



Bio-cultural refugia—Safeguarding diversity of practices for food security and biodiversity



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ABSTRACT

Food security for a growing world population is high on the list of grand sustainability challenges, as is reducing the pace of biodiversity loss in landscapes of food production. Here we shed new insights on areas that harbor place specific social memories related to food security and stewardship of biodiversity. We call them bio-cultural refugia. Our goals are to illuminate how bio-cultural refugia store, revive and transmit memory of agricultural biodiversity and ecosystem services, and how such social memories are carried forward between people and across cohorts. We discuss the functions of such refugia for addressing the twin goals of food security and biodiversity conservation in landscapes of food production. The methodological approach is first of its kind in combining the discourses on food security, social memory and biodiversity management. We find that the rich biodiversity of many regionally distinct cultural landscapes has been maintained through a mosaic of management practices that have co-evolved in relation to local environmental fluctuations, and that such practices are carried forward by both biophysical and social features in bio-cultural refugia including; genotypes, artifacts, written accounts, as well as embodied rituals, art, oral traditions and self-organized systems of rules. Combined these structure a diverse portfolio of practices that result in genetic reservoirs—source areas—for the wide array of species, which in interplay produce vital ecosystem services, needed for future food security related to environmental uncertainties, volatile financial markets and large scale conflicts. In Europe, processes related to the large-scale industrialization of agriculture threaten such bio-cultural refugia. The paper highlights that the dual goals to reduce pressures from modern agriculture on biodiversity, while maintaining food security, entails more extensive collaboration with farmers oriented toward ecologically sound practices.

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1. Introduction

In ecology, refugia are places where relict (formerly more widespread or abundant) species have found shelter during periods of stress, such as from forest fires or inclement climate. The term refers to areas where former conditions are maintained within broader geographical regions. In recent years the genetic material of a vast number of plants and other organisms has been collected and stored; one example is the large collection facility at Svalbard on the Norwegian island of Spitzbergen. Such collections are in response to concern of that industrial practices in landscapes of food–feed–fiber–fuel production could dangerously reduce

genetic diversity, affecting nearly half of all terrestrial species (Ferrier et al., 2004; Chappell and LaValle, 2009; Phalan et al., 2011). In this way a sort of collective biological memory has been created, with the capacity to restore cultivated species and habitats.

Food security is defined as being when everyone everywhere has physical and economic access to sufficient, safe and nutritious food (FAO, 1996). But if a key goal is to safeguard global food security, it is not only the biological components of ecosystems that must be curated. Due to the varying historical and geographical conditions under which species have been (and are currently) cultivated, it is also important to safeguard knowledge of management practices that relate to these conditions. Using an interdisciplinary frame of analysis, we discuss areas where food continues to be produced in a context that links biological diversity and social memory, and which carries place specific insights and experiences of stewardship (Nabhan, 2008). We call them

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bio-cultural refugia, meaning places that not only shelter species, but also carry knowledge and experiences about *practical management* of biodiversity and ecosystem services. What is the role of bio-cultural refugia when dealing with the issues of food security and biodiversity loss in agricultural landscapes and regions? This paper is not about a “museum collection” that would conserve the past; instead, it provides an intellectual perspective that can help safeguard a reservoir of practices that have been tested in a great variety of conditions and which can serve as living laboratories for innovations in landscapes of food production (Baleé, 2006; Crumley, 2007; Costanza, 2007; Dearing, 2008; Thurston, 2009; Guttman-Bond, 2010; Libby and Steffen, 2007; Paavola and Fraser, 2011). We argue here that this perspective has value in calling attention to the practical importance of diverse agricultural contexts and management practices.

As at Svalbard but in a broader context, we examine how our stock of relevant knowledge and experience should be treated. This challenge can be compared to the contemporary effort to provide a complete map of the human genome. Surely the future capacity of humankind to safeguard its food requirements is of equal strategic importance. Of course, the two projects differ in a number of ways: while mapping the human genome is essentially a natural science activity, the effort to map and safeguard agricultural practice is inter- and trans-disciplinary, combining the natural and social sciences, technology, innovation, health and practical knowledge so that both general principles and practical insights can be derived and will be open to future modification and adaptation.

Since the agricultural revolution began around 10,000 years ago, small-holding farmers have experimented with the management of plants and animals important for their livelihood. Their solutions were “system-wide”: they thought about how vulnerability to shifting conditions could be reduced by maximizing useful connections between components of the broader landscape (e.g., fields, pastures, forests and woods, water resources, soils and external human settlements). In this sense, they practiced the central concept of permaculture (e.g., Graham, 1990), a focus on relationships created among elements. We will discuss these place-specific insights for the future in the same way.

The goals of this paper are to illuminate how and where collective social memory of how to steward agricultural biodiversity and ecosystem services can be carried forward between people and across cohorts. We discuss the functions of such *bio-cultural refugia* for addressing the twin goals of food security and biodiversity conservation in landscapes of food production. Our methodological approach forges a conceptual framework that draws on four major research communities. (1) Studies in social or collective memory explore knowledge constructed through shared experience and transmitted across generations (Halbwachs, 1926; Connerton, 1989). The study of social memory has its basis in sociology, anthropology, literary criticism, and psychology; its methods are thus ethnography (e.g., the open-ended interview), the study of material culture (e.g., memorials, museums), documentary evidence, and experimental settings in which individual and collective memory is examined. We are particularly interested in social memory as it pertains to the transmission of place-based environmental information. (2) Food security focuses on the production, distribution, availability and accessibility of food (Ingram et al., 2008). In recent years, food security has been recognized as vulnerable to climate change, loss of ecosystem services, conflict, long supply chains and other factors to which many of the systems that produce and distribute food are prone. Many methods, both qualitative and quantitative, are used to collect information that would allow assessment of vulnerability and offer ways to reduce risk. Our paper focuses on vulnerabilities that result from the loss of biodiversity, the reduction in the diversity of agricultural practice, and the loss of practical,

place-based knowledge that ensures the durability of landscapes of agricultural production.

Here we are aided by the scholarship about (3) resilience, used here as the capacity of social–ecological systems to absorb shocks, utilize them, reorganize and continue to develop without losing fundamental functions (Holling, 1973; Gunderson and Holling, 2002; Carpenter and Folke, 2006). This is all framed by insights about human–environmental relations that play out at wider temporal scales than are normally considered by agro-ecologists; this perspective is provided by (4) historical ecology, a holistic, practical perspective for the study of linked human activity and environmental change on time scales from decades to millennia. Historical ecology employs concepts, methods, and evidence taken from the biological and geophysical sciences, the social sciences, and the humanities. This fourth viewpoint provides critical conceptual tools to ‘cross-check over disciplinary boundaries,’ reveal new patterns of association, and raise new questions (Baleé, 2006; Crumley, 1994, 2007; Meyer and Crumley, 2011). Our approach is thus interdisciplinary; the joining of these particular research fields appears to be the first of its kind. We searched for peer-reviewed journal papers relating these concepts, and found no previous studies using the approach of this paper. We used the search functions of Scopus-document search for journal publications until 2012, and the search fields (for abstract, key words and title), of each of the terms: *food security* OR *food production* OR *agriculture* AND *social memory* AND *biodiversity*. We found only one publication, which dealt with urban community gardens. Since our previous research experience has been in Europe, this paper focuses on the European situation, but it holds insights for other regions with a long history of agriculture (Sahu, 2011).

1.1. Collective memories and practical stewardship of diversity

Insights have emerged in recent decades that highlight the role of site-specific experiences and cultural knowledge, and their storage and transmission, for stewardship of ecosystems (Altieri et al., 1987; Dahlberg, 1993; Nazarea, 1998; Jarvis and Hodgkin, 1999; Almekinders and Elings, 2001; Berkes et al., 2003; Maffi and Woodley, 2010; Barthel et al., 2010; Siebert, 2011). We cannot know exactly when and how memories of past environmental changes survive, or how experiences of response to crises from the deep past have survived. However, research has demonstrated that social memory is maintained in communities, settlements, practice and professional groups, and religions (Halbwachs, 1926; Connerton, 1989; Climo and Cattell, 2002; Misztal, 2003). The study of social memory is a focus of research in several fields (e.g., anthropology, archeology, history, psychology, sociology, natural resource management), linking processes of remembering and forgetting to modes of retention and loss within their historical, cultural, and political contexts. The literature tells us that, while only individuals can be said to remember *sensu stricto*, individual memory processes derive from social interaction and are facilitated by supra-individual means, i.e., sharing with others: stories, artifacts, symbols, rituals, landscapes and the like. The work is especially interesting as regards the role of crisis, which can render memories indelible or, in certain contexts, entirely suppress them (Gunn, 1994; Crumley, 2000; McIntosh et al., 2000; Nazarea, 1998, 2006; Barthel et al., 2013).

We use the term *stewardship memory* (cf. Barthel et al., 2010; cf. Nazarea, 1998), because we are discussing memories that guide people in practical—on the ground—management of species, habitats and other features of ecosystems, particularly in agro-ecosystems. This use of the term can be seen as a sub-category of *social memory*, where living species, soils and landscapes, in combination with the social carriers, are part of a ‘shared container’ that captures, carries, revives and transmits practical knowledge

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