Chapter 20
Ordinary Biodiversity. The Case of Food

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Abstract The green revolution, the biotech revolution, and other major changes in food production, distribution, and consumption have deeply subverted the relationship between humans and food. Such a drastic rupture is forcing a rethinking of that relationship and a careful consideration of which items we shall preserve and why. This essay aims at introducing a philosophical frame for assessing the biodiversity of that portion of the living realm that I call *the edible environment*. With such expression I intend not simply those plants and animals (including in this category, henceforth, also fish and insects) that were domesticated for human consumption, but also the thousands of species that are regularly consumed by some human population and that are regarded to some degree as wild. The visceral, existential, and identity-related relationship that link humans with the edible environment can be regarded as *sui generis* and can constitute a ground for explaining why it should receive a preferential treatment when it comes to preservation, propagation, and development. First of all, I discuss whether we should draw a sharp divide, when it comes to preservation efforts, between *wild* and *domesticated* species (§1); secondly, I assess whether to draw a sharp divide between *natural* and *unnatural* entities, when it comes to measurements and interventions regarding the edible environment (§2); finally, I ask what is the value of biodiversity as far as food is concerned, and how best to preserve and foster it (§3 and §4). The closing section draws some suggestions for future investigations and interventions.

Keywords Food biodiversity · Wild foods · Natural foods · Food ontology

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20.1 Introduction

The concept of biodiversity is rather unquestionably associated with the idea of untamed forms of life, living entities, or parts of living entities, which developed on Earth independently of or prior to humans. Far more controversial, instead, is whether biodiversity measurements and interventions should take into account also forms of life and living entities that have been to some degree influenced by human activities (cfr. Siipi 2016, section 1, for a comparison of the opposing camps.) Some authors lean towards a very inclusive notion of biodiversity, which virtually leaves out no (actual or possible) form of life, living entity or any part of a living entity. But, no matter where one wishes to draw the line, it seems unfeasible to have a notion of biodiversity that excludes all those entities that have been *in some way or other* influenced by humans. Not only would it currently appear unfeasible to insist on protecting only those entities that are untamed; more importantly, any effort of preservation or development of such entities would by itself undermine their being in some way or other independent of human existence. Hence, any account of biodiversity seems bound to address the following two questions:

(1) Are there living entities that should be excluded from measurements of biodiversity as well as from efforts of conservation[1]?
(2) Should the criteria for inclusion in a measurement or intervention be context-dependent or context-independent? For instance, could different criteria be selected depending on circumstances?

Another important outcome of the literature on the concept of biodiversity is that, at a closer look, most accounts of biodiversity reveal a preference towards more familiar forms of life.[2] Thus, for instance, preserving the existence of pandas seems a much more important goal than preserving the existence of any species of mollusks that inhabits some remote marine areas, no matter how important such mollusks may be to a certain ecosystem; or, consider the little attention that the preservation of bacteria has received in comparison to animals or plants, which can arguably only in part be justified by the taxonomic challenge of classifying bacteria. It is important to reflect on the reasons that might have supported such preference of certain forms of life over others; are those *good* reasons, that is, reasons that justify keeping such preferences in our accounts of biodiversity? Or, are such preferences biases, which cannot be justified? Hence, the following additional question for any account of biodiversity:

[1] In this paper I shall refer to *conservation*, rather than *preservation*, efforts. I do not have in mind such a sharp distinction between the two notions, as established in the classical dispute between Gifford Pinchot and John Muir; at the same time, it seems most appropriate to speak of conservation of ordinary biodiversity, rather than its preservation, because of the active human role not only in establishing and maintaining it, but also in exploiting it for the purposes of – among others – dieting, pleasure, research, and profit.

[2] See Marques da Silva & Casetta, Chap. 9, in this volume.

(3) What are the grounds for preferring certain (possibly more familiar) forms of life over others? For instance, do such preferences rest on efficiency, or perhaps on some emotional or spiritual connection?

In this essay I aim to address the three questions just raised from a particular angle, which has thus far received relatively sparse attention from philosophers. I aim to analyze the value of biodiversity when it comes to that portion of the living realm that I call *the edible environment*. With "edible environment" I intend not simply those plants and animals (including in this category, henceforth, also fish, insects, mushrooms, and some algae) that were domesticated for human consumption, but also the thousands of species that are regularly consumed by some human population and that are regarded to some degree as wild. The edible environment constitutes a particularly significant point of entry into the preferential attitudes that humans bear towards different forms of life. The visceral, existential, and identitarian relationship that humans bear with the edible environment can be regarded as *sui generis* and, as we shall see, can constitute a ground for answering question (3), that is, why the edible environment should receive a preferential treatment when it comes to preservation, propagation, and development. The edible environment is also an intuitive entry point into questions (1) and (2). Are there edible (parts of) living entities that ought not to be included in measurements of biodiversity (e.g., GMOs)? Should measurements and preservation efforts be contextual; for instance, should they tend to clearly demarcate between biodiversity of the edible environment and other forms of biodiversity? Are the criteria employed to account for the biodiversity of the edible environment specific to it? Are they consistent across the board?

In order to investigate questions (1)–(3), in what follows I will take up a number of issues that cut across them. First of all, the issue of whether we should draw a sharp divide, when it comes to conservation efforts, between *wild* and *domesticated* species. I address this in §1. Secondly, we should assess whether to draw a sharp divide between *natural* and *unnatural* entities, when it comes to measurements and interventions regarding the edible environment; this issue will be at the center of §2. Finally, we should ask what is the value of biodiverse foods and how best to preserve and foster it; these two issues will occupy sections §3 and §4, respectively. In §5 I shall return to questions (1)–(3) and suggest some answers.

20.2 Wild and Domesticated Foods

Today the food for sale at any supermarket, deli, or food market in an agriculturally industrialized country such as the United States, Holland, or Japan is a testimony to two kinds of success stories. The first is the story of human attempt to tweak the edible environment to serve human nutritional, economic, and social purposes; call this *the conquer and divide story*. There are a few remarkable facts about the diversity of domesticated species, which reveal the importance of looking at taxonomic

levels below species when it comes to domesticated plants and animals (cfr. Especially Diamond 2002: 702). Only 14 out of 148 large terrestrial mammalian were domesticated, and only about 100 plants out of 200,000 candidates. Any of those species is in itself a remarkable success story, featuring the rise of an astonishing number of varieties[3]: – e.g. over 40,000 varieties of beans, over 10,000 varieties of tomatoes, over 8000 varieties of apples, and circa 8000 breeds of animals (for a concise and up to date overview of the diversity of animals that humans consume, cfr. Chemnitz and Becheva 2014: 22–25). But, the first success story tells also of the many ways in which humans managed to cooperate with microscopic organisms such as bacteria, yeasts, and fungi, to preserve, modify, create key staples, including cheese, yoghurt, beer, wine, vinegar, chocolate, coffee, whisky, and hundreds more.

The second, more recent, success story tells of the increasing connection of food production and distribution systems worldwide; call this *the food revolution story*. Characteristic of it is the decline or extinction of thousands of varieties and breeds produced throughout the long path to domestication. For instance, in 2012 the FAO update on the state of livestock biodiversity estimated that circa 2000 of the 8000 animal breeds are at risk of extinction or nearly extinct. Or, to make two examples regarding plants, of the 287 varieties of carrots that humans devised, only 21 are still cultivated; and of the 8000 varieties of apples that we have a trace of, only 800 are still cultivated (cfr. Fromartz 2006, Chapter 1 and Pollan 2001, Chapter 1) If we look at the broad picture, data from The Food and Agriculture Organization of the United Nations (FAO-UN) indicate that since the beginning of last century 75 percent of plant genetic diversity has been lost. To offer some additional examples, "at least one breed of traditional livestock dies out every week in the global context; of the 3831 breeds of cattle, water buffalo, goats, pigs, sheep, horses and donkeys believed to have in this twentieth century, 16% have become extinct and 15% are rare; some 474 of livestock breeds can be regarded as rare, and about 617 have become extinct since 1892" (*Conservation and Sustainable Use of Agricultural Biodiversity* 2003, paper 3, p. 23). Also, over 97% of the varieties of foods sold in 1900 in the United States had disappeared from the market by 1983 (Cfr. Fromartz 2006, Chapter 1). The shrinkage of the number of varieties is principally due to the increased integration of food markets, controlled by fewer and fewer actors at the origin and during distribution, as well as by a growing syncretism and homogeneity within diets across the planet. Within a globalized food market, only a few varieties

[3] Some reader may wonder why the data presented in this section regard *varieties* rather than *cultivars*. Although the two concepts are at times used interchangeably (cfr. ICNCP 2009, Chapter 2, Art. 2.2), the technical usage of 'cultivar' picks out a more restrictive taxonomic notion, based on three principles: (i) possession of a distinctive character; (ii) uniformity and stability of such character; (iii) heritability of said character (ICNCP 2009, Chapter 2, Art. 2.3). At the same time, though, "no assemblage of plants can be regarded as a cultivar or Group until its category, name, and circumscription has been published" (ICNCP 2009, Chapter 2, Art. 9, Note 1); yet, many extant and past varieties, that may suitably comprise a cultivar, were never inventoried; thus, in a discussion of the biodiversity of edible plants, it seems most suitable to at least start off by considering all varieties, and then possibly refine the domain by considering the stricter notion of cultivar.

per species tend to be favored, namely those varieties that deliver an economic advantage such as production cost, shelf life, or consumers' appeal.

Much of the discussion concerning food biodiversity has indeed focused on either the conquer and divide story or the food revolution story. It is hard to overestimate the importance of the first story to human evolution. There are still countless details of the processes of domestication of each animal and plant that await to be uncovered, which will shed light over the economic, medical, social, political, and cultural history of humanity (cfr. Wrangham 2009). Equally important is the astonishing shift in food production and consumption, which occurred since the advent of synthetic fertilizers and, more recently, biotechnologies. In the past century, nearly all varieties on the market have been replaced. This leaves us with two major interrogatives: to what extent biodiversity efforts should focus on preserving ancient varieties, and to what extent measurements of biodiversity within the edible environment should include cultivars created by means of techniques such as lab cloning and genetic modification.

As important as they may be, the conquer and divide story and the food revolution story are far from portraying a comprehensive picture of the biodiversity of the edible environment. Indeed, the two stories leave out so-called 'wild' organisms (which can be counted not only in terms of cultivars, varieties or races, but also higher taxa such as species and families), which not only comprise a very significant portion of human diets, but also reveal a continuum between the discussions of prototypical biodiversity conservation targets (e.g. hot spots and endangered species) and conservation targets within the edible environment. By aggregating a number of studies, ethnobotanists estimated that humans have fed themselves off of over 7000 species (Grivetti and Ogle 2000; MEA 2005). Looking at 36 studies in 22 countries of Asia and Africa, Bharucha and Pretty (2010: 2918) estimated that "the mean use of wild foods (discounting country- or continent-wide aggregates) is 90–100 species per place and community group. Individual country estimates can reach 300–800 species (India, Ethiopia, Kenya)." Most importantly to our purposes, in nearly all countries across the globe, with the notable exception of United States, wild species and domesticated species are tended and consumed jointly, and in a number of occasions they are also jointly marketed. To many farmers, the distinction between domesticated and wild species is, indeed, of little significance. At the outset of their paper, Bharucha and Pretty (2010) report the words of a woman farmer, interviewed in Mazhar et al. (2007: 18), who exclaims: "What do you mean by weed? There is nothing like a weed in our agriculture."

Hunting and gathering have coexisted with agriculture in most societies. Both hunting and gathering, when integrated into the dietary routines of a society, require a deep knowledge of the prey, which encourages strategies for favoring the reproduction of animals and plants, possibly favoring desirable traits.[4] For example, a boar hunter may favor the reproduction of certain boar families, which possess certain particularly desirable traits (e.g. size and build); a gatherer of mushrooms may favor the reproduction of certain species in a spot by facilitating or creating specific

[4] Cfr. (Kowalsky 2010).

environmental conditions (e.g. humidity, shade, enclosure from the passage of certain animals, selection of surrounding plants). From this perspective, the so-called wild species found within the edible environment are typically far from the most untamed species known on Earth. This is not surprising since eating is a relationship, which in the case in point involves humans and a few thousands species; with time, although humans did not domesticate such species, they (voluntarily or involuntarily) managed them. The study of biodiversity within agriculture should be undertaken alongside with the study of biodiversity within the wild edible environment. As Bharucha and Pretty (2010: 2923) conclude,

> The evidence shows that wild foods provide substantial health and economic benefits to those who depend on them. It is now clear that efforts to conserve biodiversity and preserve traditional food systems and farming practices need to be combined and enhanced.

Another important consideration, which shows how simplistic is the view that draws a strong divide between wild and domesticated species within the edible environment, is that such a view leaves no place for the myriads of microscopic organisms that are essential to human diets worldwide, with virtually no exception. To illustrate the point with an example, it would be unsound to claim that, at origins, humans domesticated *Saccharomyces cerevisiae* and that sourdough is one of the countless outcomes of such domestication process.[5] After all, humans were not even aware of the existence of such a microscopic fungus when they started making use of it to produce bread, beer, chocolate, etc. Rather, sourdough emerged out of a form of cooperation between humans and a variety of fungus, which was not guided by specific species design, but that likely proceeded through trials and errors guided solely by taste and, more broadly, culinary success. Yet, *Saccharomyces cerevisiae* is arguably part of the biodiversity within the edible environment that humans should aim to preserve. Parallel arguments can be developed with respect to progenitors of domesticated plants that are still lingering in the wild: they are especially precious because they typically preserve the widest genetic pool of the taxon. Hence, the discussion of the biodiversity within the edible environment found in virtually any extant human diet should include not only domesticated species and varieties.

The upshot for subsequent discussion is that any assessment of the measurement of the biodiversity found within the edible environment, and of the best means best conserve it, should recognize how variegated are the relationships that humans created with species in the edible environment. The edible environment is constituted by organisms (or parts of organisms) that can hardly be put on a scale with respect to their untamedness – from the wildest to the most domesticated. This complicates a bit the picture when it comes to decide whether to leave out certain items within the edible environment from measurements of biodiversity and efforts of conservation. Is there really a difference between domesticated and wild species, which

[5] It may be more plausibly argued, however, that *Saccharomyces cerevisiae* was in some sense *domesticated* by contemporary biotechnology, through the selection of best suited samples and genetic engineering interventions. I shall leave the issue open here.

should be reflected in the study of the biodiversity of the edible environment? What to make of microorganisms? What about bioengineered plants and animals? These questions shall occupy us in the next section.

20.3 Finding Natural Joints

In her assessment of biodiversity with respect to human modified entities, Siipi (2016) distinguishes between three main ways to devise a cutoff point between what should be included in an inventory of biodiversity and what should not. They are respectively based on the (i) history, (ii) properties, and (iii) relations of the entities under consideration. It may be useful to begin by illustrating the three ways.

(i) With respect to the first way, imagine the case of two portabella mushrooms, one of which is grown wild in a forest and one that is induced by a human in a garage; suppose further that the two mushrooms are genetically identical, because the mushroom mycelia of the wild mushroom have been transplanted in a litter in the garage, that they are hardly distinguishable when it comes to taste and nutritional characteristics (their properties), and that they have similar market and culinary value (their relations); nonetheless, since the mushrooms have different histories, which rest on their different contexts of development, the forest-grown is regarded as 'wild' or 'naturally grown' and the other is labeled as 'home-grown'.

(ii) To illustrate the second way, based on properties, imagine two portabella mushrooms grown side by side in a forest (hence having alike histories) and having similar market and culinary values (relations), but possessing quite different nutritional and gustatory properties, due to the malformation of one of them, developed just a few hours before being picked (hence, not really historically based). You can conceive of a classification according to which the malformed mushroom is regarded as 'unnatural' and the other as 'natural,' based on their morphological properties.

(iii) To illustrate the third way, based on relations, imagine two portabella mushrooms grown side by side in a forest and perfectly comparable in terms of size, nutritional and gustatory properties, but ending up in two different markets and, from there, two different restaurants; although alike in terms of origin and properties, one of the mushrooms *belongs* to the market and restaurants where it ends up, being recognized as a 'natural' element within the edible environment of the culinary culture(s) showcased within the market and the restaurant; the other mushroom instead is considered as somewhat foreign to its market, and ends up in a restaurant to be featured as an exotic, 'unnatural' item to be placed alongside the other foods.

In her paper, Siipi distinguishes in total six criteria for telling apart natural from unnatural foods for the purposes of finding a cutoff point between entities that should be relevant for biodiversity measurements and preservation, and those that

should not be so regarded. Three criteria are history-based and concern respectively: the organisms that are independent of humans (e.g. a wild herb spontaneously grown in a remote beach), the organisms that are not controlled by humans (e.g. wild blackberries), and the organisms that are regarded as non-artificial (e.g. Golden Delicious apples). Two additional criteria are property-based and regard the foods that are: alike to spontaneously occurring (e.g. two mushrooms, one forest-grown and one garage-grown, which are alike in terms of culinary and nutritional values); alike to possibly existent foods (e.g. seedless grapes, obtained by grafting spontaneously occurring samples of seedless grapes (cfr. Sperber 2007). The sixth and final criterion is relation-based and rests on whether a certain food 'belongs,' or is 'suitable to' a given context (e.g. grapes being unsuitable for the original climate and soil of Central Valley, California, and thus requiring amounts of water, pests, and herbs that are disproportionate).

Siipi's thorough examination of the ways in which a portion of an edible environment may be found to be natural or unnatural, and hence possibly included or excluded in biodiversity measurements and conservation policies, demonstrates the complexity of the matter at stake. To further her analysis, we should first of all avail ourselves of the conclusion reached at the end of the previous section. Concepts of 'wild' and 'domesticated' do little to usefully represent key relationship between humans and parts of the edible environment that are relevant for the purposes of biodiversity; these concepts should be better substituted with specific histories of the relationships between humans and parts of the edible environment, which evidence characteristic traits. But, which traits should matter? A tentative list should include things such as control over reproduction, difficulty of reproduction, potential variability of the desired trait, nutritional properties, gustatory properties, broadly cultural properties, ecological fit, culinary fit … Yet, can an exhaustive list be provided? Interesting in this context is also to recall that focusing on individual species may not be the best manner to proceed in an assessment of biodiversity; rather, we should look at broader networks of biotic and abiotic entities that produce certain foods. Indeed, the production of certain foods requires the employment of additional living organisms; for instance, any peach orchard requires bees for pollination, or any fig orchard requires a specific species of tiny wasps as well as trees that are both female and male, even though the latter produces fruits that are generally not eaten. More generally, it seems best in a number of circumstances to pay attention to ecosystems that deliver foods, rather than to single species within the edible environment; for instance, Vitalini et al. (2009) proposed a EU designation of 'Site of Community Interest,' which would stress indeed the presence of a number of biotic and abiotic conditions that are necessary to sustain portions of the edible environment. Hence, to guarantee the security of the relevant edible plants, measurements of the biodiversity of the edible environment should take into account not simply the (parts of the) species or varieties that we feed off, but also the other biotic and abiotic conditions that are necessary for their survival.

In conclusion, although a number of traits, such as the ones just listed, are arguably most relevant in the majority of contexts, it seems methodologically incorrect to proceed by devising a list that should fit every assessment of biodiversity within

an edible environment. In other terms, this discussion suggests that there is no one vantage point from which to assess the naturalness of a (part of an) organism found within the edible environment; this is because naturalness is not a matter of that (part of an) organism being domesticated or wild, but what function it plays in a system of food production, which ecological relationships it bears to other surrounding organisms, as well as what functions it could play in possible edible environments that are considered relevant for the purposes of the assessment. The remaining of the paper will elaborate on this thesis.

20.4 The Values of a Biodiverse Edible Environment

The previous two sections argued that the biodiversity within the edible environment includes a wide array of entities, which can hardly be systematized in a context-independent taxonomy. Recapping the complexity of the domain under examination will be useful to start assessing its multiple dimensions of value.

While a distinction between wild and domesticated species could be defended, based on the degree of human intervention during reproduction and selection, it would be unseemly to claim that all wild species develop(ed) fully independently of human interference. Some developed actually in conjunction with human artifice. For instance, many forms of gathering and hunting do proceed through subtle modifications of the surrounding environments by humans, which facilitate the reproduction and growth of specific populations of the designated species or variety. The spectrum of domesticated species varies significantly, as it includes plants that are reproduced by cutting (e.g. rosemary, strawberries, avocados), plants that are reproduced by grafting (e.g. grapes, most fruit trees), plants that spread by sexual reproduction (e.g. most grains), and a number of plants that can reproduced in any of those ways (e.g. avocados, cacao trees). For any of the domesticated species, we can wonder what is the degree of interference that humans have access to in *any single instance of reproduction*: with animal farming, breeding is often controlled down to the minutest details by the farmer; but, with grains, it is not feasible to control the path of all the pollen in a field and often also the selection of seeds is only partially decided by the farmer, who will work with what was provided by the previous harvest; in an orchard, the farmer cannot control the process of pollination by bees to the minutest details; ditto for controlling reproduction within a fish farm. Alternatively, we can measure the overall degree of interference between humans and the species by looking at the genetic distance of domesticated organisms from their wild progenitors, factoring in the number of generations that occur between the two samples.

Species are not the main units when biodiversity of the edible environment is at issue. Rather, cooperation among different clusters of organisms, organized in more or less spontaneous communities, seem to be the key concept. In this light, the cooptation of microorganisms to produce viable foods, which at least until Pasteur proceeded somewhat blindly with respect to the biological details of the microorganisms,

comprises a chapter of its own in the inventory of the relationships between humans and the edible environment. Beer, bread, chocolate, yoghurt, cheese are all examples of a *culture* of fermentation, which played an essential role in food production and conservation and in human evolution. Fermentation, as we know it today, is the outcome of a microbial diversity, which is formed during food preparation and aging, and which confers a distinctive specificity to food; not only it is arguable that, without being fermented, beer would not be *beer*, but it is also arguable that without certain strains and species of microbes that are characteristic to it, a certain beer style (e.g. pilsner) would be not that beer style. The research on this issue is extensive; cfr. Borghini 2014: 1118 and, for a recent significant example based on cacao Ludlow et al. 2016). But, in the human cooptation of certain microorganisms with the aim of producing viable foods, what matters most? Is it most important to preserve – say – the spontaneity of a process (as it happens in spirits which are spontaneously fermented) or, rather, to preserve certain final characteristics of a product? Do (some aspects of) the genetic profiles of the microbes fix the identity of the final product? Or, rather, should a certain style, brand, gustatory profile be privileged? These questions suggest that the diversity within the microbial world correlated to the edible environment is not all on the same level, and that privileging the diversity derived from a type of process (e.g. spontaneous fermentation) may hinder the tending to the diversity of other aspects of the fermentation process, such as the preservation of certain strains or varieties.

Finally, we should consider the complexity of biotic and abiotic factors that favor the reproduction, growth, and development of the edible environment. Hence, species of bees and wasps, varieties of soils, minerals within water, etc. It seems that an inventory of the biodiversity of the edible environment should include these items too, since they are arguably essential to the creation of a number of products, such as geographical indications (see Borghini 2014). Hence, the biodiversity of the edible environment is bound to include also a vast array of entities that are not really edible, but that are conducive to the production of the foods we eat, currently or possibly. There is here an overlap between the concept of biodiversity, when applied to edible items and when applied to non-edible items; for instance, we have reasons to protect the biodiversity of soils for reasons that are independent of food production (cfr. Brussaard et al. 2007), and yet the study of biodiversity of the edible environment will argue for their protection too.

The fluidity between the different categories of entities found within the edible environment is also reflected in the fluidity between roles taken up by food workers. For example, it is common for farmers to act as custodians of both domesticated and wild species, and to be farmers of both agricultural products and weeds; also, gatherers and hunters are oftentimes also farmers; and it is common to a fisherman to hunt too.

The edible environment showcases the complexity of the idea of biodiversity because of the multifarious forms that the relationship between humans and edible items can take and has historically taken. Such complexity is mirrored also in the *reasons* we have for valuing biodiversity within the edible environment. Because the subject matter are ordinary living entities, which are considered in relationship

to humans, it is fairly obvious that the reasons to value the biodiversity within the edible environment is entrenched with human existence and culinary cultures. I shall here divide up the field in four points: (i) food sovereignty; (ii) food security; (iii) gastronomic pleasure; and (iv) intrinsic value. Let us illustrate each of them, in order.

(i) *Food sovereignty*. With food sovereignty we intend the ability within a group of people to self-determine a sufficiently ample and relevant portion of their dietary choice by means of food production. Food sovereignty emphasizes, hence, the active ability of a society to determine which plants and animals to harvest and produce, as well as the means of production. Such a power of a society is foundational with respect to the possibility (not the necessity, of course) of actively fostering biodiversity within the edible environment. This power is especially critical when it comes to farming societies that are economically, technologically, and politically at a disadvantage. It was indeed introduced in 2002 by the World Bank with the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), a 3-year program aimed at improving food production knowledge and technology within disadvantaged societies. But, the idea of food sovereignty was implicitly already at the core of the *Universal Declaration on the Eradication of Hunger and Malnutrition*, issued during the World Food Conference of 17 December 1973. The declaration begins by noting "the grave food crisis that is afflicting the peoples of the developing countries where most of the world's hungry and ill-nourished live and where more than two thirds of the world's population produce about one third of the world's food;" it then goes on to suggest that "all countries, and primarily the highly industrialized countries, should promote the advancement of food production technology and should make all efforts to promote the transfer, adaptation and dissemination of appropriate food production technology for the benefit of the developing countries and, to that end, they should inter alia make all efforts to disseminate the results of their research work to Governments and scientific institutions of developing countries in order to enable them to promote a sustained agricultural development."

(ii) *Food security*. If food sovereignty regards the foods that are produced within a society, food security concerns instead the kinds, qualities, and quantities of foods *accessible for consumption* within a society. A consistent portion of the literature on the biodiversity of edible organisms focused on the importance of an ample spectrum of nutrients for combating malnutrition, when manifested both as a lack of sufficient calories or nutrients (undernutrition), or as an excessive amount of calories or nutrients (overnutrition) (cfr. Borghini 2017 for a philosophical analysis of hunger). In their literature review on food security and biodiversity, Chappell and La Valle (2011) provide significant evidence that "alternative agriculture, which is generally targeted at sustainability and compatibility with biodiversity conservation, is indeed on average better for biodiversity conservation than conventional agriculture, which usually (though not always) targets increases in yields to the exclusion and even detriment of direct

concerns about biodiversity, equitability, and food access." (Chappell and La Valle 2011: 17) Chappell and La Valle's conclusion, which stresses the link between food sovereignty and food security (see also Jarosz (2014) on this point), goes hand in hand with the so-called "ecoagriculture approach" (McNeely and Sherr 2002), according to which landscape biodiversity is key to ensure sustainable farming practices that are in sinking with their surrounding ecosystems.

A limitation of much literature on food security and biodiversity rests on a narrow conception of the edible environment, which is basically limited to agricultural products. As we have discussed above, landscapes comprising wild and domesticated foods come into closest contact in some of the regions where food access is most insecure. The availability of a diverse spectrum of plants, animals, and other suitable living entities for setting up an edible environment is a form of empowerment for communities that aim to improve their conditions with respect to food sovereignty (see below) and food security. Farming in urban or rural regions that present adverse climatic conditions or inadequate natural resources can be much improved by a wide stock of living entities that can adapt to different circumstances. Thus, an approach such as ecoagriculture is best appreciated when conjoined with the thesis that there is no sharp discontinuity between wild and domesticated species, and no easy cutoff point between natural and unnatural entities, at least when it comes to the edible environment.

Fostering biodiversity, hence, can aid to food security at two different levels: at the ecosystem level, and at the level of the edible environment. At the ecosystem level, biodiversity can facilitate a sustainable availability of resources, to be employed by producers with the edible environment. At the level of the edible environment, the wider the stock of organisms available to any producer worldwide, the higher will be her power to deliver suitable goods to a market; this, in turn, will increase opportunities for a diverse diet, which is key to address malnutrition. Of course, the availability of certain goods on the market is far from granting, by itself, a solution to food insecurity (cfr. Chappell and La Valle 2011: 17–18, for a discussion of this point); yet it is certainly a necessary step in order to address it.[6]

(iii) *Gastronomic pleasure*. Both food sovereignty and food security are linked to gastronomic pleasure, as they by and large shape the link between dining and civic values (cfr. Alkon and Mares 2012). Promoting a biodiverse edible environment is a mean to empower communities not only by strengthening the

[6] I should mention a difficult question arising at this point in connection to bioengineered organisms, which cannot be fully developed here. Consistent efforts are underway to engineer organisms (e.g. GM crops) and foods (e.g. lab meat), which may add to the diversity available to farmers worldwide. Arguably, these items should be included in an inventory of the (actual or potential) biodiversity of the edible environment; but, should they rank as equally valuable as their non-genetic counterparts? In keeping with the approach presented above, an answer to this question can be provided only when faced with a broader decisional framework, which keeps into account also the other three values to be considered next, that is gastronomic pleasure, food sovereignty, and intrinsic value.

sustainability of their agricultural production and by improving the likelihood that they will be food secure, but also by allowing them to diet in a manner that is most in keeping with their ethical, political, religious, an identity-related values. In this sense, the biodiversity of the edible environment is directly linked to the power of a society of choosing and determining its diet.

Slow Food may have been the first and to date the most fervent voice to insist on the link between biodiversity and gastronomic pleasure. The Slow Food movement, founded in 1986 by Carlo Petrini among others, focused since the beginning on the importance of gastronomic pleasure for any conversation concerning the political, ethical, and socio-economic discourse about food. In a telling passage of *Slow Food Nation*, Petrini writes: "Pleasure is a human right because it is physiological; we cannot fail to feel pleasure when we eat. Anyone who eats the food that is available to him, devising the best ways of making it agreeable, feels pleasure." (2013: 50) Now, for Petrini gastronomic pleasure is directly linked to the availability of a diverse array of products, which in turn can be obtained only by actively encouraging the diversity of forms by means of which humans tend the edible environment. Hence, gastronomic pleasure necessarily passes through the promotion of the diversity of the edible environment, by supporting typically small-scale tending practices, which aim to express the most meaningful relationship that humans can establish with the edible environment.

Unthinkingly, it may seem that pleasure is an accessory feature of human relationship to food, which should be kept out of the ethical and political sphere. Nonetheless, in the past three decades it has become increasingly more evident that there is a link between gastronomic pleasure and such issues as biodiversity, malnutrition, food sovereignty, and food access. Petrini's position echoed that of Wendell Berry (cfr. 1990) and has been re-proposed in different forms by several additional authors, such as Pollan (cfr. 2006) and Stiegler (cfr. 2006). Thompson (2015: Chapter 3) especially lays out a convincing discourse showing the link between dieting and the ethico-political sphere. It is impossible to tell apart the meaningfulness of the pleasure experienced during the act of eating and the sorts of food that are consumed (cfr. Borghini 2017 on this point); such pleasures are most often (positively or oppositionally) linked to values imbued in a society, to empowerment, and civic values, no matter how ordinary they may seem in any single dining occasion. For these reasons, gastronomic pleasure is to be included within the spiritual ecosystem services.

(iv) *Intrinsic value*. Finally, the value of a biodiverse edible landscape may rest on the value of the species, the varieties, and the trophic chains themselves. This may be the most intuitive value of a biodiverse edible environment in the context of a general discussion of the philosophy of biodiversity. A wider spectrum of forms of life has not only a utilitarian value, perhaps quantifiable in monetary terms like Costanza et al. (1997) provocatively suggested; rather, it is worth to invest time and resources in the fostering of biodiversity because there is a beauty and value in its mere *existence*, regardless of the consequences. When it comes to edible landscapes, the history of painting offers some neat

illustrations of the view of those who hold that biodiversity should be regarded as an intrinsic value. The paintings of Bartolomeo Bimbi, for example *Pears of June and July* (1696), entertain the spectators by simply showcasing a mesmerizing array of pears cultivated under the Medici family at the end of '600 s.[7]

In closing, it is important to ask whether the four reasons for measuring the edible environment are in some way affected or affecting a diet; more specifically, should a diet be influenced by consideration of biodiversity or, vice versa, do dietary decisions influence our stance on the measurements of the biodiversity of edible plants and animals? The fourth reason suggests implicitly that the wider a variety of edible items in a diet, the more commendable the diet; and you may wonder whether such a constraint is acceptable. You can fancy a society that is food secure, sufficiently pleased when it comes to dining, whose members have in some way come to agree in an equitable manner upon their diet, and which nonetheless survives within an extremely monotonous diet (made, perhaps, of one daily pill synthesized in dedicated laboratories). This society would arguably not contribute to the fostering of the biodiversity of the edible environment; should its members still pay dues to those in other societies who, instead, aim to foster it? If they should, in what measure should they contribute? For instance, suppose that the vast majority of the world population would come to prefer such a diet; would it still be feasible to maintain the goal of fostering an edible environment as diverse as we currently have? In other words: does the specific diet undertaken by an individual, or a society, maintain obligations to others who chose different diets? In what measures?

Since the biodiversity of the edible environment depends on human tending possibly in a more active manner than the biodiversity of other forms of life, these questions are far from trivial to answer. An important upshot is that, if we accept that the biodiversity of the edible environment is valuable independently of its consequences, then we should keep tending edible items even if they were to phase out of any human diet. To what extent this is a feasible goal is an issue that is worth further, future investigation.

20.5 What to Foster Within the Edible Environment?

Although a definitive cutoff for what is to be included in the edible environment cannot be provided, it is arguable that it is valuable for at least four reasons, no matter how we come to individuate it from time to time. But, what is it really that is of

[7] To be clear, I am not suggesting that the aesthetic appreciation of nature necessarily implies the recognition of an the intrinsic value of some natural elements, nor that all works of art illustrating nature do illustrate nature's intrinsic value; at a minimum, since the biodiversity of the edible environment depends on its relationship to human tending, showcasing and valuing it, *per se*, is also a mean to showcase and value *per se* human efforts to establish a meaningful relationship with the edible landscape; I am more modestly claiming that certain works of art can serve as illustrations of the view that nature has an intrinsic value.

value? And, are there any theoretical or practical conflicts in the items that we are seeking to foster? We shall address these two questions, in order.

With respect to the first question, we shall distinguish three kinds of items that are typically regarded as valuable in discussion of the edible environment. (1) The first, more traditionally valued kind of item is the variety or breed as established by means of reproduction. It is under this regard, for instance, that we shall include the conservation of the thousands of breeds of animals reared by humans over the course of millennia; ditto for the thousands of varieties of beans, potatoes, tomatoes, corn, and other plants; the hundreds of mushrooms that humans consume; the thousands of varieties of fungi, yeasts, and strains of bacteria coopted for food production. The problem with this proposal is that it is often controversial whether some characters of a plant or an animal are novel to the point of constituting the foundation of a new breed or a new variety.[8] The issue had been touched upon also by Darwin in the *Origins of Species*, especially Chapter II. Is a variety a cluster of organisms that has the potentiality to become a new species in a near future? That seems doubtable in the case of most edible organisms. Are varieties distinguishable at the genetic, phenotypic, behavioral, ecologic, nutritional, gustatory level? Should we pick varieties based on their significance for a certain culinary history, for their relationships with surrounding ecosystems, or rather for more arguably intrinsic characteristics of the product? Notice, finally, that to intensify the efforts to preserve a variety can imply to weaken it, because it may make it increasingly dependent from humans.

(2) In recent years a new method for marking the diversity of an item within the edible realm has come to be employed: it traces the genetic specificity of a variety of plants, of the breed of an animal, or of a microorganism. Thus, a clone of – say – Sangiovese grapes can now be identified not in terms of its phenotypic traits and ancestral history, but in terms of certain genetic traits that arguably are responsible for its characteristic phenotypic traits, such as the size of its fruits, its color, its skin, or a certain gustatory quality (cfr. also Borghini 2014 on this point). Although this method of identifying an item may seem similar to the one based on breeds and varieties, it is actually quite different. Indeed, breeds and varieties are essentially linked to ancestral history; on the other hand, fixing the identity on the basis of a selected number of genetic features is compatible with cis-genesis, cloning, and other potential forms of bioengineering. Hence, the identity of a certain breed of cattle would be fixed in terms of its genetic characteristics, no matter how the cattle would come into existence (actually, no matter whether the cattle ever came into existence or whether, instead, some of its cells where cultivated in a lab; on lab-grown meat, see Van Mensvoort and Grievink 2014).

(3) A third and last kind of item that may be worth fostering in order to foster the biodiversity of the edible environment are procedures and techniques for breeding and tending plants, animals, and microorganisms. Hence, the different manners by

[8] The more technical definition of 'cultivar' provided for plants in ICNCP (2009, Chapter II Art. 2.3) does not help here, because it still relies on a judgment regarding the novelty of the plant character.

means of which humans have facilitated, reared, and coopted new breeds of animals, new varieties of plants, and clusters of microorganisms. Should techniques employed within bioengineering be included in this list, too? Should they receive equal weight with respect to older methods?

To the purposes of the present discussion, which aims at framing a philosophical discussion of biodiversity when it comes to the edible environment, it is important to point out that there are some incompatibilities among the three kinds of items that may be targeted for being fostered. I have hinted at one incompatibility already when presenting genetic specificity. If the policy of an institution is to foster the continuation of existence of certain genetic traits, that may imply to have to change procedures and techniques for tending it, as well as changing its reproductive history (hence, what are commonly regarded as breeds or varieties); for example, some speculated that in order to keep producing Champagne in Champagne, farmers will have to introduce genetically modified clones of grapes, possibly employing different techniques for planting (and perhaps harvesting and processing) them. On the other hand, concentrating on certain methods of, say, wine production, will typically imply that at some moment farmers will have to discard clones that are not in sinking with relevant changes within the ecosystem of production, thereby also compromising the genetic identity of the clones. Finally, focusing on breeds and varieties based on ancestry, implies embracing genetic changes over time as well as methods of production that would best meet such changes. The upshot of this analysis is that, when issuing policies for fostering the biodiversity of (some part of) the edible environment, it is relevant to specify both which kind of items are to be fostered and to what extent the kinds of items that are not to be fostered should be kept into account into the measurement and intervention efforts. This is far from being accomplished by the extent literature on the topic as well as by extant policies, such as the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources for Food and Agriculture.

20.6 Conclusions

We shall at last return to our initial three questions and suggest answers based on the considerations made thus far. *(1) Are there living entities that should be excluded from measurements of biodiversity as well as from conservation efforts?* When it comes to the diversity of the edible environment, the first suggestion is to consider the importance of so-called wild species, which to date play a critical role in integrating agricultural and industrial produce in most societies, constituting also an

important back-up safety net for food security purposes. A second suggestion is to proceed with great care when it comes to drawing cutoff points between items that are natural enough to deserve inclusion in an inventory of food biodiversity and items that are not so; it seems most prudent to proceed by devising cutoff points that are suitable to specific sub-domains; these can be individuated on different grounds, such as biological taxa (e.g. cucurbitaceae, beans, mushrooms) or methods of production (e.g. grafting, sexual reproduction, genetic modification). Thus, we have multiple possible inventories to choose from, giving rise to our second question.

(2) Should the criteria for inclusion in a measurement or intervention be context-dependent or context-independent? For instance, could different criteria be selected depending on circumstances? A successful discussion of the matter, I submit, would demarcate as clearly as possible what are the conceptual and axiological differences between the criteria, as well as their potential practical consequences. It is important to remark here that the diversity of the edible environment is deeply entrenched with human cultures, so that the criteria for biodiversity measurement must reflect human perspectives within different societies, embedded in the conceptions of plants, animals, and dieting.

(3) What are the grounds for preferring certain (possibly more familiar) forms of life over others? For instance, do such preferences rest on efficiency, or perhaps on some emotional or spiritual connection? This question addresses the values that are involved across possibly different context of evaluation, e.g., food sovereignty, food security, and gastronomic pleasure. It is important to explore how such values differ across societies and whether convergence over a few selected values is a desirable goal, or if lack of convergence is actually more fruitful for the purposed of the biodiversity of the edible environment.

The new agricultural technologies introduced by the Green Revolution between the 1930s and the 1960s, followed by the more recent innovations in biotechnology, along with an increased capacity of transportation, have deeply subverted the relationship between humans and food. Such a drastic rupture is forcing a rethinking of that relationship, and a careful consideration of which items we shall conserve and why. This essay aimed at introducing a philosophical a frame for assessing the biodiversity of the edible environment, and pointing at a number of questions that seem in need of being addressed in the near future.

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