



Impacts of Industrialization on Foraging in Peri-Urban Areas. Insights from Padua, NE Italy

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Abstract

Western European societies, ecologies, and economies were significantly impacted by industrialization after WWII. Steadily increasing urbanization and the abandonment of traditional agricultural activities led to a rapid erosion of local environmental knowledge (LEK). We conducted 40 semi-structured interviews in Padua, one of the most industrialized areas of Italy, to identify changes and drivers of change in plant foraging. We documented the use of 56 plant, fungal, and animal taxa, including the most foraged *Humulus lupulus*, *Silene vulgaris*, and *Papaver rhoeas*. These are mainly prepared in risottos, frittatas, and boiled mixtures. During their lifetime, 68% of the interviewees redirected their foraging area, 25% completely abandoned their foraging practice, and 7% abandoned foraging but resumed it after retirement. Changes in the foraging area and foraging abandonment were mainly driven by increased pollution and lack of land accessibility, as well as partially related lifestyle changes and (micro)climate change. In the face of such changes and with the aim of re-establishing the connection between peri-urban communities and their land, some local committees are struggling to take back the unused spaces of the industrial area and prevent future loss of land accessibility and consequent loss of LEK.

Keywords Local ecological knowledge (LEK) · Generational transmission of LEK · Foraging · Urban ethnobotany · Ethnobiology · Wild foods · Industrialization · Padua · Northeast Italy

Introduction

Cultural and practical knowledge of wild plants, animals, and fungi results from human co-evolution with their environment (Vandebroek & Balick, 2012). In recent decades, erosion of such local and Indigenous knowledge systems (LINKS (UNESCO, 2023) or LEK) has led to a rapid loss of biocultural biodiversity (Signorini et al., 2008; Turner & Turner, 2008; Aziz et al., 2022). Industrialization, urbanization and globalization and their embedded cultural processes, such as cultural homogenization and standardization,

are pivotal factors in the decline of local ecological knowledge, practices and beliefs (Aswani et al., 2018).

In Western Europe, global changes over the last century shrank traditional rural societies and ways of life and along with local ecological and botanical knowledge and practices (Signorini et al., 2008). Nevertheless, foraging of wild foods is often persists, albeit transformed and eroded, in several contexts. Foraging has been essential in natural, economic, and political crises (Redžić & Ferrier, 2014; Sardeshpande et al., 2021). However, in most European contexts, gathering wild foods is no longer practiced to guarantee food security but possibly to supplement diets, especially in southern Europe (Pieroni et al., 2023), and as a recreational activity (Sardeshpande et al., 2021; Teixidor-Toneu et al., 2023). Nevertheless, LEK, often held by older people and traditionally passed down to the younger generations orally and visually, is at risk of disappearing (Signorini et al., 2008; Łuczaj et al., 2012).

Ethnobotanical research has highlighted the importance of LEK and foraging practices, especially in rural areas, but there is little similar research on foraging in urban spaces, and what there is focuses mainly how green spaces can

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enhance people's lives recreationally (Sardeshpande et al., 2021). Research on contemporary foraging emphasizes how it contributes to connections with nature and the solidification of social ties through the exchange of knowledge and products, creating a sense of belonging (Poe et al., 2013; Galt et al., 2014; Sachdeva et al., 2018), and supporting sustainability through interactions between local traditions and influences from other cultures, and avoiding clashes with nature conservation issues (Łuczaj et al., 2021). Despite scholars agreeing on an overall loss of LEK related to the harvest of wild plants, in recent years social media has fostered a renewed popularity of foraging (McLain et al., 2014; Sachdeva et al., 2018; Grandjean, 2022). Indeed, a growing number of researchers advocate safeguarding foraging practice from further erosion on the basis of the loss benefits it creates on multiple levels from supporting sustainability goals (Giraud et al., 2021; Paddeu & Roussel, 2022) to diversifying urban landscapes, including green spaces that are beneficial to offset the impact of industrial pollution (McLain et al., 2014).

We identify perceived changes in foraging practices and the uses of wild foods (and medicinal plants) in a peri-urban area of the city of Padua, Northeast Italy. Our specific research objectives were:

1. to document current and past LEK related to foraging (especially plants for food purposes) practiced by people living in an industrial peri-urban area of the city of Padua;
2. to identify local perceptions of the LEK changes and their drivers during the past 50 years.

Finally, on the basis of our results, we propose possible environmental policy trajectories.

Materials and Methods

Study Area

Our research focuses on an area located in Northeast Italy, on the eastern outskirts of Padua (Fig. 1), which we selected because it is one of the most industrialized regions of Italy, hosting over 200 industrial companies (Scartezzini et al., 2021). As of 2021, the Camin and Granze di Camin population numbered 5,321 people (Padovanet, 2023). The area is flat and is bordered by the Bacchiglione River on the South-east and the Piovego River to the North.

The land use of study area remained little changed from 1675 to 1954 (according to registers and recent pictures). The area was cultivated with corn, wheat, and barley. The edges of each field were lined with grape vines grown with the local traditional “a cassone” system (Squizzato & Ravazzolo, 2020). The boundaries of each property and the streets followed the natural landscape and were often bordered by maple, elm, sycamore, and locust trees. Ditches and small canals between different properties provided water for agrarian production and a thriving areas of biodiversity (Squizzato & Ravazzolo, 2020).

We selected the research site because of its rapid industrialization and loss of land access over the last 60 years. In the 1950s, the dream of “progress” fostered the idea that Padua would become a hub of industrial progress for the region. The agricultural landscape was to be turned into an area accommodating many industries that would provide good jobs for the local population (Squizzato & Ravazzolo, 2020).

Therefore, starting in 1950s, albeit with much protest from local citizens, the Paduan countryside was slowly transformed into a sprawling industrial complex. Until the

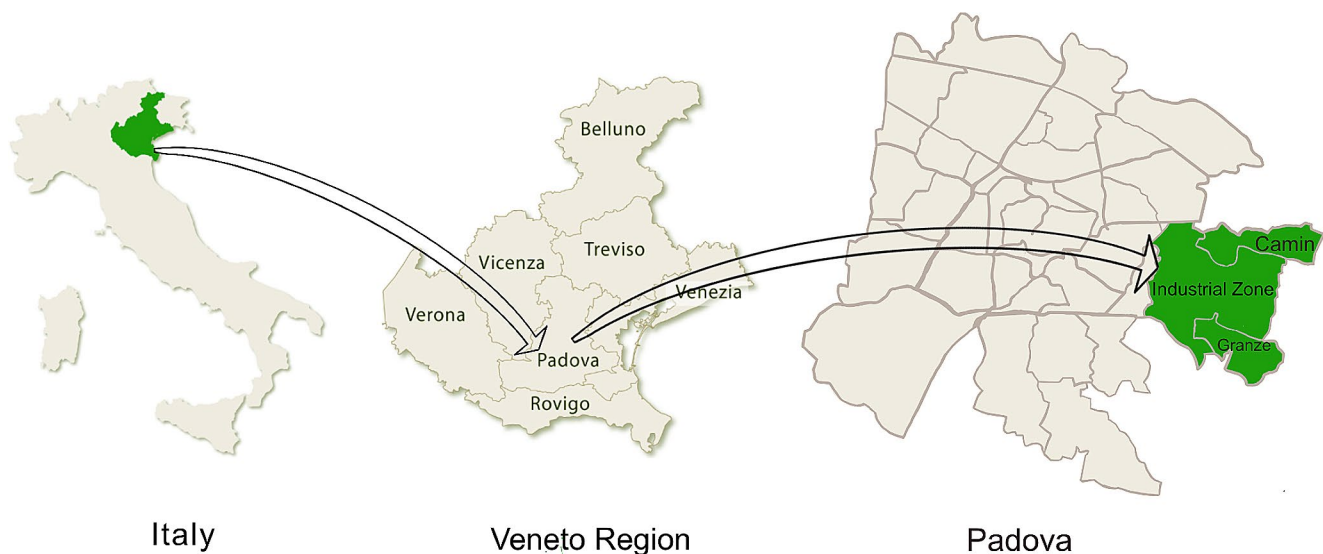


Fig. 1 Map of the study site showing the studied localities in green (map on the right). Design by Corey King

2000s, the project expropriated seven million square meters of agricultural land to build the necessary infrastructure (Belloni, 2017; Squizzato & Ravazzolo, 2020). It is estimated that 800 households, about 3000 people, changed their housing and abandoned agricultural jobs (Squizzato & Ravazzolo, 2020; Squizzato, 2023). The consequent concreting of the area caused the loss of a variety of different landscapes typical of the Paduan countryside, including farmhouses, agricultural fields, meadows, groves of trees and bushes, and a canal.

The “General Guidelines for Government 2022–2027,” approved by the Padua City Council in July 2022, stated that there would be no further land loss and that city should initiate the ecological transition, supporting projects that aim to regenerate the existing urban fabric (Ecopolis Legambiente, 2023).

Methods

We conducted our research in the suburbs of “Camin” and “Granze (di Camin)” surrounding the industrial area of Padua. The interviewees were residents of these neighborhoods for at least 20 years and up to 80 years, mainly elderly people with long-term relationships with the landscape. We did not include younger interviewees as they could not recognize the diachronic changes following the industrialization of the peri-urban area. We recruited interviewees through a post published on the neighborhood page on Facebook, where we explained the project and our research objectives. From the first interviews, we used “snowball” sampling to reach a total of 40 interviewees considered suitable for our ethnobiological research (Parker et al., 2019).

We followed the Ethical Guidelines of the International Society of Ethnobiology during the interviews (International Society of Ethnobiology, 2006). Before the start of each interview, we clarified the project’s objectives and obtained verbal consent for data use. Subjects were anonymized in the study.

The 40 semi-structured interviews took place between July 2022 and February 2023. The skeleton of the interviews consisted of questions about the current and past foraging (including fishing) practices (objective 1; e.g., What do you forage in this area? How do you prepare these products? Do you use them only for food consumption, or do you use some of them for healing? If yes, which ones? In what area do you harvest them?), their changes and the perceived drivers of change in LEK (objective 2; e.g., Over the years, have you noticed any changes in your foraging practice? Why? When do you harvest this plant, and have you seen a shift over the years? How has your collection changed since the industrial area was expanded?

Are you noticing a change in the quantity/quality and variety of choices?). We used free listing to obtain the information on the species collected. The participants were also asked to indicate on a map the past and present areas where they collected wild edible products. The interviews lasted approximately 15 to 50 min, with an average duration of 25 min and were conducted in Italian and the local Venetian dialect.

With the interviewee’s consent, the first author recorded the conversation, which was later transcribed. The data collected from the interviews were organized in a Google Sheet database according to topic. We managed the foraged species by scientific name. The species/taxa were identified through the local names and descriptions of the interviewees, and were verified in the online taxonomic databases Plants of the World Online for the plant species, Mycobank for the fungi, and International Union for Conservation of Nature (IUCN) for animal species. In another sheet, we organized the narratives relative to the changes and the drivers of change in foraging.

Results

Current and Past LEK Related to Foraging in a Peri-Urban Area of Padua

Fifty-six taxa from 38 different biological families are collected in this area; 43 belong to the plant kingdom, eight to the animal kingdom and five to the fungi kingdom (Table 1).

The most foraged plants are *Humulus lupulus*, *Silene vulgaris*, and *Papaver rhoeas*. The most well-represented families were Asteraceae (8). The preparations of these products remain unvaried between subjects and over time. The main preparations are “risotto” (rice cooked in stock), “frittata” (an Italian dish made with fried beaten eggs, resembling an omelette), “verdura cotta” (boiled greens), and “fritta in pastella” (fried after being dipped in a batter, usually made of flour and eggs). All participants indicated springtime is the primary time for foraging these products. During spring and fall, fruiting bodies of mushrooms are highly appreciated.

Ten participants indicated the use of some plants for medicinal use, albeit very limited. *Matricaria chamomilla* and *Urtica dioica* are the most mentioned. A 75-year-old male, recounts:

Nettle (*Urtica dioica*) kills lice [aphids] on roses; you don’t boil it but macerate it. After four to five days, it kills the lice; you spray it on the plant.

According to the participants, collecting these wild foods is an enjoyable experience, an occasion to spend time with

Table 1 List of foraged species in Granze and Granze di Camin

Common name (Taxon – Family)	Local name	Part(s) used	Local uses	Quotations
PLANTS				
Chives (<i>Allium schoenoprasum</i> L. – Liliaceae)	Erba cipollina	Aerial parts	Frittata	10
Common mugwort (<i>Artemisia vulgaris</i> L. – Asteraceae)	Artemisia	Aerial parts	Grappa flavouring	1
English daisy (<i>Bellis perennis</i> L. – Asteraceae)	Pratoline	Flowers	Salad	1
Fat hen (<i>Chenopodium album</i> L. – Amaranthaceae)	Farinello	Leaves	Raw, sautéed, boiled	1
Common chicory (<i>Cichorium intybus</i> L. – Asteraceae)	Cicoria	Young aerial parts	Boiled	2
Hawksbeard (<i>Crepis</i> spp. – Asteraceae)	Radichietta	Leaves	Boiled	2
Perennial wall-rocket (<i>Diplotaxis tenuifolia</i> (L.) DC. – Brassicaceae)	Rucola selvatica	Leaves	Salad	8
Field horsetail (<i>Equisetum arvense</i> L. – Equisetaceae)	Equiseto	Aerial parts	Infusion, decoction for plant growth	1
Ground-ivy (<i>Glechoma hederacea</i> L. – Lamiaceae)	Edera terrestre	Aerial parts	Raw, seasoning	1
Jerusalem artichoke (<i>Helianthus tuberosus</i> L. – Asteraceae)	Topinambur	Rhizomes	Boiled	1
St. John's wort (<i>Hypericum perforatum</i> L. – Hypericaceae)	Iperico	Flowering aerial parts	Perfuming agent	1
Common hop (<i>Humulus lupulus</i> L. – Cannabaceae)	Bruscàndolo/ Bruscàndolo	Shoots	Risotto, frittata, savory pie	34
Common mallow (<i>Malva sylvestris</i> L. – Malvaceae)	Malva	Flowering aerial parts and roots	Infusion. Used as an expectorant. Roots in a decoction added to semolina to treat cow mastitis.	8
Chamomile (<i>Matricaria chamomilla</i> L. – Asteraceae)	Camomilla/ Camomila	Flowering tops	Infusion for relaxation or stomach issues.	10
Field poppy (<i>Papaver rhoeas</i> L. – Papaveraceae)	Rosola/Ròxola/ Piattello	Young leaves	Boiled and then sautéed. Intestinal cleansing agent	31
Lichwort (<i>Parietaria officinalis</i> L. – Urticaceae)	Parietaria	Leaves	Sautéed or boiled	1
Narrowleaf plantain (<i>Plantago lanceolata</i> L. – Plantaginaceae)	Piantaggine	Leaves	Raw, sautéed	1
Common purslane (<i>Portulaca oleracea</i> L. – Portulacaceae)	Portulaca/Erba Porseara	Leaves	Risotto	10
Primrose (<i>Primula vulgaris</i> Huds. – Primulaceae)	Primule	Flowering tops	Salad	1
Black locust (<i>Robinia pseudoacacia</i> L. – Fabaceae)	Fiori di robinia/ Fiór de rubina	Inflorescences	Fried. Infusion for respiratory issues.	21
Garden sage (<i>Salvia officinalis</i> L. – Lamiaceae)	Salvia	Leaves	Aromatics	1
European elder (<i>Sambucus nigra</i> L. – Adoxaceae)	Sambuco	Inflorescences	Fried, syrup or gelatin	4
Salad burnet (<i>Sanguisorba minor</i> L. – Rosaceae)	Pimpinella	Leaves	Seasoning	1
White campion (<i>Silene alba</i> Muhl. ex Rohrb. – Caryophyllaceae)	Orecchie di Lepre/Rece de lievore	Young leaves	Frittata or soup	4
Bladder campion (<i>Silene vulgaris</i> (Moench) Garcke – Caryophyllaceae)	Carletti	Young aerial parts	Risotto, frittata, savory pie	33
Sow thistle (<i>Sonchus</i> spp. – Asteraceae)	Crispigno	Leaves	Raw, sautéed, boiled	1
Common dandelion (<i>Taraxacum officinale</i> F.H. Wigg. – Asteraceae)	Tarassaco/Dente di leone/ Pissacani/ Pissacàn	Leaves and root	Salad or boiled. Roots in decoctions for liver support.	29
Bigleaf linden (<i>Tilia platyphyllos</i> Scop. – Malvaceae)	Fiori di tiglio	Flowers	Infusion for respiratory issues	1
Meadow salsify (<i>Tragopogon pratensis</i> L. – Asteraceae)	Barba di becco	Young shoots	Salad, boiled	1

Table 1 (continued)

Common name (Taxon – Family)	Local name	Part(s) used	Local uses	Quotations
Common stinging nettle (<i>Urtica dioica</i> L. – Urticaceae)	Ortica/Ortriga/Otriga/Artriga	Leaves	Risotto, soup, macerated preparations. Infusion for the digestive system and maceration for removing lice/aphids from roses	15
Common cornsalad (<i>Valerianella locusta</i> L. – Valerianaceae)	Scarseette/Valerianella	Young aerial parts	Salad	12
Sweet violet (<i>Viola odorata</i> L. – Violaceae)	Violette	Flowers	Salad, risotto	2
FUNGI				
Field mushroom (<i>Agaricus campestris</i> L. – Agaricaceae)	Prataioe/Pradariòl	Fruiting body	Sautéed	2
Honey fungus (<i>Armillaria mellea</i> (Vahl) P. Kumm. – Physalacriaceae)	Chiodini	Fruiting body	Sautéed, risotto	12
Poplar mushroom (<i>Cyclocybe aegerita</i> (V. Brig.) Vizzini - Strophariaceae)	Pioparelli/Pioparei/Pioppini	Fruiting body	Risotto, sautéed	16
Morel (<i>Morchella esculenta</i> (V. Brig.) Vizzini – Morchellaceae)	Spugnola/Sponxòlo	Fruiting body	Sautéed	3
Oyster mushroom (<i>Pleurotus ostreatus</i> (Jacq.) P. Kumm. – Pleurotaceae)	Sbrise	Fruiting body	Sautéed	10
ANIMALS				
Black bullhead (<i>Ameiurus melas</i> R. – Ictaluridae)	Pése gato	Whole fish	Fried	2
European eel (<i>Anguilla anguilla</i> L. – Anguillidae)	Bisàto	Whole fish	Fried	1
European carp (<i>Cyprinus carpio</i> L.- Cyprinidae)	Carpa/Raina/Rumatera	Whole fish	Fried	1
Northern pike (<i>Esox lucius</i> L.- Esocidae)	Luccio	Whole fish	Fried	1
European perch (<i>Perca fluviatilis</i> L.- Percidae)	Gobeti/Gobi	Whole fish	Fried	2
Common frog (<i>Rana temporaria</i> L.- Ranidae)	Rana	Legs	Fried	2
Rudd (<i>Scardinius erythrophthalmus</i> L.- Cyprinidae)	Scardola/Scardolon/Scardoette	Whole fish	Fried	1
Tench (<i>Tinca tinca</i> L.- Cyprinidae)	Tinche/Tenche	Whole fish	Fried	2

others and a way to connect to nature. Self-provisioning is regarded as fun, nutritious, resourceful, empowering, and often related to tradition, territory and cultural identities.

Seventy-two per cent of the interviewees forage with family and friends, while the remainder prefer to forage alone. However, the consumption of foraged products is something that is regarded as a community or family event. Four participants mentioned the April, 25th (a national Italian holiday) as a significant date to forage *Humulus lupulus*. During this day, the participants describe gathering with their families and friends, foraging for wild herbs, cooking specifically “frittata with bruscandoli (*Humulus lupulus*),” and sharing a meal along the riverbank.

Eighty-two per cent of participants began foraging under the age of 10. All participants indicated that this knowledge was passed down to them through family members, women being the primary knowledge holders. The vicinity of the territory is paramount in passing down this knowledge and the ability to forage these wild foods.

Locals’ Perceptions of the LEK Changes and Their Drivers over the Past 50 Years

Nearly two-thirds (68%) of the interviewees have continued their foraging practices, although they have had to relocate their search areas. Most also described how foraging was carried out in the past as a necessity but currently is practiced more as a leisure activity. Lack of time is also a significant factor affecting their foraging practices. One-quarter of the interviewees completely abandoned their foraging practice because of the loss of land and the increased pollution of the area. A focus group with four participants [held in Padua, January 2023] explained that it is easier and better for them to purchase goods at the grocery store since “the soil is no longer good”. Traditionally, foraged products like *Papaver rhoeas* and *Silene vulgaris* can now be found on supermarket shelves, indicating how these goods are considered a highly valuable part of the local culture.

Seven per cent of the informants abandoned foraging practices during their working years but started again later in life:

“By the time I was 8–10 years old, many uses of these plants had been lost. Then I was very busy at work ... from forty-forty-five years old, I had more time and curiosity to resume this practice.” (F.M., a 71-year-old female.)

The results were mixed when we asked interviewees whether they were sharing and teaching their knowledge to others. A focus group with four participants shared the sentiment: “Young people are bred chickens.” Most mentioned how the younger generations might enjoy the dishes prepared with the foraged ingredients but have little to no interest in learning the skills and knowledge linked to the collection of the products. Nevertheless, four participants also shared how foraging practices and dishes prepared with foraged products are receiving renewed attention by being mentioned on the media like radio programs and the television program “Masterchef”:

“Now you even see on Masterchef that they make French frog risotto, but I used to make it too.” (A.M., a 75-year-old male,).

The interviewees reported three main drivers of changes affecting foraging: industrialization (including loss of land accessibility, increased pollution/contamination), change of lifestyle, and climate change (Fig. 2).

First, accessibility to the areas once used for foraging is currently occupied by warehouses and infrastructure

(Figs. 3 and 4). Indeed, a group of interviewees described the difference in the foraging landscape:

“A time ago, it was enough to leave the house, and you could find everything; the countryside was everywhere, no need to go so far.” (F.M., a 71-year-old female.)

“It was tremendous; it’s even more tremendous now that so many of them (warehouses) closed. So, to know that that land underneath was a field feeding a family is an immense sadness. How much despair there was. Now, there is still despair because little untouched soil is left. After all, they give poisons everywhere.”

The increased pollution that the area is experiencing is driven by industrial production, transportation, and lack of proper waste management. All the interviewees have noticed the effects of pollution from industrialization and climate change on the territory.

, explained:

“Now, too many trucks, too many fumes. You have to be careful to go to places where you know it is clean. If they grow along the road, they don’t get picked up because of the exhaust fumes.” (N.T., a 77-year-old woman.)

For this reason, participants have avoided altogether foraging in the areas close to the roads and have indicated a

Fig. 2 Relations between changes in foraging and their drivers, according to the peri-urban interviewees. The number of interviewees who mentioned each driver is put into brackets

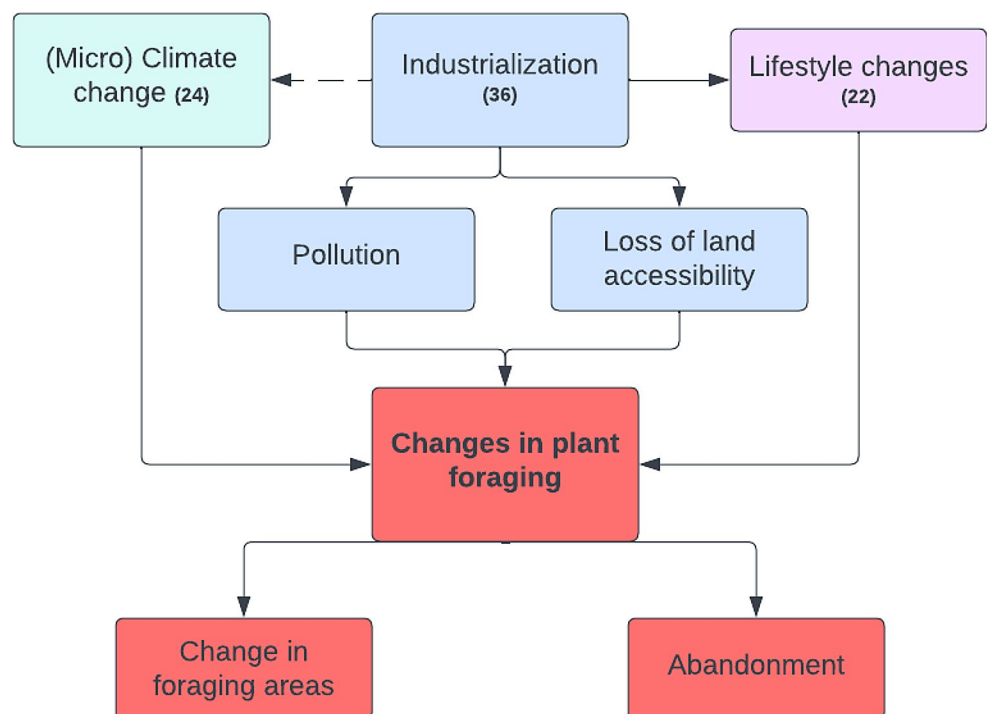


Fig. 3 Present and past areas used for foraging - Google Maps. Purple areas represent areas foraged in the past, while yellow areas are currently foraged





Fig. 4 The area where the new supermarket is planned to be built. Modified from Ecopolis Legambiente (2023)

perceived change in the quality and quantity of the foraged goods. Industrial pollution and the use of herbicides by city management and agribusiness were potential reasons for the limited growth of some foraged items and the loss of biodiversity.

said:

“I used to catch frogs in the evening and take them to my aunt. I used to catch seventy-eighty a night. Now, there are none. The waters were pure. Because the frog lives in clean water.” (A.M., 75-year-old male.)

The same interviewee also mentioned the disappearance of fish. He described fishing “by hand” and “pulling up buckets of them,” but now “there is nothing left.” Pollution and the redirection of streams in the area have halted this practice.

Second, the inhabitants of Camin and Granze di Camin profoundly changed their pace of lives. The hectic lifestyle currently being experienced leaves a limited amount of free time to spend in the kitchen and less time available to search for, collect, and preparation of foraged goods. Most informants cited lack of time as the leading factor for not conducting searches and harvests.

“You have to have time. I see so many retired people who go because they have time. I would have to go in a hurry.” (A.T., 58-year-old female.)

They described how often the foraging and cleaning of the products is more time-consuming than cooking them:

“Who has time to wash them? They are a lot of work. Now you can buy them from the market, and they are already a little clean.” (S.T., a 62-year-old woman.)

Lack of time has also affected interpersonal relationships, thus reducing opportunities to socialize and to share knowledge among community members. Tied to this, participants reported loss of local traditions that strengthened the social fabric and bonds between people.

Third, more recently, climate change has contributed to changes in foraging patterns. There is a common sentiment that the drought and heat the area has been experiencing in recent years due to climate change influences the quality and quantity of the available herbs. Notably, three participants indicated that *Morchella esculenta* is no longer found in the area. It was also noted that the foraging period has changed compared to previous years, with the winter months being shorter than they used to be.

Discussion

Our findings reveal that foraging practices in the study have changed since the creation of the industrial area, which generated a decrease in accessibility to green spaces due to increased desertification and pollution. Also, participants cited global changes such as lifestyles and climate change as possible drivers of change. Nevertheless, while LEK about the traditional uses of plants is fading it has persisted in the area, but mainly as the heritage of the older members of the population and is therefore at high risk of complete disappearance.

Changes in Foraging and Associated Ecological Knowledge

In line with Squizzato and Ravazzolo (2020), our interviewees recalled that until WWII, households living in the area would grow most of their food and were self-reliant for the most part. With the establishment of the industrial area, the territory lost agricultural area and the population shifted from farmers to factory workers, becoming more dependent on the (globalized) market economy for their livelihoods. Nevertheless, some foraged products, such as *Humulus lupulus*, *Silene vulgaris*, *Urtica dioica*, and *Papaver rhoeas*, can still be found in local markets and supermarkets.

The limited number of currently foraged species is not a surprise, as globally, people have become increasingly dependent on only a couple of dozen of domesticated species that provide up to 85% of the world's food (Turner et al., 2011). Indeed, many of the interviewees explained that foraging is a time-consuming practice, and food is more often bought from the supermarket. The optimal foraging model demonstrates that a population will use more easily accessed and nutritious resources (ibid.). Nevertheless, some scholars argue that foraging provides a more diversified and nutritious diet, leading to better health and other emotional and spiritual benefits (ibid.).

Despite the enjoyability of foraging activity reported by our interviewees, significant socioeconomic changes contribute to the reduction of foraging practices, which are now regarded as a leisure pastime (Sardeshpande et al., 2021; Grandjean, 2022; Mattalia et al., 2023) but one that is closely connected to memories of the past (Signorini et al., 2008; Mattalia et al., 2021). Indeed, foraging practices are interlinked with cultural identity, health, and traditional knowledge systems (Turner et al., 2011). The harvesting, preparation and serving of these foods are tied to the knowledge and traditions of an area. Further erosion of this knowledge contributes to/results from the globalization and standardization of taste with the loss of local cultural identity. Despite the negative perception of elderly interviewees,

younger generations are moved by new values concerning wild edibles collection, which may serve as leverage of connectedness with the territory and local ecological knowledge “dynamic” preservation (Volinia et al., 2024).

Loss of Land Access and Increasing Pollution

Establishing the industrial zone resulted in two main local changes affecting foraging knowledge and practices: loss of land accessibility and pollution. The study area was heavily impacted by the loss of foraging land accessibility, instigating the loss of LEK and relationships established over time. Concerning land consumption, Veneto, the region of Padua, is in second place among the 20 Italian regions, with 11.9% of land covered with concrete against the total surface as of 2022. Padua province has a higher percentage of 19% of its surface covered with concrete (Munafò, 2023).

More recently, the new supermarket project planned to transform 15,485 hectares of agricultural land into three new warehouses (Ecopolis Legambiente, 2023). Only 22% of the land in the neighbourhoods of Camin and Granze di Camin is left as agricultural and green spaces (Ecopolis Legambiente, 2023). Moreover, in Padua, as of 2022, there are 122 unused warehouses covering 313,528 square meters (Fig. 4; Ecopolis Legambiente, 2023). This is causing further emotional turmoil among our interviewees about possible future land loss. Indeed, a growing feeling of disconnection from nature is among the social effects of industrialization, leading to a socio-ecological crisis (Yu et al., 2019).

Some members of the local population formed in a committee to safeguard one of the last remaining sites of agricultural land in the area, which is threatened by the project of the new supermarket chain. However, many of the older interviewees expressed a feeling of resignation towards this issue. They feel they have already lost so much in their lifetime and putting up a fight is futile. Preserving territory permits biodiversity conservation and the practices and relationships linked to the same. The safeguarding of LEK related to foraging practices is necessary as an additional layer to the reasoning behind this protection.

Padua has become one of the most polluted European cities, with a PM10 over the limit for over 70 days in 2022 (ARPAV, 2023). Pollution is a well-known direct consequence of industrial plants (e.g. Khalid et al., 2018). The impacts of industrialization are coupled with the effects of climate change. For instance, in terms of micro-climate, the 10.5 km² of the industrial zone constitutes the area with the highest waterproof index. It determines the main “heat island” in the Padua area, with temperatures exceeding 40 °C in summer (Ecopolis Legambiente, 2023). In the face of significant climate changes, the implementation of environmental policies that strive to preserve and increase green

(forageable) spaces can provide positive repercussions in both food security and food sovereignty (Clark & Nicholas, 2013; McLain et al., 2014; Bunge et al., 2019). Two local associations, Comitato Cittadini di Granze di Camin and Wigwam[®], have taken various actions to contest further industrialization of the area and loss of territory (Fig. 5). After analysing the new supermarket project, they shared significant inconsistencies with the city administration and prepared and published a technical dossier on the proposed new logistics hub project which they delivered to city council group leaders. These associations also organised demonstrations in front of project headquarters with other organizations, silent presidia with placards at Padua City Council sessions, and public meetings with the citizens of Granze di Camin, Camin (PD), Neighborhood Councils, as well as the mayor, councilors, and investors. They collected 2300 physical and online signatures for the “Stop Cemento no Ampliamento” petition (Stop Cement no Expansion).

Since 2021, they have spearheaded the “Green Granze” project, which aimed at upgrading green areas and promoting collective/community activities. Other projects that will take place at the end of 2023 include meetings with the local kindergarten on sustainable and green foods, animated readings, and creation of a school garden.

The perception of many of the interviewees is that the younger generation has a general disinterest in the gathering of wild products. However, recent literature also indicates a few counter-trends, since foraging is also a re-emerging practice in Western countries (McLain et al., 2014; Sachdeva et al., 2018; Bunge et al., 2019; Grandjean, 2022;). Our results show how 20% of the participants had abandoned the practice because of entering the workforce; however, they re-established it in later years when more time was available. It cannot be excluded that younger generations will behave similarly. The conservation of the remaining green spaces allows current knowledge holders to practice their



Fig. 5 A protest in Granze, 1978, “Let’s take over the uncultivated plots of the industrial area” (Copyright Zona Industriale di Padova)

knowledge and promotes its transmission to future generations. Preserving and safeguarding green spaces are necessary to secure people's right to culture, health, spirituality, language, economic independence, and foodways (Grandjean, 2022).

Policy Implications

During the interviews, our participants explained their struggle to keep their natural “interstices” alive and attached LEK in the face of ongoing land grabbing, further industrialization, and additional pressures. The socio-ecological importance of interstitial green spaces should not be overlooked, especially in peri-urban environments. As long as the necessary conditions, including people, accessible areas, and plants, persist, the erosion of foraging practices may be reversed (Aceituno-Mata et al., 2021). But these spaces must be preserved; loss of land access and the related soil consumption not only increases the negative effects of climate change, including heat, desertification, and drought, but is also a significant factor in affecting the relationship to place and the knowledge associated with that space. Traditional knowledge holding participants retain a picture of the surrounding environment and territory prior to industrialization. Activists, policymakers, and political and economic institutions should consider this essential knowledge to achieve sustainability goals. Biocultural activists' role in preserving this knowledge can take different forms, including advocacy, education, and community leadership (Poe et al., 2013).

Land loss would put further constraints on the ability of knowledge holders to safeguard, practice, and share their knowledge. Therefore, policymakers and city planners must consider the implications of additional land loss.

Our results emphasize the complexity of maintaining and reactivating local ecological knowledge and practices in peri-urban areas. However, they point to some possible steps towards these goals:

- identify and engage with local communities through community meetings, workshops, field trips or other forms of outreach, as ethnobiology participatory approaches suggest;
- develop local nature programs tailored to the community's needs and interests; these programs may include community gardens, traditional ecological knowledge workshops, and nature walks led by local experts;
- provide resources and training, including seeds, gardening spaces, and community garden tools or training in traditional ecological knowledge practices. Involving local experts and elders in the training process is also essential;

- foster community stewardship, evaluate, and adapt; this can be done by involving community members in decision-making, providing opportunities for leadership and ownership, and creating a sense of pride and ownership in the programs;
- evaluate the programs and adapt them as needed; this could involve collecting feedback from community members, monitoring the program's success, and making necessary changes to meet the community's needs and goals.

The emergence of new local committees and environmental activism that this study witnessed could represent a possible LEK resurgence and foster the implementation of further commons-driven initiatives aimed at celebrating the central idea of sharing (Ostrom, 2002; Graeber, 2014).

Food justice recognizes foraging as a right for people in their local communities (Poe et al., 2013). It is necessary for governmental agencies to also recognize green spaces in a community as an area to practice knowledge, safeguard traditional foodways, and foster community interaction; therefore, they need to protect these areas from further erosion. Foraging can also serve as a means to increase the food security, particularly in times of crisis (Aziz et al., 2022). Governmental agencies should consider foragers as stewards and co-managers of urban green spaces (Landor-Yamagata et al., 2018; Sardeshpande & Shackleton, 2023).

Moreover, more research should address the effect of new environmental activism on food sustainability, i.e., how the ability of local food systems to provide healthy and nutritious food for everyone can also contribute to protecting the environment, conserving natural resources, and supporting the livelihoods of farmers and food workers. Finally, formal and informal educational platforms should highlight the importance of local ecological knowledge and language, inspiring the younger generations to become more involved in foraging and its related practices.

Conclusion

Our findings reveal that industrialization dramatically contributes to the diminishment of food foraging practices in the peri-urban area of Padua, Northeast Italy. This occurs due to three main perceived crucial phenomena: industrialization, lifestyle, and microclimate changes. However, changes in food foraging are also affected by global changes such as climate and lifestyle changes. Considering that foraging practices support food sovereignty, strengthen community bonds, increase cultural identity, enhance the quality of life, and provide a buffer in times of crisis and beyond, additional research should be carried out to analyze the impacts

of further land loss on the area, its biodiversity, and its associated local ecological knowledge.

However, our research included few participants under 50. In future research should address the perspectives of the younger generations on the erosion of LEK that they may have acquired but not directly experienced and their perceptions of the future of foraging practices. Urban and peri-urban foraging could also represent ideal platforms for further investigating the potentialities of this practice as a social practice for fostering social well-being, food sustainability, and environmental education. Future researchers should especially address how LEK in other peri-urban areas interplays with complexities linked to environmental activism and its resilience. It may also be crucial to study how activists and local policymakers consider this knowledge, given that the food sustainability of urban socio-ecological systems will be a critical point for the agendas of the following decades.

Our study ultimately underlines the need to maintain agricultural land and green spaces, transmit LEK, and encourage the attainment of food sustainability goals through collaborative, interdisciplinary and intergenerational efforts. The people who hold knowledge of their local territory, its history and traditions are central to this project, should be included by institutions and policymakers in the development of policies and strategies for maintaining environmental sustainability. The depth of local knowledge is irreplaceable and an essential element in such decisions.

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Data Availability The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

Declarations

Ethics Statement The local legislation and institutional requirements did not require Ethical review and approval for the study on human participants. Written informed consent for participation was not needed for this study by the national legislation and the institutional requirements.

Conflict of Interest The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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