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Following the food: the case of Grana Padano

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Abstract

The geography of food has recently produced a lot of analysis and theories. The paper covers the recent history of this rich line of research and looks at certain important aspects to produce an analysis which considers the whole food system. The central aim is of connecting consumption (and the new role of culture) with production, its socio-ecological evolution and the environmental impact on the entire food process. The methodology used to link the different phases is "following-food" (Cook et al., 2006). This approach consists in following a certain food through its transformations. This is useful to connect not only consumption and production, but also different dimensions: culture, economy, society, ecology, health. In particular, the paper analyses the links between the foodscape of milk production, focusing especially on Grana Padano PDO cheese in the Lombardy Region. The research has been used in an educational laboratory with a primary school, in which the researchers helped students to discover the local foodscapes of production and consumption.

Keywords: Food, Foodscapes, Following-Food, Grana Padano, Lombardy

1. Introduction

This paper aims to introduce a cultural approach to food chain analysis, adopting a geographical perspective in the field, and to improve students' awareness of eating attitudes. The central aim of these developed activities was to investigate the "interconnectedness" of places (Gold and Revill, 2000, p. 15), by connecting consumption (and the new role of culture) with production (and its socio-ecological evolution) and looking at the environmental impact of the entire food process. The methodologies of analysis we adopted in these educational activities are "following-food" (Cook et al., 2006) and footprint analysis. Between October 2016 and March 2017 the educational project "GeoLab: *alla scoperta del paesaggio geografico*" has been developed with students between 9-10 years old.

The integration of these methodologies has been adopted to answer the demand to integrate consumption and production analysis in food

studies. The different sub-fields of food geography presently only pay attention either to consumption or production. Accordingly, geography needs to reconnect the different elements of the food chain (Winter, 2003; Cook et al., 2006, 2008, 2010). Working in this direction is Cook et al. (2006, 2007, 2008, 2010, 2013; for a review of food geographies see Colombino, 2014) who have proposed the "following-food" methodology (see also "follow the thing" in Marcus, 1995; Hannerz, 2004). The method aims to unravel the links between the different places of food consumption and production with their economies, cultures, histories, art, creativity, nature and communities. It consists in following commodities, ingredients or food from any point in the chain with the aim of overcoming the linearity of the political economy approach (from production to consumption). According to this method, researchers interact both with consumers and farmers, influencing their actions and sharing experiences. On the other hand, the footprint analysis offers a quantitative approach to the issue, useful for a visual representation of their impact.

Thus, we believe that the combination of these two approaches is useful to study the relationships between production, transformation and consumption processes with potentialities in education at different ages. Through the following-food approach, the students can discover the people and places involved in the food chain. Through the footprint analysis, they can evaluate their own impact looking at each phase of the chain.

Therefore, according to the "backwards" and multi-scalar approach offered by this method these educational activities have moved analysis onto the production, transformation and consumption processes of milk, with particular focus on the *Grana Padano* chain. The focus on *Grana Padano* is justified as it is a PDO (Protected Designation of Origin) cheese, which is based in Lombardy. It is one of the main dairy and milk production sites in Italy (Zuccali et al., 2018; https://www.clal.it/?section=razioni-lombardia).

Thus, the paper starts with a brief review of food geography. After this, we introduced the following-food methodology integrating it with the ecological footprint. We then discussed Geolab didactic activities, moving our analysis "over the boundaries of the farm" and following the production and consumption chain of *Grana Padano* through observing the places directly or indirectly involved. As part of the educational activity, the footprint analysis is presented to evaluate the impact of consumers' choices following the entire food process. We have proposed the footprint family focusing on carbon and water footprints as tools to increase awareness of the impact of food systems.

2. Geographies of food: an overview on the topic

The geography of food has obtained significant success and has produced a considerable number of publications, especially over the last decade (Colombino, 2014; Cook et al., 2006, 2008, 2011), discussing food by different perspectives.

Before the cultural shift to consumption studies, food was investigated simply in terms of production in agricultural geography. The agricultural geography analyzed food mainly as a raw material in agricultural activity, something disconnected from the market and its dynamics and focused simply on elements inside a farm's boundaries (Winter, 2003, 2004, 2005). Subsequently, a family of studies, called agro-food geographies (Winter, 2003, 2004, 2005) and described by McDonagh (2014) as rural geographies and food, shifted attention to the market beyond farm boundaries to look at the whole food chain system (Winter, 2003). This approach discusses in particular, the interconnection between "farming and food, food and politics, food and nature, and farmers and agency" (Winter, 2003, p. 510). It focuses on the "farmer dimension" and especially on how farming and farmers are changed by different socio-economic-political dynamics and how they are evolving as a result of globalization.

With the postmodern turn towards the cultural dimension of geography, a relevant body of the food literature has focused on consumer implications, analyzing the role and culture of consumption (Winter, 2003; Colombino, 2014; Shaw, 2014; Bell and Valentine, 1997; Cook and

Crang, 1996). Friedberg (2003) is in this optic of "new cultural geographies of food", such as studies on "foodways", which define attitudes connected with food, for instance what move people when shopping or eating (Alkon et al., 2013, p. 127; Miewald and McCann, 2014). These choice attitudes are the basis of food customs, which are part of the "identity, memory and tradition" of a community that "play a key role in protecting and preserving cultural sustainability" (Williams-Forson, 2014, p. 71).

This new awareness of the consumption dynamics and of the relations between food and socio-cultural interlinks has helped food studies to go beyond the economic point of view and beyond the boundaries of the farm. Nevertheless, we should not forget the political issue, which considers the importance of power relationships in the food system starting from agro-food policy and farmers' condition (see the political ecology – PE perspective in Winter, 2004; Moragues-Faus and Marsden, 2017). According to the PE approach, the environmental impact and relations between the environment and socio-cultural dimensions are important elements to reconnect food production with consumption (Moragues-Faus and Marsden, 2017).

Another relevant approach looks at alternative ways to consume. "Alternative models of production and consumption" (Stassart and Whatmore, 2003, p. 449) are discussed as counterparts to the dominant model. These studies are part of a broad family of studies on "alternative economic geographies" (Goodman and Bryant, 2013) which also involves work on food chains and retailers such as alternative food networks (Goodman et al., 2011; Holloway et al., 2007; Whatmore et al., 2003), global commodity chains, alternative geographies of food, alternative systems of food provision (Watts, Ilbery and Maye, 2005), alternative food practices (Guthman, 2008; Slocum, 2006), and alternative food institutions (Allen et al., 2003).

In urban studies, food has stimulated a rich scientific production, aimed first to understand the role of food in shaping urban space and life (see e.g., the critical geography of urban agriculture, Tornaghi, 2014; and food places by Feagan, 2007). In this group, there are studies on foodscapes (Goodman, 2016; Moragues-Faus and Morgan, 2015; Johnston et al., 2009; Miewald and McCann, 2014; Morgan, 2010; Winson, 2004; Yasmeen, 1996; see also "urban foodscapes" in Cummins and Macintyre, 2002; Morgan and Sonnino, 2010). The concept is used especially to explain food diffusion in urban spaces (Winson, 2004; Yasmeen, 1996; Johnston et al., 2009). Johnston et al. (2009) define foodscapes as the result of relationships within social, cultural and spatial contexts such as "contested spaces where actors struggle to define the terrain of political action, including the extent of market involvement and private ownership of food" (Johnston et al., 2009, p. 513). Accordingly, Goodman (2016) uses the term to identify the relational dimension of food, sustaining that "food is more-than-food". The author suggests the usefulness of this approach in particular to study inequalities and hunger, connecting this work with the food justice movement.

With the food justice movement (Heynen et al., 2012), are identified those studies which adopt a critical perspective on food implications in human life, and in particular in producing situations of social and environmental disparity. In this group certain subcategories can be identified like black food geographies (e.g., Ramirez, 2014), according to which food movements are often represented as "white spaces" (Slocum, 2006), and food deserts (see also urban food deserts, Breitbach, 2007). These identify places where the access to healthy food is made difficult by high prices and shortage of food providers (Cummins, 2014; Walker et al., 2010). Other perspectives in this field are food security and sovereignty and the social geography of food (van der Ploeg, 2009). In particular, food sovereignty refers to "the right of nations and people to control their own food systems, including their own markets, production modes, food cultures, and environments" (Wittman, Desmarais and Wiebe, 2009, p. 2).

As shown in this literature overview, the complexity of the geographies implied in the food chain has inevitably promoted a sectoral approach. On one side, it is essential for in depth knowledge of the geographical implications of the different phases of food life, on the other one we believe there is a need to adopt an overview. In terms of educational impact, an overview ap-

proach has more potential to communicate and promote a critical approach in students and consumers' choices. Accordingly, we decided to adopt the following-food approach.

3. The following-food approach: a methodological proposal

Following-food is a methodology based on the "follow the thing" approach combining actor network theory and the study of social component linked to the life of objects (Marcus, 1995; Hannerz, 2004; Colombino, 2014). Multi-site ethnography is the basis of this method developed, in geography, by Ian Cook (Cook, 2004; Cook et al., 2006, 2007, 2008, 2010, 2013; Colombino, 2014). This implies that we can explore food geographies starting from each point of the chain. The nodes along the chain can reveal different and meaningful aspects for further examination, following various tracks and food footprints (Colombino, 2014). The main topic of our work was to apply this methodology which helps us to move within food geographies, unveiling social, cultural and ecological aspects for educational purposes. Moving within food geographies means describing the different places that connect foods by following them. To follow all the connections, behind, around and beyond a particular food, implies investigating what happens, in the places involved in food production, transformation and consumption in the globalization era. Local is more and more interconnected and influenced by global, not only in terms of markets and logistics but also of human stories and experiences (Cook et al., 2006).

Food narratives are related to these communities and individuals in the different phases of food life and so they represent a really powerful educational tool. Thus, following-food also means considering every point of the chain and describing and mapping the links between these different stories.

Thanks to this methodology, students can explore characteristics and impacts related both to consumption and production. Looking at consumption (Colombino, 2014) we analyzed topics like consumer trends, the concepts behind food, the image of food conveyed by advertising, the impact of certain diets. Looking at production we focused on aspects like the environmental justice of farming, the economic effects and the environmental consequences of certain agricultural crops and methods (Winter, 2003, 2004, 2005; Moragues-Faus and Marsden, 2017).

Considering these aspects, we gradually discover a number of information, data, stories, places, communities, which all help us to understand the complex system of food and how each part is interconnected with each other. For instance, how the choice of consumers influences the lives of farmers and vice versa. The analysis of these interconnections also considers socio-ecological justice within the food chain, looking at power relationships and inequalities, studying alternative food networks as processes of rapprochement between farmers and consumers. This means looking at the agro-food system in order to reconnect farms, people, the environment, and policy (Winter, 2003, 2004; Moragues-Faus and Marsden, 2017).

The following-food methodology has been applied to a lot of kinds of food: fish, beef, fresh veg, fresh fruit, hot pepper sauces, chewing gum, tomato, French bean, papaya (for a complete review of this see Cook, 2004; Cook et al., 2006, 2007, 2008, 2010, 2013). The methodology uses different types of data: qualitative data such as stories and images, and quantitative data such as statistics and data reports. The Geolab project has applied this methodology looking not only at the scientific but also the educational perspective. The workshop activities guided the pupils to discover qualitative and quantitative aspects of milk and cheese considering production and consumption and, thanks to their ecological footprint, the impact of these processes on the places involved.

3.1 A tool to follow food processes considering impact

We decided to join the ecological footprint (EF) to the following-food approach for a number of reasons. The first is related to the potential of the EF to capture relationships between demand and supply of natural resources at different scales, taking into account the links be-

tween production, consumption and transformation processes. The second refers to the potential of the EF to estimate the impact of lifestyles from a global to a regional and local community scale, to that of institutions, enterprises, products and services, as well as to the family and individual citizens.

This multi-scalar representation, together with the ability of the methodology to capture the relationships between different geographical levels, allows us to understand how lifestyles can impact the environment according to a geographical perspective.

The EF is defined as the total area of terrestrial and aquatic ecosystems necessary to provide all the resources needed by the population to live, given prevalent technology and resource management practices (Wackernagel and Rees, 1996; WWF, ZSL and GFN, 2008). It includes both the resources used as input and those needed to reabsorb output (wastes, etc.) produced by the population itself. Thanks to research, the EF methodology has been refined and extended, creating an integrated and coherent system for environmental accounting.

On the supply side is the biocapacity, in other words the ecological supply from natural resources, which represents an estimate of the potential of local ecosystems to provide natural resources used at various scale levels, from the local to the global. On the demand side, first of all, there is the ecological footprint indicator known technically as the Ecological Footprint of Consumption (EFC) as it estimates the usage of ecological resources arising from local consumption and the Ecological Footprint of Production (EFP) which encompasses all global demand that draws on local natural resources (for a detailed analysis see Bagliani and Pietta, 2012). These three indicators make up the Ecological Footprint Analysis (EFA).

This methodology introduces a very interesting perspective, which allows us to consider the relationship between local ecosystems and productive areas located at a great distance. Indeed, the demand side distinction makes it possible to separately identify processes and effects created. On one hand these include those created by consumption considering the pressures generated in any part of the world to produce the goods and services consumed locally. On the other hand, they include those created by production processes, which put pressure on local ecosystems to produce the goods and services consumed globally.

By comparing the supply of a territory's ecosystem resources respectively with the EFC and the EFP it is possible to obtain information on the use of natural resources. Comparing the biocapacity and the EFC, if the local supply of ecosystems is lower than the local demand for global natural resources, then we have an ecological deficit. This provides an indication of the degree of responsibility which a population has for the use (or over-use) of global ecosystem resources. Considering the food component, it means that a population is responsible for both over-using and degrading local cropland, grazing land, fishing and importing the resources from other territories, included those embodied within imported foodstuffs, to guarantee food consumption.

These processes have particularly bad consequences on landscapes in which these resources are located. At the same time, this population is also responsible for increasing GHG emissions, assessed through the CO_2 emissions embodied in food, contributing to worsening climate change as the local forest surface cannot absorb all of them. Comparing the biocapacity and the EFP, if the local supply of ecosystems is lower than the global demand for local natural resources, the situation is over-utilization of local biocapacity and EFP, leading to its degradation. Considering the food component, this means that we are over-using and degrading local cropland, grazing land, fishing ground, to satisfy our food needs with negative consequences on the local landscapes.

The EFA also allows us to estimate trade flows, by helping us to answer questions such as those presented in section 4.1, e.g., where exactly do the soy meal or soybean for our animal feeding come from? This is so if we eat food including commodities from other parts of the world and what are the consequences of this?

Considering the links between production, consumption and transformation processes the methodology provides an in-depth view. This is based on the assumption that for each unit of material or energy consumed, there is a corre-

sponding area of territory capable of providing the resources and absorbing the waste. Considering both direct and indirect consumption of energy and natural resources along the supply chain and the CO_2 emissions embodied in food, this means that the methodology captures, on one hand, consumption of energy and natural resources along the supply chain, such as farming, accounting for all meat, fish, cereals and vegetables consumed directly. It also includes all of the meat, fish, cereals, vegetables and energy used to feed and harvest food products as well as food handling and processing, packaging and transportation. On the other hand, it quantifies the CO_2 emissions embodied in food[1].

Investigating the links between production, consumption and transformation processes, it is also important to consider that today the literature talks about the so called "footprint family". After the development of the EF at the beginning of the 1990s by William Rees and Mathis Wackernagel (Rees, 1992; Wackernagel and Rees, 1996), many other scholars contributed to the development of new indicators maintaining a common baseline consisting in estimating pressure and impact from the amount of resources and emissions required to support human production processes and consumption activities. Hoekstra (2003) introduced the water footprint (WF), which measures the amount of direct and indirect water used to produce each good and service we use. Then, the carbon footprint (CF) (Wiedmann and Minx, 2007) was developed to quantify the overall emission of GHG directly and indirectly caused by an activity or accumulated over the life stages of a product. To conclude, the nitrogen footprint (NF) relates to the cascade of effects generated by the introduction of reactive nitrogen into the biosphere (Leach et al., 2012).

Looking at food, the footprint family can capture not only consumption and production, but also transformation processes along the supply chain through hidden emissions of food. Certain foods release more greenhouse gas emissions and/or nitrogen than others, some foods consume more water and/or release more polluted water than others, some foods consume more ecologically productive land than others. Thus, this methodology can estimate the impact of lifestyles related to food.

[1] One of the most relevant limits of this methodology is referred to the fact that it only captures CO_2 emissions, ignoring the other greenhouse gases and other food system waste streams. However, another indicator of the footprint family, the carbon footprint, is focused on all the greenhouse gas emissions.

4. GeoLab: following *Grana Padano* in a didactic laboratory for the primary school

The dairy agro-food system was adopted in the laboratory for the fifth grade of the primary school at the *Istituto Scolastico Comprensivo of Travagliato* in the province of Brescia. This Institute, in collaboration with the University of Brescia and the Catholic University of Brescia, promoted the Geolab project, funded by the *Fondazione Comunità Bresciana* (Call "Cultura 2016"). The project was made up of a series of educational "packages" proposed to the different classes from kindergarten to the lower secondary school. One of these packages was dedicated to the geographical analysis of the food system. The dairy agrofood system is an important element of the local economic system and contributes to shape the rural landscape of the lowland in the province of Brescia. Activities with students were created in collaboration with teachers, and were strictly linked to the territorial evolution of Travagliato.

Travagliato is a small town in the Brescia Province with about 14,000 inhabitants. It is located in the south-west countryside of Brescia (Lombardy region), at the margins of the *Pianura Padana*. Breeding and agriculture were the main activities until the delocalization of industry from the city and other parts of the province. These activities continue to have a central role in local life, shaping the surrounding landscape. Accordingly, the purpose of the activity was to reconnect young people with the local landscape and agricultural traditions, starting with milk and cheese production. *Grana Padano* is based in the countryside area of Lombardy region.

The first part of the laboratory divided the food system into three phases: production, transformation and consumption. In this way, the concepts of local and global food were introduced.

In the second part, the following-food approach was proposed: starting from a bottle of milk, easy and cheap to buy for students' families, the dairy agro-food system was explained (see par. 4.1). Through the analysis of pictures representing the different phases of production, local landscapes involved in dairy production were observed: industrial factories, fields of maize and soy, pasture, farms, stables, cows, etc.

Then, together with researchers, the pupils filled in some datasheets on these topics: the first was about where to buy milk and dairy products, the second on food transformation, labels of quality and origin and the third considered where cows live and what they eat to produce milk. At the end of each sheet, we talked with the pupils and guided them towards the different connections between dairy production and the local context. The pupils discovered how many different landscapes (e.g., Italian, Brazilian, Argentinian) and how many communities are related to the milk in the bottle and to the production of dairy products, such as *Grana Padano*. In particular, we analyzed the origin of each ingredient and the routes and transformation of food, including the dairy cows' diet, with a critical approach on the local origin of labelled products. The aim was to improve their ability to connect the different phases of food production, transformation and consumption to their own landscapes.

The third part of the activity (4.2) looked at the spaces of food consumption. After an introduction on milk and cheese distribution in the world, attention moved to the retail system. In particular, places of consumption, such as alternative food chains and supermarkets were investigated. Then, some advertisement images have been analyzed to discuss discrepancies between imaginary and real spaces of production/consumption.

The fourth part (4.3) of the laboratory consisted in analyzing the impact of food expenditure considering the whole chain. With the aim of improving community awareness of eating attitudes, we asked the pupils to calculate their own personal water and carbon footprint using an integrated calculator available online. This allowed us to demonstrate that their eating habits are unsustainable and to help them think consciously about what they eat. We gave them practical advice offering insight and solutions for a more sustainable food-consumption pattern.

The responses of the pupils were really stimulating and never obvious. The contribution and collaboration of the teachers were fundamental for the success of each activity.

In the following paragraphs, we report information and data used during the laboratories dedicated to the pupils looking at three main aspects: production and transformation, consumption and the ecological impact of milk and *Grana Padano* cheese. This shows how each part of the food chain could be more thoroughly analyzed and explained to the pupils to produce a scheme based on the following-food methodology.

4.1 How many landscapes do we "eat"? Following *Grana Padano*

The transformation of the agro-food sector, and also of milk and dairy production, in Europe and in Italy is strictly related to the European Common Agricultural Policy (CAP), created in 1962 and changed over its fifty-seven years of life. In the beginning, the role of the CAP was to sustain the production of agricultural commodities through incentives based on increased production. From the 1992 reform and following CAP reforms, increasing importance was attributed to sustainable agriculture and the introduction of eco-conditionalities linked to CAP payments. The role of farmers changed throughout the years, from simple producers of commodities to pillars of sustainability and food quality. The territorial consequences of these changes were evident in the rural landscape, for instance from the mono-cultural landscape of maize in the Po Valley to crop rotation and diversification (EU, 2012, 2017).

Considering the quality of production, the introduction of quality labels is also part of the CAP: e.g., the Protected Designation of Origin (PDO) guarantees the geographical origin, the Protected Geographical Indication (PGI) links the quality to a certain region, and the Traditional Specialities Guaranteed (TSG) underlines traditional character. The disciplinary of produc-

tion has influenced agricultural techniques, land use, crop cultivation, economic viability, landscapes and ecological impact. Milk and dairy production are an important part of the agro-food system in Italy and in Lombardy Region. The quality of food is a characteristic of Italian food production which means: 166 products with label PDO, 123 with label PGI. In Lombardy there are 21 PDOs and 14 PGIs (ISTAT, 2018). Simply in the province of Brescia there are eight PDO labels and the most important, in quantitative terms, is *Grana Padano* cheese. The *Grana Padano* area of production includes Lombardy, Veneto, Trentino Alto Adige, Piedmont and parts of Emilia Romagna. The production and transformation of the milk used for this labelled cheese involves 4,174 producers and 179 companies (ISTAT, 2018). The high-level quality of the product, the local origin and the image created by the brand are the main elements of success.

Working with students on *Grana Padano* during the Geolab certain questions emerged. Below, we present the steps we followed in the educational activity/analysis about cheese production in the farmland.

- *Where the dairy cows live.*

With the pupils, we opened our analysis observing some advertising images. What emerged was that the images of the dairy production proposed by advertising were often related to certain standardized aspects of rural life: e.g., a happy family or a farmer in a green mountain landscape, where free cows eat grass in the pastures.

We then tried to show the real face of the dairy cows life. Presently, 92% of the cows in Lombardy is reared in lowlands and on intensive livestock farms. The Lombardy region produces 43% of the Italian milk. 40% of this milk is used to produce *Grana Padano* (https://www.clal.it/?section=razioni-lombardia).

- *How cows' diet is made up, where the products come from and what about the landscapes of origin.*

Ingredients	**Kg**
Maize Silage	24
Maize mash	5
Grass silage	3
Soy Meal 42% (Protein)	2.8
Maize meal	2.7
Hay	1.3
Italian Ryegrass Lolium	1.2
Alfalfa field dried	1
Barley rolled	1
Linseed expeller	1
Soybean toast	0.8

Table 1. Dairy cows diets example. Source: data from CLAL (https://www.clal.it/?section=razioni-lombardia).

Another relevant indicator we used was the dairy animals-diet. According to this analysis, a map of animal diet can be created and certain relevant questions can be unrevealed. The dairy cows' diet for Grana Padano is composed of a large amount of maize silage, forage made from different types of grass, maize mash, soy meal or grain, maize meal and other ingredients. These elements are mixed and distributed to the cows every day. The example of the daily diet shown in Table 1 is relative to a cow that produces about 36 litres of milk per day.

The maize, for example, is produced mainly in the fields around the farms but partially, it is imported from the EU and other parts of the world. Today the maize crop is typical of the local countryside in the Lombard Po Valley during spring and summer. Analyzing the Lombard landscape of the lowland, we can find fields of grass or alfalfa fields, maize fields and a very few and recent fields of soya beans. The proteins of soy are essential to maintain high levels of production, quality of dairy products and consequently of profit margins.

- *Where the soya meal or soya beans for our animal feeding comes from.*

We focused on this specific product central to the cattle's diet, soya, to introduce other topics, such as environmental justice and globalization. Contrary to their expectations, the pupils discovered that soya comes mainly from South America, in particular from Brazil and Argentina. In Europe, a growing production of soya is located in Ukraine. Italy imports more than 85% of its consumption (Assalzoo, 2015).

Moreover, they observed that connecting the different landscapes of soya production is complicated. After the 2001 Argentina crisis and the diffusion of the "*modelo sojero*", the genetically modified (GM) soybean was widespread in Argentina and this contributed economically to soya producers' profits. On the other hand it gave rise to conflicts between traditional local cultivation and the new *modelo sojero*, with consequences on biodiversity and social justice (Leguizamon, 2013).

Similar situations also took place in Brazil, which hosts the most important rainforests in the world. Considering the WWF report (2014), the pupils learnt about the impact of soya in terms of deforestation and local rural economy and about the potential role of consumers in orienting markets, for instance substituting soya beans with other vegetal proteins or using certified soya. The history of soya in Brazil is in part the history of animal feed in Italy and Europe. Indeed, we are one of the main world importers of soya (WWF, 2014).

- *We produce a PDO cheese.*

Last step of this activity was focused on a critical discussion of the meaning of labels and their contradictions. Do we do the right thing using commodities from other parts of the world? *Grana Padano* depends both in quantitative and in qualitative terms on the use of soya proteins. The profitability of local farmers in Lombardy depends on soya meal and maize silage, which impacts biodiversity, water consumption, use of agrochemical products and fertilizers. The equilibrium between nature, economy and socio-cultural conditions of farmers is complex.

The farmers' tales in Lombardy reflect socio-ecological changes in techniques of cultivation and animal feed, cultural consciousness, agricultural policies and consumption choice. Today when we talk about food the key aspects are sustainability, local origin and quality. To reduce the impact of cheese production we must consider not only the local impact of farmers' activity but also the socio-ecological effects created all around the world importing commodities. The excellence of the Italian *Grana Padano* is made with the aid of Latin America's farmers. These interconnections could undermine the local origin of this cheese and open a critical analysis on foods labelled as local.

4.2 Consuming Grana Padano

After the production analysis, the pupils were questioned on the consumption dimension. This discussion started with an analysis of the local diet. Diet analysis is fundamental in the following-food approach because it allows us to understand the geographies of food consumption. Accordingly, we "broke down" *Grana Padano*, focusing first on milk consumption geographies. Thus, the role of milk and derivatives was considered, with some statistical data, to understand the weight that it presently has in different geographical contexts.

According to this analysis, milk and derivatives play a central role in Western countries, in North Africa and South America (FAOSTAT, 2011; Pulina et al., 2011). Recently, the consumption of milk has diminished especially in developed countries; among the causes there is the increasing of intolerance (Zingone et al., 2016). According to the Canadian Dairy Information Centre[2], the consumption of fluid milk in Italy has been reduced by about 10 litres per capita between 2010 and 2017, with a constantly negative trend. The same trend has been registered in other European countries such as the Netherlands, France and Spain. The consumption has been relatively constant in the United Kingdom and Germany, and is increased in a few countries such as Luxembourg and Lithuania. Negative trends have been registered also in

[2] Global milk consumption (litres per capita). Available at: http://www.dairyinfo.gc.ca/index_e.php?s1=dff-fcil&s2=cons&s3=consglo&s4=tm-lt.

extra-Europe countries, such as Egypt, Iran, Argentina, Brazil and North America countries.

On the contrary, consumption of cheese is increased in almost all countries evaluated by CDIC, with only a few exceptions. In Italy, France and Switzerland the trend is constant. That is probably due to the stable presence of the product in the traditional diet. In any case, per capita consumption of cheese in Italy (22.2 Kg in 2017) is one of the highest in the world. It is also higher than the European average (18.7 Kg in 2017).

European countries have the highest levels of milk and cheese consumption in the world. Five countries surpassed 100 litres per-capita in 2017. Outside Europe, these levels have been reached only by Australia and New Zealand. In cheese consumption, the European countries are the only ones to go over quota 20 Kg per capita. This is the case for Austria, Cyprus, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Sweden, Switzerland, Iceland (the first consumer) (CDIC data, March 2019).

So the pupils focused on *Grana Padano*, trying to understand its diffusion and consumption trends. The demand for *Grana Padano* has increased over the last decade, with 38% exported (Bava, 2018). According to CLAL-ISTAT data, export of *Grana Padano* and *Parmigiano Reggiano* has increased by about 25% since 2012. It has increased 20% in extra-EU countries, and 29% in the European Union. The main destinations are Germany, United States, France and United Kingdom.

At this point, a cultural dimension was added to the analysis. Consumption of these cheeses is part of the Mediterranean diet and Italian cuisine, integral to the Italian table. In the same way, many European countries are culturally associated with the production and consumption of cheese or milk derivatives. This is the case of France, Switzerland and Greece. A study of the Catholic University of Piacenza also showed the positive health effects of consuming *Grana Padano* in reducing blood pressure (Crippa et al., 2011).

The pupils were then asked about the role of consumers and on the power of their choices. As observed in the production analysis, the livestock industry has a relevant impact on climate change, and dietary choices can have a powerful role in directing the market. According to Macdiarmid et al. (2016) concerning meat, there are three aspects that should be considered in consumers' answers to advertisement on dietary impact, lack of awareness, the perception of the impact of personal consumption and distrust to change. We could also add the distrust that individual choice could have a meaningful influence on the market and economic system of production and distribution.

As the FAO states, sustainable consumption can contribute to a better quality of life (Norwegian Ministry of Environment 1994, cited in Black and Cherrier, 2010, p. 438). The responsibility of consumers' choices is a central element in shaping the consumption system and its sustainability (Meulenberg, 2003). Thus, the first step should be to change consumers' perspective and as a consequence, their individual daily life behaviour (Tononi et al., 2017; environmentally aware citizens see also Ottman, 1993). Dietary choices are the first aspect to consider.

The role of consumer consciousness or awareness is also recognized by Blake et al. (2008), Macdiarmid et al. (2016), and Pohjolainen et al. (2016) and for strategies suggested by Apostolidis and McLeay (2016) there is consumer education (others include financial incentives and regulatory mechanisms).

Consequently attention has moved to the question *how can we define a sustainable diet?* For this purpose, the definition provided by FAO (2010, p. 10) is useful. In particular, it states "diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and nutritionally adequate, safe and healthy; while optimizing natural and human resources".

Thus, FAO does not limit the definition to an environmental dimension, guiding us towards a multi-dimensional interpretation of diet that considers different levels of sustainability and landscapes. In this definition, the connection between food and culture is strong and an analysis on food cannot ignore the cultural role that it

plays in society. Moreover, the impact of our diet in environmental terms, is a key topic to complete the analysis of the food chain as described in the next paragraph.

4.3 How to estimate the impact of food chains

To complete the analysis of the complexity of the food system, reconnecting the different elements of food chains, we decided to use the Ecological Footprint Analysis looking at footprint family indicators.

According to the literature, different approaches and methodologies are used to define and calculate the "foodprint". Birney et al. (2017) define a foodprint as "the resource and environmental impact associated with an individual's eating habits and choices". Goldstein et al. (2016) talk about urban foodprint as the various elements of diverse resource consumption and environmental impact associated with the production, processing, distribution and waste generation of food demanded by urban residents. Other authors only focus on the GHG contribution, so the foodprint concept refers to the total amount of GHG emitted through "growing, rearing, farming, processing, transporting, storing, cooking and disposing of a food" (Abrams, 2014, in Kim, 2017, p. 366).

In our didactic laboratory, we showed the pupils the relevance of their personal foodprint, which depends on diet. Starting with the previously mentioned FAO definition of sustainable diet (FAO, 2010), we introduced the food pyramid and the environmental pyramid (Figure 1) explaining the direct relationships between food impact on health and the environment.

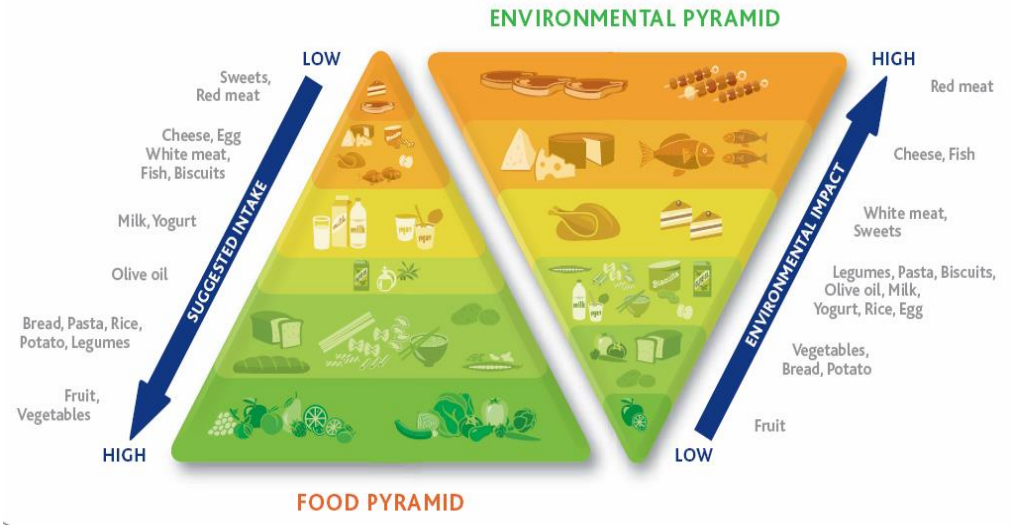

Figure 1. The food pyramid and the environmental pyramid. Source: Barilla Center for Food Nutrition (www.barillacfn.com/it/divulgazione/doppia_piramide/).

In doing so, we introduced how the EF and the NF work, and which elements of the food chain can be captured and connected. We also used the WWF online calculator on "the environmental cost of household shopping" (http://www.improntawwf.it/carrelloENG/), focused on the WF and the CF. This personal calculator is particularly useful from an educational point of view in analysing the impact of food daily life choices from a geographical perspective considering the whole chain. Comparing the impact of a meal predominantly based on meat with one predominantly based on cereals and vegetables allowed us to demonstrate that the pupils-eating habits were unsustainable and to help them think consciously about what they eat.

In particular, we followed the *Grana Padano* process through a bottle of milk focusing on the different results in terms of water and carbon footprint. As a consequence of the issues discussed in the previous paragraphs, compared with vegetables and fruit, meat and dairy products have a larger foodprint consuming more energy and resources and emitting a relevant share of CO_2 through longer periods of production, processing and transportation. According to this calculator, to produce 1 L of milk you need 1,033 L in terms of water footprint and 0.24 Kg CO_{2eq} in terms of carbon footprint; to produce 1 Kg of beef meat the contribution in terms of water footprint is equal to 15,503 L and in terms of carbon footprint is equal to 6.32 Kg CO_{2eq}; 1 Kg of potatoes implies 289 L of water footprint and 0.21 Kg CO_{2eq} of carbon footprint.

Thus, our methodology offered a number of relevant findings from the geographical point of view to discuss with pupils. To conclude, we gave them practical advice offering insights and solutions for a more sustainable food-consumption pattern. We also explained that personal dietary choices can collectively change consumption forces to improve the environment.

5. Conclusions

This paper is an experiment in reconnecting the different parts of the food system. It also has some important educational aspects. The dissemination of results to the community starts from the school as a key factor in food and sustainability education. The research project and proposed laboratory has given a role to culture in agro-food systems, promoting education and knowledge inside the community about the production system and socio-ecological consequences of the entire food cycle.

Understanding the elements involved in the food system could also reduce the distance between consumers and farmers, both in geographical and in cultural terms. The idea to join the "following-food" methodology to the EF was useful in creating a foodscape analysis of the local and global landscapes and territorial dynamics of the agro-food system linked to dairy production. In particular, it was possible to connect cultural aspects, from plate to field, with environmental problems, social and ecological justice, ethical or health consequences of food choices and, to conclude, to think about possible solutions to reduce impact. The aim of our work was to stimulate a critical approach to food geographies starting with the new generations of food consumers and producers. This was to understand what and who is behind food, to know the stories of the people, places and nature that feed us on all scales, connecting local and global.

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