

## Article

# The Social Ecology of Food: Where Agroecology and Heritage Meet

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**Abstract:** The current food system is unsustainable and no longer able to cope with the challenges caused by climate change and consumer behaviours. In this context, agroecology, with its commitment to crossing disciplinary boundaries, has been endorsed as one of the main approaches to the creation of a sustainable food system. Despite this, the integration of the social research on food has not been evident enough in agroecology as a discipline. To be sure, studies related to foodways, food traditions, and, more recently, food heritage have long been present, and have provided important insights into the social and cultural aspects of food. However, there appears to be little convergence between this body of research and the mainstream agroecology literature. This paper aims to address this disconnection between the sociocultural and environmental aspects of the food system, and to propose ways of moving forward. We argue that knowledge about food heritage can be a catalyst for the achievement of agroecology's vision for whole-system transformative change, and a moving towards global food security and nutrition. Using the agroecology framework of the United Nation's Food and Agriculture Organization (FAO) and looking at the examples of the subak system in Indonesia and the EU-funded BigPicnic project, we employ the elements of 'co-creation and sharing of knowledge', 'culture and food traditions' and 'human and social values' as entry points for the creation of sustainable transitions of the food and agricultural systems.

**Keywords:** agroecology; socio-cultural research on food; food heritage; food system; food tradition; co-creation of knowledge



**Citation:** Rahman, D.; Moussouri, T.; Alexopoulos, G. The Social Ecology of Food: Where Agroecology and Heritage Meet. *Sustainability* **2021**, *13*, 13981. <https://doi.org/10.3390/su132413981>

Academic Editor: Antonino Galati

Received: 19 October 2021

Accepted: 9 December 2021

Published: 17 December 2021

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## 1. Introduction

As the current food system is deemed to be unsustainable and no longer able to meet the world's food demand, the transition of a food system to multidimensional and transdisciplinary approaches that highlight complex interactions between the visible and invisible elements of the food system becomes more important. Traditionally, natural sciences tend to address the more visible elements of the food system, such as food production, processing, and distribution, as well as their environmental impacts, while social sciences examine invisible elements such as food preparation, traditional/local food knowledge, food choice and diets, and the values that underpin them. Agroecology has been promoted as a holistic and transdisciplinary approach that can offer a multi-scale and long-term perspective that could facilitate transformative change towards a sustainable food system. Agroecology is considered to be an approach that engages broad aspects of the food system and takes into consideration political, economic, social, and cultural factors to transform the food system [1]. As will be detailed in the following sections, agroecology constitutes both an academic discipline that has generated a significant body of research, and also a movement and a set of practices. In this paper, our focus is on agroecology as a discipline.

Meanwhile, in the last few decades, the field of cultural heritage studies has emerged and is increasingly addressing aspects of the food system such as food cultures and traditional agricultural practices. This is an interdisciplinary area of study that has brought

together scholars from a wide range of academic backgrounds, but it is also directly connected with the wider cultural sector (e.g., international heritage organisations, museums, archaeological services) and the professionals that deal with various forms of cultural heritage [2–4]. This field has recently started to tackle directly the previously overlooked intangible dimension of heritage, and has brought together various strands of social research into a conceptualisation of food as a form of cultural heritage [5]. Overall, the notion of ‘food heritage’ encompasses traditional practices of food production and consumption that: (1) characterise the foodways of specific groups of people, regions, or nations; (2) employ forms of knowledge and craftsmanship, skills, methods, processes, and tools; and (3) are part of specific cultural or religious celebrations, festive events, performances, customs, and rituals. This food heritage discourse has developed a relevant body of research in the last decade that has existed in parallel, but not necessarily in conversation with, the agroecology approach. This research is influenced by, but also systematically seeks to critically engage with, the existing practices of the cultural heritage sector and the development of relevant policies on the local, national and international scale.

Despite agroecology’s pledge to bring interactions between plants, animals, humans, and the environment, as well as traditional and local knowledge, to the core of the food system [6], many scholars have commented on the detachment of social science from agroecology [7–9]. Mendez et al. [10] found that many agroecological approaches are grounded in natural science and, hence, risk disarticulating many contributions of non-Western knowledge and traditional practices. At the same time, Morgan and Trubek [9] highlighted the absence of food culture and tradition in the existing agroecology literature. Taking these observations even further, this paper emphasises the importance of an intersection between the agroecological literature and the literature that addresses the notion of food as cultural heritage. The latter could allow the discipline of agroecology to better articulate, integrate and address food traditions, foodways, and the social and cultural values of food.

This paper aims to address the aforementioned disconnect between the natural and social science research on the food system. Specifically, it synthesises cross-disciplinary research related to food heritage and discusses how this can intersect with research conducted within the discipline of agroecology. We believe that, in order to deal with the complexity of the food system, natural and social scientists must work together to develop innovative approaches for tackling food security and creating sustainable transitions of the food system. Thus, this paper aims to contribute to the development of a shared knowledge base and language at the interface between natural and social science concepts. It argues that the cultural heritage of food fundamentally shapes and is shaped by culture, food traditions, and human and social values. As such, it is essential for ensuring the social and cultural viability of the design of sustainable food and agricultural systems. The agroecological approach would greatly benefit from a closer engagement with food heritage discourse, while researchers of food heritage could better address some of the overlapping interests and global food challenges by relying on the long tradition of the discipline of agroecology.

This paper starts by outlining the evolution of agroecology and some of its key principles and issues. The perceived disengagement of cultural knowledge from agroecology is then addressed by exploring how culture and food traditions are conceptualised from an agroecological perspective, whilst also reflecting on the apparent dichotomy between natural and social sciences that characterises the agroecology literature. This is followed by a brief reflection on how heritage studies can weave together the sociocultural research on food. An expanded transdisciplinary frame is then proposed as a heuristic to help bring together cultural and natural knowledge about food. Specifically, we adopt FAO’s 10 elements of agroecology framework, which conceptualises pathways of transformative change towards sustainable food and agricultural systems, and use the three elements which are the most pertinent to this discussion—namely the ‘co-creation and sharing of knowledge’, ‘culture and food traditions’, and ‘human and social values’—as entry points. Having identified the three entry points, we use findings from our own research to iden-

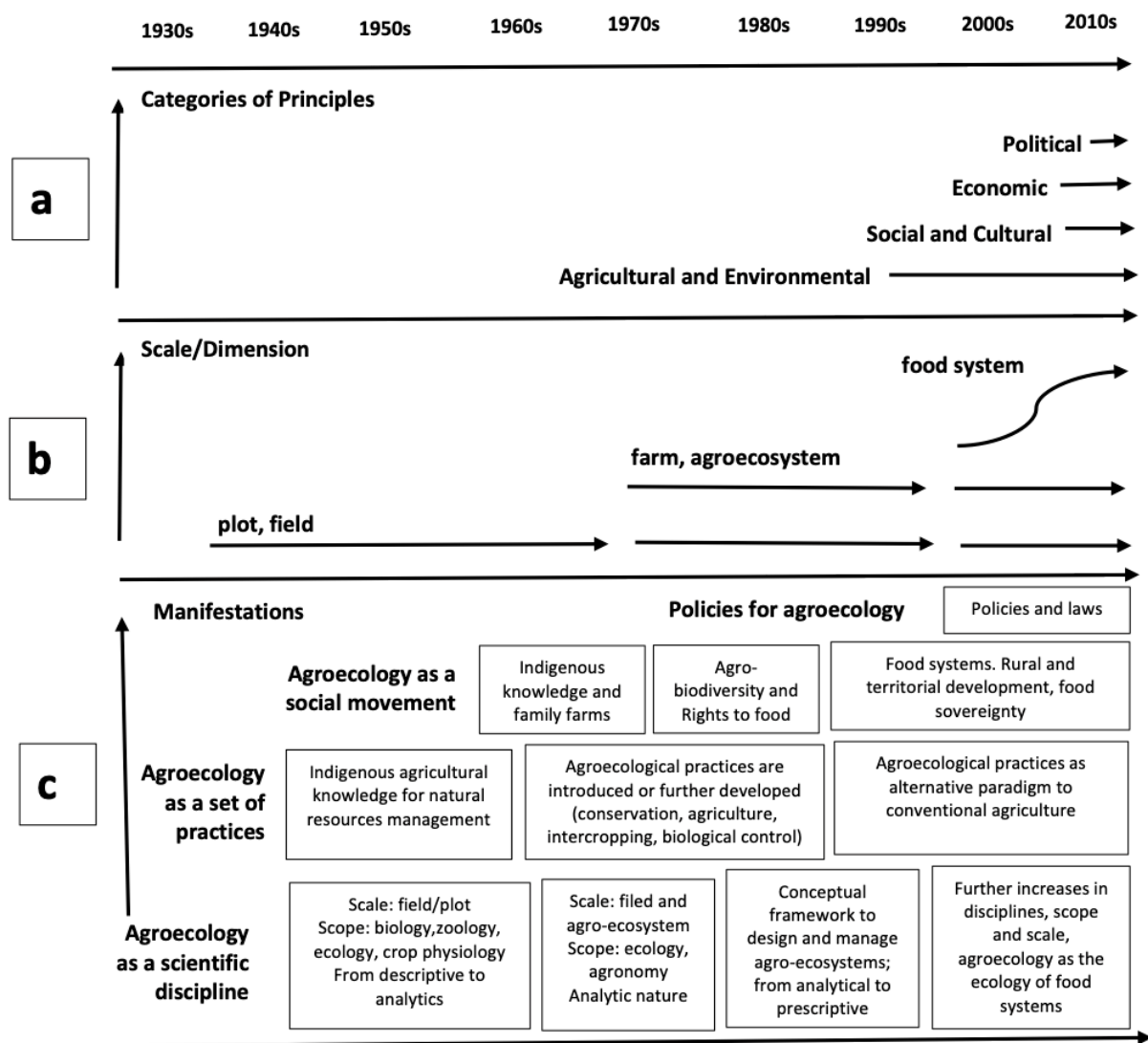
tify the linkages between discourse and social action. Specifically, we draw on two case studies, the *subak* system of agricultural practice in Bali, Indonesia, and the EU-funded BigPicnic project, to create evidence-based narratives to describe plausible transition pathways. Subak is a cooperative water management system of ‘democratic and egalitarian farming practices’ which is recognised as World Heritage of universal value [11] and the information employed in this paper derives from extensive ethnographic research in the area [12]. The BigPicnic project, on the other hand, was a multi-case study that set out to explore food security and sustainability in the context of botanical gardens (across Europe and in Uganda) with diverse audiences. The project highlighted the special implications of the food heritage notion for these topics [13]. The authors of this paper have been directly involved in research on these case studies, and draw on their personal experiences and findings in order to pinpoint the importance of the application of a heritage lens for the achievement of agroecological transitions towards sustainable food and agricultural systems. Both case studies were also selected because they highlight the vital roles that food knowledge creation and sharing, culture and food traditions, and the human and social values that underpin these can play in the afore-mentioned process. The paper concludes that, owing to its capability to make the invisible elements of the food system and its actors visible, food heritage research can fulfil the vision of the agroecology discipline to link food knowledge, values and traditions to natural science research and innovation, deliver co-benefits to nutrition and communities, meet key policy priorities, and transform the food system.

## 2. The Evolution of Agroecology and Key Issues

Agroecology studies the ways in which the different agroecosystem components interact [14], and it constitutes the implementation of ecological principles for the understanding and development of sustainable agroecosystems, bringing together ecologists and agronomists [15]. Agroecology is the ecology of food systems [16,17] with the explicit goal of the “transformation of food systems toward sustainability where there is a balance between ecological soundness, economic viability, and social justice” [15] (p.20). The term agroecology developed in the 1980s as a defined corpus of agricultural practices and techniques, rooted in ecological processes, which aims at the development of a more “environmental-friendly” or “sustainable” agriculture and which is rooted in local traditional knowledge of peasant and indigenous cultures [18] (p. 670).

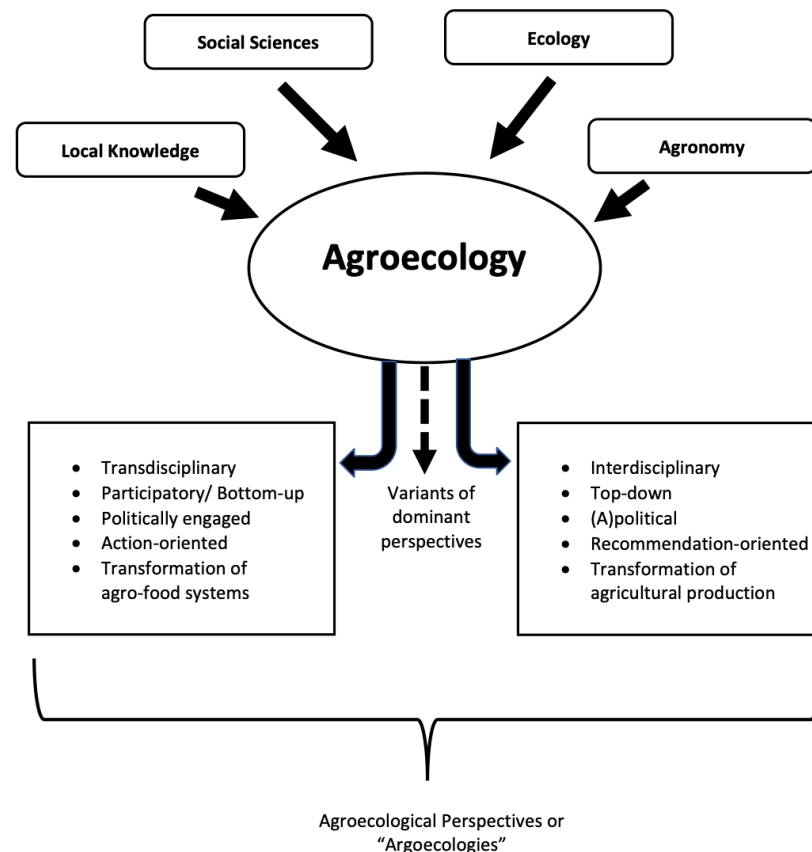
However, many scholars argue that the concept of agroecology could be traced back to the 1930s, when it was first used to apply ecological knowledge and methods in agricultural practices [19–21]. Until the 1960s, agroecology was mostly discussed as a scientific concept, and was used in relation to issues at the farm level and the ways in which to improve food production using ecological knowledge. In the late 1970s, agroecology emerged in southern Mexico [17] and evolved from a merely scientific discipline into a movement and a set of practices [21]. Since then, the scope of agroecology increased from the farm plot to the agroecosystem level. By the end of the 1990s, agroecology was considered to be a discipline that encompasses the whole food system as much as the agroecosystem management [22]. Agroecology discussions engaged much broader aspects of the food system, taking into consideration political, economic, social, and cultural factors to transform the current unsustainable food system. In the 2010s, agroecology was globally seen as an innovative approach to improve both agricultural productions and the food system.

Figure 1 illustrates the historical evolution of agroecology and its principles: (1) the set of principles with which agroecology is associated in its different manifestations, and which reflect priorities, concerns, values and relationships, as well as how these are articulated from each disciplinary perspective (Figure 1a); (2) the scales of application of agroecology (Figure 1b), from the field, farm and agroecosystem scale to the food system scale; and (3) the gradual broadening of the key topics covered by the different manifestations of agroecology across time (Figure 1c).



**Figure 1.** “Historical evolution of agroecology and its principles” (adapted from [22] (p. 5): (a) the categories of principles and their disciplinary basis, (b) the development of scale and dimensions in the concept of agroecology, and (c) the development of the three dimensions of agroecology (science, practice and social movement) and the key research topics and nature of the research carried out.

Agroecology is currently seen as a dynamic and holistic socio-ecological approach that has the potential to bring about the food system transformation that is needed to meet the SDGs. As such, it has gained prominence in scientific, political, social, and agricultural discourse. Gliessman (2018) asserted that agroecology has evolved into a transdisciplinary approach that requires an integration of research, policies, and actions to achieve a sustainable food system. It is also understood as an “alternative to conventional high input or industrialized agriculture and the unsustainability of food systems” [18] (pp. 667–668) and “as an alternative paradigm to corporate-led industrial food systems” [23,24] (p. 561). However, it is not a homogenous discourse, and different interpretations and definitions worldwide see agroecology as a practice, as a movement, and as a scientific discipline [18]. As emphasised in Figure 2, the agroecological approach has now been developed into a framework that pursues to integrate transdisciplinary, participatory, and action-oriented approaches, and is also critically engaging with political-economic issues that affect agro-food systems [25].



**Figure 2.** “Agroecologies”— a schematic representation of the evolution of different types of agroecology [25] (p. 7).

### 3. Disengagement of Cultural Knowledge from Agroecology: Going beyond the Dichotomy between Natural and Social Sciences

#### 3.1. Agroecology and the Socio-Cultural Aspects of Agricultural Practices and Food

Oteros-Rozas et al. indicated that agroecology demonstrates the potential to reuse and reshape the narratives of the past and present to sustain the future community. Furthermore, agroecology also contributes to the re-establishment of the connection between humans and nature [25]. The so-called food systems approach in agroecology [16,26] has placed a greater emphasis on the social dimensions of food. Meanwhile, in the field of social sciences, a number of research topics have been increasingly linked to agroecology [26] (pp. 182–183). Some of the topics that indicate a common ground between natural and social science approaches include food sovereignty [27], the right to food [28] and food security [29,30], to name a few. The term ‘food sovereignty’ has multiple definitions [31] (p. 663) however, in the context of agroecology it is often associated with “the right of the peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems” [32] (p. 9).

Social research, especially concerning traditional knowledge of farming, cultural and traditional values, and food traditions, is important owing to its ability to shape both the global understanding of the relationship between food habits and culture as well as the entire global food system [1,7,20,33,34]. Social sciences have contributed to agricultural sustainability since the early 1990s by assessing and understanding the social forces that affect agricultural research and policy [35]. Indeed, both sustainable agriculture and agroecology are considered to be ‘social movements’ that emerged following the development of the international environmental movement [35] (pp. 176–177). In some cases, knowledge of traditional farming systems has helped tackle the problem of hunger, poverty, and malnutrition, and has replaced unsustainable industrial food production [36–38]. Wezel et al. [26]



have demonstrated how the combined approaches of natural and social sciences can potentially enrich the concept of the agroecology of the food system, addressing more efficiently and holistically the impacts of the research results.

Outside of agroecology, a significant body of literature has engaged with food, with a significant emphasis on the socio-cultural properties and values that food traditions and cultures hold. It has been argued that cultural practices, cultural beliefs, and identity influence food choices, food consumptions, and food waste [33,39–41]. In many disciplines, such as anthropology, geography, and sociology, food has been considered as having social, cultural, and symbolic meanings, as well as being intrinsically linked with economy, culture, security, sustainability, and sovereignty [3,42,43]. Foodways, for instance, is a concept that brings together various disciplines and has defined how research about food is articulated. According to Engelhardt [44] (pp. 1–2), foodways deal with “the study of what we eat, how we eat, and what it means”. They constitute the exploration of socially bounded lifestyle groups whose social network includes the sharing of a food system [45]. This notion is truly relevant to agroecology, and together with the concept of food heritage (which will be the focus of the next section), it can provide a significant body of interdisciplinary research which can be beneficial to current debates about the food system. The insights gained from this body of research, linking food with culture, have inspired several other disciplines to further explore topical areas of research interest. For example, drawing on the seminal work of social anthropologist Jack Goody (1982), researchers in the field of communication and media studies critically examined the media coverage of sustainable food in Romania through the lens of Goody’s five-phase framework of production, distribution, preparation, consumption and disposal, and “mediatization” theory [46].

However, it has been pointed out that despite some sporadic empirical research that connects cultural food traditions and agroecology, little work has been done to illustrate how the two intersect [9]. This has been observed despite the recognition that, for agroecology, the problem of the food system cannot be separated from the study of human communities [47], even though agroecology should seek to consciously “combine the experiential knowledge of farmers and indigenous peoples with the latest insights from the science of ecology” [48] (pp. 287–288). Within agroecology there remains a need for the conceptualization of traditional and ‘culturally appropriate’ foods or diets in their full, modern complexity, particularly in the mobile, global world, and in a post-colonial context [49]. Such a lack of engagement with elements of culture and food traditions that are actually associated with every aspect of the food system may lead to a possible neglect of an important part of the conversation. Mendez et al. [10], for example, have pointed out that grounding the agroecological approach mainly in natural science research leads to a narrowed focus that runs the risk of silencing contributions of non-Western knowledge or traditional practices that can enrich agroecology.

The aforementioned discussion shows that agroecology has fostered the importance of the socio-cultural aspects of food, but there is still great potential in weaving together a significant body of research that has remained outside the confines of agroecology. The next section discusses the concept of food heritage and the relevant research that could better intersect with agroecology in order to provide a more holistic view of the food system.

### *3.2. Heritage Studies: An Opportunity to Weave Together the Sociocultural Research on Food*

The emergence of heritage studies and its increasing preoccupation with food as a form of cultural heritage—recognising both the tangible and intangible elements that are associated with food traditions and cultures—offers a new dynamic approach to approaching food. Indeed, this paper argues that the approach advocated by heritage studies fits well with several of the aims and objectives of agroecology’s approach, while also directly encompassing the rich body of literature from fields of research such as anthropology, sociology, geography and foodways.

Heritage studies emerged as both an academic discipline and an intellectual engagement in the 1980s and, following a ‘boom’ in the 1990s [4,50–52], it has been established

beyond the confines of the Anglophone world into a globally significant field of study. Initially, its contours and agenda were influenced by the post-war ideas, principles, and developments of the heritage profession through, for example, heritage conservation, historic preservation, and heritage (or cultural resource) management [50], favouring the material values of heritage places and elements [53]. Overall, heritage studies exists in an interdisciplinary space [50,54], and this has—to a great extent—influenced its ability to encompass theoretical orientations, perspectives, approaches, and research methodologies from a vast range of disciplines [2,52,55]. In this sense, heritage studies shares a commitment to interdisciplinarity with agroecology.

Before we establish the connections of this discipline with food, it is important to emphasise that a substantial ideological shift has been accomplished in the last 15 years by the establishment of the notion of intangible cultural heritage. This shift can be attributed, on a practical level, to the gradual recognition of intangible heritage values through UNESCO's 'Convention for the Safeguarding of the Intangible Cultural Heritage' [56,57]. On a theoretical level, it mirrors relevant changes in the thinking of both heritage professionals and heritage studies scholars [2,53]. Indeed, calls for a more critical, politically aware, and inclusive way of thinking about and doing heritage have led to so-called 'critical heritage studies' [52,58].

Some of the aforementioned developments have brought about the notion of food heritage. Initially, advocates of heritage studies considered people's diet and drink to be part of the fields of heritage in the category of 'activities' [51]. However, with food emerging as a crucial element of intangible cultural heritage through UNESCO's activity, the notion of food heritage has now gained a lot of currency [5]. This new direction that heritage studies has embraced within its expanding areas of interest has been deemed to reflect a process of food heritagisation [59], the so called 'food heritage fever' [60] (p. 89), or the 'heritage turn' in food studies [61]. The notion of foodways—along with cuisine, gastronomy, and epicurean delicacies—can be viewed as an element of the broader system of cultural heritage [62]. Indeed, recent scholarship approaches foodways as an important part of or as a form of cultural heritage [63–65], and often specifically as intangible cultural heritage [5,66,67].

It is important to underline that food heritage can consist of both tangible and intangible elements, can be multi-sensory (potentially engaging all five senses: sight, smell, taste, touch, hearing), and is often linked with the human understanding of the universe and human relationships with nature and earth. Consequently, food heritage has a crucial role in the environmental, economic, social, and cultural sustainability of food systems. Food heritage is dynamic. It can change through time and, although it can connect the past with the present and the future, it nevertheless reflects a process of cultural production in the present.

### *3.3. Heritage Studies and Agroecology: Mutual Interests*

In a previous section, we mentioned that natural and social science approaches to agroecology have mutual interests in topics like food sovereignty, the right to food, and food security. The role of food heritage has also been increasingly considered in terms of such topics. For example, definitions of food sovereignty promote the right to 'culturally appropriate' food [31], and the discourses of food heritage can help identify and articulate what is culturally appropriate while recognising the dynamic nature of the concept and its often dissonant and contentious nature. Moreover, discussions of the 'right to food' can be combined and complemented by the notion of cultural rights within the notion of food heritage. The Human Rights Council of the United Nations supports the right of everyone to take part in cultural life, including the ability to access and enjoy cultural heritage [68], and the relevant resolution can be assumed to naturally extend to food as a form of cultural heritage. Efforts to tackle food security can be more effective when bearing the role of food as a form of cultural heritage [40].

Overall, food sovereignty supports bottom-up approaches to the promotion of traditional diets and the empowerment of people in terms of what they eat [9] (p. 6) in the same way that heritage discourses promote the democratisation of cultural heritage through public and/or stakeholder participation [69]. A growing number of agroecology researchers have embraced community-based and participatory action research in an attempt to bring forward the expertise of non-researchers, and in order to generate knowledge that has been co-created and that is actionable [70]. Participatory action research has also inspired the wider cultural heritage sector [71], particularly in recent years, where the principle of co-creation has gained currency [72]. This is a significant point of convergence between natural and social sciences, and by extension between agroecology and food heritage research. Notions such as citizen science—which refers to processes in which the citizens collaborate with scientists and can potentially generate new scientific knowledge [73]—have been deemed very important for sustainable development and agriculture [74], but have also inspired heritage professionals [75,76].

Another point of convergence between agroecology and food-related heritage studies is the recognition of the importance of traditional agricultural practices that are associated with cultural landscapes (viewed as agricultural heritage) and this is evident in the protection afforded to certain examples included in both UNESCO's World Heritage List and FAO's 'Globally Important Agricultural Heritage Systems' (GIAHS). The FAO acknowledges several common objectives between the GIAHS programme and agroecology systems, such as the importance of farmers' cultures and social involvement, ingenious local and traditional knowledge and innovations, and the consideration of the social aspects required for a sustainable and fair food system [77]. Some organisations, such as the Northeast Slow Food and Agrobiodiversity Society, go as far as to associate agroecology with the preservation of the heritage and tradition of indigenous people [78].

To-date, a significant body of literature under the umbrella of heritage studies has been dedicated to a wide range of aspects that emphasise the cultural and social role of food as a form of local, regional, national, and global heritage. Further reflections on why agroecology and heritage studies are placed at an interesting confluence of research about food is presented below.

#### **4. Pathways to Transition to Sustainable Food Systems: Applying a Food Heritage Lens**

##### *4.1. FAO's Elements of Agroecology*

In this section, we bring together current thinking about agroecology research with innovative research in food heritage to demonstrate how evidence generated through food heritage research can realise agroecology's vision of adopting a truly holistic approach. We start by examining recent developments on a policy level that have accelerated the support of agroecological transitions towards sustainable food and agricultural systems, followed by some concrete ideas about how food heritage can help achieve these.

A pivotal moment for the wider recognition of the role of agroecology for the sustainable food system came in 2014 when it was adopted as one of FAO's strategies to achieve global food security and sustainable development [79]. The FAO is one of the most influential international organisations that have the capacity to advocate for a closer connection between agroecology and cultural heritage. This comes as no surprise, given the fact that just like UNESCO—which is the par excellence international organisation for the protection and preservation of cultural heritage—the FAO is also situated under the umbrella of the United Nations.

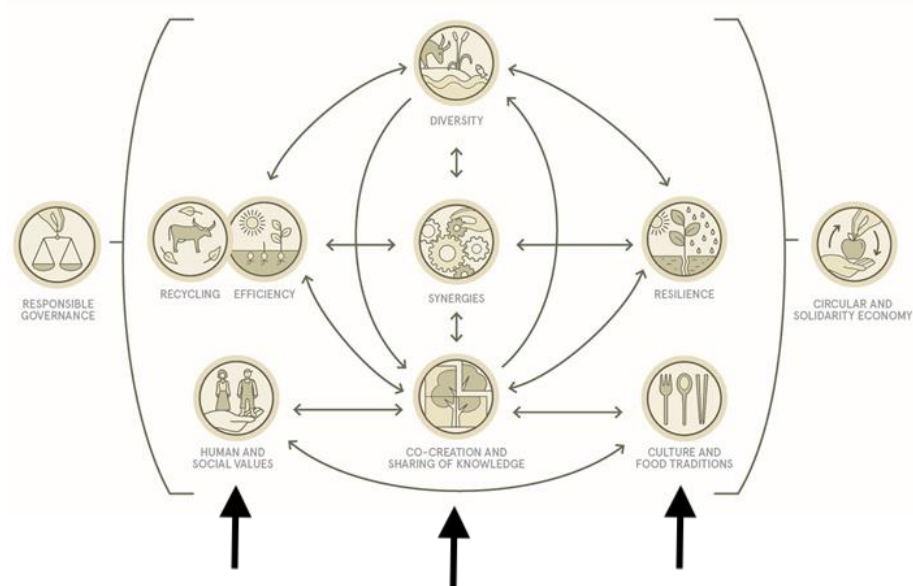
Between 2015 and 2018, the FAO convened several regional meetings and an International Symposium which recognised the potential of agroecology to facilitate necessary and transformative changes to meet Sustainable Development Goal 2, which is to 'end hunger and all forms of malnutrition' by 2030 [79]. The insights about key principles of agroecology, along with multi-stakeholder consultations, resulted in the creation of 10 salient elements that comprise agroecology (Figure 3) [6,80]





**Figure 3.** The 10 elements of agroecology according to the UN's Food and Agriculture Organization [81].

The FAO advocated all of these 10 elements of agroecology, which cover ecological as well as the socioeconomic, cultural and political dimensions, as potential entry points for transformative change towards sustainable food and agricultural systems [82]. Drawing on the work of Wezel et al. [22], who highlighted four entry points of transition pathways with a focus on the ecological and political dimensions of agroecology, this paper draws attention particular to social and cultural dimensions. Specifically, we employ the elements of culture and food traditions, human and social values, co-creation and the sharing of knowledge (Figure 4) as entry points that incorporate food heritage for plausible transition pathways. Using two case studies from our research, we highlight the pivotal role of food heritage research in the amplification of the transformative character of agroecology, which enables it to respond to the current challenge of the agri-food system and its impact on human health and the environment. The first case study focuses in on the *subak* system, and the second one uses *BigPicnic*—an EC-funded project—as a case study. The data for the subak system is drawn from both extensive ethnographic fieldwork on the island of Bali, including participant observation and unstructured interviews [12], and an analysis of secondary data. The data from the BigPicnic project come from a series of participatory action research (PAR) studies and a survey carried out with diverse audiences at 14 botanic gardens in Europe and one in Uganda [49,83,84]. Section 4.2 below summarises the findings from both the PAR and the survey [40].



**Figure 4.** Three socio-cultural and participatory entry points in the FAO's 10 elements of agroecology framework to build transformative change pathways towards sustainable food and agricultural systems [6].

#### 4.2. Subak System in Bali, Indonesia

The subak system of the Bali Province in Indonesia has been listed on UNESCO's List of World Heritage Sites as a cultural landscape since 2012. According to the World Heritage Committee [11], subak is a cooperative water management system, consists of democratic and egalitarian farming practices, and constitutes a manifestation of the *Tri Hita Karana* Philosophy, which brings together the realms of the spirit, the human world and nature.

The subak system is an example where food production and consumption need to be seen holistically. It is often understood as the traditional irrigation system of Balinese rice fields. Farmers gather in a subak organisation to manage irrigation water and prevent competition over the same water sources. The subak system, however, is much more than an irrigation system. This traditional rice plantation system is also a pest prevention system, regulates rice plantation schedules, and contributes to the continuity of Balinese religious practices. The whole rice production cycle—from the preparation of the rice fields to the harvesting season—cannot be seen as an individual process, as it is linked to a cycle of subak ceremonies. Similarly, each component of the subak system, including the organisation, rice field terraces, farmers, and rituals, need to be integrated harmoniously to create a working subak.

Protecting the subak system also means protecting the rice production, cultural practices, traditional farming knowledge, and social relationship amongst farmers. Knowledge related to subak is not only passed down during farming activities but also during social, cultural, and religious activities in Balinese society. This makes subak both a food and a cultural institution. Rice and many foods in Balinese culture possess not only an economic value but also a symbolic value and cultural significance, and represent the ideology of the Balinese community. Despite its primary role as a rice production system, subak could also be seen as an integrated food system, as it concerns the ways in which rice is produced and consumed, as well as how food-related knowledge is disseminated and modified.

Using the lens of human and social values, subak can be seen as a product of a multi-stakeholder collaboration. It is mainly managed by farmers who gather and make communal decisions through a subak organisation. However, priests, merchants, craftsmen, and other villagers are often involved in different stages of the rice production process. Thus, the success of both the rice production and preservation of this traditional system depends on the protection of the social value and the integrity of subak organisations. Strengthening the social relationship and the subak organisation is therefore crucial to ensure the sustainability of the subak system and protect farming as the main livelihood of the community. Although farming is a male-dominated job, the religious element of the subak system enables women to take part in farming activities. Women have also been involved in subak as seasonal workers during the harvesting season, which enables them to obtain additional income for their families.

The subak system also demonstrates the importance of the co-creation and sharing of knowledge to transition towards a sustainable food system. Allowing farmers to experiment with innovative methods of rice production is crucial to encouraging knowledge exploration and increase young farmers' interests in the agricultural process. This is also a way to enable farmers to find a suitable adaptive mechanism for the mitigation of the impacts of climate change. The subak system has been perfected through a thousand years of trial and error and the continuity of this system also depends on the ability of farmers to adapt to the current social, economic, and environmental challenges. The impact of the absence of co-creation was seen during the Green Revolution in the 1970s, when farmers' knowledge was marginalised by an international standardised farming approach. This brought crop failure, destroyed many rice fields, and poisoned hundreds of farmers, in contrast to the increase of productivity.

Culture and food traditions are also crucial components of subak. The subak system adjusts to the cultural and environmental conditions of Balinese society. For instance, it can be seen in the way in which the water management of Subak Jatiluwih—which has terraced landscapes—differs from that of Subak Pakerisan, which has a relatively flat landscape.

The farming schedules are also designed to be aligned with the Balinese calendar and other religious ceremonies. Such a consideration exists to balance economic and cultural activities in Bali, while ensuring the sustainability and effectiveness of rice production amidst the growing environmental pressures on the island. Like other indigenous knowledge, the transfer, co-creation, and sharing of knowledge related to the subak system happens through stories, best practice, informal meetings, and many religious and cultural events. Subak knowledge can also be incorporated into other Balinese systems, such as temples, palaces, and customary villages, as it is a crucial component of the culture. In Bali, many foods connect human beings with their ancestors, as can be seen in the ways in which the Balinese give a small portion of food for their ancestors before they eat. Various rices and foods are needed for different ceremonies, which demonstrate how the local food production is also crucial for the continuity of the Balinese culture and religion.

#### *4.3. The BigPicnic Project*

The second multi-case study focuses on the EU-funded BigPicnic project. Bigpicnic ran between May 2016 and April 2019, and was a collaboration between 19 partners, including fifteen botanical gardens, from twelve European countries and one from Uganda [49]. As stated by the FAO [81], it is more effective to respond to local challenges when the agroecological innovations are co-created through participatory processes and embrace context-specific knowledge. In a similar manner, the BigPicnic partners organised with their local communities several activities focused on several food security issues in which the co-creation and sharing of knowledge played a pivotal role [85].

BigPicnic was a participatory multi-stakeholder project at the heart of which was the co-creation and sharing of knowledge about food security, the food system, and the future of food through a series of co-created events, traveling exhibitions, and science cafés. Co-creation was the very core of all of these activities, with the aim to create shared values in collaboration with the communities. This meant that different levels of expertise were considered equally valuable in this process, and the participants sought to build a relationship based on dialogue, and the exchange of ideas and values. The co-creation process was an excellent opportunity to blend scientific knowledge with traditional and indigenous (the latter referring to views from local tribes in Uganda and African diaspora communities in Belgium) knowledge, as well as with the practical knowledge from different members of the food industry (farmers, producers and traders). Collectively, the botanic gardens and the co-creators produced over 102 co-created science cafés and 103 exhibitions, which covered a range of topics ranging from climate change, food waste and biodiversity to urban gardening, meat consumption and eating cultures [13]. For example, participants at the botanical garden of Leiden co-created an outdoor exhibition that dealt with various aspects of food provenance, production, and consumption. In Norway, school children co-created a photographic exhibition about food and climate change using their own views on the subject. Botanical gardens in Warsaw and Edinburgh employed digital storytelling that focused on the narratives, stories, and memories of various members of the public. Overall, the co-creation processes highlighted food as a form of cultural heritage and the role of food heritage in ensuring food security and sustainability. Furthermore, this process enabled co-creators to delve into and share various food heritage practices and traditional forms of knowledge.

BigPicnic created of an environment in which European citizens from varied backgrounds and with varied abilities and experiences were able to fully participate in the co-creation process and have their experiences and voices heard. As a result, a range of human and social values of citizens who are at the heart of food system (including people who produce, distribute, and consume food) were revealed. These highlighted the roles that human and social values play in promoting wellbeing and improving livelihoods in communities. In this context, provision for food education stood out as a principal factor, as participants underlined the value of knowing how to access information about food, acquiring food skills, preparing healthy food, and adopting a balanced diet. Another

important outcome aligning specifically with good health and wellbeing was the role attributed to the food choices that people make. Here, the emphasis was placed on having the ability to choose organic or natural products, the affordability of food products, and the importance of food that is regional or local. At the same time, access to food was considered the primary element that could tackle hunger.

Conceptualising food as a form of cultural heritage became evident across all of the co-created events, traveling exhibitions, and science cafés. This aspect demonstrated the connections between food culture and traditions and food security. Traditional eating defined many aspects of people's eating behaviour. Specific types of food, plants and dishes have traditionally been consumed because they are familiar, or because people are culturally attached to them. In many cases, specific types of food were associated with special situations (events, celebrations, rituals) that relate to national, ethnic, regional, or local identity. The latter was particularly highlighted by African diaspora communities in Belgium and local communities in rural Uganda. In Belgium, for example, a series of events co-created with members of the diaspora, focusing on edible insects and their consumption in relation to food security, provided interesting insights on dietary habits, how practices such as entomophagy are directed by tradition, and the value of culturally appropriate food. Co-created activities in Greece engaged with superfoods, aromatic plants and herbs that are traditional and hold nutritional or medicinal properties, while participants in Bulgaria indicated their attachment to home-grown vegetables that are used in traditional dishes. Culinary traditions such as the Mediterranean diet emerged as especially important for audiences in Spain, Portugal, Italy, and Greece, tapping into notions of health and seasonality but also cultural attachment and its links to a sense of place and locale.

The role of food in forming cultural identity and the accessibility of food ingredients from the home country were also very prevalent in the events that touched on the aspirations and values of diaspora communities. For example, members of the African community of Belgium stressed the importance of the availability of food crops from their native countries, indicating that both quality and price are important. At the same time, people with a migratory background underlined the role of food in reconnecting with the homeland through memories, traditions, and habits.

The commensality of food and its associations with specific memories and stories that are valued by individuals and groups of people were not only highlighted by participants that were confined to diasporic communities. Childhood memories related to culinary traditions, and the uses of specific plants and dishes appeared strong in defining attitudes towards and knowledge about food.

## 5. Conclusions

Although the importance of social science in creating a more sustainable food system has been acknowledged widely by FAO and food scholars, this paper highlighted that the disconnection between the natural and social sciences in food system research persists, and threatens to disarticulate the contributions of non-Western knowledge and indigenous practices on the improvement of the food system. Agroecology has been proposed as a way to integrate social and natural science approaches. However, little work has been done to demonstrate how culture and food traditions intersect with agroecology [9].

This paper proposes three (out of the ten) of the FAO's elements of agroecology—namely the co-creation and sharing of knowledge, culture and food traditions, and human and social values—as entry points to transformative change towards sustainable food and agricultural systems. These entry points reflect the importance of culture and food heritage as part of agroecology. The case studies of the *subak* system and the Big Picnic project highlighted how culture and cultural practices could affect food production and consumption, and manifest a direct link to food security. Culture and tradition also have a prominent role in affecting people's choices of food, as it reconnects them with their homeland through memories, identity, traditions, and habits.

This research demonstrated that geographical, cultural, and social context need to be taken into account when implementing agroecological approaches. The case study of the *subak* system underlined how agricultural systems that do not integrate food heritage can destroy the food system and its actors. A traditional food system is often presumed to be a rigid system that cannot cope with global and future challenges [86], but *subak* has demonstrated its ability to adapt to the changing needs of its society. On the other hand, the emergence of modern farming techniques and the Eurocentric knowledge of farming has disrupted the traditional knowledge of the *subak* society and has slowly eroded how the agricultural system is valued and practised. Subsequently, the absence of the full range of learning processes and experiences embodied in the *subak* co-creation and sharing system directly affect the sustainability of the food system. Thus, instead of approaching food heritage as an element of a food system or agroecology, this paper argues that food heritage could be seen as the ‘glue’ that makes the food system and knowledge work.

The BigPicnic case study demonstrated the importance of co-creation and knowledge sharing in the engagement of food actors and stakeholders in various stages of the food system. This is particularly crucial to encourage food innovation, adaptation, and knowledge transfer, and to develop an effective and sustainable agriculture and food system. Co-creation and knowledge sharing could be done through storytelling, exhibitions, informal conversations, food stories, and interactive activities, as well as religious and cultural events, but it is essential to ensure that these are adjusted to diverse cultural and social settings. Food-related cultural practices and traditional knowledge are more useful when shared with the scientific community and placed in a dialogue with established scientific knowledge. In addition, culturally appropriate diets and food habits reaffirm the strong relationship between cultural identity, a sense of place, landscapes, and food systems. BigPicnic highlighted the value of the co-creation and sharing of knowledge as a means of delving deeper into traditional and local food knowledge creation and sharing, and the particular social, physical and cultural context in which this knowledge is situated. This speaks to the long-held vision of agroecology to bring traditional and local food knowledge to the core of food system knowledge, and highlights pathways to achieve this through the application of a heritage lens.

This paper underlines the added value of adopting an approach that bridges the research conducted in the fields of agroecology and food heritage. This approach can render more nuanced explorations of the socio-cultural aspects of food *vis a vis* the recognition of different forms of ecological thinking and practices, and their contribution to the food system as a whole. We argue that a more effective convergence of agroecology and food heritage research, a closer collaboration between the two, and a cross-fertilisation of theoretical concepts and methodological approaches would be very beneficial. Moreover, this could potentially redress the balance between the environmental and economic, and the social and cultural dimensions of the food systems, and ensure that the latter are not being overlooked in favor of the former.

**Author Contributions:** Conceptualization, D.R., T.M., G.A.; writing—original draft preparation, D.R., T.M., G.A; writing—review and editing, D.R., T.M., G.A.; funding acquisition, T.M. All authors have read and agreed to the published version of the manuscript.

**Funding:** The Big Picnic research received European Commission Horizon 2020 Funding—‘Science with and for society’. ISSI.1.2014.2015, ‘Pan European public Outreach: exhibitions and science cafés engaging citizens in science’. The research on the *subak* system was funded by the Indonesian Endowment Fund (LPDP).

**Institutional Review Board Statement:** The study of the *subak* system was approved by the Chair of the Ethic Committee of the UCL Bartlett School Environment, Energy & Resources, London, UK (approval received via email on 27 April 2017). The BigPicnic study was approved by the Ethics Committee of the University of Innsbruck, Innsbruck, Austria (approval received via email on 10 December 2016).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.



**Conflicts of Interest:** The authors declare no conflict of interest.

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