supplied by the Department of Geography of the University of Padova, which consists in a listing of all the public green spaces in the municipality. This database provides details about the area, the perimeter, and the ownership of each public green space within the municipality. To identify appropriate sites for the implementation of our two urban agroecological alternatives, a series of indicators were designed. These indicators are derived from case studies of successful community gardens and food forests in other European cities, which highlight some features of ideal sites for such projects. Their presence/absence was determined with the help of Google Earth Professional.

The first indicator to be defined was the area to be considered in Padova. Then, additional indicators were developed to determine whether either alternative could be implemented. Indeed, because community gardens and food forests tend to flourish on relatively similar sites, most of the indicators do not discriminate between the two. However, they differ in terms of minimum surface requirements and maximum tree cover. Thus, these two last indicators distinguish areas appropriate for community gardens from those fitting for food forests, which was the last step of this identification process.

b) Cases studies:

Community Gardens:

There is a lack of academic research on the optimal land features for community gardens. However, there are many examples of successful community gardens. Since Padova is a middle-size city of over 200,000 inhabitants with a population density of 2 270,15 hab./km², two examples of community gardens in comparable European middle-size cities are examined.

- **Grüne Beete (Münster, Germany)**

The Grüne Beete is a community garden project that was started in 2013 by students as a campus garden but aspires to be a social meeting point for all the inhabitants of Münster. There, both fruit, vegetables, herbs, and flowers are grown in an ecologically-sound way, be it directly in the ground, in pallets or under a greenhouse. There are no private parcels, and the harvest is shared among members of the community. Additionally, they also have a beehive. Its members describe their garden as a social, political, and cultural center which offers a space for experiences, education and exchanges. This not

only takes place through gardening but also through the organisation of workshops and events (Grüne Beete, 2020).

The garden is situated somewhat out of the historic centre of Münster, on the campus of the university. It covers around 4000 square meters, and has a rectangular shape, with a length of approximately 75m and a width of around 55m. It is bordered by buildings on one length and one width. The other length is bordered by young trees and the other width by a path. There are several dozen parking spots available in a 50meter radius from the garden.

Figure 2 Grüne Beete garden. Source: mapped on Google Earth Pro,2020

- **Huerto del Rey Moro (Seville, Spain)**

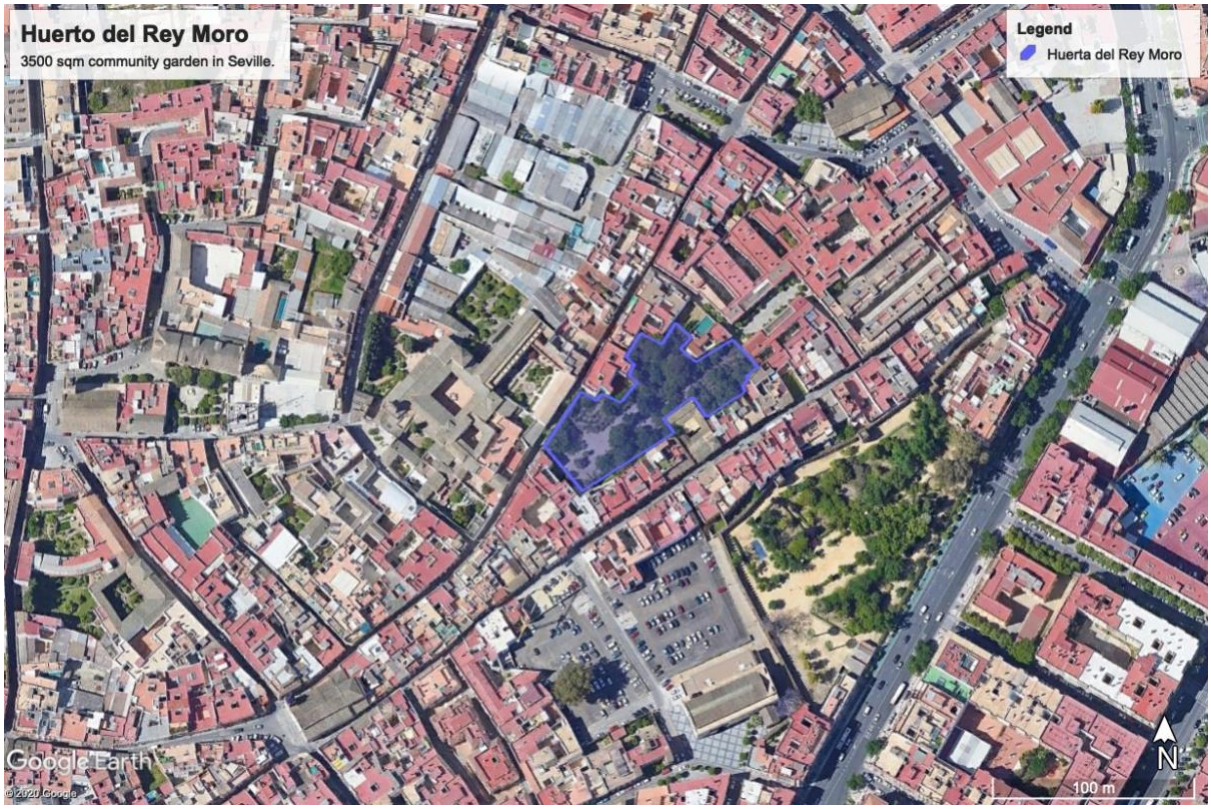
The Huerto del Rey Moro is a community garden run by a neighbourhood-based, self-managed collective. The purpose of the garden is the recreation, health, and social cohesion of the neighbourhood, with urban agriculture as the "binding element of people, ideas, learning and coexistence". On their website (https://www.huertodelreymoro.org/), they express an interest in agroecology. It comprises neighbourhood gardens, an experimental permaculture terrace, a space for the organisation of activities (e.g. environmental activities, communal meals, summer cinema, musical and theatrical performances) and a playground for children, among others (Satorras, Lara & Ruiz-Mallén, 2020).

The garden is situated in the historic centre of the city where it claims to be "the largest public space that is neither urbanized nor commercialized". It covers an area of around 3,500

sqm, of a roughly rectangular shape. On average, it has a length of 100m and a width of 30m. It can be accessed through a street on the length of the garden. Except for that access point, the garden is surrounded by buildings on all sides. The area is basically flat.

The site was occupied and recovered by the neighbourhood from administrative abandonment in 2004 against plans to use the space for new construction of public housing. According to the garden's website, archaeological searches have revealed that the site has been used as an orchard between the 11th and the 17h century. During the last centuries, it was abandoned and changed following the neighbourhood's needs without ever losing its nurturing function (Huerto del Rey Moro, 2020). Since 1985, the site has been protected as an Asset of Cultural Interest.

Figure 3 Huerto del Rey Moro. Source: mapped on Google Earth Pro,2020



Food forest:

The next step is to define the characteristics that would be most suitable for establishing food forests in Padua. To this end, we have analysed the characteristics of two different food forests in urban/ suburban and temperate zones. This allows them to remain comparable with our area of interest.

- **Picasso Forest (Parma, Italy)**

The Picasso food forest is the first example of an urban and public food forest experiment in Parma and perhaps the first in Italy. Launched in December 2012, self-financed by citizens and activists, the project aims to create a public food forest whose fruits will be made available to the citizens of Parma. The inhabitants will be able to study the evolution of this small ecosystem over the years and seasons.

Figure 4 Picasso Food Forest. Source: Google Earth Pro, 2020.

The site covers an area of approximately 4500 square meters and is divided into two rectangles arranged in an L-shape. On the west side, the area is partially bounded by a laurel hedge and on the other by a metal fence. On the east side, it is bordered by a drainage channel and a one-way asphalt secondary road. On the south side, it is bordered by a pavement. On the north side, there is a fence that separates them from the apartment building. The area is essentially flat.

The project was started on a public green space that previously consisted of a lawn mower regularly on a relatively compact site containing some building material residues. The area is located at the border between the city and the agricultural area and has a purely clay soil (Picasso Food Forest, 2019).

- **Veldens Voedsel (Velden, the Netherlands):**

Veldens Voedsel is a project led by a group of citizens who started and maintained the forest garden in the centre of the village. The area where the forest garden is established is about 3000 square meters, and it is municipally owned land. The area is surrounded by houses and the local primary school is located nearby. The project has a core group of four villagers and 15 members. The project was started on a public green space that consisted mainly of grass (Verbeek, 2019).

Figure 5 Map of Veldens Voedsel, food forest

c) Common indicators to identify areas for Food Forest and Community Gardens implementation:

1. **The area circumscription**: The projects should be implemented in areas close to a school to exploit the educational potential of community gardens and food forests for children (Ledant, 2017, p. 33). It could also be interesting to build them in densely populated areas to recreate social links and to facilitate community access to them. It is based on these two characteristics that we have determined an area of interest in which people could benefit from community gardens or food forests.

Figure 6 Areas of interest. Source: data of the municipality of Padova, 2020

2. **Municipality-ownership**: More than being on the municipality, the project would be conducted and supervised in partnership with the municipality. Indeed, the municipality is the right interlocutor for projects of this magnitude. With a view to extending it on a larger scale, perhaps at that time one could imagine using space belonging to the region or the nation. Moreover, we have a meeting scheduled for January to discuss the potential of the project, which shows interest on the part of the municipality. Therefore, it was more judicious to select only the spaces belonging to the commune. Fortunately, the database provided by our university indicated the ownership of the different spaces. So, we selected those under "DENOMINAZI: COMUNE DI PADOVA".

3. **Accessibility**: Simple and secure access by public roads is necessary to implement the alternatives to allow residents to access the site. It is also necessary to have a parking space available nearby to bring equipment or to be able to come by motorized means.

Figure 7 Unselected are for difficult access. Source: mapped on Google Earth, 2020

4. **Perimeter:**

For community gardens, in order to easily connect and have suitable spaces, we determined that a maximum 1/4 ratio of length to width was required. This is because more plots would be in direct contact with each other than on a more stretched lengthwise area. This also allows for the establishment of a central space where infrastructures with a communal purpose (e.g. a common greenhouse) could be built and activities could be organised, which is a crucial factor in building community (Firth, Maye & Pearson, 2011, p. 561).

Concerning the food forests, this ratio is also favourable to its development, especially from the point of view of biodiversity. Indeed, this would allow for the plantation of a wider variety of species of trees and plants because those in the center would benefit from the protection of the more robust trees at the periphery of the food forest as well as a higher temperature. It would also provide a quieter shelter in the center of the forest for wildlife (One Community, 2019). To establish the ratio, we used the following formula, based on basic algebra:

Max(A)=(b^2)/4 b=(2Max(A))^(1/2) Max(P)=5b/2	A= Area b= Length size P= Perimeter

Figure 8 Areas unselected for the unsuitable shape. Source: data of the municipality of Padova

5. **Proximity of other community gardens**: We prioritized spaces that were not close to existing community gardens. This allows a fairer distribution of the benefits of urban agroecology projects among the neighbourhoods of Padova. Moreover, it favours access to this kind of projects by a maximum number of people.

Figure 9 Area unused because close to another urban garden. Source: data of the municipality of Padova

d) Indicators to discern if is suitable to implement Food Forest or Community Gardens in the area:

6. Area: In order to define the surface area needed to establish a food forest or a community garden, we made case studies in similar environments to the one in Padova. We then looked at which area sizes were most suitable for the establishment of the two specific projects.

With regards to community gardens, in the case studies selected in cities of about respectively 300 000 (Münster) and 700 000 inhabitants (Seville), they covered between 3500-4000sqm. However, community gardens can potentially be much smaller, such as the GemeinsamGarten in Konstanz, which is only 400 square meters big. Because the municipality of Padova owns a lot of green areas measuring between 2000sqm and 4000sqm, we chose 2000sqm as the minimum surface for community gardens. As community gardens are meeting places, they should ideally afford enough room to bring people together and become a center for learning and exchange. Community gardens under 2000sqm would have limited room for

community-building. Given our focus on highly urbanised parts of the municipality, we decided to set the maximum surface for community gardens at 6000sqm.

Concerning Food Forests, from the examples we studied, we could see that there are some ranging from 3000 to about 4500 square metres. Nevertheless, in the Netherlands, which is the European country with the most referenced food forests, there are forests that can be as large as 20 hectares (Voedselbossen van Nederland En België, n.d.). As we've seen with the case study of Veldens Voedsel, a Food Forest of 3000sqm requires the involvement of a core group of four people and 15 benevoles. Doubling the size of the project would then require approximately 30 people. As we seek to establish the first food forest(s) in Padua, we will continue to focus on areas smaller than 6000 square metres to keep the space manageable by a small team. Furthermore, from an empirical point of view, there are more examples of forests in these intervals on spaces belonging to municipalities. Larger sites should be reserved for future work once experience is gained on smaller spaces or for professional activities (Verbeek, 2019).

7. Canopy surface: For a community garden to flourish, many crops need long time exposure to direct sun rays. For this reason, we have defined that the surface area of the canopy should not exceed 20% of the surface area (Abucejo, 2020).

Concerning Food Forests, In the examples we were able to study, the forests had started on areas completely covered with grass. Nevertheless, it is possible to start food forests in areas already occupied by trees. To do this, the forest must not be too dense and there must be space so that the other layers of the food forest can be planted. (Establishing a Food Forest in Existing Woods, 2018). As we will be basing ourselves mainly on Digital Earth, we will be basing ourselves mainly on the surface occupied by the canopy. To allow the other layers to flourish because plants need sunlight to grow, the surface area of the canopy should not exceed 80% (One Community, 2019).

Figure 10 area not adopted because of the canopy

8. Proximity to fields: When plots are close to a field, it is important to check that the field is not subject to watering with pesticides or herbicides that could be harmful to the vegetables growing in the community gardens. In order to avoid this, it may be more appropriate to establish food forests instead of community gardens in such areas. In addition, forests could help restore biodiversity in monoculture spaces (Barrios et al., 2017).

Figure 11 not suitable for proximity to pre-existing fild

e) Summary of Indicators

Indicators	Description	FF	CG
Area Circumscription	The green space lies in an area of Padova that is highly urbanised and close to schools.	Yes	Yes
Municipality ownership	The green space is owned by the municipality of Padua.	Yes	Yes
Accessibility	There is public road access and a parking	Yes	Yes
Perimeter	The ratio of the width to length of the plot is equal to or greater than...	1/4	1/4
Proximity of other community gardens	There are urban gardens nearby	No	No
Area	Limits of suitable areas to implement the project	3000 - 6000 sqm	2000 - 5000 sqm
Canopy surface	Proportion of canopy surface to total area	0-80%	0-20%
Proximity to fields	There may be a field nearby	Yes	No

f) Limitations

This methodology presents two major limitations that should be kept in mind for the successful implementation of the project. Two indicators were considered but had to be abandoned given the lack of available data. First, food forests should be developed on healthy soil. Planning to implement a project on ancient brownfield or in contaminated areas asks additional and careful soil testing to ensure of having a non-polluted ground (Mok et al, 2014, p. 37). This could be done by the municipality, but a more participatory approach would be to involve the inhabitants of the neighbourhood in which an area has been identified as fit for a food forest (for the benefits of linking citizen science and agriculture see Ryan et al., 2018). Soil health is less important for community gardens as fruit and vegetables can easily be cultivated in elevated garden beds, as in the example of Grüne Beete.

Second, the implementation of urban agroecology could be prioritised in vulnerable and low-income areas of the city. Indeed, it has been identified as being especially valuable in that context, as it provides a "much-needed supplemental source of food" as well as possibly "skills in collaborative decision-making" that could promote their better insertion on the job-market (Mount, 2017, p. 21). In the absence of data on this variable, we had to exclude it from the criteria used to locate ideal grounds for the project. However, this could be taken into account by the municipality of Padova in deciding which initiatives to support.

3. Output 2 - Storymap

The second output proposed is a story map through which it is possible to refer to contents, and study cases we choose in a visual way while using the storytelling approach. It has been a crucial instrument in order to combine the analytical framework we adopted to choose the suitable site where to implement community garden and food forest project and the qualitative approach we adopt using both study cases and our presence on the territory of the city of Padova.

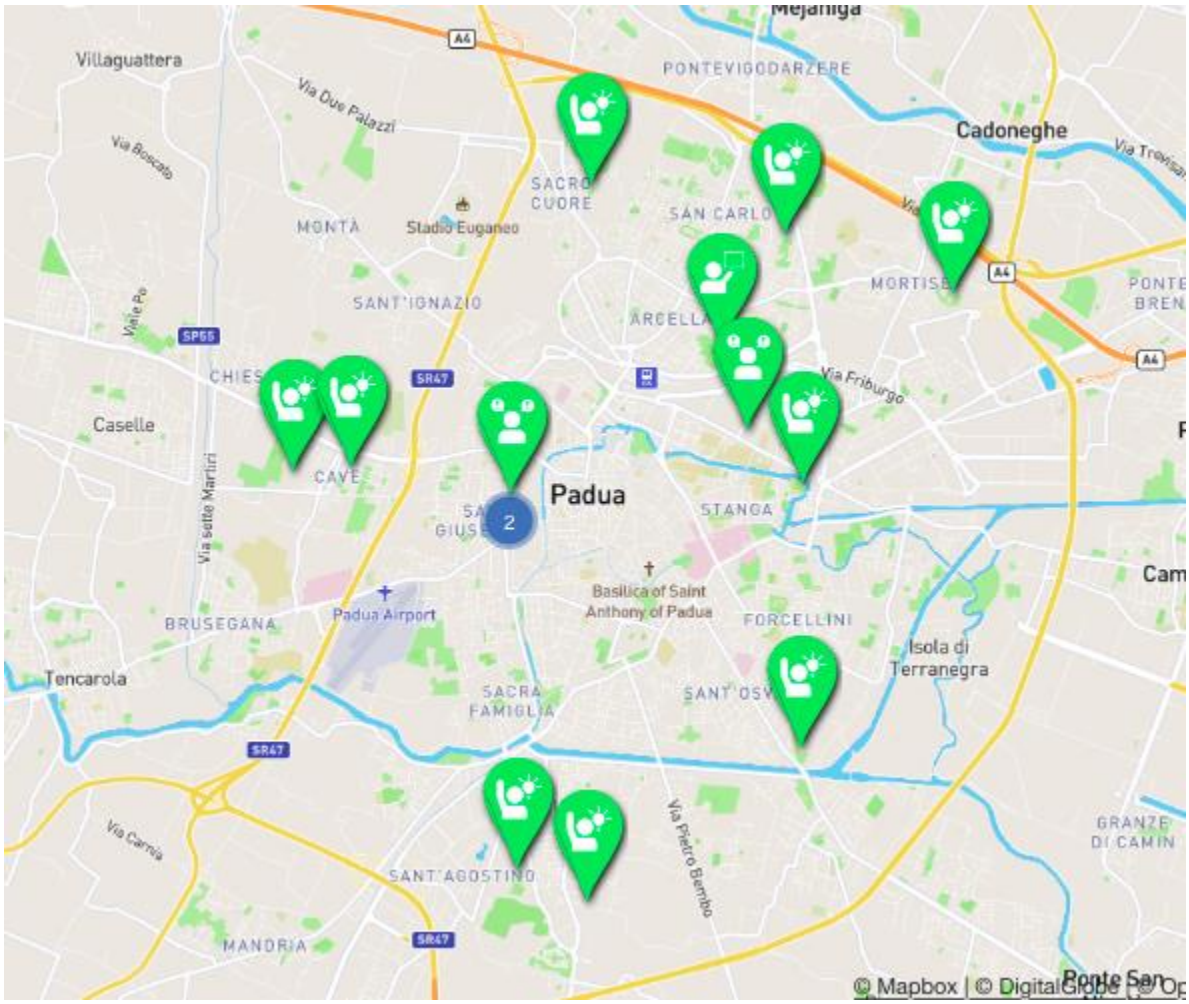
- link to have access to the story map:

https://uploads.knightlab.com/storymapjs/ac591357998a5e0c9d1668db326dc46d/geovisualisation-implementing-urban-agroecology-in-padova/index.html

4. Output 3 - Citizen mapping

The final output of this project is the proposition of the 10 identified areas on the GeoCitizen portal as “ideas” in the channel “Living Urban Parks Padova (LUP)” (https://app.geocitizen.org/lup_padova). The platform is useful to collect data. Moreover, it allows citizens to determine themselves whether there is demand in the area. Thus, it would turn our proposed community gardens and food forests into participatory processes organised around common projects, which is at the heart of community gardens and food forests.

Figure 12 Geocitizen participatory map, 2020



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