Science for Sustainable Societies

Osamu Saito *Editor*

Sharing Ecosystem Services

Building More Sustainable and Resilient Society

Science for Sustainable Societies

Scope of the Series

This series aims to provide timely coverage of results of research conducted in accordance with the principles of sustainability science to address impediments to achieving sustainable societies – that is, societies that are low carbon emitters, that live in harmony with nature, and that promote the recycling and re-use of natural resources. Books in the series also address innovative means of advancing sustainability science itself in the development of both research and education models.

The overall goal of the series is to contribute to the development of sustainability science and to its promotion at research institutions worldwide, with a view to furthering knowledge and overcoming the limitations of traditional discipline-based research to address complex problems that afflict humanity and now seem intractable.

Books published in this series will be solicited from scholars working across academic disciplines to address challenges to sustainable development in all areas of human endeavors.

This is an official book series of the Integrated Research System for Sustainability Science (IR3S) of the University of Tokyo.

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Osamu Saito
Editor

Sharing Ecosystem Services

Building More Sustainable and Resilient Society

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Chapter 1
What and How Are We Sharing? The Academic Landscape of the Sharing Paradigm and Practices: Objectives and Organization of the Book

Osamu Saito and Hyeonju Ryu

Abstract Sharing of resources, goods, services, experiences, and knowledge is one of the fundamental practices that has been widely embedded in human nature. The advance of information and communication technology has contributed to significant growth in the "sharing paradigm." In spite of the increasing attention on the new sharing phenomenon and its potential contribution to a sustainable and resilient society, there is a lack of comprehensive understanding of varied sharing practices in the context of sustainability and resilience. This chapter starts mapping out the academic landscape of sharing studies and examines what and how we share by a systematic literature review. The chapter also discusses research gaps in sharing paradigm studies and the potential contribution of sharing to building sustainable and resilient societies. The chapter reviews how sharing ecosystem services and shared/social values of ecosystem services have been captured by recent ecosystem services assessments including regional assessments conducted by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Finally, the chapter illustrates the objectives and organization of the book.

Keywords Sharing paradigm · Information and communication technology · Sustainability · Resilience · Ecosystem services · IPBES · Social values

> Things have values, which are emotional as well as material; indeed, in some cases, the values are entirely emotional. Our morality is not solely commercial. We still have people and classes who uphold past customs and we bow to them on special occasions and at certain periods of the year. (p. 63)

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Marcel Mauss (1923–1924) *Essai sur le don*. Available in English as *The Gift: Forms and Functions of Exchange in Archaic Societies*. Translated by Ian Cunnison. Cohen & West Ltd, London, 1966.

1.1 Introduction: Emergence of Sharing Economy and Sharing Studies

Sharing is "to have, use, pay, or take part in (something) with others or among the group, rather than singly; to divide and give out in shares" (*Longman Dictionary of Contemporary English*). Sharing resources, goods, services, space, skills, labor, experiences, and knowledge is one of the fundamental practices that has been widely embedded in human conscience. Sociocultural sharing such as food exchange happens everywhere. Gift exchange can also be considered a form of sharing. On the basis of the profit orientation and ownership transfer, sharing activities have been divided into six types: "selling," "gifting," "renting," "lending," "servicing," and "volunteering" (Chasin et al. 2018). Gifting and selling refer to the provision of physical objects, but selling involves payment, whereas gifting does not. Lending and renting give access to tangible resources for no profit and for profit, respectively. Volunteering is the provision of intangible resources for free, whereas servicing requires compensation for such provision.

Mauss (1923–1924) explored forms and functions of gift exchange in archaic societies in his masterpiece, *The Gift*. His book successfully extracts common rules, principles, and three forms of obligations: giving, receiving, and repaying. Gift exchange still plays an important role in our modern society. When you purchase a gift for someone important for you at a department store, the object is treated as a commercial material through a market-based transaction. However, when you present the purchased gift (material) to your important person, your emotional value of gifting becomes more important than its economic value. In this sense, indeed, "Things have values which are emotional as well as material" (Mauss 1923–1924, p. 63).

In the past few years, the concept of sharing evolved into the "sharing economy," which shapes an "economic model based on sharing assets among groups of people rather than owning them" (Ballus-Armet et al. 2014). Information and communication technologies (ICTs) have advanced and facilitated a number of sharing economy initiatives by seamlessly connecting sharing partners, something that previously required the creation, manipulation, or transport of a physical object. This change not only concerns the economic or cultural domain but also affects scientific and technical practices, management, design, interpersonal communication, public expression, and the media (Aigrain 2012).

In the late 1990s and mid-2000s, online-based sharing became a popular business models. The eBay, an e-commerce corporation founded in 1995, was developed to facilitate the sale of secondhand goods via its website. Home sharing has also been stimulated by online platforms such as CouchSurfing, which provides the

service to arrange free homestays since 2003. In the late 2000s, the success of sharing businesses such as Airbnb (sharing accommodations) and Uber (sharing rides) drew a huge attention to the new sharing phenomenon (Martin 2016). BCycle provides a public bicycle sharing service of bicycles and solar-powered stations. Freecycle and Fashion Libraries offer platforms for sharing secondhand goods. Biobank offers health information from a large number of volunteer participants to approved researchers to improve the prevention, diagnosis, and treatment of a wide range of serious and life-threatening illnesses.

More and more scholars have discussed the evolving sharing activities, resulting in a rapid growth in the volume of sharing studies. Preceding studies explained the new sharing phenomenon using not only the term "sharing economy" but also other terms such as "collaborative consumption," "access economy," and "peer economy" (Botsman and Rogers 2010; Dredge and Gyimóthy 2015; Pettersen 2017). Collaborative consumption involves new forms of sharing practices through technology and peer communities, as well as traditional sharing, bartering, lending, renting, gifting, and swapping (Botsman and Rogers 2010). Access economy emphasizes the transition to access regimes, where things can be accessed without owning them individually (Kassan and Orsi 2012; Rifkin 2001). Peer economy, also known as "peer-to-peer economy," focuses on the monetization of goods, assets, and skills within their possession through online marketplaces (Cheng 2014).

The concept of the "sharing paradigm" was first proposed by McLaren and Agyeman (2015) to provide a comprehensive view of divergent sharing concepts. The sharing paradigm encompasses multiple dimensions of sharing things, services, activities, and experiences. The sharing paradigm consists of four quadrants divided by two axes (Fig. 1.1). The first axis indicates the contrast between sociocultural (or informal) sharing and mediated sharing. An example of sociocultural sharing is lending a book to a friend. Mediated sharing includes posting information on blogs for sharing experience or knowledge. The second axis reflects the contrast between extrinsic (commercial) and intrinsic (communal) motivations. Sharing motivated by

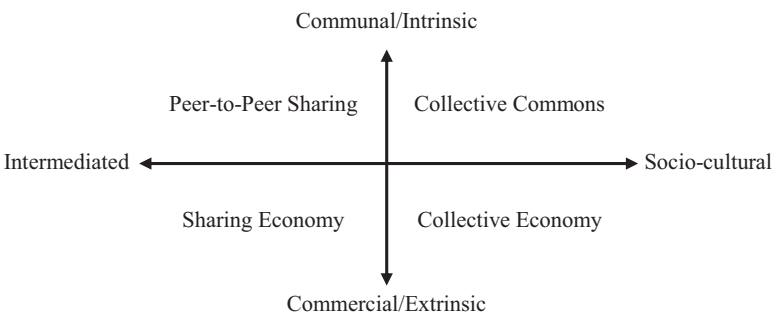

Fig. 1.1 Sharing paradigm (Adapted from McLaren and Agyeman 2015). The vertical axis shows the contrast between intrinsic (communal) and extrinsic (commercial) motivations of sharing. The horizontal axis represents the contrast between intermediated and sociocultural sharing. Major terms in the realm of sharing studies are displayed across the quadrant

extrinsic factors is accompanied by monetary compensation, such as the cases of home sharing via Airbnb and ride sharing via Uber. Sharing practices motivated by intrinsic factors are voluntary based on a sense of community, such as giving a gift for someone's birthday and sharing photos on social media. According to this paradigm, the "sharing economy" falls under the quadrant of intimidated and commercial sharing, whereas "peer-to-peer sharing" includes mediated and communal sharing. "Collective economy" represents sociocultural and commercial sharing, and "collective commons" imply sociocultural and communal sharing.

1.2 The Academic Landscape of the Sharing Paradigm and Practices

A review by Ryu et al. (2018) mapped out the academic landscape of the sharing paradigm by reviewing 1,275 peer-reviewed articles published from 2008 to 2017. Their results showed that commercial and intermediated sharing such as product service systems and the sharing economy drew a lot of attention from academia

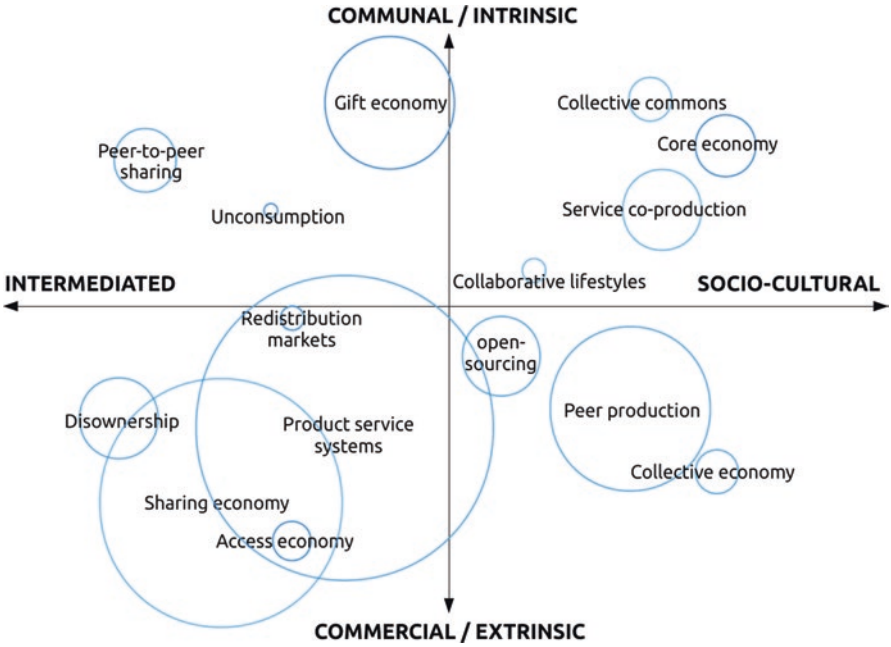

Fig. 1.2 The academic landscape of the sharing paradigm. The vertical axis shows the contrast between intrinsic (communal) and extrinsic (commercial) motivations of sharing. The horizontal axis represents the contrast between intermediated and sociocultural sharing. The size of the circles represents the number of publications on each term published between 2008 and 2017, as retrieved from Scopus. (Ryu et al. 2018)

(Fig. 1.2). Product service systems are those where "the customer pays for using an asset, rather than for its purchase" (Retamal 2017). For instance, car-manufacturing companies such as Volkswagen provide rental services of their products, besides sales, allowing temporary access to their vehicles. Meanwhile, few research studies have been implemented on communally-motivated sharing such as collective commons, peer-to-peer sharing, and service co-production (Ryu et al. 2018). In the past few years, since 2014, studies on the sharing paradigm have increased exponentially, mostly focused on the sharing economy (Fig. 1.3). Meanwhile, only a limited number of studies are available on peer production – a process where individuals collaborate to produce a unit of information or culture without being coordinated by managers nor price (Benkler 2002) – and gift economy (an economy based on gifting rather than profit-oriented transactions).

Sharing is a universal behavior of human beings. However, preceding studies tended to focus on sharing practices in the western culture (Cheng 2016; Ryu et al. 2018). Among the sharing paradigm literature, more than half of the papers discussed cases of sharing in Europe and North America, 37% and 20%, respectively (Ryu et al. 2018). The authors also outlined that the number of studies on sharing in Asia Pacific, including Australia, South Korea, and China, started to increase in 2014, yet these regions remained underrepresented (9%). Only a few studies analyzed sharing practices in Africa and South America (1% each). The underrepresentation of non-western countries in the sharing paradigm literature implies a limited number of

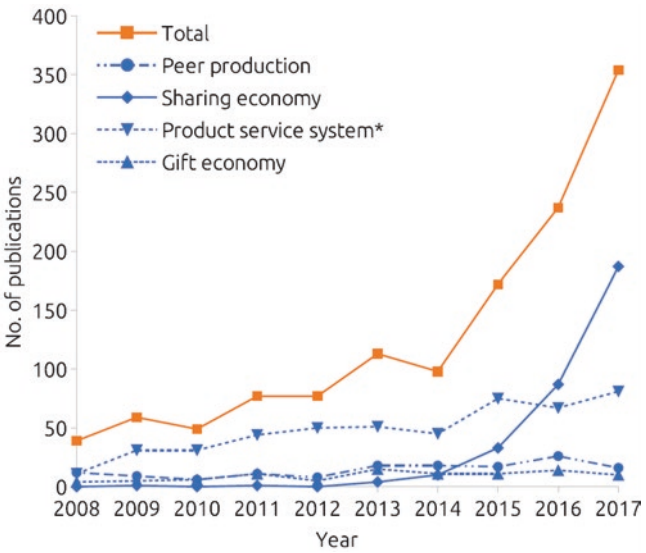

Fig. 1.3 Research trends in the sharing paradigm (n = 1,275). Each keyword referring to the sharing paradigm shown in Fig. 1.2 was searched in Scopus. The graph shows the trend in the total volume of sharing paradigm studies and the four most frequently appearing keywords. (Ryu et al. 2018)

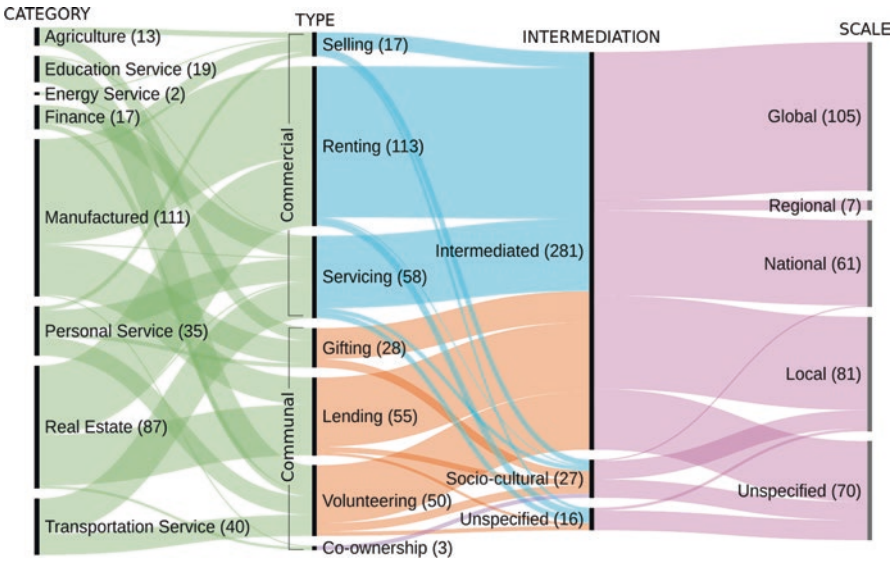

Fig. 1.4 The overview of the sharing practices identified in the sharing paradigm literature (n = 324). The thickness of the lines indicates the number of cases, which are also given in the parentheses. (Ryu et al. 2018)

studies on sharing consider the cultural and social context, despite its important role and value in those countries (e.g., Kamiyama et al. 2016; Tatebayashi et al. 2019).

Figure 1.4 presents an overview of what and how we share based on the review of the sharing paradigm literature by Ryu et al. (2018). The authors categorized sharing by sector: agriculture (e.g., home garden products), education services (e.g., knowledge sharing), energy services (heating and electricity), finance (e.g., crowd funding and money lending), manufactured goods (e.g., clothes, tools, and vehicles), personal services (e.g., cleaning, dog walking, and cooking), real estate (e.g., housing, parking lots, farmlands, and offices), and transportation services (e.g., carpooling). Among these sectors, sharing of manufactured goods appeared the most frequently in the literature, and 40% of the cases were rentals of vehicles like cars. Real estate was the second most frequent, mostly accommodations. In this review, the sharing process was analyzed with regard to three features: type (based on profit orientation and ownership transfer), intermediation, and scale (Fig. 1.4). As for motivation, commercial sharing appeared more often than communal sharing in the literature. Among the commercial sharing cases, renting of manufactured goods and real estate were dominant. In terms of the existence of intermediaries in sharing, the majority of sharing practices identified in the literature involved intermediated sharing, for example, via online platforms, accounting for 87% of the cases. As for the scale of sharing, which means the spatial scale of interaction between providers and recipients, sharing cases at the global level appeared the most frequent ones, followed by those at the local level and the national level. On

the basis of Fig. 1.4, we can also observe that most of the sociocultural sharing practices take place at the local scale.

Despite the rapid expansion of studies on the sharing paradigm, there are knowledge gaps in comprehending the sharing phenomenon. First, in the preceding studies, sharing has been explored in a limited range of sectors, such as manufactured goods and real estate. With the success of the business models of Airbnb and Uber, a number of case studies have been carried out using these two well-known sharing practices to explore the behaviors of users and to analyze the socioeconomic impact of these businesses. Car rentals are another common subject in sharing studies, probably due to their dominance in online sharing (Chasin et al. 2018). With the advance of ICT, the diversity of shared goods and services has increased at multiple scales. Internet-based platforms and mobile applications have facilitated sharing activities, allowing the easier matching between potential sharing partners. For example, you can search for available gardens in your neighborhood for growing herbs and vegetables on your own via an online platform such as Landshare. Furthermore, communal sharing at the local level involves exchange of varied things beyond cars and apartments. Boyko et al. (2017) identified 41 different sharing activities in a city, which range from food, plants, and livestock to gardens, rides, and knowledge. For a holistic understanding of the sharing paradigm, more studies need to look into diverse sharing cases, beyond car and apartment rentals.

Second, the analysis of the regional distribution of sharing paradigm studies reveals the underrepresentation of sharing in non-western cultures. Culture is an essential element affecting what and how we share, because culture shapes social norms and motivations for sharing (Mauss 1923–1924; Albinsson and Perera 2009; McLaren and Agyeman 2015; Wittel 2011). For example, a comparison of food sharing between Europe and Japan by Plieninger et al. (2018) demonstrated that sharing occurs in different scales under different motivations associated with social challenges that the countries are facing. The authors found that local food sharing in Europe was motivated by scenery, rural tourism, and nature conservation, whereas food sharing in Japan was culturally embedded as a part of social capital and well-being, which could also contribute to revitalization of local economies. Despite the important role of the sociocultural context in sharing practices, little is known about the sharing paradigm in Asia, Africa, and South America, at least in the global academia (knowledge shared in the English language).

Finally, it is yet far from clear whether the sharing paradigm contributes to the sustainability of our society. A large part of the sharing paradigm, especially the sharing economy and collaborative consumption, has often been considered a global movement toward a sustainable lifestyle (Ala-Mantila et al. 2016; Albinsson and Perera 2012; Martin 2016). Some scholars have argued that sharing increases the efficiency of resource use, avoiding excessive production and consumption (Akbar et al. 2016; Retamal 2017). In fact, according to Ryu et al. (2018), 20% of the sharing studies contain the term “sustainability” in their keywords, discussing sharing as a means of sustainable development and examining sharers’ attitudes toward sustainability and impact on social capital (Fig. 1.5). The few studies that investigated the impact of sharing on ecological footprints, such as carbon emission

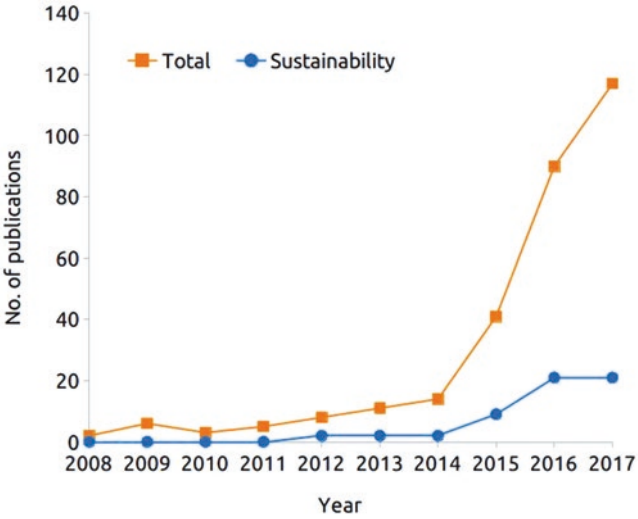

Fig. 1.5. The publication trend in the sharing paradigm studies linked with sustainability between 2008 and 2017 (n = 297)

and resource efficiency (e.g., Ala-Mantila et al. 2016; Berners-Lee 2011; Lahti and Selosmaa 2013), suggested the need for more empirical studies to examine whether sharing actually contributes to sustainability or not.

1.3 Sharing Ecosystem Services and Shared/Social Values

1.3.1 Ecosystem Services and Nature's Contributions to People

Ecosystem services are defined as the benefits obtained from ecosystems, and they include provisioning services such as food and water; regulating services such as regulation of floods, drought, and diseases; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, and other nonmaterial benefits (Millennium Ecosystem Assessment 2005). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) was established in 2012 to provide policymakers with objective scientific assessments about the state of knowledge regarding biodiversity, ecosystems, and the benefits/contributions they provide to people, as well as the tools and methods to protect and sustainably use this vital natural capital. IPBES redefined ecosystem services as "nature's benefits to people" (NBP) to make this concept more inclusive by capturing all the benefits (and occasionally losses or detriments) that humanity obtains from nature (Díaz et al. 2015). The element "NBP" was adopted by the IPBES Second Plenary in 2014. The IPBES Fifth Plenary in 2018 agreed with replacing NBP with "nature's contribution to people" (NCP) (Díaz et al. 2018) to recognize the central and pervasive role that culture plays in defining all links

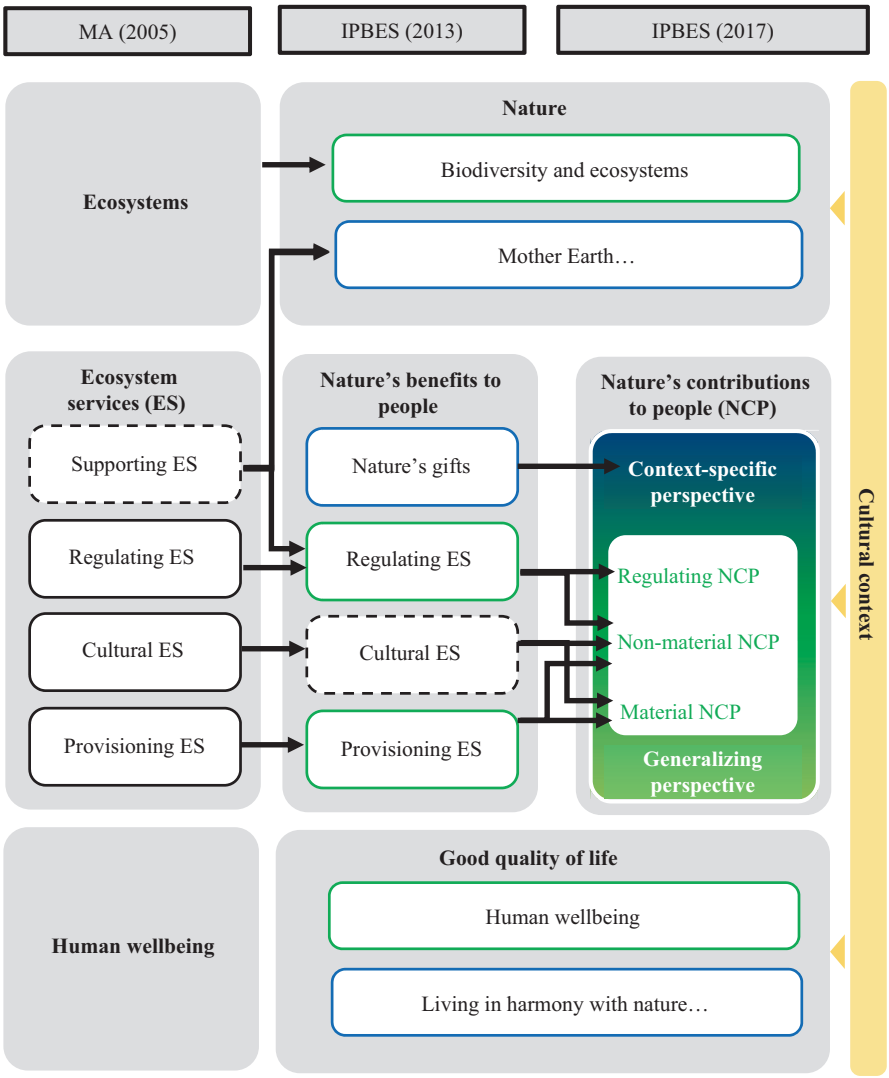

Fig. 1.6 Evolution of nature's contributions to people (NCP) and other major categories in the IPBES conceptual framework (1) with respect to the concepts of ecosystem services and human well-being as defined in the Millennium Ecosystem Assessment (2). (Modified from Díaz et al. 2018)

between people and nature and to emphasize and operationalize the role of indigenous and local knowledge in understanding NCP (Fig. 1.6). Duraiappah et al. (2014) defined "natural capital" as "the underlying biodiversity, ecological processes, and functions that contribute to human well-being." Natural capital can produce benefits for human well-being directly as ecosystem services or NCP, such as in the case of regulating services (e.g., climate regulation and pollination), but also indirectly, when the benefits or disservices from natural capital are delivered in combination with humans and produced capital such as timber, fiber, and biofuel. Although

cultural ecosystem services were defined as a separate ecosystem service category in the Millennium Ecosystem Assessment (MA), IPBES instead recognized that culture mediates the relationship between people and all NCP (Fig. 1.6).

Categories in gray are part of the framework, but not the focus of Díaz et al. (2018). Concepts pointed by arrowheads replace or include concepts near arrow tails. Concepts in dotted-line boxes are no longer used; following the present view of the MA community, supporting ecosystem services are now components of nature or (to a lesser extent) regulating NCP.

IPBES identified 18 such categories for reporting NCP within the generalizing perspective (Fig. 1.7), organized in three partially overlapping groups (regulating, material, and nonmaterial NCP), and defined them according to the type of contribution they make to people's quality of life (Díaz et al. 2018). Material contributions are substances, objects, or other material elements from nature that directly sustain people's physical existence and material assets (e.g., food, energy, or materials for ornamental purposes). Nonmaterial contributions are nature's effects on subjective or psychological aspects embedded in people's quality of life, both individually and collectively. Regulating contributions are functional and structural aspects of ecosystems that modify the environmental conditions.

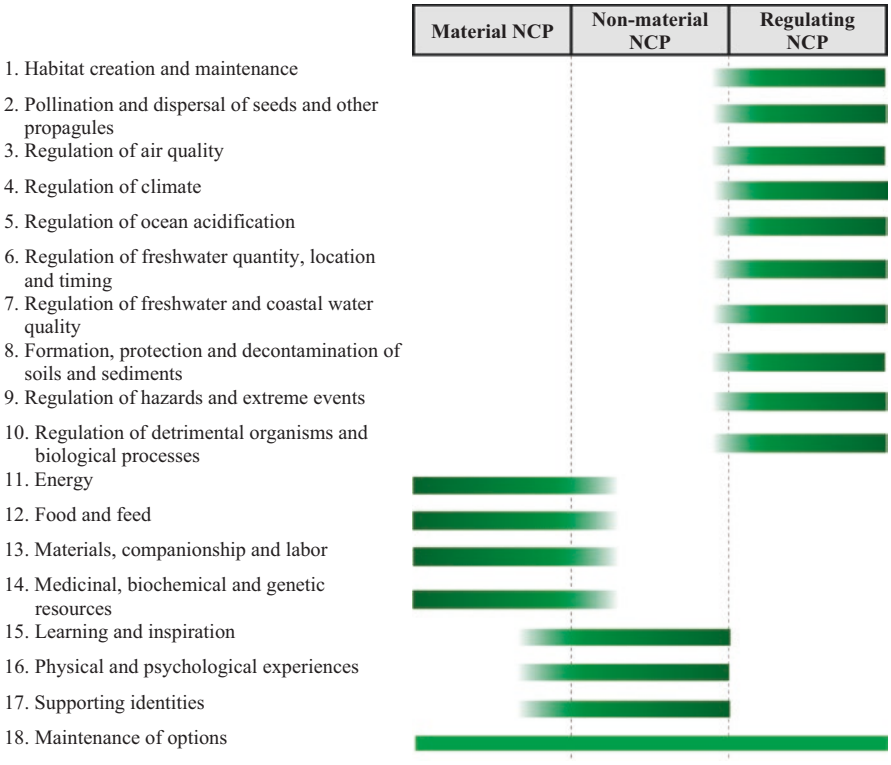

Fig. 1.7 Mapping of the 18 NCP reporting categories used in IPBES assessments onto three broad groups distinguished within the generalizing perspective. (Modified from Díaz et al. 2018)

1.3.2 "Sharing" Concepts in IPBES Regional Assessments

In 2018, four regional assessments, namely, for Africa, the Americas, Asia Pacific, and Europe and Central Asia, were approved by the IPBES Plenary. The overall scope of the regional assessments was "to assess the status and trends regarding biodiversity, ecosystem functions and ecosystem services, and their links; the impact of biodiversity, ecosystem functions and ecosystem services, and threats to them on good quality of life, and the effectiveness of responses, including the Strategic Plan for Biodiversity 2011–2020 and its Aichi biodiversity targets, the sustainable development goals, and the national biodiversity strategies and action plans developed under the Convention on Biological Diversity" (https://www.ipbes.net/deliverables/2b-regional-assessments).

Although these regional assessments have not fully captured sharing practices as described under the sharing paradigm, there are some relevant examples and cases. The notion of sharing has been often used and discussed in line with the Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their use, especially in the regional assessments for Africa, Asia Pacific, and the Americas (IPBES 2018a, b, d).

The regional assessment for Africa highlighted an example of community benefit sharing as a widely used livelihood incentive for biodiversity conservation, using revenues generated by protected areas to finance various development activities in adjacent rural areas in East Africa (e.g., in Ethiopia and Kenya) (IPBES 2018a). Africa's regional assessment also introduced a case demonstrating the role of informal institutions in natural resource management by Afar people, the Cushitic people inhabiting the Horn of Africa. Their institutions and traditions include the *Dagu* as an effective traditional human-based information and knowledge sharing network, through which anything anywhere that is relevant to the pastoral life of Afar is made accessible to individuals and households (Yimer 2013).

The Asia-Pacific regional assessment (IPBES 2018b) identified science and technology as indirect drivers of change in ecosystems and their services and stressed that the increased availability of ICT-mediated information and knowledge sharing platforms is key to promoting socioeconomic development and strengthening environmental governance. In addition, the assessment described the importance of stakeholder empowerment through knowledge sharing and increase in local legitimacy and policy salience when applying participatory scenario building in delivering a sustainable future (IPBES 2018b).

Europe and Central Asia's regional assessment (IPBES 2018c) grouped future pathways into four distinctive sustainability narratives: *green economy*, *low carbon transformation*, *transition movements*, and *ecotopian solutions*. The *green economy* and *low carbon transformation* narratives share three alternative pathways: *technological innovation*, *land sparing* with strong nature protection in designated areas, and *land sharing* with lower use intensity and diversification of production of NCP. *Transition movement* pathways emphasize change toward relational values, promoting resource-sparing lifestyles, continuous education, new urban spatial

structures, and innovative forms of agriculture where different knowledge systems (including indigenous and local knowledge) are combined with technological innovation (IPBES 2018c). *Ecotopian solution* pathways focus on radical social innovation to achieve local food and energy self-sufficiency and the production of multiple contributions from nature to people (IPBES 2018c). Although the controversy between land sparing and land sharing is not part of the sharing paradigm discourse, these potential pathways should be further explored for our future sustainability.

On the basis of a survey of 1,300 marine divers and recreational anglers in the UK, the Europe and Central Asia's regional assessment indicated that the sharing of knowledge and experience with others is a valued cultural ecosystem service (IPBES 2018c; Jobstvogt et al. 2014). This is essentially important for our understanding of the relationship between ecosystem services and sharing of knowledge and experiences. One of the reasons why IPBES introduced the notion of NCP lies in the fact that NCP can embody such relational values that reflect elements of cultural identity, social cohesion, social responsibility, and moral responsibility toward nature (Pascual et al. 2017).

1.3.3 Sharing Ecosystem Services and Shared/Social Values of Ecosystem Services

In the IPBES regional assessments, the notion of sharing mainly focused on three aspects: (1) access and benefit sharing of genetic resources including community benefit sharing, (2) information and knowledge sharing as both an indirect driver of change and a management tool, and (3) land sharing as a future pathway toward lower use intensity and diversification of ecosystem services production. Even though sharing food, water, medicinal plants, fuel, and non-timber forest products is a common practice in many countries (Kamiyama et al. 2016; Boafo et al. 2016; Saito et al. 2018), empirical studies are quite limited in the current research community of ecosystem services. Among 297 articles of the sharing paradigm studies reviewed by Ryu et al. (2018), none directly mentioned "ecosystem services." There are 14 studies of sharing practices, which partly include ecosystem services such as sharing of farmland, food, and yard work, gardening, and home garden products. Some studies focused on land sharing platforms or initiatives that facilitate finding and lending of land for growing crops and vegetables (e.g., Landshare) (Harvey et al. 2017; Wekerle and Classens 2015). Gifting or exchanging fruits and vegetables harvested from home gardens was explored, while food swap, including giving out leftover meals, was also examined in a few studies (Binninger et al. 2015; Schor et al. 2016; Zurek 2016). A couple of papers investigated TaskRabbit, an online platform that matches freelance labor with local demands in everyday tasks, which include yard work such as gardening and lawning (Schor 2017; Thebault-Spieker et al. 2017). The results show that ecosystem services in sharing literature were

limited to food production. There is clearly a need to investigate sharing practices of a wider range of ecosystem services and understand the knowledge on sharing ecosystem services from around the world.

Through the lens of the sharing paradigm, with its four dimensions (informal, mediated, communal, and commercial sharing), we can further explore and enrich ecosystem services research beyond the current IPBES conceptual framework and assessments. For example, food delivering for low-income households with children was launched in Japan by collecting contributions of rice and canned foods from private business enterprises. This service was initiated by one of the municipalities of Tokyo and now has been increasingly implemented by other prefectures beyond the city. This example can be interpreted as a new form of peer-to-peer sharing, which is intermediated and noncommercial sharing. ICT and advanced distribution systems also facilitate such sharing practices in both developed and developing countries.

In addition to exploring various practices of sharing ecosystem services, we should also investigate "shared/social values" of ecosystem services more explicitly. Kenter et al. (2015) provided a conceptual framework of the different dimensions of shared/social values in order to identify shared values of ecosystem services to enhance legitimacy, effectiveness, and transparency of valuation approaches. The term "shared values" has been used to refer to guiding principles and normative values that are shared by groups or communities or to refer to cultural values more generally. On the other hand, the term "social value" can refer to the values of a particular community or the cultural values and norms of society at large: the public interest, values for public goods, the values that people hold in social situations, the contribution to welfare or well-being, the willingness to pay of a group, or values derived through a social process (Kenter et al. 2015). The term "shared social values" has been used to refer to subsets or combinations of the various concepts described above.

1.4 Objectives and Organization of the Book

Despite the growing attention paid to the sharing economy and household food production, the nonmarket and non-monetized sharing of homegrown food has largely escaped scholars' attention (Jehlicka and Danek 2017). Reflecting this recent growing attention to the sharing concept and its application in the economic and urban context, this book explores opportunities and challenges to build a more resilient and sustainable society in harmony with nature by the critical examination of sharing practices in rural landscapes and seascapes around the world. The book introduces not only traditional communal and nonmarket sharing practices in different rural areas but also new forms of sharing through integration of traditional practices and modern science and technologies. By using "the sharing paradigm" as described by McLaren and Agyeman (2015) as a guiding concept, the book demonstrates that "sharing" has truly great potential to make rural society resilient,

sustainable, and inclusive through enriching all four sharing dimensions: informal, mediated, communal, and commercial sharing.

Even though IPBES introduced NCP instead of ecosystem services, in this book, the term "ecosystem services" is retained, as it is widely accepted in both science and policy communities and it can be used to capture the benefits (and occasionally losses or detriments) that humanity obtains from nature. We believe that it is not about which term we choose but about how we use the term "ecosystem services."

The book is divided in two parts. In the first part, we present case studies of sharing ecosystem services in Japan (Chaps. 2, 3, 4, 5, and 6). Then, we present, in the second part, case studies from around the world including Asia-Pacific, South America, and Europe (Chaps. 7, 8, 9, 10, and 11).

Chapter 2 focuses on sharing home-based food provisions and social capital in Japan. In the rural area of Japan, where the natural environment and people's livelihood have corroborated over many years to create a diversity of sustainable practices and products, it has been empirically found that pervasive practices like sharing or gifting home-based agricultural products with neighbors and relatives are embedded in social structures and principles of reciprocity. This chapter identifies a general trend of home-based food consumption and social links associated with use of natural resources quantitatively in the municipal level based on a web questionnaire survey collecting information from over 1,500 respondents throughout Japan.

Chapter 3 provides a case study of food provisioning services via home gardens and communal sharing in *Satoyama* socio-ecological production landscapes on Japan's Noto Peninsula. *Satoyama* is a Japanese term encompassing socio-ecological production landscapes and seascapes (SEPLSs) with a mosaic of ecosystems along with human settlements that have been managed to produce bundles of ecosystem services for human well-being. Although sharing of food provisions in SEPLSs may substantially promote human well-being by not only maintaining nutrition but also building social relations, few studies have investigated the sharing practices by relating quantities and varieties of homegrown food to localized landscapes. This chapter characterizes the quantity and varieties of home-based foods consumed per household at the community level and discovers how food is shared in social relations based on face-to-face questionnaires and interviews in the Noto Peninsula.

Chapter 4 presents another case study of nonmarket food provisioning services on Hachijo Island, Japan, with its implications for building a resilient island. The resource-consumption pattern of remote islands is assumed to differ from that of the mainland because of the constraints of both material distribution and human interaction. In this chapter, we investigate food production and consumption patterns on remote islands, focusing on the food supply flow, the food sharing network, and food stock for emergencies based on a household questionnaire survey and interviews with the residents of Hachijo Island, Tokyo.

Chapter 5 focuses on sharing experiences and associated knowledge in the changing waterscape, Mikatagoko area (Five Lakes of Mikata), Fukui Prefecture, Japan. In order for ecosystem services to actually flow and provide benefits to people, it is necessary to utilize knowledge on previous practices to manage the supply and flow of ecosystem services. Sharing the traditional and local experiences

and associated knowledge is thus crucial for sustainable use of ecosystem services. The analysis of 986 paintings collected between 2009 and 2014 is analyzed to understand diverse experiences with organisms inhabiting and ecosystem services from the local rivers and lakes.

Chapter 6 investigates sharing tacit knowledge of apiculture and mushroom production with future generations. By exploring the status and trend of the transmission and sharing of knowledge on non-timber forest products, as well as identifying the factors and underlying issues that shape knowledge systems, in two rural areas in separate prefectures in Japan, we elucidate how the proper transmission of traditional knowledge can contribute to the holistic and sustainable management of ecosystems and their services in complex socio-ecological production landscapes (SEPLs) through the case studies on apiculture and shiitake mushroom production.

Chapter 7 explores the integration of digital and traditional sharing practices for managing common natural resources in Palau, Micronesia. The shared economy, driven by advancements in information and communication technology, is becoming increasingly popular, but there is a big gap between the traditional communal sharing practices and the modern digital sharing phenomenon. Through a case study in the Republic of Palau, Micronesia, we examine the contemporary value of traditional sharing practices with the aim to bridge that gap based on an intensive survey of the use of natural resources by urban and rural residents over 10 years.

Chapter 8 focuses on solidarity economy in Brazil toward institutionalization of sharing and agroecological practices. Solidarity economy is often focused on autonomous initiatives outside the regular market system. In Brazil, in the 2000s, the leftist national government supported a number of solidarity economy initiatives by institutionalizing the ideal and practices of sharing and sustainable production and consumption within the regular market system. New actors, policies, and procedures were instrumental in this institutionalization. However, the questions of how the actors, policies, and procedures interact and how this interaction becomes socially and politically relevant remain largely unaddressed. In this chapter, we explore implications of the interactions for the establishment of solidarity economy based on agroecological practices carried out by small family farmers in Brazil.

Chapter 9 introduces a case of sharing knowledge and value for nurturing socio-ecological production landscapes in Rejoso watershed, Indonesia. Payment for ecosystem services (PES) is a policy tool that incentivizes landholders in production landscapes through voluntary and performance-based conservation contracts toward creating SEPLs that benefit all societies living within the landscape. The design of PES covers explicitly defining ecological baselines of targeted landscape, calculating conservation opportunity costs, customizing contract agreement and payment modalities, and targeting agents with credible land claims and threats to ecosystem service degradation. In the context of developing countries, conservation contracts of the PES scheme are mostly assigned to farming groups. Thus, a group-level auction is organized to accommodate collective decision-making in the payment level for the scheme. This chapter discusses how group-level auctions enhance allocation efficiency due to the sharing process during the auctions, as compared with individual-level auctions.

Chapter 10 shows a case study on the loss of suburban landscape to urbanization in India as a sharing place. Suburban landscapes are fast changing with the loss of their own characteristics and transforming into new landscapes with a new mosaic set of characteristics that are strikingly different from the previous ones. There is an increasing trend across the world to transform these suburban areas, just outside the periphery of bigger cities, into satellite towns so that they can accommodate the city's increasing population as well as become development hubs. In this chapter, we investigate how the local communities perceive sharing their land with new residents living in high-rise apartments and how the change in the status of home gardens and sharing of their products has changed the social relationships in the area.

Chapter 11 provides a comparative case study of sharing practices and property rights, in particular focusing on cow sharing and Alpine ecosystems. Sharing is a trending issue, and there is a swiftly growing interest in the sharing paradigm, sharing economy, and its various opportunities, challenges, and impacts. Although new sharing practices mediated via Internet platforms are already established in urban contexts, discussions and practices in rural, landscape, and ecosystem contexts are still in the very beginning. This chapter analyzes a particular type of sharing, i.e., web-mediated cow sharing in the European Alps, which are hotspots of diverse and vulnerable ecosystems.

Chapter 12 revisits and summarizes all case studies from Chaps. 2 to 11 and identifies the positive and negative effects of sharing practices on sustainability and resilience. It also proposes three key approaches toward a sustainable and resilient future: (1) combination of traditional knowledge and scientific knowledge/technologies, (2) coexistence of market and nonmarket sharing mechanisms, and (3) new normative metrics for measuring the multiple values of sharing. Along with new ICTs, web-based platforms and smartphone applications, the sociocultural communal sharing and exchanging of goods and capitals can enhance the mutual satisfaction of people's interests and define those interests without compromising the sustainability and resilience of socio-ecological systems.

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Chapter 2
Home-Based Food Provision and Social Capital in Japan

Chiho Kamiyama, Shizuka Hashimoto, and Osamu Saito

Abstract In rural areas of Japan—places where the natural environment and people's livelihood activities have worked in concert over many years to create a diversity of sustainable practices and products—it has been empirically well known that pervasive practices like sharing or gifting home-based agricultural products with neighbors and relatives are embedded in social structures and principles of reciprocity. The objective of this chapter is to understand a general trend of home-based food consumption and social links associated with use of natural resources quantitatively in municipal level. We conducted web questionnaire survey collecting information from over 1500 respondents throughout Japan and found that (1) people share diverse agricultural products grown in their own homegardens, (2) the amount of such shared products consumed in household was significantly higher in rural municipalities compared with urban municipalities, and (3) social connections relating to use of natural resources were stronger in rural municipalities. These results suggest that self-production and sharing practices substantially relate to human nutritional well-being and social relations, especially in rural areas. The findings could also provide basic information to increase regional resilience by ensuring food availability in emergencies, which are, for example, caused by climate change, natural disasters, or social changes such as aging and shrinking populations.

Keywords Homegarden · Agricultural products · Self-production · Social relations · Human well-being · Questionnaire survey · Ecosystem services

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2.1 Introduction

Giving and/or receiving something in a non-market transaction (without a financial transaction) between members of a society can be defined as sharing or gifting, which is often associated with reciprocal relationships (Morton et al. 2008; Davis et al. 2010). From the viewpoint of anthropology as shown in the previous chapters, sharing or gifting natural resources (i.e., ecosystem services) has played an essential role in social integration and building social capital (Price 1975; Nolin 2012; Widlok 2017). Such activities are often observed in home-based agriculture with agricultural, forest, and fishery products, between relatives, neighbors, and friends within and beyond the community (Davis et al. 2010; Stryamets et al. 2012; Kamiyama et al. 2014; Saito et al. 2015, 2018; Tatebayashi et al. 2018). The Millennium Ecosystem Assessment (MA) reported how ecosystem services contribute to human well-being and indicated that food provisioning service, which is one of the vital ecosystem services, is linked not only to security, basic material for a good life, and health but also to good social relations (social cohesion, mutual respect, and the ability to help others) (MA 2005).

In Japan, Befu (1968) summarized the anthropological importance of gift-giving and suggested that pervasive practices—for example, sharing crops with neighbors and relatives—are embedded in social structures and principles of reciprocity, especially in rural areas. Furthermore, personal connections supported by such practices of home-based foods have played an important role in preserving traditional cultures and knowledge in several rural areas of Japan (United Nations University 2013; Nakazawa et al. 2014; Saito et al. 2015)—places where the natural environment and people's livelihood activities have worked in concert over many years to create a diversity of sustainable practices and products (Photos 2.1, 2.2, and 2.3).

Photo 2.1 Typical rural area of Japan. (Nanao City, Ishikawa Prefecture)

Photo 2.2 Typical rural area of Japan. (Wajima City, Ishikawa Prefecture)

Photo 2.3 Typical rural area of Japan. (Chichibu City, Saitama Prefecture)

Therefore, it can be understood that such rural areas comprehend many aspects of human well-being without a financial transaction. However, few studies investigate the general trend of home-based food provision and sharing quantitatively throughout Japan.

Recently, an interest in strengthening local food production is growing also from a viewpoint of food security, and more attention has fallen upon homegardens and family farming (United Nations 2014). While agricultural and economic statistics are effective means to capture yield, sales, and household expenditure to understand the contribution of food provisioning services to the society, it often fails to capture the contribution of home-based food provision and sharing without market transaction to actual household's food consumption. In Japan, such household food production is expected to increase community and regional resilience by ensuring food availability in emergencies caused by climate change, natural disasters, or social changes such as aging and shrinking populations (Kamiyama 2017).

The aim of this Chap. 3 is to understand the current situation of non-market food consumption comprehensively throughout Japan by quantifying the variety and quantity of agricultural, forest, and fishery products that households acquired by non-market transactions by growing in their own homegardens or receiving from others. In this chapter, "non-market food" is defined as self-producing, harvesting, and/or receiving food without market transaction. We conducted a nationwide web questionnaire survey and discovered the general trend of rural areas compared to urban areas at municipal level in Japan.

2.2 Methods

2.2.1 Nationwide Web Questionnaire Survey

A nationwide web questionnaire survey was conducted from January 8 to 13, 2015, in Japan to understand a general trend of non-market food consumption and social links associated with use of natural resources in municipal level, collecting information from 1525 respondents over 20 years old. The respondents were pre-screened to avoid bias in terms of gender, occupation, and region across Japan (details are shown in Saito et al. 2018). List of questions is summarized in Table 2.1.

2.2.2 Characteristics of Municipality

The agricultural area classification (AAC) system developed by Japan's Ministry of Agriculture, Forestry and Fisheries (MAFF) was considered during the pre-screening process to collect equal size of samples from each of AAC. The AAC

Table 2.1 Summary of main questions of the web questionnaire survey

Question:		
We are going to ask you about food quantities (proportions) and variety your household consumes during a year		
(1) First, we ask you about the relative quantities of food (a) grown home (%); (b) received from neighbors, relatives, or friends through sharing (%); and (c) purchased from markets (%). Please answer the proportion by selecting one from the following five options such that sum of (a), (b), and (c) will be 100% for each rood category		
Rice	(a) **Grown at home**	
	[Options] **1**. 0% **2**. about 20% **3**. about 40% **4**. about 60% **5**. about 80% **6**. 100%	
	(b) **Received from neighbors, relatives, or friends through sharing**	
	[Options] **1**. 0% **2**. about 20% **3**. about 40% **4**. about 60% **5**. about SC% **6**. 100%	
	(c) **Purchased from markets**	
	[Options] **1**. 0% **2**. about 20% **3**. about 40% **4**. about 60% **5**. about SC% **6**. 100%	
Vegetables		In a same way as rice
Fruits		
Forest products		
Fishery products		
(2) Next we ask you about the variety of the food grown at home and/or received from neighbors, relatives, or friends through sharing. Please answer the species number by selecting one from the following five options for each food category		
Rice		
[Options] **1**. 1–5 species / **2**. 6–10 species / **3**. 11–15 species / **4**. 16–20 species / **5**. 21–25 species / **6**. 26–30 species / **7**. 31–40 species		
Vegetables		[Options] is same as rice
Fruits		
Forest products		
Fishery products		

system categorized all municipalities in Japan into four types—mountainous agricultural municipality, semi-mountainous agricultural municipality, flat agricultural municipality, and urbanized municipality—based on the criteria shown in Table 2.2. These criteria have been simplified from MAFF's original criteria revised, due to the mismatch of some agricultural statistics after the major consolidation of municipalities that occurred after 2008. We compared the AAC using both the simplified and the original criteria and found that the rate of matching was 84% (Kamiyama et al. 2014). Data from World Census of Agriculture and Forestry in Japan in 2010 and from Population Census in 2010 was used for the classification. This study tried to collect equal size of questionnaire samples from the four types of AAC.

Table 2.2 The criteria for agricultural area classification (AAC)

AAC	The simplified classification criteria used in this chapter	The original classification criteria proposed by MAFF
Mountainous agricultural municipality	Municipalities with over 80% of forest cover and less than 10% of farmland cover	Municipalities with over 80% of forest cover and less than 10% of farmland cover
Semi-mountainous agricultural municipality	All municipalities not fitting the criteria for the other three categories	Municipalities with over 20% of farmland cover and not fitting the criteria for urbanized and mountainous agricultural municipality
		Municipalities with less than 20% of farmland cover and not fitting the criteria for urbanized mountainous apicultural municipality
Flat agricultural municipality	Municipalities with over 20% of farmland cover	Municipalities with over 20% of farmland cover and less than 50% of forest cover
		Municipalities with over 20% of farmland and 50% of forest cover and with less than 10% of sum of rice fields with a gradient of more than 1/20[a] and vegetable fields with a gradient of more than 8°
Urbanized municipality	Municipalities with population densities over 500 people/km^2 and less than 80% of forest cover	Municipalities with over 5% of Densely Inhabited District (DID) ratio to inhabitable land and either with population densities over 500 people/km^2 or with over 20,000 DID population
		Municipalities with over 60% of residential land ratio to inhabitable land and with population densities over 500 people/km^2, but not with over 80% of forest cover
(Determination order)	Urbanized ➔ mountainous agricultural ➔ flat agricultural ➔ semi-mountainous agricultural municipality	Urbanized ➔ mountainous agriculture ➔ flat agricultural and semi-mountainous agricultural municipality

[a]A slope which is elevated more than 1 m per horizontal length of 20 m

2.2.3 Variety, Quantity, and Economic Value of Non-market Food

Respondents were asked to identify the variety and relative quantities (proportions) of each food category (rice, vegetables, fruits, forest products, and fishery products) acquired outside market transactions during a year (Table 2.1). For each category, we asked respondents about the quantities of food (a) grown at home (%); (b) received from neighbors, relatives, or friends through sharing (%); and (c) purchased from markets (%). The sum of (a) and (b) is the quantity of non-market food consumed.

By using household expenditure statistics "Yearly Amount of Expenditures, Quantities and Average Prices per Household" on the Family Income and Expenditure Survey (reported by the Statistics Bureau, Ministry of Internal Affairs and Communications) and by assuming that the amount of household expenditure is comparable to the (c) relative quantity (proportion) of food purchased from markets, economic value of non-market food (X_f) is estimated for each food category according to Kamiyama et al. (2014):

$$X_f = \frac{r_f}{1 - r_f} \times E_f$$

where f is food category (rice, fresh vegetables and fruits, fresh forest products, fresh fishery products), r is the relative quantities (proportions) of non-market food identified by this Chap. 3 as the sum of (a) and (b), and E is the yearly amount of household expenditure in 2014 recorded in the statics.

2.2.4 Analysis

To analyze how agricultural area classification (AAC) affects the variety and quantities of non-market food consumption, we applied a simple generalized linear model (GLM) to infer changes in each food category (rice, vegetables, fruits, forest products, and fish products). The model's explanatory variables included respondent's residential AAC and age and sex. In the model capturing the food variety as a response variable, we assumed that the error distribution was Gaussian and chose an identity link function. In the models capturing the food quantities ratios, we assumed that the error distribution was binomial and chose a logit link function. We evaluated the effect of explanatory variables by ascertaining whether the Wald 95% confidence interval for each coefficient included zero. Models were fitted to data using R 3.1.2 software (R Development Core Team 2014).

2.3 Results

Characteristics of agricultural area classification (AAC) were shown in Table 2.3. The questionnaire survey targeted totally 1947 municipalities of Japan and finally we collected 396 (26%), 393 (26%), 330 (22%), and 406 (27%) samples, respectively, from mountainous agricultural municipality, semi-mountainous agricultural municipality, flat agricultural municipality, and urbanized municipality. As described

Table 2.3 Characteristics of agricultural area classification (AAC)

AAC		Percentage of forest area (%)		Percentage of cultivated area (%)		Population density (/km^2)	
		Mean	Range (min–max)	Mean	Range (min–max)	Mean	Range (min–max)
Urbanized municipality	(n = 719)	23.6	0.1–79.4	13.1	0.1–55.1	3831.9	503.8–21,881.5
Flat agricultural municipality	(n = 214)	31.5	0.1–68.5	33.7	20.0–69.7	222.7	7.5–499.2
Semi-mountainous agricultural municipality	(n = 659)	64.5	0.7–82.7	9.1	0.0–20.0	166.7	4.6–500.0
Mountainous agricultural municipality	(n = 355)	86.8	80.1–97.6	2.6	0.0–9.8	53.8	1.6–1285.7

in the criteria for AAC, mean percentage of forest area is the lowest in urbanized municipality (23.6%) and the highest in mountainous agricultural municipality (86.8%). Mean percentage of cultivated area is the lowest in mountainous agricultural municipality (2.6%) and the highest in flat agricultural municipality (33.7%).

Households in urbanized municipality consume significantly smaller quantities of food grown at home and/or received from others than households in agricultural municipalities (i.e., mountainous agricultural, semi-mountainous agricultural, and flat agricultural municipality) in all food categories except fruit (Fig. 2.1). In terms of food species diversity, households in urbanized municipality consume significantly lower number of total species by producing and/or receiving than households in agricultural municipalities, while there was no significant difference among municipalities in each food category (Fig. 2.2). In other words, households in agricultural municipalities consume significantly higher quantities and diversity of home-based non-market food and smaller quantities of food purchased from market compared with urbanized municipality. Other than the difference among AAC, we found that female respondents tend to receive significantly higher quantities of home-based non-market food in rice, vegetables, and fruits.

Estimated economic value of non-market food at household per year of AAC is shown in Table 2.4, which can be understood as saved money by producing and/or receiving home-based food without market transaction. Households in flat agricultural municipality consume home-based food corresponding to totally 43,058 Japanese yen (JPY) (395 USD, 109 JPY USD^{-1}) annually, which is the highest value among AAC followed by 40,055 JPY (367 USD) in semi-mountainous agricultural municipality, 38,096 JPY (350 USD) in mountainous agricultural municipality, and 22,123 JPY (203 USD) in urbanized municipality. Among food categories, the economic value is the highest in vegetables followed by rice, fruit, or fishery products and forest products.

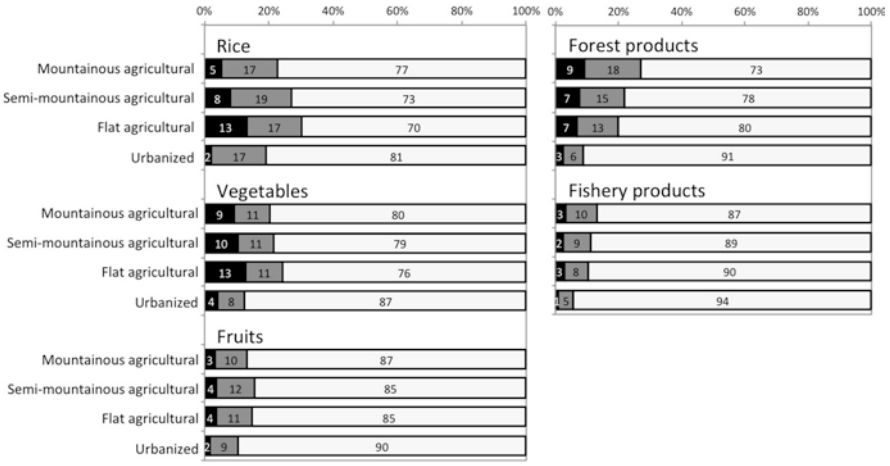

Fig. 2.1 Comparison of average ratios of food quantities among four different municipality types. Black columns indicate food grown at home or gathered from forests or oceans (non-market). Gray columns indicate food received from others (non-market). Open columns indicate market purchases in each category (rice, vegetables, fruits, forest products, fishery products)

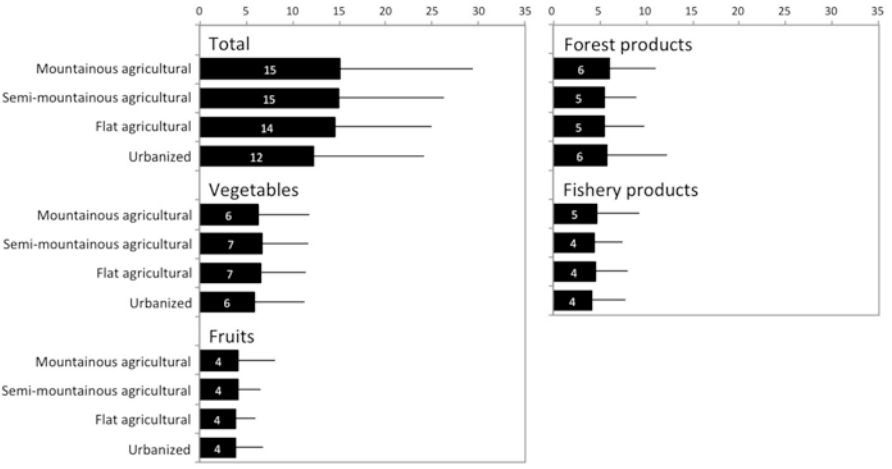

Fig. 2.2 Comparison of average number of food variety consumed by non-market food provision among four different municipality types in total, vegetables, fruits, forest products, and fishery products. Whiskers represent the range of standard deviations

Table 2.4 Estimated economic value of non-market food (JPY/year)

Food category	Household expenditure[a] (JPY/year)	Estimated economic value of non-market food (JPY/year)			
		Mountainous agricultural	Semi-mountainous agricultural	Flat agricultural	Urbanized
Rice	25,108	7301	9312	10,844	5993
Fresh vegetables	57,433	14,715	15,594	18,338	8210
Fresh fruits	34,962	5241	6405	5977	4061
Fresh forest products	10,446	3901	2953	2613	1033
Fresh fishery products	45,753	6938	5792	5286	2827
Total	173,702	38,096	40,055	43,058	22,123

[a]Original source: "Yearly Amount of Expenditures, Quantities and Average Prices per Household" in 2014 on the Family Income and Expenditure Survey reported by the Statistics Bureau, Ministry of Internal Affairs and Communications

2.4 Discussion

This study quantified the contribution of home-based food provisioning to daily livelihoods comprehensively throughout Japan. It found that households in agricultural municipalities consume significantly higher quantities and diversity of home-based food and smaller quantities of food purchased from market compared with urbanized municipality. Households in agricultural municipalities consume home-based food corresponding to approximately 40,000 Japanese yen per year (367 USD, 109 JPY USD^{-1}), which is about two times as much as households in urbanized municipality. We believe that this report is the first to assess quantitative values (variety and quantity) of home-based foods consumption at a municipal level in a developed country in the context of ecosystem services.

Home-based food or local food systems including market transactions secure a food supply and enhance regional resilience, when the long-distance transport of food is interrupted, particularly by natural disasters (Yokohari 2012). Given this situation, peri-urban agriculture and fisheries have attracted attention as sustainable food sources for urban municipalities, providing local food grown for local consumption (Hara et al. 2013). This study quantifying the variety and quantity of home-based foods produced and shared within a municipality would shed light on the role of self-production in rural municipalities and enable a more accurate estimation of its consumption relative to market foods. Such quantitative assessment would contribute to the accounting system for "Food Supply Capability" which was proposed in 2014 by the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF), which gives a better estimation of the food that would be available in emergency situations compared to the "Food Self-sufficiency Ratio," which had traditionally been used by MAFF. Quantifying home-based foods would also

contribute to achieving Sustainable Development Goal (SDG) 2 on hunger and food security, specifically targets 2.3 and 2.4 (United Nations 2015).

Several papers have reviewed the multidimensional roles of homegardens in enhancing human well-being (Buchmann 2009; Galhena et al. 2013; Taylor and Lovell 2014). Tatebayashi et al. (2018) quantified the shadow benefits of non-market food distribution in a remote island of Japan by estimating annual monetary savings per household and the daily caloric intake of non-market foods per person. The consumption of non-market food saved 219,543 JPY household^{-1} year^{-1} (2018 USD, 109 JPY USD^{-1}), while the non-market food accounted for 17% of the daily caloric intake in Hachijo island (Tatebayashi et al. 2018). Economic saving in the island is nearly five times larger than that of semi-mountainous agricultural municipality in this study. This suggests that economic saving and contribution to health by non-market food or food sharing network tends to be larger in remote rural areas including remote islands.

Homegardens can build resilience among households by increasing food security, individual empowerment, social relation, resistance to marginalization, community development, production of cultural identity, ecological processes and biodiversity, and conservation (Taylor and Lovell 2014). Therefore, our result suggests that rural areas in Japan tend to involve multidimensional benefit attributed to homegardens. Indeed, households in agricultural municipalities generally owned higher accessibilities to natural resources because of the landscapes with more cultivated and/or forest area than that in urbanized municipality, which can potentially promote many aspects of human well-being associated with ecosystem services. Consuming and sharing of home-based food in rural agricultural municipalities can also be understood as long-standing customs connecting people and nature. The significantly higher quantities and the greater varieties and quantities of home-based foods in agricultural municipalities may be explained by more chances to get to know neighbors who grow food for personal consumption and to receive the products from them. For the detail of the relationship between home-based food consumption and social relation, further in-depth survey at community level will be needed (Chap. 3).

2.5 Conclusion

This chapter revealed a general trend of home-based food consumption and social links associated with use of natural resources quantitatively in municipal level in Japan, based on nationwide web questionnaire survey. The results of this study suggest that home-based food production and sharing might act as an important network for the sharing of ecosystem services among local societies. Nonetheless, the social capital associated with producing and sharing foods has arguably been eroded in Japan at the same time, especially in rural areas where rapid population aging and decline have hindered such practices. Thus, it is important to identify the

appropriate forms of support and governance connecting rural and urban area required to facilitate further sharing of home-based foods, thereby improving food security.

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Chapter 3
Food Provisioning Services Via Homegardens and Communal Sharing in *Satoyama* Socio-ecological Production Landscapes on Japan's Noto Peninsula

Chiho Kamiyama

Abstract *Satoyama* is a Japanese term for a socio-ecological production landscapes and seascapes (SEPLSs) with mosaic of ecosystems along with human settlements that have been managed to produce bundles of ecosystem services for human well-being. Although sharing of food provisioning service (mentioned in this chapter) in SEPLSs may substantially promote human well-being by not only maintaining nutrition but also building social relations, few studies have investigated the sharing practices by relating quantities and varieties of homegrown food to localized landscapes. The objective of this chapter is to characterize the quantity and varieties of home-based food consumed per household at the community level and to discover how food is shared in social relations. We conducted face-to-face questionnaires and interviews on Japan's Noto peninsula and found that (1) households in inland and coastal *satoyama* communities consume greater varieties and quantities of food grown at home than households in semi-urban community; (2) the varieties and quantities correlated positively with the number of sharing partners, indicating that households with more connections to other households consume greater food varieties and quantities; and (3) rural households primarily share food within their communities, while among semi-urban households, social connections beyond their communities, particularly connections to rural communities, enhance non-market food consumption. However, urbanization and globalization in recent decades have weakened such sharing practices. Balancing market and sharing mechanism in food provisioning services would be one of the key challenges to build localized models of sustainable society in harmony with nature.

Keywords Agricultural products · Self-production · Social relations · Social capital · Human well-being · Face-to-face interview · Ecosystem services

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3.1 Introduction

Just a 1-h drive from any of Japan's cities, the countryside is a blend of *satoyama* landscapes. *Satoyama* is a Japanese term for a socio-ecological production landscape with mosaic of ecosystems—secondary forests, farmlands, paddies, irrigation ponds, and grasslands—along with human settlements that have been managed to produce bundles of ecosystem services for human well-being (Takeuchi 2010; Duraiappah et al. 2012). This form of coexistence between nature and people, which are often integral to people's livelihood, customs, traditions, spirituality, and social relations, has been receiving increased attention internationally, building on the adoption of the "Satoyama Initiative" in 2010 at the tenth meeting of the Conference of the Parties (COP 10) to the Convention on Biological Diversity (CBD). The concept of *satoyama* has been extended to *satoumi* for marine and costal ecosystems.

Sharing and/or gifting can generally be defined as giving and/or receiving something in a non-market transaction (without a monetary transaction through the market) between members of a society, and these actions are often associated with reciprocal relationships (Morton et al. 2008; Davis et al. 2010). From the viewpoint of anthropology as shown in the previous chapters, sharing or gifting natural resources (i.e., ecosystem services) has played an essential role in social integration and building social capital (Price 1975; Nolin 2012; Widlok 2017). Food provisioning, which is one of a vital ecosystem services, often involves sharing or gifting agricultural, forest, and fish products between relatives, neighbors, and friends within and beyond the community (Davis et al. 2010; Stryamets et al. 2012; Kamiyama et al. 2014). It is known that sharing of homegrown food at homegardens (home-based food) is associated with human well-being by not only maintaining nutrition but also building social relations (Galhena et al. 2013; Taylor and Lovell 2014; Sioen et al. 2017; Plieninger et al. 2018). Plieninger et al. (2018) analyzed "place-based food networks" in Japan and Europe, which are the food production and consumption practices such as home-based food sharing and discussed multiple benefits of local food provision services. However, few studies have assessed the benefits brought by sharing activities of home-based food qualitatively, especially in the conventional economy.

Chapter 2 focused on sharing of home-based food provisioning service in Japan and investigated the quantities of food self-consumption. It was found that approximately 19% of vegetables consumed by households are grown at home and shared with others (i.e., neighbors, relatives, friends, etc.), with a higher proportion in agricultural municipalities (22%) than in urban municipality (12%) in Japan. This result can be supported by the fact that agricultural municipalities consist in large part of *satoyama-satoumi* socio-ecological production landscapes and seascapes (SEPLSs) than urban municipalities (Japan Satoyama Satoumi Assessment 2010) and suggests that the active sharing of food provisioning service in SEPLSs may substantially promote human well-being by not only maintaining nutrition but also building social relations. Few studies, however, have investigated the sharing practices by relating quantities and varieties of homegrown food to localized landscapes.

While the form of coexistence between nature and people in SEPLSs has been recognized as an important model of society (Takeuchi 2010; Duraiappah et al. 2012), Japan's industrial growth since the 1960s has created jobs and concentrated the population, resulting in the conversion of farmland to urban land, decreases in rural populations with increases in the average age, and shrinkage of workforces in agriculture, forestry, and fisheries. Besides globalization, diminished urban ecosystems and a reduced rural workforce have degraded *satoyama* and *satoumi* practices (Okuro et al. 2012; Kohsaka et al. 2014). In 2011, the Food and Agriculture Organization (FAO) designated Noto peninsula in Ishikawa prefecture, Japan, as Globally Important Agricultural Heritage Systems (GIAHS) which is outstanding landscape of aesthetic beauty combining agricultural biodiversity, resilient ecosystems, and a valuable cultural heritage for the first time in Japan. In particular, the site was recognized for the mosaic of socio-ecological production managed systems referred to as *satoyama* and *satoumi*, which provides rich natural and cultural resources, and the resources can be utilized as regional development including local tourism development (Uchiyama and Kohsaka 2016; Kohsaka et al. 2016). Their hilly and mountainous geography and remoteness from large consumption markets provide various opportunities for maintaining and developing ecosystem services (Hashimoto et al. 2015), although it is not immune to their degradation (Nakamura and Yamamoto 2012).

In Chap. 4, we quantified the variety and quantity of agricultural, forest, and marine food products that households acquired by non-market transactions by growing in their own homegardens or receiving from others and discovered how these households shared food and how sharing fostered social relations. We also estimated economic value of the home-based food, which is understood as saved money by producing and/or receiving home-based food without market transaction, by using household expenditure statistics. In this chapter, "non-market food" is defined as self-producing, harvesting, and/or receiving food without market transaction. Face-to-face household interviews are conducted in community level, which are representative and important local societies of Japan.

3.2 Materials and Methods

3.2.1 Study Site

Noto peninsula contains nine municipalities located in Ishikawa prefecture. Nanao city is the most populous city on the Noto peninsula and is located in the center of the peninsula (Fig. 3.1, Table 3.1). As of 2015, the city had 55,325 inhabitants and 20,855 households in an area covering 318.32 km^2. Nanao city has large areas of paddies, high fish catches (particularly shellfish), and cultural values that uphold recreation and heritage (Hashimoto et al. 2015). We chose 3 communities within Nanao city and selected about 30 households, respectively, for their varied

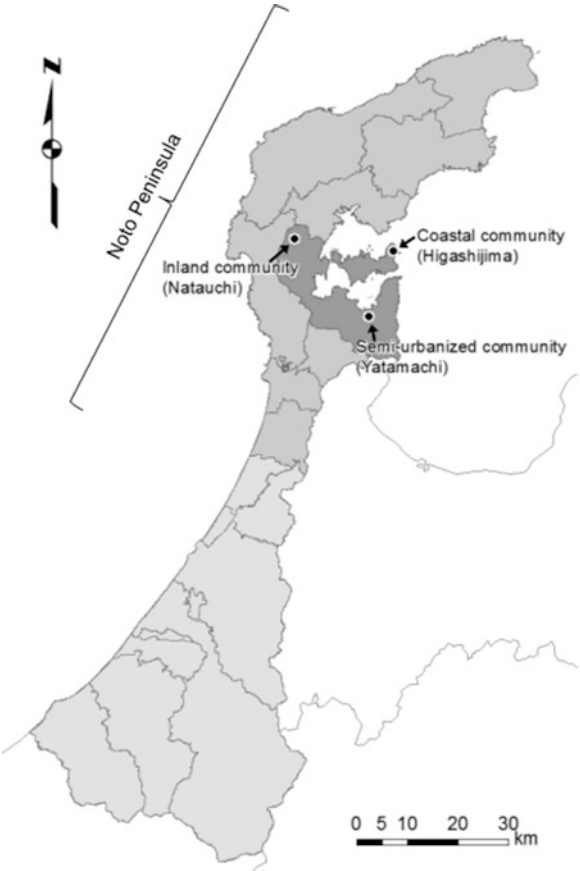

Fig. 3.1 Location of studied communities in Noto peninsula. (Kamiyama et al. 2016)

socio-geographical attributes, Natauchi, Higashijima, and Yatamachi (Table 3.2), to compare home-based food consumption and sharing among the three communities. In this chapter, "Community" refers to local groups of interacting people who live in the same place and share an environment or indigenous characteristics historically. It is representative and important local societies of Japan and serves as a basis of ties among people having a place of residence in a set area, which may not necessarily be the current administrative jurisdiction. Natauchi grows mainly rice and is located inland in an area that is 88% forested, thus fulfilling the characteristics of *satoyama*. Famous for maritime fishing, Higashijima is on the eastern coastal Notojima island near Nanao Bay and has been connected by bridges to the peninsula since 1982. It fulfills the characteristics of *satoumi*. Yatamachi, near Nanao City Hall, has been influenced by 30 years of progressive urbanization.

Table 3.1 Characteristics of Nanao city

	Nanao city
Belonging prefecture	Ishikawa prefecture
Description	The most populous city on the *Noto peninsula*[a]. It has large areas of paddies, high fish catches (particularly shellfish), cultural heritage, and diversity of socio-ecological production landscapes and seascapes. Notojima is an island in the Nanao Bay with less than 500 m off the coast
Area (Km^2)	318.32
Forest area (Km^2)	203.88
Cultivated area (Km^2)	34.40
The number of households	20,855
Population	55,325
The number of investigated households	89
Investigation period	October 2013–August 2014

[a]Noto peninsula was designated as Globally Important Agricultural Heritage Systems (GIAHS) by FAO in 2011 for the first time in Japan

3.2.2 Sampling and Data Collection

Field surveys were conducted from October 2013 to August 2014 in Noto peninsula. To ensure participation in the survey and efficient data collection, we avoided the busy farming season (spring and autumn) and local festival and shrine ritual seasons. Interviewer(s) including the author administered structured questionnaires face-to-face at respondents' homes. Each interview ran 20–60 min. A household was used as a sampling unit, and it in this case was defined as people who live together in their own houses (not in rented rooms, dormitories, or boarding houses) and share living expenses. Assisted by local coordinators, households were randomly selected, and we contacted them before the survey to explain its purpose and make appointments. We directed questions to respondents who were most familiar with their homegarden and/or kitchen work in each household. Both husbands and wives often joined the survey.

3.2.3 Measures

We asked respondents to identify the variety and relative quantities (proportions) of each food category (rice, vegetables, fruits, forest products, and fish products) acquired by non-market transactions during a year by production in their

Table 3.2 Socio-geographic characteristics of studied community in Noto peninsula

Community name	Natauchi	Higashijima	Yatamachi
General description	One of the famous production communities of rice in Noto peninsula, located in inland area of Nanao city, having characteristics of *satoyama*	One of the famous production communities of marine fishes in Noto peninsula, located in coastal area of Notojima island in Nanao city, having characteristics of *satoumi*	Near from urbanized area with Nanao city office and urbanization has been promoted in recent 30 years
Area (Km^2) (2006)	28.71	12.04	2.91
Forest area	25.26 (88.0%)	9.02 (74.9%)	1.15 (39.5%)
Cultivated area	2.89 (10.1%)	2.22 (18.4%)	0.66 (22.7%)
Building area	0.48 (1.7%)	0.39 (3.2%)	1.03 (35.3%)
The number of households (2014)	329	361	995
Population (2014)	948	1083	2718
The number of investigated households	27	32	30
Investigation period	23–36 Nov 2013	28–31 Oct 2013 23–26 Jul 2014	18–21 Aug 2014

Source: Kamiyama et al. (2016)

homegardens and/or sharing. All foods were recorded, defining "variety" as the number of foods. For each category, we asked about the quantities of food (a) grown at home or gathered themselves from nearby forests or oceans (%); (b) received from neighbors, relatives, or friends through sharing, gifting, and/or exchanges (%); and (c) purchased from markets (e.g., groceries and supermarkets) (%). The ratios of these parameters to the total quantity of food consumed (100%) were calculated. The sum of (a) and (b) is the total food variety and quantity acquired by non-market transactions. We also asked about their food-sharing relationships and their partners' residences. Residential information was sorted by distance from respondents within the same community, within the same municipality (different community), within the same prefecture (different municipality), and within Japan (different prefectures). Information about respondents' ages, occupations, years of residence, and number of housemates was also gathered.

3.2.4 Analysis

To analyze how household attributes affect the variety and quantities of non-market food consumed, we applied a simple generalized linear model (GLM) to infer changes in each category (rice, vegetables, fruits, forest products, and fish products). The model's explanatory variables included community of residence, age, occupation, years of residence, number of housemates, and number of sharing partners. To evaluate the relationships between household attributes and the spatial dispersion of sharing partners, we applied GLM to infer changes in the number of partners within the same community, municipality, prefecture, and country. The model's explanatory variables were community of residence, age, occupation, years of residence, and number of housemates. Details of these models are described in Kamiyama et al. (2016).

By using household expenditure statistics "Yearly Amount of Expenditures, Quantities and Average Prices per Household" on the Family Income and Expenditure Survey (reported by the Statistics Bureau, Ministry of Internal Affairs and Communications), economic value of non-market food is estimated. Because respondents in three study communities we chose are fulfilling the characteristics of *satoyama* and *satoumi* and expected to consume considerably higher amount of non-market food and spend less amount of money to purchase food than general trend showed up in statistics, total quantity (proportion) of food consumed (100%) was assumed to comparable to the household expenditure statics. Then, saved money by producing and/or receiving home-based food which can be understood as economic value of non-market food is calculated in the same way as Tatebayashi et al. (2018) by multiplying the household expenditure statics by the relative quantities (proportions) of non-market food identified by Chap. 4 as the sum of (a) and (b). As the household expenditure statics, yearly amount of household expenditure in 2014 in Hokuriku region of Honshu (incl. Niigata, Toyama, Ishikawa, and Fukui prefectures) was used in this calculation.

3.3 Results

3.3.1 Quantity and Variety of Non-market Food

The effects of respondents' residential community to the ratio of quantities of food in Noto peninsula are shown in Fig. 3.2. In contrast to the term "urban," "rural" describes places in which the population density and proportions of built-up area to total land area are low. Inland and coastal rural households grew more food at home or gathered it from nearby forests or oceans and purchased less from markets (e.g., groceries and supermarkets) than did semi-urban communities in all categories. For example, the ratio for the quantity of homegrown vegetables consumed by inland and coastal households significantly exceeded that of semi-urban households.

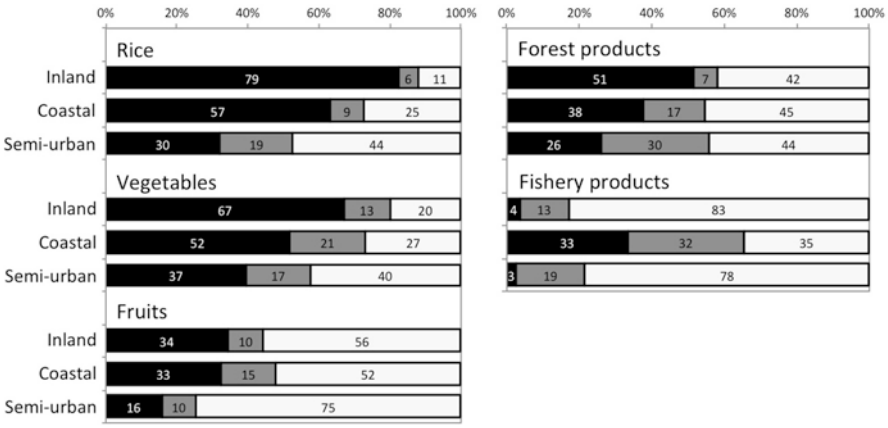

Fig. 3.2 Comparison of average ratios of food quantities among communities (inland, Natauchi; coastal, Higashijima; semi-urban, Yatamachi) in Noto peninsula. Black columns indicate food grown at home or gathered from forests or oceans (non-market). Gray columns indicate food received from others (non-market). Open columns indicate market purchases in each category (rice, vegetables, fruits, forest products, fishery products)

Semi-urban households displayed higher ratios of quantities received from others in rice, forest products, and fish products than inland and coastal households did. However, there are exceptions reflecting attributes of the two rural communities. Inland community households neither gathered more fish products from nearby oceans nor did they receive more products, resulting in more fish products being purchased (Fig. 3.2). The average consumption of non-market fish products in coastal communities was 65%, whereas in inland communities, it was 17%. The consumption of non-market rice by inland community households reached 85% owing to significant home production, whereas consumption in coastal communities was 66%.

The effects of respondents' residential community to the varieties of non-market food consumed per household are shown in Fig. 3.3. The variety of forest mushrooms consumed by inland community households was significantly higher, and the variety of fish products consumed was significantly higher in coastal than in semi-urban community households. An average ratio of food grown at home and received from others in the non-market food variety consumed in households is shown in Fig. 3.4. The ratio of food grown at home is the highest in inland community (85%), while the ratio of food received from others is the highest in semi-urban community (42%). It indicates that non-market food consumption in semi-urban community is largely supported by sharing activity with others.

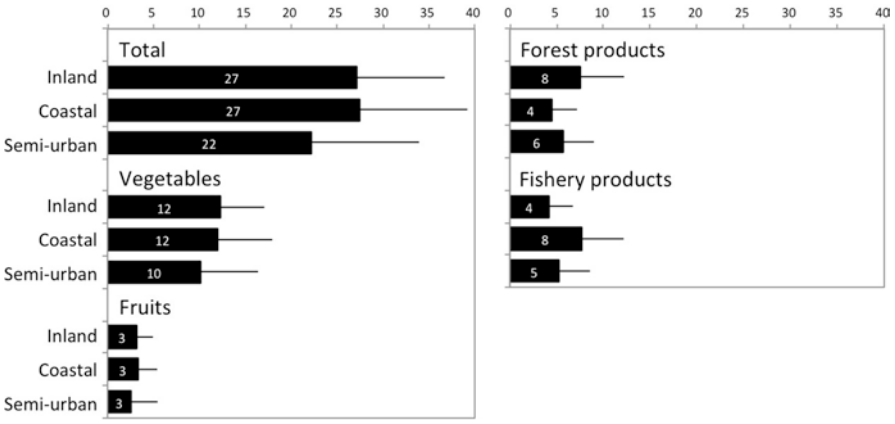

Fig. 3.3 Comparison of average number of food variety consumed by home-based food provision among communities (inland, Natauchi; coastal, Higashijima; semi-urban, Yatamachi) in Noto peninsula in total, vegetables, fruits, forest products, and fishery products. Whiskers represent the range of standard deviations

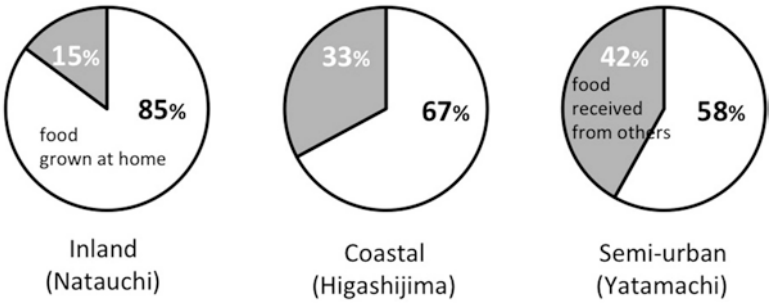

Fig. 3.4 Comparison of average ratios of home-based food variety among communities in Noto peninsula. Open parts indicate food grown at home or gathered from forests or oceans. Gray parts indicate food received from others

3.3.2 Sharing Partners

The number of sharing partners per household significantly affects the quality of non-market food consumption. The number of sharing partners correlated positively with the total varieties (Fig. 3.5a) and variety in vegetables (Fig. 3.5b) and forest plants. Such trends were found in the ratio of food quantities as well. The quantity of homegrown rice, vegetables (Fig. 3.5c), fruits, and fish products correlated positively with the number of sharing partners. In other words, households with more sharing partners (i.e., with more connections to other households) tend to consume greater amount and varieties of non-market food.

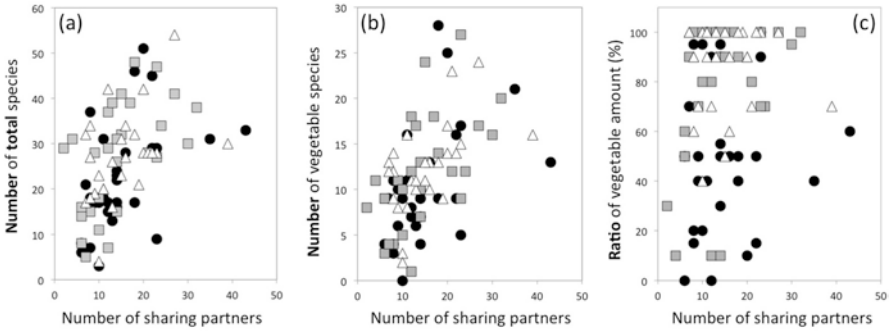

Fig. 3.5 Relationship between varieties of non-market foods and number of sharing partners in Noto peninsula in (**a**) total, (**b**) vegetables, and (**c**) relationship between ratio of non-market vegetables consumed (sum of home production and received from others) and number of sharing partners. Open triangles indicate Natauchi (inland). Gray-filled squares indicate Higashijima (coastal). Black circles indicate Yatamachi (semi-urban). (Source: Kamiyama et al. 2016)

Furthermore, we analyzed the composition of sharing partners based on the residence locations. Although the number of partners did not differ among communities, the semi-urban community households had fewer partners within their community but more within their municipality and prefecture than households in inland and coastal communities did.

3.3.3 Economic Value of Non-market Food

Estimated economic value of non-market food at household per year of studied communities is shown in Table 3.3, which can be understood as saved money by producing and/or receiving home-based food without market transaction. Households in costal rural community (Higashijima) consume home-based food corresponding to totally 119,881 Japanese yen (JPY) annually, which is the highest value among studied communities followed by 102,268 JPY in inland rural community (Natauchi) and 72,110 JPY in semi-urban community (Yatamachi). Among food categories, the economic value is the highest in vegetables followed by rice, fruit or fishery products, and forest products. In proportion to the ratio for the quantity of home-based food (Fig. 3.2), the estimated economic value in coastal community (Higashijima) is higher in fish products, while that in inland community (Natauchi) is higher in rice.

Table 3.3 Estimated economic value of non-market food (JPY/year) in the three communities

Food category	Household expenditure[a] (JPY/year)	Estimated economic value of non-market food (JPY/year)		
		Natauchi	Higashijima	Yatamachi
Rice	25,983	22,037	17,133	12,775
Fresh vegetables	60,005	48,115	44,066	32,203
Fresh fruits	37,212	16,539	17,779	9427
Fresh forest products	11,220	6524	6117	6246
Fresh fishery products	53,134	9052	34,786	11,459
Total	187,554	102,268	119,881	72,110

[a]Original source: "Yearly Amount of Expenditures, Quantities and Average Prices per Household" in 2014 in Hokuriku region of Honshu (incl. Niigata, Toyama, Ishikawa, and Fukui prefectures) on the Family Income and Expenditure Survey reported by the Statistics Bureau, Ministry of Internal Affairs and Communications

3.4 Discussion

Inland and coastal rural households of Noto peninsula consumed greater varieties and quantities of foods grown at home and/or received from others via sharing and, as a result, saved much money by consuming the home-based food than semi-urban households did. We also found different consumption trends between the inland and coastal community rural households. The varieties and quantities of non-market fish products consumed were significantly higher in the coastal communities; the varieties and quantities consumed of forest products and rice were greater in the inland. For the total number of non-market foods, however, semi-urban households displayed values similar to those of the two rural communities. We believe that this report is one of the first to associate quantitative values of foods produced at home and shared with local socio-geographical attributes at a community level in a developed country in the context of ecosystem services. Understanding and quantifying how ecosystems provide services may be the first step in integrating ecosystem services in landscape planning, management, and decision-making (Fisher et al. 2009; de Groot et al. 2010).

Smith (2002) compared the production and exchange of home-based food in two sites in Slovakia and found that households in provincial cities buy fewer market potatoes, vegetables, and fruits than households in the capital do. Smith (2002) attributed these findings to long-standing economic practices and not to economic necessity. In our studied locale, Noto peninsula, indigenous dishes and local festivals are long-standing traditions grounded in the diversity of indigenous vegetables (The Noto Regional Association for GIAHS Promotion and Cooperation 2010).

The greater varieties and quantities of home-based foods in our studied communities align with long-standing customs connecting people and nature. Further, through these foods, traditional knowledge and skills are being passed on to younger generations. Possessing traditional knowledge, on the other hand, can often inter-

fere with uptake of modern knowledge, particularly among older and more experienced farmers (Kohsaka et al. 2015). Hence, it is needed to examine the dynamics of the two knowledge systems and find a solution for better integration.

The variety and ratio of food quantities per household correlated positively with the number of sharing partners. Households with more connections to other households consumed greater quantities and varieties of home-based food. This quantitative result suggests that food grown at home and/or shared with others is substantially associated with nutritional well-being (food variety and amount) and social relations. The latter is underappreciated in the Millennium Ecosystem Assessment (MA 2005).

Our study uncovered no differences in the total number of sharing partners among communities, although Morton et al. (2008) reported that rural households are significantly more likely to be linked to family, friends, and neighbors to share fish, meat, and garden products. The result explains why semi-urban households report higher numbers of total non-market foods and higher quantities of forest and marine products received from others than rural households do. In other words, quantity and variety of non-market food consumed in semi-urban community are largely supported by the sharing activity with others. When dispersion of sharing partners was considered, the number of partners was higher within households in rural inland and coastal communities, where households share food mainly within their communities. The number of more widely dispersed partners (municipalities, prefectures, and nationally), however, was higher in semi-urban than in rural communities. The results for semi-urban communities suggest that extra-community distant relationships, particularly with rural communities, may contribute to consumption qualitatively and quantitatively. Such distant relationships have been established presumably because many residents of semi-urban communities had lived in rural inland or coastal communities before relocating for jobs, public services, or education and maintain connections with their home communities. Recent local food movements, namely, local production and local consumption, aimed at community stability and environmental sustainability (Jones 2002) have begun to focus not only on market farms but also homegardens and family farming in peri-urban areas (Metcalf and Widener 2011). Our findings of distant networks connecting rural and semi-urban households for sharing home-based foods might illuminate a system of local sustainable agriculture.

With respect to sharing partners, the study in Noto peninsula did not quantify the exact ratio of reciprocity, but other case study in Sado island mentioned the reciprocal nature of non-market food transactions that have been embedded in their customs and traditional lifestyle (Box 3.1). Most of respondents in Sado island answered that they either give fresh foods they produced or give processed foods when they receive home-based food from others, indicating reciprocal relationship with bartering food for food. We also observed that this sharing of home-based food sometimes occurs beyond bartering (Box). Such social relationship and sharing custom may not only maintain nutrition but also promote human well-being involved in *satoyama-satoumi* socio-ecological production landscapes and seascapes (SEPLSs).

The consumption of non-market food saved 98,086 JPY household^{-1} year^{-1} (900 USD) in average among studied three communities. Households in costal rural community (Higashijima) consumed home-based food corresponding to totally

Box 3.1: How Reciprocal Relationships Are Promoted by Home-Based Food Sharing?

Sado island consists of one municipality named Sado city in Niigata prefecture (Fig. 3.6) and is the sixth largest island of Japan in area following the four main islands and Okinawa island. Noto peninsula in Ishikawa prefecture and Sado island in Niigata prefecture, Japan, were designated as Globally Important Agricultural Heritage Systems (GIAHS) for the first time in Japan. To understand how reciprocal relationships are promoted by home-based food sharing, questionnaire survey was conducted from December 2016 to March 2017. Three communities (Kanaizumi, Sotokaifu, and Uchikaifu community) were chosen fulfilling the characteristics of *satoyama and satoumi* and collected answers from totally 84 households. As of 2015, the city had 57,255 inhabitants and 22,401 households in an area covering 855.61 km^2. The city consists of two parallel mountain ranges running roughly southwest (Kosado range) to northeast (Osado range), enclosing a central Kuninaka plain. The main industries on the Sado island are agriculture and fishing, taking advantages of the climate and the soil, which is relatively rich for an island surrounded by the sea.

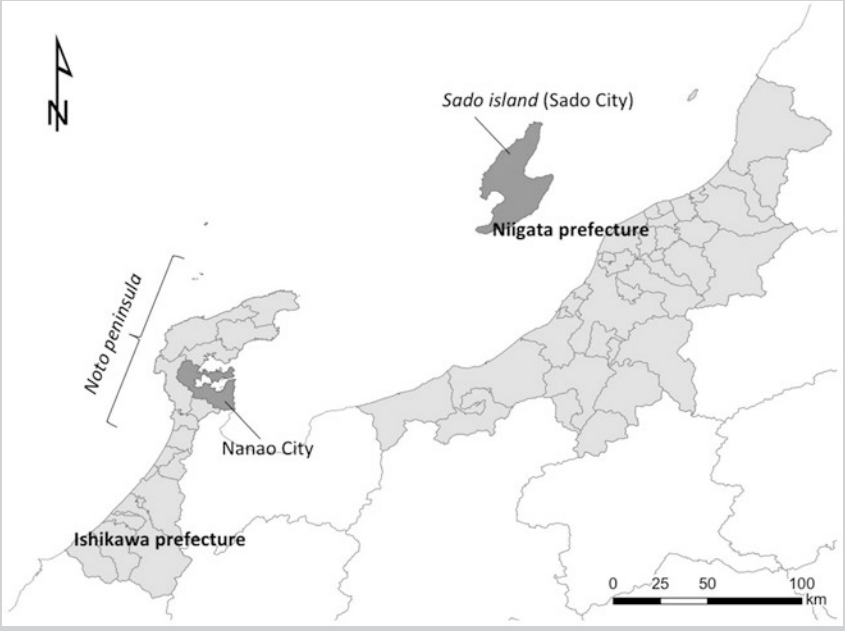

Fig. 3.6 Location of Sado island referring to Noto peninsula (in Ishikawa prefecture). The right gray area is Niigata prefecture. Sado island is an isolated island off the coast of mainland Niigata (dark gray). Black lines in each prefecture indicate municipal boundaries

(continued)

Box 3.1 (continued)

Respondents were asked "what do you do when you receive home-based food from others?" and selected options from (a) to (j) where multiple answers were allowed. Result was shown in Fig. 3.7. To the question, 58 and 53 households selected "(a) give fresh foods you produced, harvested and/or caught in your homegarden, forests and/or sea" and "(b) give processed foods you purchased and/or dishes you made," respectively, which is significantly higher number compared with other options. However 54 households selected more than 1 option, and 35 households selected at least 1 option other than option (a) and (b). As a result, we found reciprocal relationship with not only bartering food for food but also other benefit, where 17 households selected (h) pay attention to community's safety, followed by (c) help with small jobs around the house (14 households), (g) pay attention to his/her health (14 households), (d) invite to your place (8 households), and (e) provide your expert knowledge (5 households). It is suggested that reciprocal relationships via home-based food sharing function as one of the means of daily communication and activity with others and for the community.

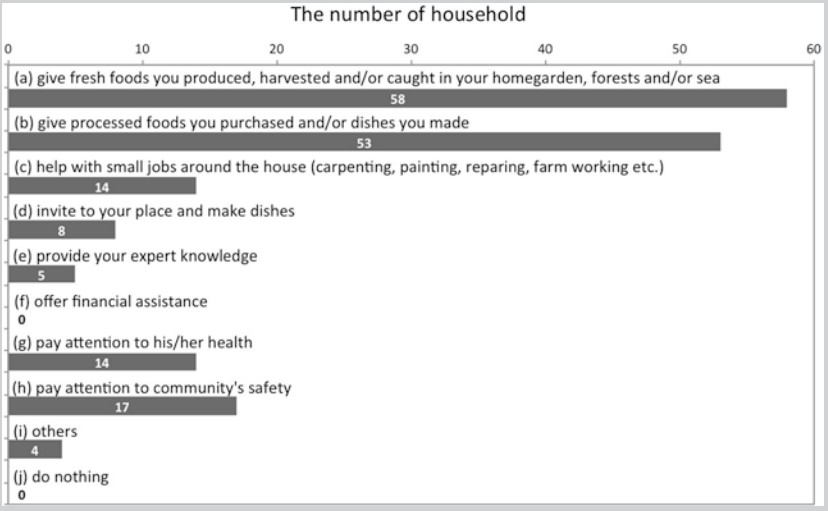

Fig. 3.7 The number of households that selected options from (a) to (j) to the question "what do you do when you receive home-based food from others? (multiple answers allowed)"

119,881 JPY year^{-1} (1100 USD, 109 JPY USD^{-1}) annually, which is the highest value among communities followed by 102,268 JPY year^{-1} (938 USD) in inland rural community (Natauchi) and 72,110 JPY year^{-1} (662 USD) in semi-urban community (Yatamachi). Similar savings were reported in a remote island of Japan, Hachijo Town (219,543 JPY household^{-1} year^{-1}(2018 USD), Tatebayashi et al.

2018), which suggests that economic saving by non-market food tends to be larger in rural areas including remote islands by producing larger amount of home-based food and/or receiving larger amount of food from others via sharing network. However, it should be noted that the economic values are presumably overestimated, because producers need to spend certain amount of money on a process to grow the shared food (e.g., cost for seeds, seedlings, fertilizer, labor, etc.) although sharing or gifting itself can be done without a financial transaction. These costs borne by each members of a society can be assumed as an economic value of sharing to achieve the reciprocal relationships, which may help to promote further understanding on a value of human well-being involved in SEPLSs.

Personal connections and mechanisms for sharing home-based food have also arguably degraded throughout Japan, where depopulation and aging especially in rural areas have hindered the custom of self-production (Kamiyama et al. 2014). In Japan, many rural people have engaged in agriculture, fishing, and/or forestry simultaneously and, therefore, have a deep connection to the surrounding mountains and the sea. This has helped maintain the renowned features of *satoyama-satoumi* landscapes for decades. This way of living, however, has been undergoing unprecedented changes in recent years, and the loss of such connections poses a serious concern. For example, the reduction of forest management has resulted in reduced harvests of edible plants and wild mushrooms for self-consumption and sharing (Nakazawa et al. 2014). Developing systems and incentives to encourage personal connections via self-production and sharing home-based food is needed to build local identity and integrated societies (Galhena et al. 2013), preserve traditional cultures and knowledge (United Nations University 2013; Nakazawa et al. 2014), and also maintain socio-ecological production landscapes and seascapes.

3.5 Conclusion

Our results show that households in the Noto peninsula consume quantities and varieties of food acquired without financial transactions. In other words, they grow food in homegardens, harvest food from forests or oceans, and/or receive it from families, neighbors, and friends. These patterns of production and consumption reflect communities' socio-geographical attributes. Our results also reveal that distant networks connecting rural and semi-urban households enhance food provisioning qualitatively and quantitatively. We conclude that non-market provisioning of food grown at home and/or shared with others enhances human nutritional well-being and social relations. Our findings indicate that sharing food is a social activity among networks within and beyond the community. The current accounting system of food provisioning services depends only upon statistics of market transactions and often ignores non-market food in many countries including Japan. This study empirically demonstrates that the current market-based accounting system reflects only part of the value of the entire food provisioning ecosystem services. Balancing market and sharing mechanism in food provisioning services would be one of the key challenges to build localized models of sustainable society in harmony with nature (Photos 3.1, 3.2, 3.3, and 3.4).

Photo 3.1 Landscapes and seascapes in Noto peninsula (Higashijima community)

Photo 3.2 Homegarden in Noto peninsula

Photo 3.3 Wild mushrooms gathered from near forests for self-consumption

Photo 3.4 Fishes gathered from near oceans and paddy field for self-consumption

Acknowledgments This study was supported by the Environment Research and Technology Development Fund (1–1303&S15-1, Japan's Ministry of the Environment) and Grants-in-Aid for Scientific Research (KAKENHI, Japan Society for the Promotion of Science).

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Chapter 4
Non-market Food Provisioning Services on Hachijo Island, Japan, and Its Implications for Building a Resilient Island

Osamu Saito, Kana Tatebayashi, Chiho Kamiyama, and Takanori Matsui

Abstract The resource consumption pattern of remote islands is assumed to differ from that of the mainland because of the constraints of both material distribution and human interaction. This study investigates food production and consumption patterns of remote islands with a focus on the food supply flow, a food-sharing network, and food stock for emergencies. The study uses a household questionnaire survey and interviews with the residents of Hachijo Island, Tokyo. We find that sharing food provisioning services plays an important role by sustaining roughly half of the total food consumption during the high cropping and harvesting season of agricultural and marine products. A large proportion of the islanders' annual consumption of potatoes, vegetables, seafood, and fruits are obtained through the food-sharing network. Non-market food largely saves the household budget and provides calories and a wide variety of nutrients. The results also indicate that many households own additional deep freezers to store food product, which are then shared and exchanged with neighbors and relatives on Hachijo Island. Based on the findings from Hachijo Island, we discuss the potential role, opportunities, and challenges of this food-sharing culture to build an island resilient to natural disasters and socioeconomic changes.

Keywords Remote island · Non-market food provision · Sharing · Resilience · Food storage · Social network · Local production for local consumption

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4.1 Introduction

Globally, the demand for food is increasing rapidly as the world population continues to soar. Despite this, there has been growing concerns for securing food production against the impacts of climate change, such as diminishing water resources and increased frequency and intensity of natural disasters. The current food production system is highly inefficient. Not only does it require a colossal quantity of petrochemical fertilizers, energy, and water, but it also creates a large quantity of food waste through its production, transport, and consumption processes. The system itself is contributing to environmental and social degradation. Given this, it has become an urgent task for many governments worldwide to create a smarter, more sustainable food production and transport system, simultaneously maximizing the use of renewable resources by recycling water and using solar energy.

Currently, many experts around the world are discussing how to incorporate these ideas into Sustainable Development Goals, which are a collection of 17 global goals to be set by the United Nations. In the latest proposal for Sustainable Development Goals, Goal 2 is to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" (UN General Assembly 2015). This goal includes the following two associated targets: "2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers" and "2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality."

Examples of such systems are often found in traditional, rural communities because they have developed a mutual assistance network by sharing and exchanging non-market food within their community. Such food-sharing networks are believed to play a crucial role in sustaining not only the rich food culture of these communities but also the local traditions and social bonds between the small-scale food producers (Yoden 1983; Smith 2002). This has been demonstrated in many Japanese rural landscapes, also known as *satoyama* (Kamiyama et al. 2014). In other parts of Asia, it is also common to find various types of home gardens where backyards and the surrounding shelterbelts are integrated within the landscape. These socio-ecological landscapes not only provide sufficient food provisioning services and diverse ecosystem services but also contribute to community resilience when these communities are hit by natural disasters and other emergencies (Mohri et al. 2013; Saito and Ichikawa 2014).

Isolation is known to often strengthen social cohesion and facilitate sharing of non-market food within communities. The best way to test this hypothesis is to investigate the pattern of resource consumption on a remote island, where transport of materials and humans is more restricted than on the mainland. In Japan, approximately 430 out of some 6852 offshore islands are inhabited (Center for Research and Promotion of Japanese Islands 2004). These island residents need to be more self-reliant during emergencies because, when typhoons or other adverse weather conditions strike, transport from the mainland is often temporarily interrupted. Nevertheless, challenges are mounting because the population of these communities are aging and shrinking at a rate equivalent to higher than that of the rural mountain communities on Japan's mainland (Center for Research and Promotion of Japanese Island 2014). Therefore, understanding the flow of food provision and consumption and the amount of emergency food stockpiled on a remote island should also provide useful insights for improving the resilience of mountain communities.

For ecological science, islands are particularly useful model systems because they are closed systems with clear physical boundaries, relatively small geographic areas, and comprehensible driving forces that can be disaggregated and experimentally controlled (Bateson 1972; Vitousek 2006). Islands are relatively easy-to-track inputs and outputs of materials produced both inside and outside of the island since material entry points of islands such as harbor port and airport are normally limited. Because of remoteness and small geographic areas, island populations often face the challenges of limited resource availability, tenuous resource security, and limited natural carrying capacity (Deschenes and Chertow 2004). Thus, populated islands typically have fragile ecosystems and economies, are heavily dependent on imports for a broad range of goods, and suffer from size constraints in the development of resilient water, sanitation, energy, and waste management systems.

Therefore, this study investigates the level of non-market food obtained through food-sharing networks and the emergency food stock held by households on a remote island. The study uses interviews and a questionnaire survey. Hachijo Island is chosen for the case study because of its proximity to and ease of access from Tokyo. In this chapter, we highlight the role of a food-sharing culture in maintaining community resilience. To do this, we (1) identify the structure of the food-sharing network and non-market food species, (2) quantify the composition of food distribution channels by systematic food categories, and (3) elucidate the comprehensive shadow benefits provided by non-market transactions. In addition, we discuss the opportunities and challenges that remote island communities might face during natural disasters or socioeconomic changes.

This chapter was developed by integrating the publication of Saito et al. (2015) with that of Tatebayashi et al. (2018).

4.2 Study Area and Methods

4.2.1 Study Area

Hachijo Island (69.5 km^2), which is administered by Tokyo, is an offshore island located 287 km south of Japan's capital (Figs. 4.1 and 4.2). Of the many offshore islands in Japan, Hachijo Island is large in both size and population (7591 people and 4392 households in 2017) (GSI 2017; Hachijo Island Department of Financial Planning 2017). Thirty-eight percent of the population consists of elderly residents (aged over 65). Access to the mainland is relatively convenient, with three return flights daily to Tokyo and a ferry service to the island. The island is volcanic and belongs to the Fuji Volcanic Belt. It looks like a gourd because of the way the two stratovolcanoes, Mt. Miharayama (700.9 m) and Mt. Hachijofuji (854.3 m), are located in the southeast and northwest, respectively. The majority of the residents live in two northwestern communities, Okago and Mitsune, where economic activity is focused, while the others live in three southeastern communities, Kashitate, Nakanogo, and Sueyoshi (Fig. 4.1).

The three main industries of the island are floriculture, fishery, and tourism. The island is famous for its traditional produce, such as the Japanese spirit "shochu," fermented fish "kusaya," and silk textile "kihachijo." In 2010, the percent of residents engaged in primary, secondary, and tertiary industries was 17.0%, 18.1%, and 64.8%, respectively (Hachijo Island Department of Financial Planning 2017). The gross agricultural production in 2016 was 1.8 billion JPY (1.7 million USD, 109 JPY USD^{-1}), of which 84% consisted of horticultural products such as *Phoenix*

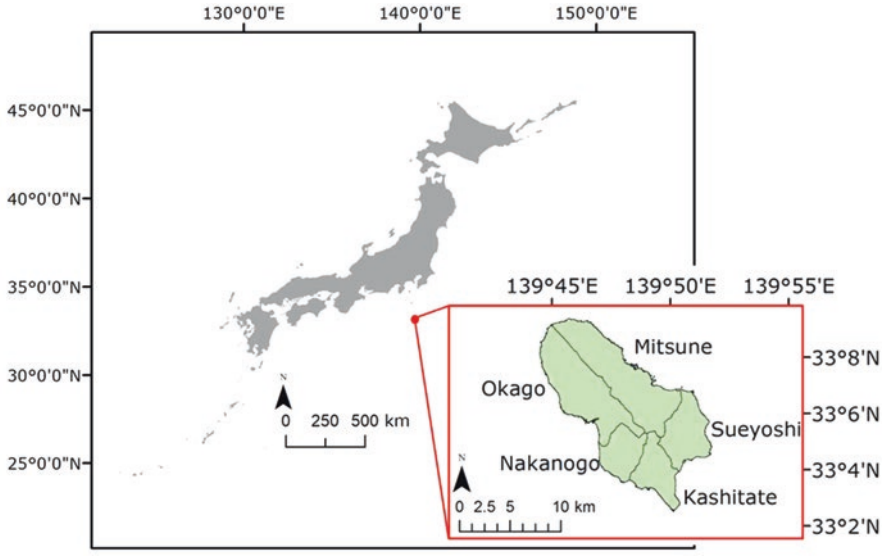

Fig. 4.1 Map showing location of Hachijo Island

Fig. 4.2 Hachijo Island

roebelenii and *Rumohra adiantiformis* and 15% consisted of agricultural crops such as *Angelica keiskei*. The seafood in 2016 weighed 1060 t and produced 940 million JPY (8.6 million USD, 109 JPY USD^{-1}). Red snapper, flying fish, and mackerel scad are the main marine products.

According to the material flow analysis in Hachijo Island conducted by Shirai et al. (2015), the total amount of import to the island was estimated as 218,952 (time/year), which was ten times of the exported amount (28,059 time/year) from the island. Sands and gravels for maintaining sandy beaches were dominant materials in the imports contributing to huge stocks in the island (Shirai et al. 2015). In 1999, a geothermal generator (3300 kW) was installed in Hachijo Island for the first time on all remote islands in Japan. In 2016 the geothermal plant generated 12.15 million kWh which accounted for 24.9% of the entire power generation of the island (Hachijo Island Department of Financial Planning 2017).

The island has a subtropical climate with an annual average temperature, precipitation, and humidity of 17.8 °C, 3202 mm, and 80%, respectively. Within 300 km of Hachijo Island, 198 typhoons hit over the past 66 years (Digital Typhoon 2018), for an annual average hit frequency of 2.96 per year (SD = 1.62). The years with the most typhoons were 1988, 2012, and 2013 with six hits, whereas no hits occurred in 1964, 1984, and 1999. The mean typhoon lifetime and mean central pressure were 155.4 h (SD = 76.1) and 953.9 hPa (SD = 28.7), respectively.

4.2.2 Methods

We investigated the pattern of non-market food provisioning and consumption on Hachijo Island through interviews and two rounds of questionnaire surveys administered from August to November 2014 (first survey) and from October to December 2016 (second survey). The sampling unit consisted of a single household.

4.2.2.1 First Survey

To develop the questionnaire, we first interviewed several residents who were recommended by the Hachijo Island Women's Association and town officers. In September 2014 we distributed approximately 500 questionnaires to the association members. Of these, 457 were returned by 15 November 2014. Between August and October 2014, 207 additional questionnaires were collected from residents at the airport, the farmers' markets, and those working in the hotel industry. The total number of completed questionnaires was 664. Given that the island held 4472 households in January 2015, the response rate was 14.8%. The questionnaire was conducted in Japanese, and the methods and results were translated into English by authors.

The questionnaire contained mostly open questions. It included questions in the following items:

1. The sociodemographic characteristics of the respondents
2. The list of household items or appliances
3. The location and means of purchasing food and other daily necessities (including Internet shopping)
4. Food items received from others between spring and fall and in winter
5. The proportion of food in the daily diet that was (a) purchased, (b) grown in the home garden or self-gathered, or (c) received from others
6. The list of food items stocked for emergency situations (e.g., typhoons) when transport from the mainland is interrupted

We asked respondents to list their household items and appliances because the ability to produce and store excess food might be supported by the presence of particular household appliances. The level of sharing non-market food is generally much higher from spring to fall when food is more abundant than in winter. Therefore, we asked respondents to list food items received from others for each of the two seasons. For question (5), the base units for estimating the proportion of food in the daily diet might have varied between the respondents because we never specifically asked them to use the price or weight of food. Many estimated these proportions based on food volume in their daily meals. Because Japanese typically serve different food (e.g., grilled fish or pickled vegetables) on separate plates, some estimated the proportion based on the number of different plates served. This meant that our data cannot be assessed in strictly quantitative terms. However, because our

aim is to understand the pattern of food purchased and consumed by Hachijo residents, we treated these units as somewhat equivalent in calculating the average proportions and assessed them qualitatively and semiquantitatively.

For this study, we define non-market food to include not only food that people produce and harvest themselves but also items received from others without a market transaction. The proportion of non-market food in their daily diet was calculated by adding the proportion of self-produced and harvested food to that of the food received from others. We created a contingency table with four levels (0–19%, 20–39%, 40–59%, and 60–100%) against the following predictor variables: community of residence, gender, age group, and years of residence. The expected value for each cell was calculated, and the data were analyzed by using the chi-squared statistics. Whenever significant differences occurred, a residual analysis was done to identify the categories responsible for the difference.

For question (6), the emergency food stocked was classified into four categories: "nothing in particular," "food," "water and other beverages," and "daily necessities." The food category was further subdivided into six groups: (a) rice, potatoes, fruit, and other vegetables; (b) frozen food; (c) canned food; (d) instant and precooked food; (e) dried food including flour, biscuits, and noodles; and (f) sauces and spices. We created a second contingency table containing the four levels of the non-market food in the daily diet versus these categories (including the subcategories). The expected value for each cell was calculated, and the data were analyzed by using the chi-squared statistics. As above, a residual analysis was done whenever significant differences occurred.

4.2.2.2 Second Survey

Interview Survey

Fifteen Hachijo residents ranging in age from their 20s to their 80s were interviewed from November to December 2016. The interviewees (15 residents) were recommended by the Hachijo Island Tourism Association, Hachijo's town office, and the Hachijo Island Women's Association. The interviewees' ages ranged from the 20s to the 80s (mean age 54 years, SD 16.4 years). Thirteen interviewees were female with a thorough knowledge of food production, purchase, and preservation. The interviewees covered four communities of Hachijo Island, and most of them were native to the island. The interview comprised seven questions:

1. What types of food are grown in the home garden?
2. What types of food do they give to or receive from neighbors, relatives, and friends?
3. With how many people do they share their food?
4. What is the relationship between them and their food-sharing partners?
5. Where are they and their food-sharing partners located?

6. Were the food shared within their food-sharing network self-produced or processed?
7. What is their opinion about consuming food produced on the island?

After extracting the shared food, the text data obtained from the interview survey were visualized as directed graphs representing the food-sharing network. The variety of non-market food, the relationship between the interviewees and their sharing partners, and the number of sharing partners were classified by season and by the direction of the sharing activities.

Questionnaire Survey

While the first questionnaire survey aimed at understanding general trend and pattern of food consumption and sharing practices in the island, the second questionnaire survey was designed to identify the distribution channels through which the residents acquired their food with more detail food categories. Three hundred questionnaires were distributed to the island residents from October to November 2016, of which 251 were returned, for a response rate of 84%, which is equivalent to 3.8% of the adult population of Hachijo Island (Hachijo Island Department of Financial Planning 2017). The questionnaires were distributed through the Hachijo Island Women's Association, Hachijo Town Hall, and Hachijo Tourism Association. The questionnaire survey included questions about the following items:

1. The proportion of annual household food consumption from the following three distribution channels: (a) grown at home and gathering from nearby forests or oceans (household food production in percent); (b) received from neighbors, relatives, or friends through food-sharing networks (sharing networks, in percent); and (c) purchased from markets (e.g., groceries and supermarkets) (purchase, in percent)
2. For each food category, (a) the frequency at which food produced on Hachijo Island was purchased and (b) the frequency of receiving food produced on Hachijo Island
3. The means to purchase food and the frequency of purchasing food
4. The reason for group buying and/or mail-order purchases
5. The reason for not consuming food produced on Hachijo Island

To quantify the amount of food acquired through non-market transactions, we requested the distribution channels of the respondents' food sources [grown at home (channel a), acquired through the community food network (channel b), or purchased from markets (channel c)]. Channel (b) includes both food self-produced by Hachijo residents and processed food, as defined by Saito et al. (2018). According to our interview survey, most received food on Hachijo Island was self-produced in home gardens. Therefore, the sum of the percent of distribution channels (a) and (b) is the total percent of the non-market food. The food categories in our questionnaires were defined following the National Health and Nutrition Survey (MHLW

2016), which reports the caloric and nutrient values of 17 food categories per daily intake (crops, potatoes, sugar, beans, nuts, vegetables, fruits, mushrooms, seaweed, seafood, meat, eggs, dairy products, fats and oils, confectionery, beverages, and seasonings and spices).

Based on the data obtained from the questionnaire surveys, the proportion of each food category received through a given distribution channel was calculated. The three distribution channels are (a) household food production (*hp*), (b) sharing networks (*sn*), and (c) purchase (*pc*). Thus, the proportion of non-market transactions (Rnm) is the sum of the proportion of household food production (Rhp) and the proportion of food from sharing networks (Rsn):

$$\mathrm{Rnm}_i = \mathrm{Rhp}_i + \mathrm{Rsn}_i, \tag{4.1}$$

where Rnm_i, Rhp_i, and Rsn_i denote the proportion of food category i in non-market transactions, exclusively produced by households, and exchanged through the sharing networks, respectively. The economic savings due to consumption of non-market food were estimated by multiplying the proportion of non-market transactions by the annual food expenditure of Hachijo Island households obtained from ZGI (2016):

$$\mathrm{Enm}_i = \mathrm{Ehac}_i \times \mathrm{Rnm}_i, \tag{4.2}$$

where Enm_i is the money saved by non-market food i [JPY household^{-1} year^{-1}] and Ehac_i is the household expenditure on food i on Hachijo Island [JPY household^{-1} year^{-1}]. The proportion of non-market transactions was multiplied by the daily caloric intake per person on Hachijo Island:

$$\mathrm{Cnm}_i = \mathrm{Chac}_i \times \mathrm{Rnm}_i, \tag{4.3}$$

where Cnm_i is the caloric intake of food acquired from non-market transactions in food category i [kcal day^{-1} person^{-1}] and Chac_i is the daily caloric intake of food category i per Hachijo Island resident [kcal day^{-1} person^{-1}]. Similarly, the daily nutrient intake per person through non-market transactions was estimated as

$$\mathrm{Nnm}_{i,l} = \mathrm{Nhac}_{i,l} \times \mathrm{Rnm}_i, \tag{4.4}$$

where $\mathrm{Nnm}_{i,l}$ and $\mathrm{Nhac}_{i,l}$ are the daily intake of nutrient l per Hachijo Island resident obtained through non-market transactions and from all sources, respectively, of food category i [mass day^{-1} person^{-1}]. The selected nutrients are those defined in the Overview of Dietary Reference Intakes for Japanese (MHLW 2014).

Table 4.1 summarizes the annual household expenditures and daily caloric and nutrient intakes of each food category per person on Hachijo Island. In this analysis, the shadow benefits of non-market food are defined as the money saved by receiving non-market food, Enm_i; the caloric intake through non-market transactions, Cnm_i; and the daily nutrient intake per person through non-market transactions, $\mathrm{Nnm}_{i,l}$. The information is described in detail in Tatebayashi et al. (2018).

Table 4.1 Annual household expenditure on food, and daily calorie and nutrient intake, of Hachijo Island residents

Food category	Annual household expenditure on food	Daily calorie intake	Protein	Lipid	Saturated fatty acid	Mono-unaturated fatty acid	n6 fatty acids	n3 fatty acid	Cholesterol	Carbon-hydrate	Total of dietary fiber	Soluble dietary fiber	Insoluble dietary fiber	Vitamin A	Vitamin D	Vitamin E
Unit	∗1	∗2	∗3	∗3	∗3	∗3	∗3	∗3	∗4	∗3	∗3	∗3	∗3	∗5	∗5	∗4
Crops	135,488	776	15.3	4.7	1.3	1.2	1.0	0.0	2.6	156.7	3.2	0.7	2.4	2.4	0.0	0.5
Potatoes	11,208	38	0.6	0.1	0.0	0.0	0.0	0.0	0.0	8.2	0.9	0.2	0.7	0.1	0.0	0.2
Sugar	1643	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	0.0	0.0	0.0
Beans	23,160	69	4.8	3.8	0.6	0.8	1.7	0.3	0.0	2.8	1.0	0.3	0.7	0.0	0.0	0.3
Nuts	5216	10	0.4	1.1	0.2	0.4	0.4	0.0	0.0	0.6	0.2	0.0	0.2	0.1	0.0	0.1
Vegetables	110,483	70	3.0	0.5	0.0	0.0	0.1	0.0	0.2	16.2	5.4	1.5	3.9	285.8	0.2	1.6
Fruits	80,848	64	0.6	0.3	0.0	0.1	0.0	0.0	0.0	16.6	1.4	0.3	1.1	27.1	0.0	0.3
Mushrooms	12,688	3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.7	0.1	0.6	0.0	0.4	0.0
Seaweed	12,858	2	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.9	0.5	0.0	0.0	10.9	0.0	0.0
Seafood	122,640	107	12.2	4.3	0.9	1.4	0.2	0.8	56.6	1.5	0.0	0.0	0.0	17.7	5.0	0.8
Meat	128,410	185	14.8	14.3	4.7	5.8	1.3	0.1	65.0	0.5	0.0	0.0	0.0	72.4	0.2	0.2
Eggs	14,398	53	4.0	3.1	0.8	1.1	0.5	0.1	130.0	0.1	0.0	0.0	0.0	44.0	0.6	0.3
Dairy products	59,821	95	5.2	5.4	3.3	1.4	0.1	0.0	16.9	9.9	0.0	0.0	0.0	47.6	0.2	0.2
Fats and oils	10,425	92	0.0	10.9	1.9	4.7	3.0	0.5	2.7	0.0	0.0	0.0	0.0	6.1	0.0	1.3
Confectionery	136,340	88	1.7	3.5	1.3	1.2	0.5	0.1	15.9	14.5	0.5	0.1	0.3	15.9	0.1	0.3
Beverages	148,060	81	1.9	0.1	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.8	0.0	0.0
Seasonings and spices	47,333	106	3.7	5.5	0.8	1.9	1.0	0.2	5.2	10.7	0.7	0.1	0.6	5.5	0.0	0.5
Total	1,061,019	1863	68.0	57.6	15.9	20.0	9.7	2.1	295.2	253.6	14.5	3.4	10.6	536.4	6.7	6.5

Food category	Vitamin K	Vitamin B1	Vitamin B2	Niacin	Vitamin B6	Vitamin B12	Folic acid	Panto-thenic acid	Vitamin C	Sodium	Salt	Potassium	Calcium	Magnesium	Phosphorus	Iron	Zinc	Copper
Unit	∗5	∗4	∗4	∗4	∗4	∗5	∗5	∗4	∗4	∗4	∗3	∗4	∗4	∗4	∗4	∗4	∗4	∗4
Crops	0.4	0.2	0.1	1.5	0.1	0.0	27.5	1.2	0.0	374.3	1.0	168.9	42.4	42.5	180.4	1.0	2.4	0.4
Potatoes	0.0	0.0	0.0	0.3	0.1	0.0	8.9	0.2	6.9	1.5	0.0	151.9	8.5	7.4	12.9	0.2	0.1	0.0
Sugar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.7	0.4	0.1	0.1	0.0	0.0	0.0
Beans	59.7	0.0	0.1	0.2	0.0	0.0	18.0	0.4	0.0	10.7	0.0	128.5	58.1	28.8	67.4	0.9	0.5	0.1
Nuts	0.1	0.0	0.0	0.2	0.0	0.0	2.6	0.0	0.1	1.2	0.0	13.9	12.1	5.8	9.8	0.1	0.1	0.0
Vegetables	120.5	0.1	0.1	1.0	0.2	0.0	112.4	0.6	37.8	220.7	0.6	541.5	89.3	35.5	81.4	1.1	0.6	0.1
Fruits	0.0	0.0	0.0	0.3	0.1	0.0	16.9	0.2	31.3	1.0	0.0	182.8	9.5	10.3	15.9	0.2	0.1	0.0
Mushrooms	0.0	0.0	0.0	0.6	0.0	0.0	4.6	0.2	0.0	2.0	0.0	39.2	0.4	1.6	13.3	0.1	0.1	0.0
Seaweed	8.7	0.0	0.0	0.1	0.0	0.2	7.0	0.0	0.8	62.1	0.2	52.7	11.1	8.2	5.4	0.2	0.0	0.0
Seafood	0.4	0.1	0.1	3.8	0.2	4.0	7.6	0.4	0.7	244.9	0.6	175.0	33.5	20.5	140.8	0.7	0.7	0.1
Meat	10.4	0.3	0.1	3.7	0.2	0.8	9.6	0.7	4.8	154.3	0.4	168.0	5.1	14.2	128.0	0.7	1.8	0.1
Eggs	3.8	0.0	0.1	0.0	0.0	0.3	11.1	0.4	0.0	41.3	0.1	39.8	15.8	3.4	55.6	0.6	0.4	0.0
Dairy products	1.9	0.0	0.2	0.1	0.0	0.4	6.6	0.6	0.9	102.3	0.3	199.2	166.8	15.8	146.2	0.1	0.6	0.0
Fats and oils	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	0.0	0.5	0.3	0.0	0.3	0.0	0.0	0.0
Confect-ionery	1.5	0.0	0.0	0.2	0.0	0.0	4.8	0.2	0.4	55.4	0.1	50.9	15.0	5.8	27.4	0.2	0.2	0.0
Beverages	2.2	0.0	0.1	1.6	0.0	0.0	37.0	0.1	10.9	20.2	0.1	157.7	17.2	15.5	23.9	0.4	0.1	0.0
Seasonings and spices	6.1	0.0	0.1	0.8	0.1	0.1	13.3	0.2	0.6	2,583.3	6.6	160.5	26.1	22.9	67.1	0.9	0.3	0.1
Total	229.7	0.9	1.1	14.3	1.1	5.9	287.9	5.4	95.1	3,888.4	9.9	2232.8	511.3	238.4	975.9	7.4	8.0	1.1

∗1 [JPY ousehold^{-1} year^{-1}] (109 JPY USD^{-1}) ∗2 [kcal person^{-1} day^{-1}] ∗3 [g person^{-1} day^{-1}] ∗4 [mg person^{-1} day^{-1}] ∗5 [μg person^{-1} day^{-1}]
∗3 [g person^{-1} day^{-1}] ∗4 [mg person^{-1} day^{-1}] ∗5 [μg person^{-1} day^{-1}]

4.3 Results

4.3.1 Sample Composition

4.3.1.1 First Survey

The majority of respondents were female (71.2%), with male and gender unknown comprising 20.2% and 8.6%, respectively. The proportion of females in our survey is 21.2% higher than the sample population, because the gender ratio on the island is exactly 50:50 (Hachijo Island Department of Financial Planning 2013). Similarly, the percent of people over 70 years of age (32.4%) and in their 60s (29.3%) is significantly greater than in the sample population (25.6% and 19.0% in 2012, respectively). This means that those over 60 years old are 17% overrepresented in the survey. In contrast, the proportion of the respondents in their 50s (13.0% as opposed to 13.8%) and in their 40s (10.7% as opposed to 11.0%) are similar to the sample population. Approximately 58.8% of the respondents were born on the island; however, the lack of census data prevents a comparison against the sample population. The sample size and the corresponding response rate in each community as of January 2015 are as follows: Mitsune (14.2%), Okago (9.3%), Kashitate (14.4%), Nakanogo (19.5%), and Sueyoshi (11.0%). Unknown community of residence accounts for 88 samples.

4.3.1.2 Second Survey

The interviewee ages range from 20 to 80 years (mean age 54 years, SD 16.4 years). Thirteen interviewees were female with a thorough knowledge of food production, purchase, and preservation. The interviewees covered four communities of Hachijo Island, and most of them were native to the island.

Eighty-four percent of all questionnaire respondents were female. The respondents fit into the following age brackets: 20s (2.0%), 30s (8.0%), 40s (13.1%), 50s (12.4%), 60s (30.7%), 70s (23.5%), and over 80 (10.4%). The residential community breakdown of the respondents was Mitsune (47%), Okago (20.3%), Kashitate (14.3%), Nakanogo (14.3%), and Sueyoshi (3.6%). Unknown community of residence accounted for one sample. The occupation breakdown was full-time homemakers (24.7%), company and government employees (21.5%), part-time workers (21.5%), unemployed (14.7%), self-employed (farmers, fishers, and forestry workers) (7.2%), self-employed (commerce, industry, and service industry) (6.4%), and others (3.2%). In our samples, the percent of female respondents in the 60s and 70s was 1.8 times greater than in the 2016 demographic statistics (Hachijo Island Department of Financial Planning 2017), and the percent of respondents under 30 was reduced. This can be explained by the large number of respondents (84%) recruited through the women's organization.

4.3.2 Location and the Means of Purchasing Food and Daily Necessities Including Internet Shopping

Approximately 70% of the respondents purchased their food and daily necessities from the two large supermarkets in Okago and Mitsune townships. Food and other goods were purchased by 20–30% of the respondents from two grocery stores in the southeastern regions. The average number of shopping trips per week to these supermarkets and grocery stores was twice or more. On a weekly basis, 5.9% of respondents also purchased goods jointly from the co-op.

Our study revealed that 91.1% of respondents had used online shopping, at least once in their life, which is very close to the national average of 92.8% (Japan Direct Marketing Association 2014). The most frequently purchased items were "furniture, electrical appliances, and utensils" (70.4%) and "clothes" (70.2%), followed by "food" (49.3%). Few shops sell furniture, electrical appliances, and clothing on the island, so the results indicate that a significant portion of respondents relied on Internet shopping to compensate for any shortfalls.

4.3.3 Household Items and Appliances

The results highlight that, in addition to the normal fridge freezer, almost 40% of respondents owned a freestanding chest freezer that could store food at −20 °C (Table 4.2). The residents appeared to use these freezers to keep various seasonal produce for longer periods, particularly when flying fish and bamboo shoots become highly abundant. Surprisingly, more than 10% of the households even owned an industrial deep freezer that could store food at −60 °C. The results support the anecdotes that many households rely on chest freezers to make the most of seasonally abundant resources. Light vehicles were more common than the passenger vehicles on Hachijo Island. In fact, the number of light vehicles owned per household exceeded the national average number of passenger vehicles owned per household. Finally, 6.9% of households owned a generator that could be used as an emergency power source. This is also a unique characteristic of remote islands and represents community resilience against natural disasters.

4.3.4 Non-market Food

4.3.4.1 Food Grown in Home Gardens and/or Harvested by Households

The results revealed that a rich variety of non-market fruits and vegetables was grown and harvested by the respondents. While the monetary value of this produce remains unknown, this phenomenon remains quite remarkable considering that

Table 4.2 Household vehicles and appliances

Items	Hachijo Island (2013)		National average (2013)[a]	
	Penetration[b]	Number of items owned per household[c]	Penetration	Number of vehicles owned per household
Passenger vehicles	40.7%	1.25	Passenger vehicles 84.1%	Passenger vehicles 1.38
Light vehicles	72.6%	1.45		
Boats and ships	3.9%	1.23	–	–
Agricultural machines	25.6%	1.51	–	–
Motorcycles	14.0%	1.18	–	–
Bicycles	30.6%	1.39	–	–
Power generators	6.9%	1.02	–	–
Beds	55.7%	1.61	–	–
Refrigerators	96.4%	1.55	–	–
Freestanding chest freezers (−20 °C)	38.7%	1.19	–	–
Freestanding chest freezers (−60 °C)	11.6%	1.13	–	–
TVs	94.0%	2.08	99.3%	2.25
Air conditioners	84.0%	2.22	90.5%	2.64
Washers	95.3%	1.18	–	–
Computers	56.2%	1.28	78.0%	1.28
Mobile phones	86.7%	1.71	95.0%	2.35

[a]CAO (2014)
[b]Penetration= the number of respondents who owned the items/all respondents (n = 664)
[c]The number of items owned per household = the estimated number of items per household/the number of respondents/ households who owned the items

floriculture accounted for 84.8% of the island's gross domestic product in 2011, whereas agriculture only contributed 13.4% (Hachijo Island Department of Financial Planning 2013).

The most common food type grown in home gardens and/or harvested were potato crops and other vegetables (61.6%), followed by fruits (34.8%) and seafood (9.2%; see Table 4.3). A total of 106 varieties of vegetables were grown in home gardens. Each household grew 6.3 different varieties on average, with the 36 being the maximum number of varieties reported. The most popular vegetables grown were okra, cucumbers, eggplants, taro, sweet potatoes, potatoes, bell peppers, and a local herb called "ashitaba" (*Angelica keiskei*). In contrast, a total of 60 varieties of fruit were grown in home gardens and/or harvested. Each household grew and/or harvested 2.3 different varieties of fruit on average, with 11 being the maximum number of varieties reported. The most common fruit were bitter oranges, watermelons, passionfruit, guavas, melons, and mandarins.

A total of 37 varieties of seafood were harvested by respondents (Table 4.2). Each household harvested 2.1 different varieties on average, with the maximum number of varieties harvested being 8. The most common fish species was the

Table 4.3 Food grown in home gardens and/or harvested by households and food received from others

		Food grown in home gardens and/or harvested by households				Food received from others			
		Vegetables and potatoes	Fruits	Seafood	Others	Vegetables and potatoes	Fruits	Seafood	Others
Responses		409	231	61	36	454	319	513	78
Percent of cases (%)		61.6%	34.8%	9.2%	5.4%	68.4%	48.0%	77.3%	11.7%
Maximum item number per response		36	11	8	5	17	8	16	9
Average item number per response		6.3	2.3	2.1	1.5	3.4	1.9	2.7	1.7
The number of species		106	60	36	35	68	35	72	61
Top 10 species	1.	Okra	Bitter oranges	Mackerel scad	*Phoenix roebelenii*	Potatoes	Watermelons	Mackerel scad	Confections
	2.	Cucumbers	Watermelons	Skipjack tuna	Flowers	Taro	Passionfruit	Flying fish	Rice
	3.	Eggplants	Passionfruit	Greater amberjack	Strelitzia	Sweet potatoes	Melons	Skipjack tuna	Tea
	4.	Taro	Guavas	Large-tailed drummer	Freesia	Okra	Mandarins	Red bream	Beer
	5.	Sweet potatoes	Melons	Splendid alfonsino	House plants	Cucumbers	Apple	Mahi-mahi	Eggs
	6.	Potatoes	Mandarins	Red bream	Inland pepper	Eggplants	Guavas	Splendid alfonsino	Kusaya
	7.	Bell peppers	Japanese persimmon	Mahi-mahi	*Ruscus*	Japanese radish	Bitter oranges	Japanese butter fish	Alcoholic drink
	8.	Ashitaba	Kumquat	Flying fish		Tomato	Pear	Ruby snapper	Strelitzia
	9.	Japanese radish	Banana	Blacktip grouper		Bell peppers	Grape	Japanese ruby fish	Pickles
	10.	Tomato	Lemon	Striped jack		Ashitaba	Papaya	Kusaya	Laver

mackerel scad (*Decapterus macarellus*), which could be caught at the breakwaters. This was followed by the skipjack tuna (*Katsuwonus pelamis*), the greater amberjack (*Seriola dumerili*), the large-tailed drummer (*Kyphosus vaigiensis*), and the splendid alfonsino (*Beryx splendens*). These groups of fish are largely consistent with the top 10 fish species for the island's fishing industry (Hachijo Island Department of Financial Planning 2013). The only notable exception based on our survey answers was the absence of economically significant fish, such as deepwater tuna and snapper.

In other items, a total of 35 species were listed (Table 4.2). Many of these items included inedible ornamental flowers and plants, perhaps reflecting the prominence of floriculture on the island.

4.3.4.2 Food Received from Others

Seafood ranked in the top spot, with 77.3% of households having received some type of seafood from others (Table 4.3). Every year when the flying fish (*Cheilopogon agoo*) are in season, fishermen share them with their families and friends. This is often done in such a large quantity that the fish end up being transported significant distances around the island because surplus is usually shared among friends, who further pass the fish onto others, and so on (NANKAI TIMES 2014). *D. macarellus* was the most frequently received fish, followed by *C. agoo*, *K. pelamis*, *B. splendens*, and *C. hippurus*.

In contrast, 68.4% of households received some type of vegetable. Potatoes, taro, and sweet potatoes were the most popular. It was very common for the residents to produce tubers and root crops well in excess of their own requirement and to share the excess with others. A significant amount of this produce was also posted to their relatives and friends who do not live on the island. Vegetables that ranked fourth or lower on the list were also commonly produced in home gardens. Domestic produce booths have recently been allocated at the local supermarkets, indicating an increasing popularity for locally grown vegetables (NANKAI TIMES 2014).

Forty-eight percent of households received fruits, and the top 10 fruits included many varieties not commercially produced on the island. Residents often ordered this fruit directly from the growers on the mainland and/or received them as gifts from their relatives and friends who did not live on the island. Any surplus was, again, commonly shared among others on the island. Other food items received from others included sweets, rice, green tea, beer, eggs, fermented dried fish, pickled vegetables, and seaweeds. Many of these items were received from their colleagues and/or acquaintances as biannual gifts, which is customary in Japan.

4.3.4.3 Structure of Food-Sharing Network

Figure 4.3 shows the food-sharing network by seasons. The abbreviations in the circular nodes represent the five communities. The directional edges between the nodes represent the non-market transactions. The edge widths and directions reflect the number of sharing partners and the distribution routes of the non-market food, respectively. Table 4.4 lists the food items in the food-sharing network by season and direction. The contents of each cell are the shared food species.

All interviewees in all communities shared food within and beyond the island. The 151 shared food species were dominated by vegetables (29.1%), fruits (20.5%), and seafood (14.6%). The interviewees often exchanged food with food-sharing partners off the island, especially in summer and winter. This reflects the traditional Japanese customs of *Chugen* and *Seibo*, which are the summer and end-of-year gift-giving festivities, respectively. The gifts offered demonstrate one's appreciation of daily support from close friends and relatives. During *Chugen* and *Seibo*, the

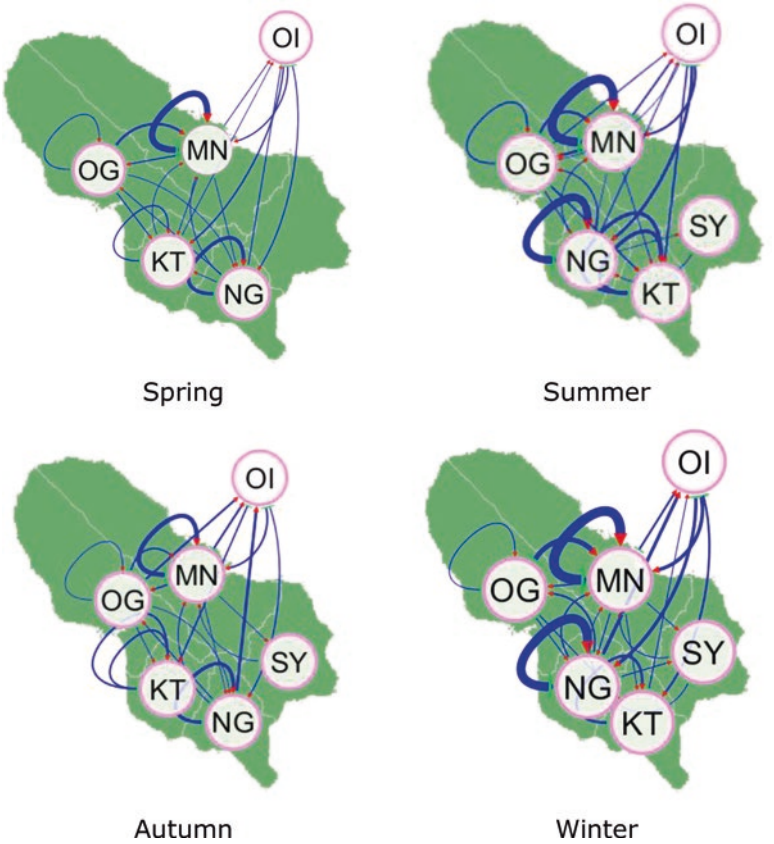

Fig. 4.3 Food-sharing network by season. *OI* Outside Hachijo Island, *MN* Mitsune, *OG* Okago, *KT* Kashitate, *NG* Nakanogo, *SY* Sueyoshi

Hachijo Island residents grew vegetables and fruits in their home gardens and offered them to their food-sharing partners off the island. In summer, the representative food gifts were vegetables (e.g., okura and green peppers), seaweeds (e.g., kelp), and fruits (e.g., melon, citrus hassaku, and cherries). The year-end gifts were dominated by potatoes (including taros), vegetables (e.g., cauliflowers, ginger, and Japanese radishes), and fruits (e.g., kumquats, apples, and pears). These species are seasonal fresh food in winter. From off of Hachijo Island, the residents mainly received confectioneries (e.g., Western-style and Japanese cakes), beverages (e.g., tea, coffee, and alcoholic drinks), and meat (e.g., roast beef and roast pork) in summer and confectioneries (confections and Western-style and Japanese cakes), beverages (e.g., tea), and fats and oils (e.g., salad oil) at the end of the year. Most of the food received from off the island was processed food. These non-market transactions play an important role in complementing the livelihoods of residents and enhancing the diversity of their food.

Osusowake is the Japanese practice of sharing food and giving gifts on a small scale. Social relations are an important aspect of Japanese culture, and gifting maintains and strengthens the social ties of Japanese people (Befu 1968; Suzuki 1988; Ichikawa 1989). Food-sharing activities are also valued because they maintain reciprocity in social relations and create a feeling of community membership (Quandt et al. 2001). Household food production and personal connection establish cultural identity and maintain traditional knowledge (Galhena et al. 2013; United Nations University 2013; Nakazawa et al. 2014). As shown in Table 4.4, the distribution of the types of shared food within and beyond Hachijo Island depends on the season, but food-sharing activities take place throughout the year, maintaining the social relations among residents. Social capital supports the food-sharing network of the Hachijo residents and is itself strengthened through maintenance of the food-sharing network.

4.3.4.4 Proportion of Market and Non-market Food

The proportion of food received from others was much greater between spring and fall than in winter when food became scarce. Between spring and fall, 33.5% of the daily food consumption was from food received from others, whereas 48.7% was from market sources (Fig. 4.4). In winter, conversely, 13.3% of food was received from acquaintances, whereas purchased food comprised 70.0%. The proportions of self-grown and harvested food were remained at a similar level between spring and fall (18.3%) and in winter (17.3%). The results indicated that non-market food comprised over 50% of the daily diet between spring and fall and approximately one-third in winter.

When we reported our preliminary results to four trustee members from the Hachijo Island Women's Association in April 2014, they resonated with our finding that non-market food was important in their diet. For example, one said, "At times when I look at our dinner, I realize none of it had been purchased." Another added, "We receive far too much seafood, so we always end up sharing with others."

Table 4.4 Food items disseminated through the food-sharing network, organized by season and direction

	(A) From outside to Hachijo Island	(B) Within Hachijo Island	(C) From Hachijo Island to outside
Annual	Western-style cake, confection, tea, rice, seaweed, soy source, sugar, hijiki, alcoholic drink, kelp, salmon, Japanese cattle, adzuki bean, beef, chicken, pork	Seaweed, confection, kelp, hijiki, rice, sugar, egg, alcoholic drink, Western-style cake, soy source, peanuts, Japanese cake, squid, mixnuts, sushi, rice ball, octopus, Japanese cattle	Western-style cake, kelp, beer
Spring	Sake, sweet Watson pomelo	Flying fish, mackerel shad, bonito, green onion, onion, *Citrus reticulata* Siranui, Kiyomi orange, broccoli, cabbage, carrot, garlic, kidney bean, summer tangerine, *Angelica keiskei*, broad bean, mugwort, sweet Watson pomelo, purple Washington clam, bamboo shoot, cloud ear, potato, yellow pickled radish, celery, sweet potato, snow pea, legume, loquat, *Hypnea japonica*, red bream	Onion, *Angelica keiskei*, flying fish, mackerel shad, mugwort
Summer	Japanese cake, coffee, ham, roast beef, roast pork, olive oil, salad oil, cherry, citrus hassaku, beer, seasoning powder, peach, corn, green soybean, pear, miso	Cucumber, bitter orange, watermelon, green peppers, eggplants, Okura, tomato, sweet pepper, melon, guava, corn, Indian snapmelon, mackerel shad, yellowtail amberjack, bitter melon, prince melon, black-eyed pea, oriental melon, peach, broccoli, *Stephanolepis cirrhifer*, carrot, juice, taro, pear, beer, cherry, tea, passionfruit, broad bean, snap pea, banana, Ishidatamigai, red bream, *Thunnus albacares*, ham, roast beef, roast pork, green pea, green soybean, red pepper, orange, papaya, kusaya (fish dipped in salt water and dried in the sun), salad oil, shochu	Okura, eggplants, green peppers, broccoli, cucumber, sweet pepper, tomato, melon, peanuts, citrus hassaku, corn, cherry, confection
Autumn	Japanese persimmon, cherry, La France pear, pear, Pacific saury, sweet potato	Potato, sweet potato, Japanese persimmon, taro, greater amberjack, lettuce, laver, *Angelica keiskei*, cabbage, black soybean, red kidney bean, scarlet runner bean, soybean, Chinese yam, yam, guava, buckwheat noodles, Pacific saury, Japanese yam, red leaf lettuce, *Vitis ficifolia*, *Pholiota nameko*, spiny lobster, striped jack	Sweet potato, potato, taro, *Angelica keiskei*

(continued)

Table 4.4 (continued)

	(A) From outside to Hachijo Island	(B) Within Hachijo Island	(C) From Hachijo Island to outside
Winter	Orange, ham, apple, salad oil, Japanese cake, roast pork, roast beef, coffee, pear, beer, olive oil, miso, sake, seasoning powder, citrus junos, grape, kiwi fruit, La France pear, satsuma mandarin orange	Japanese radish, orange, apple, ginger, banana, taro, red bream, celery, bitter orange, komatsuna, spinach, Mahi-mahi, cabbage, laver, flying fish, mackerel shad, yellowtail, *Angelica keiskei*, Bok choy, turnip, shiitake mushroom, kakina (green leafy vegetable of the genus *Brassica*), Chinese cabbage, guava, kumquat, pear, potato, grape, juice, carrot, blacktip grouper, striped jack, beer, snow pea, tea, green onion, satsuma mandarin orange, ham, garland chrysanthemum, kiwi fruit, tuna fish, roast beef, roast pork, shallot, citrus junos, lemon, albacore, salad oil, sweet potato, burdock, cauliflower, Chinese chive, eggplants, *Citrus leiocarpa*, *Hypnea japonica*, kusaya (fish dipped in salt water and dried in the sun), sake, shochu, miso	Taro, kumquat, *Angelica keiskei*, potato, cauliflower, celery, La France pear, pear, blacktip grouper, ginger, Japanese radish, komatsuna, spinach, apple, snow pea, confection

The shared food species in each cell is ordered by its sharing transaction number

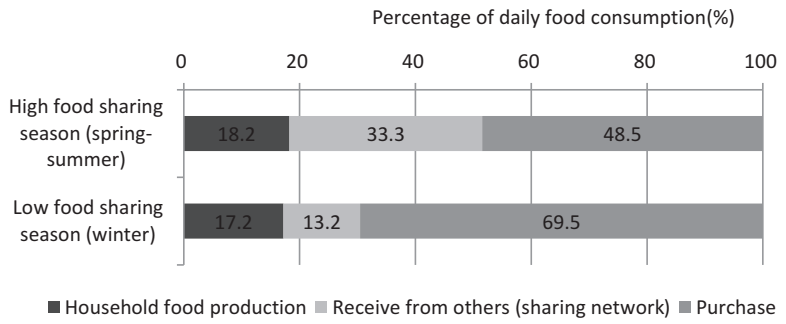

Fig. 4.4 Proportion of market and non-market food (self-production and food sharing)

However, as one member commented, "Receiving food from others does not necessarily mean our food spending is halved" (NANKAI TIMES 2014) because it is customary to send a "thank you" gift in return.

Kamiyama et al. (2014) conducted a nationwide online questionnaire survey using a similar method ($n = 1036$). They classified non-market food into six categories and investigated the proportion of each category in the Japanese diet. Approximately 20% of the daily diet comprised of potato crops, legumes, other vegetables, and grains from non-market transactions, whereas 10% was from fruit, edible wild plants, and seafood. Although our study did not investigate the propor-

tion of each food category, 30% of the daily diet consisted of non-market sources in winter, which is higher than the national average. However, sampling bias might have raised the proportion of non-market food in the present study. Many respondents were over 60 years old and belonged to the Women's Association—they had lived on the island for a long time and had well-established social networks and food-sharing partners. Therefore, we analyzed the data by using chi-squared statistics to determine whether the proportion of non-market food was influenced by four respondent characteristics (community of residence (five communities or unknown), gender (male, female, or unknown); age (20s–30s, 40s, 50s, 60s, over 70s, or unknown), years of residence (fewer than 3 years, 3–9 years, 10–19 years, 20–29 years, 30–39 years, 40–49 years, over 50 years, or unknown); see Table 4.5).

We found significant differences existed between gender, age, and years of residence, but not between communities. To identify where the significances came from, residual analyses were done by calculating the adjusted standardized residual (see *a* and *b* in Table 4.5 for significant differences).

Irrespective of the two seasons, women were more likely to have higher proportion of non-market food in their diet than men. For example, a significantly higher

Table 4.5 Proportion of non-market food by communities, gender, age, and years of residence

		Between spring and fall (n=558)						Winter (n=529)					
		0%–20%	20%–40%	40%–60%	60%–100%	Total	χ^2 (p-value)	0%–20%	20%–40%	40%–60%	60%–100%	Total	χ^2 (p-value)
Community of residence	Okago	30	28	24	38	120	18.73 (0.226)	66	17	17	12	112	26.20 (0.036)
	Mitsune	47	55	67	77	246		118	61	30	24	233	
	Kashitate	6	4	13	11	34		16	9	7	2	34	
	Nakanogo	9	18	22	15	64		29	18	8	4	59	
	Sueyoshi	4	5	4	5	18		9	2	5	1	17	
	Unknown	12	13	17	34[a]	76		36	8[b]	15	15[a]	74	
Gender	Male	44[a]	26	13[b]	21[b]	104	51.48 (0.000)	70[a]	12[b]	11	4[b]	97	24.57 (0.000)
	Female	58[b]	85	122[a]	140	405		178[b]	93[a]	67[a]	46	384	
	Unknown	6	12	12	19	49		26	10	4	8	48	
Age	20-30s	27[a]	5[b]	10	16	58	86.35 (0.000)	40[a]	8	5	1[b]	54	78.95 (0.000)
	40s	30[a]	14	10[b]	13[b]	67		57[a]	5[b]	2[b]	1[b]	65	
	50s	11	23[a]	20	19	73		45[a]	12	8	4	69	
	60s	17[b]	32	51	74[a]	174		61[b]	43	38[a]	23	165	
	Over 70s	22[b]	46	51	54	173		67[b]	44	26	27[a]	164	
	Unknown	1	3	5	4	13		4	3	3	2	12	
Years of residence [years]	Fewer than 3	30[a]	3[b]	4[b]	7	44	111.11 (0.000)	36[a]	2[b]	3	1	42	67.0 (0.000)
	3-9	14[a]	4	8	13	39		24	9	0[b]	3	36	
	10–19	12	8	9	13	42		27[a]	4	3	4	38	
	20–29	6	15	13	13	47		30	9	5	2	46	
	30–39	7	15	23	18	63		31	15	10	7	63	
	40–49	14	22	18	23	77		41	17	9	3	70	
	Over 50	20[b]	54	71	87[a]	232		79[b]	56	49[a]	36[a]	220	
	Unknown	5	2	1	6	14		6	3	3	2	14	
Total		108	123	147	180	558	-	274	115	82	58	529	-

Notes a: Adjusted standardized residual > 1.96 (Significant level p = 0.05) in residual analysis
b: Adjusted standardized residual < -1.96 (Significant level p = 0.05) in residual analysis

number of men had less than 20% of non-market food in their diet, whereas significantly fewer women fell into this category. Even during winter, a significantly higher number of women had 20–60% of their diet from non-market sources. Older generations also had a higher proportion of non-market food in their diet, irrespective of season. For example, the lowest category (0–19%) contained significantly fewer people over 60 than the expected value.

Similarly, non-market food share in their diet increased with the years of residence on the island. Again, in the lowest category of the proportion, significantly fewer people were found who had lived on the island 50 years or longer. In contrast, significantly higher numbers of people who lived on the island fewer than 5 years fell into this category, even during spring and fall. In winter, significantly higher numbers of those who lived on the island 50 years or longer had 40–100% of their diet from non-market sources, indicating that experience decreases the dependence on market food. We reported these findings to the residents on three occasions, April 2014 and February and March 2015, and they confirmed that the results matched the level of non-market food in their diet.

4.3.4.5 Food Distribution Channels by Food Categories

Figure 4.5 shows the proportion of food type obtained from the various distribution channels and local production for local consumption in each food category. Household food production was dominated by potatoes (31%), followed by

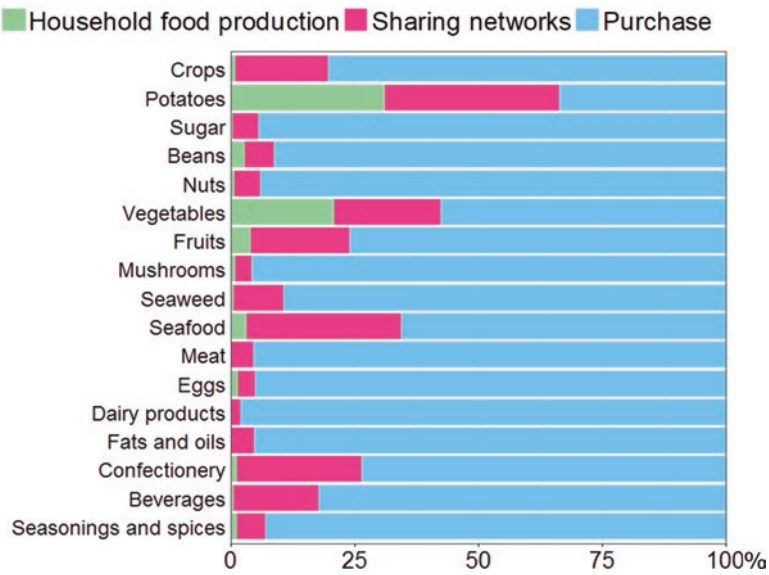

Fig. 4.5 Proportions of food obtained from various distribution channels organized by food categories

vegetables (21%). The sharing networks contributed 35% of the potato consumption and 21% of the vegetable consumption. The purchased products were dominated by dairy products, meat, mushrooms, fats and oils, and eggs.

4.3.4.6 Monetary Savings and Caloric Value of Non-market Food

When Hachijo residents grow food in their home gardens or receive such food through the food-sharing network, they reduce their food expenditure and thus save money. Figure 4.6 shows the estimated annual monetary savings per household and the daily caloric intake of non-market food per person. The left and right bars show the total monetary savings and total caloric intakes, respectively, when producing and receiving food in each category. The consumption of non-market food saved 219,543 JPY household^{-1} year^{-1} (2018 USD, 109 JPY USD^{-1}). Ninety percent of these savings were due to sharing vegetables, seafood, confectionery, crops, beverages, and fruits. These foods are generally expensive and account for 69% of the total annual food expenditure on Hachijo Island. Thus, the non-market food reduced by as much as 25% the annual food expenditure on Hachijo Island.

The caloric value of the non-market food and all food consumed by Hachijo Island residents was 324 and 1876 kcal person^{-1} day^{-1}, respectively (see Table 4.1). That is, non-market food accounted for 17% of the daily caloric intake. Rice was the major contributor, providing 46% of the caloric intake. Staple foods (especially rice) are the main staple food in Japan and account for almost half of the daily caloric intake. Thus, even when rice constitutes a low proportion of the non-market food, staple foods are the dominant contributor from a caloric viewpoint. The other

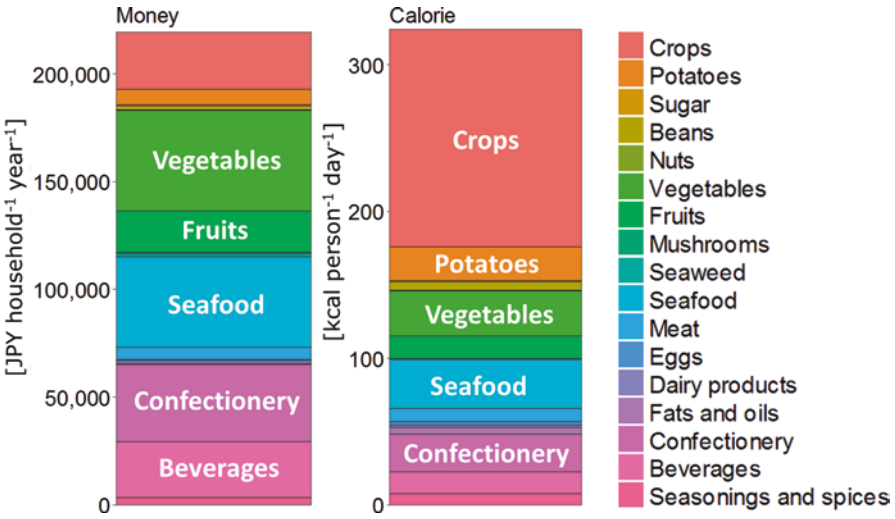

Fig. 4.6 Monetary savings (left) and caloric values (right) of non-market food

calorie-dominant foods were seafood, vegetables, potatoes, and confectionery, which comprise a large proportion of the non-market food.

4.3.4.7 Daily Nutrient Intake of Non-market Food

Figure 4.7 shows the proportion of the estimated nutrient intake of each non-market food. The horizontal axis represents the estimated nutrient intake of the non-market food relative to the total nutrient intake for Hachijo Island. The source-food categories are color coded. Non-market food provided 9–32% of the total nutrient intake, confirming that the food-sharing network provides health benefits to the Hachijo residents. The top five nutrients in the non-market food, providing the largest proportions of nutrient intake, were vitamin C, soluble dietary fiber, insoluble dietary fiber, total dietary fiber, and vitamin D.

4.3.5 Relationship Between Non-market Food and Preparedness for Extreme Events

We analyzed the relationship between the proportion of non-market food in the daily Hachijo diet from spring to fall and the preparedness of Hachijo residents for extreme events such as typhoons (Table 4.6). Those that consumed the least amount of non-market food tended to be the least prepared for an emergency and were less likely to stockpile "rice, potato crops, fruit, and other vegetables," "frozen food," "canned food," "sauces and spices," and "daily necessities." In contrast, those in the 40–59% category were more likely to stockpile "canned food" and "daily necessities." For those in the 60% or higher category, "rice, potato crops, fruit, and other

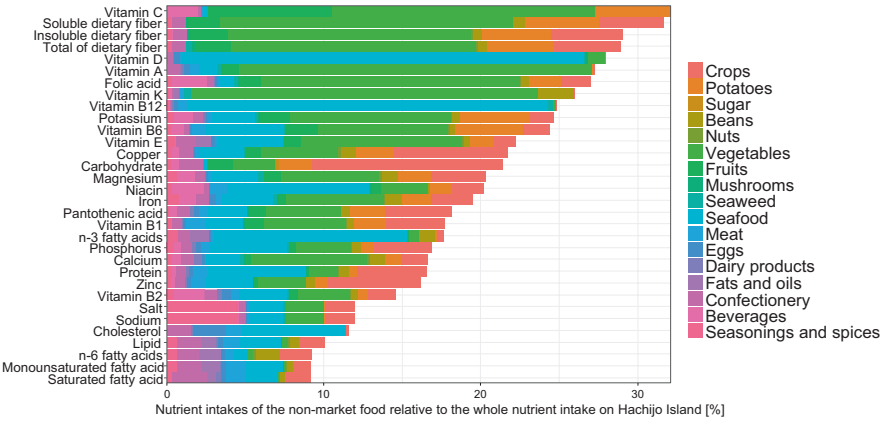

Fig. 4.7 Daily nutrient intake of non-market food per person

Table 4.6 Relationship between proportion of non-market food in daily Hachijo diet from spring to fall and preparedness of Hachijo residents for extreme events

		0%–20%	20%–40%	40%–60%	60%–100%	Total	χ^2 (p-value)
Responses		91	111	124	162	488	-
Nothing in particular		17[a] (18.7%)	9 (8.1%)	5 (4.0%)	11 (6.8%)	42 (8.6%)	14.40 (0.002)
Food	Rice, potato crops, fruit and other vegetables	17[b] (18.7%)	39 (35.1%)	57 (46.0%)	92[a] (56.8%)	205 (42.0%)	67.47 (0.000)
	Frozen food	12[b] (13.2%)	26 (23.4%)	34 (27.4%)	44 (27.2%)	116 (23.8%)	
	Canned food	25[b] (27.5%)	36 (32.4%)	64[a] (51.6%)	63 (38.9%)	188 (38.5%)	
	Instant and pre-cooked food	31 (34.1%)	23 (20.7%)	33 (26.6%)	44 (27.2%)	131 (26.8%)	
	Dried food including flour, biscuits and noodles	18 (19.8%)	28 (25.2%)	28 (22.6%)	47 (29.0%)	121 (24.8%)	
	Sauces and spices	2[b] (2.2%)	4[b] (3.6%)	16 (12.9%)	33[a] (20.4%)	55 (11.3%)	
Water and other drinks		24 (26.4%)	21 (18.9%)	16[b] (12.9%)	36 (22.2%)	97 (19.9%)	5.47 (0.141)
Daily necessities		17[b] (18.7%)	37 (33.3%)	51[a] (41.1%)	53 (32.7%)	158 (32.4%)	8.24 (0.041)

Notes a: Adjusted standardized residual > 1.96 (Significant level p = 0.05) in residual analysis
b: Adjusted standardized residual < -1.96 (Significant level p = 0.05) in residual analysis

vegetables" and "sauces and spices" were more likely to be stockpiled for emergencies. Rather than relying on instant, ready-made, or canned food during emergencies, these resourceful people preferred cooking food, so that food could be better rationed—until normality returned.

4.4 Discussion: Implications for Building More Resilient Islands

In order to minimize the disparity between the remote islands and mainland Japan, Japanese government undertook a development policy of remote islands based of the enactment of Remote Islands Development Act. The act aims at eliminating "backwardness," and a lot of national budget was invested to promote development of remote islands. This disparity between the remote islands and mainland is often addressed by ignoring the shadow benefits of non-market food through sharing network in remote islands as demonstrated by this study (Tatebayashi et al. 2018).

Many communities on offshore Japanese islands are likely to experience increased social vulnerability and the erosion of resilience due to aging and shrinking population, and these challenges are likely to increase. For example, climate change might cause sea levels to rise, increasing the risk of salt water invading groundwater (Ministry of Education, Culture, Sports, Science and Technology et al. 2013). The communities might also face increased risks from more frequent and intensified natural disasters. Torrential rains causing landslides could wreak deadly

destruction, as experienced on Izu Oshima Island in October 2013 when Typhoon Wipha struck the island. Therefore, these island communities must not only adapt to short-term changes (e.g., torrential rains) but must also develop a strategic plan against the long-term changes (e.g., rising sea levels).

Resilience is the capacity of a social-ecological system to absorb such disturbances and still retain its basic function and structure (Walker and Salt 2006). When a system fails to absorb such shocks (and cannot be maintained because of ecological, economic, or social factors), the system's capacity to transform into a fundamentally new system becomes important. Antwi et al. (2014) conducted field surveys in Ghana's rural villages and developed a community resilience matrix containing ecological, engineering, and socioeconomic indicators. For ecological resilience, heterogeneity of land use and diversity of ecosystems were the important indicators. Crucial for engineering resilience are agricultural technologies, such as access to irrigation and soil improvement technologies, improved crop variety, weather monitoring, and reliable early warning systems. For socioeconomic resilience, diversity of income and farm animals and the presence of active community groups were identified as key indicators. If we were to identify these indicators for Hachijo Island, the ecosystem's food provisioning services that provide diverse foods would be the ecological resilience indicator. The engineering resilience indicator would be the presence of a chest freezer that allows long-term storage of seasonal produce (Table 4.2). Finally, sharing practices of non-market food would be a perfect indicator for assessing their community's socioeconomic resilience. Nevertheless, very few studies have explicitly used non-market food sharing as a resilience index or matrix for assessing community resilience (Antwi et al. 2014; Magis 2010; Cutter et al. 2008). Even when non-market food sharing was incorporated, the sharing culture of non-market food was treated merely as part of a much wider "social network." Without clearly defined boundaries, previous studies have paid almost no attention to its roles and significance in building more resilient communities.

Sharing non-market food with neighbors plays a crucial role in building and maintaining community-level resilience. For example, after the deadly Chuetsu Earthquake isolated their village in northwestern Japan in October 2004, the residents of Yamakoshi village managed to survive by sharing food and other necessities with one another until the emergency response team arrived. Surrounded by steep mountains, the rural community has long cherished the sharing culture of non-market food, helping one another for many generations. This helped them to survive remarkably well during this devastating event (Okada 2012). Similarly, in March 2011, following the magnitude 9.0 earthquake and tsunami that struck northeastern Japan, global attention focused on the voluntary efforts of the survivors—many who were victims themselves—in establishing and running shelters in isolated areas with limited resources. Many scientists have already suggested that food-sharing networks can strengthen resilience against future socioeconomic changes and natural disasters (Quandt et al. 2001; Kamiyama et al. 2014; Saito et al. 2015; Boafo et al. 2016; Saito et al. 2018). We quantified the contributions of the Hachijo food-sharing network to the balances of specific calories and nutrients, thereby

providing a large quantitative basis for designing local food resilience. Thus, a fusion of regional disaster management systems with the food-sharing network is of crucial importance.

The importance of the culture of mutual assistance in dealing with extreme events was highlighted by Mugikura et al. (2013). His team interviewed the residents of Otsuchi-cho town (Iwate Prefecture)—one of the areas most affected by the 2011 earthquake and tsunami—to investigate how they managed to survive the first 3 days after the event. They focused particularly on crucial items: the availability of water (including for drinking), food, heating equipment, and fuel. They revealed that sharing locally produced non-market food with one another functioned as a *lifeline* for countless survivors in their isolated communities, until the emergency response teams arrived. In addition to securing the emergency stock at local shrines and temples, a significant amount of food was donated by shelter organizers, farmers, fishermen, and other residents from the surrounding areas. In terms of food, the evacuees at Otsuchi-cho shelters were almost completely self-sufficient.

Sharing resources within one's community is important. However, what is noteworthy here was that many lives were saved by having an established mutual assistance network in the wider community during the emergency. Sharing non-market food in our daily lives contributes to supporting a rich and diverse culinary tradition, maintaining strong bonds within communities and self-reliance within the region. Simultaneously, it functions as a safety net during emergency by securing food and other resources (Kamiyama et al. 2014; Mugikura et al. 2013). Thus, it is crucial to encourage this cooperation within a local community and the wider community, further extending it into a much wider area of their daily lives.

However, for remote island communities, modern lifestyles might present many challenges that hinder such sharing practices. For example, although many households typically purchased food and daily necessities from supermarkets and grocery stores on Hachijo Island, they also used online shopping to purchase various goods, to the same extent as the Japanese average. Receiving goods on remote islands used to incur additional delivery charges. In recent years, however, major distributing companies have started to offer free delivery to island residents. Due to increased convenience and the sheer diversity of goods available, the resident's use of Internet shopping is likely to grow further. If people start purchasing more food through Internet shopping, the demand for non-market food might decrease, and, as a consequence, the level of production of non-market food might decrease. This result also demonstrates the close association between the level of non-market food in the daily diet and the emergency preparedness. An increase in online shopping is a considerable threat for community resilience because a decline in non-market food sharing could lead to reduced emergency food stocked on the island. Simultaneously, the reduced availability of non-market food from home gardens would mean that less non-market food would be shared during an extreme event.

The mutual assistance and sharing that happened during past emergencies might only be temporarily present in the modern society (Mugikura et al. 2013) because it requires a much smaller social network. Urbanization and technological advances are potentially weakening such networks even further. According to Kamiyama

et al. (2014), who compared the responses of various age groups in Japan, older generations tend to notice these social changes. Respondents 60 or older were more likely to agree that fewer households now share non-market food compared with when they were much younger. Mutual assistance (including food sharing), which plays a crucial role in community resilience immediately after a natural disaster, is ephemeral in nature because the community needs and will receive external assistance, in the form of public aid, during the recovery period. Given these, we need to reinterpret the role of sharing non-market food during emergency and non-emergency situations, to build more resilient islands. An appropriate "support system" also needs to be installed to facilitate sharing practices all around the island and ensure its continuation. For example, such a system could include opening a café where locals and tourists could enjoy traditional meals prepared from non-market food provided by residents or organized bus tours to visit farmers' markets in various regions. Development of these ideas and successfully implementing them would require thorough discussions with all stakeholders involved: the residents, the council, and the tourism industry (NANKAI TIMES 2015). Maintaining community resilience by encouraging non-market food sharing in their daily lives could be a lifeline for isolated communities when faced with the impacts of climate and socioeconomic changes.

Food-sharing activities provide both local staples and specialty food from the regional natural capital. Our detailed spatiotemporally research reveals that the summer and end-of-year gift-giving culture, coupled with the usual food-sharing culture, enhances the non-market food distribution on Hachijo Island. Shared processed food arrived from outside the island, whereas seasonal food were mainly shared among the island residents. Seasonal fruits and vegetables are highly nutritious (Tomita and Mizutani 2012), and seasonal vegetables contain much more vitamin C and carotene than those cultivated out of season (Enomoto 2008). Additionally, Lachat et al. (2018) discovered that dietary species richness, defined as the number of different food species consumed, increases the adequacy of nutrient intake. Thus, sharing various kinds of seasonal food may be said to promote the health of Hachijo Island residents.

This study reveals that an additional chest freezer plays an essential role in storing non-market food on Hachijo Island. Rather than encouraging individual households to acquire an additional freezer, communal ownership of such appliances could be considered. This would spare individuals the purchasing and running cost of the freezer and would reduce the environmental impact of thousands of households running such appliances all year around. More importantly, communal freezers would encourage growing, harvesting, and sharing non-market food and increase the amount of emergency food for all residents, safeguarding the remote island.

Kuwahara (2012) identified recent changes in Japanese remote islands policy: (a) a change from development to environmental protection; (b) a shift from security, national defense, economic development, and resources development to the identification of the value of island diversity; and (c) a shift from the concepts of disparity such as eliminating the backwardness caused by their isolation. At the same time, it should be noted that the importance of remote islands in national security has been

broadly recognized as represented by the issue of Northern Territory and disputes on Takeshima and Senkaku islands (Kuwahara 2012). Further study requires to investigate how to integrate multiple functions of food-sharing practices and associate social capitals into remote island policy to enhance overall resilience against natural disasters and socioeconomic changes including climate changes and political tensions with neighboring countries.

4.5 Conclusions

Sharing non-market food is often a very common practice for many who live on remote islands. This study reveals qualitatively and semiquantitatively the level of non-market food in the daily diet using Hachijo Island as a case study. The results indicate that access to an additional large freezer, which many households owned, enabled long-term storage of seasonal produce and, therefore, played a key role in fostering the sharing practices of non-market food on the island. The results also indicate that isolation might have helped strengthen mutual assistance among the inhabitants and supported food diversity around the island. Based on the reviews on community resilience, we evaluated the potential role, opportunities, and challenges of non-market food in absorbing shocks. This study graphically presents the food-sharing network on Hachijo Island and identifies the seasons and directions of the food species distributed through the non-market transactions. The Hachijo residents grow seasonal food in their home gardens and share them within and beyond the island throughout the year. The study also identifies the food distribution channels and quantifies the contributions of household food production and sharing networks to the dietary habits of the residents. Hachijo Island residents produce large amounts of potatoes, vegetables, fruits, and seafood, which are widely shared and consumed across the island. Other food such as confectionery, beverages, and crops are sourced from outside the island and shared through the food-sharing network. By integrating the present quantification and the available statistical data, this study comprehensively describes the shadow benefits of non-market food, such as monetary benefits, caloric value, and nutritional value. Non-market food accounts for approximately one-fifth of each household's finance and energy intake. It also supplies a wide variety of nutrients and a large portion of the required vitamins. The practice of sharing food has become part of the traditional culture on Hachijo Island, by which the inhabitants access nutritional food and maintain their social relationships. We conclude that sharing non-market food is absolutely crucial for building more resilient islands and to safeguard them against natural disasters and socioeconomic changes. Therefore, such practices need to be encouraged by providing appropriate support systems. Directions for future research should include comparing islands of varying proximity to the mainland, making a multiscale analysis of the amount of non-market food shared within a local community and with the wider community, and balancing market and non-market food and/or their potential integration through remote island policy reform.

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Chapter 5
Sharing Experiences and Associated Knowledge in the Changing Waterscape: An Intergenerational Sharing Program in Mikatagoko Area, Japan

Ryoto Tomita, Hasu Project (a NGO in Mikatagoko area), and Takehito Yoshida

Abstract In order for ecosystem services to actually flow and provide benefits to people, knowledge of managing the supply and realizing the flow of ecosystem services is necessary, although that knowledge appears to have been disappearing at an accelerating pace. Sharing the traditional and local experiences and associated knowledge of ecosystem services is thus crucial for sustainable use of ecosystem services. In this chapter, we document a case of sharing experiences and associated knowledge in the Mikatagoko (Five Lakes of Mikata) area in Fukui Prefecture, Japan. Elementary school students in the area interview the local adults about the past waterscape, biodiversity, and ecosystem services that they experienced, and then the children draw a painting of the past waterscape and experiences of the adults. This environmental-educational program, named the Painting by Children of the Past Waterscape program, is arranged by the local NGO (Hasu Project), and all the paintings are collected and exhibited at public spaces and in the web site to be shared in and outside the local community, as well as being used for community-based workshops to promote further sharing. The analysis of 986 paintings collected between 2009 and 2014 revealed that diverse experiences with organisms inhabiting and ecosystem services from the local rivers and lakes were shared through these activities among the local children and adults. The children learned what they have otherwise never happened to know in the modern waterscape that

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has changed from the past, although the paintings cannot be used to make simple comparisons between the past and the present waterscape as the paining also reflects the social context of the past. The experiences and knowledge shared through the program and associated activities were perceived as new discoveries by children and as rediscoveries by adults, suggesting that the potential of ecosystem services from the local rivers and lakes were recognized and shared in these out-of-the-ordinary opportunities. In that sense, this program in the Mikatagoko area has been making important contributions to the management of ecosystem services from a variety of perspectives shared in the local community.

Keywords Traditional and local knowledge · Intergenerational sharing of experiences · Environmental education · Ecosystem services · Mikatagoko (Five Lakes of Mikata)

5.1 Introduction

When ecosystem services actually flow and provide benefits to people, the supply of ecosystem services are produced by ecosystem functioning and biodiversity, and, at the same time, the demand of ecosystem services arises from the human society (Tallis et al. 2012; Jone et al. 2016). Either the supply or the demand may limit the actual flow of ecosystem services, so that they need to be balanced, otherwise some part of the supply would remain unused or the demand from the human society would not be fully met. Thus, understanding how the supply and the demand are actually formed in a socio-ecological system is vital when seeking the sustainable use of ecosystem services. The supply of ecosystem services is determined by the interaction of nature and ecosystem management by human society, which includes both conservation and restoration, and this interaction is more pronounced in the socio-ecological production landscapes and seascapes (Japan Satoyama Satoumi Assessment 2010). Ecosystem management requires plenty of knowledge including scientific, local, and traditional ones (Berkes 1999; Chapin et al. 2009). The demand of ecosystem services is also determined by the knowledge of how to use ecosystem functioning for benefits to human society (Tomita 2014; Jones et al. 2016). Thus, in order for ecosystem services to actually flow and provide benefits to people, knowledge of managing the supply and producing the demand is necessary, and the local and traditional parts of the knowledge can be unique and native to local communities, although the local and traditional knowledge have been disappearing at an accelerating pace in many human societies (Maffi 2005; Gómez-Baggethun et al. 2013). Sharing the local and traditional experiences and associated knowledge of ecosystem services is thus crucial for sustainable use of ecosystem services. In this chapter, we document a case of sharing experiences and associated knowledge in the Mikatagoko (Five Lakes of Mikata) area in Fukui Prefecture, Japan.

Mikatagoko (Five Lakes of Mikata) is located in Wakasa and Mihama towns, Fukui Prefecture, on the coast of the Japan Sea and consists of five lakes that have different salinity levels depending on the position off the sea (Fig. 5.1). Hasugawa River is the largest inflow river of the lakes and flows through the Mikata lowland to

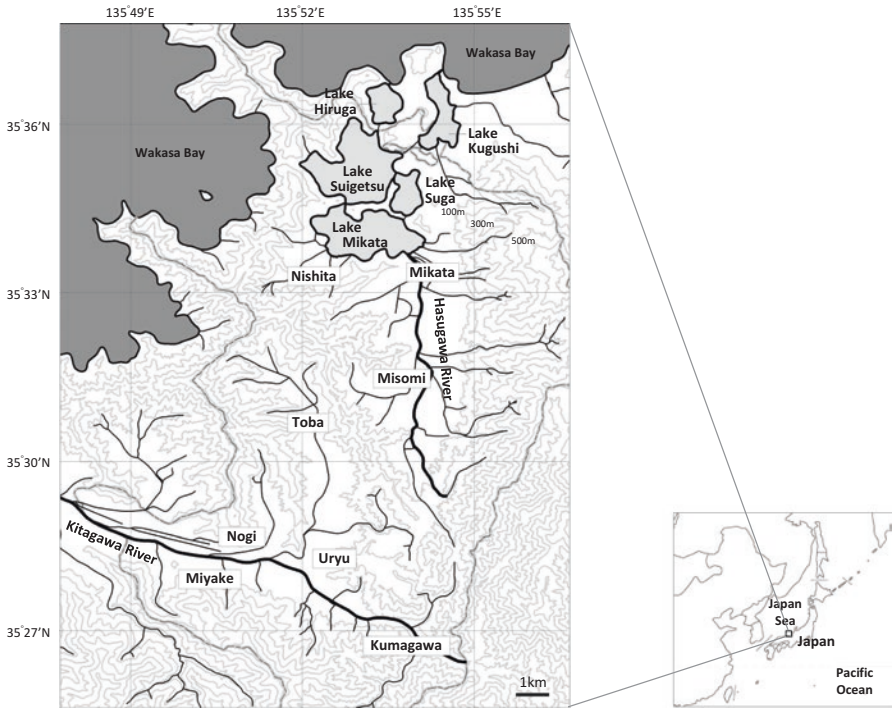

Fig. 5.1 Map of the Mikatagoko area in Fukui Prefecture, Japan

the Lake Mikata. The land use of the Mikata lowland is dominated by paddy fields and some residential area. The water flows out from Lake Mikata to Lake Suigetsu and Lake Suga and then to Lake Kugushi that is connected to the Japan Sea. Lake Hiruga is isolated from the other lakes and connected directly to the sea. This salinity difference makes each lake unique and being inhabited by different species of fish and other aquatic organisms, resulting in the rich biodiversity of Mikatagoko as a whole. The Mikatagoko is designated as a Place of Scenic Beauty, a part of Quasi-National Park, and a Ramsar Site. Humans have inhabited this area since the early Jomon period, and thus there is a long history of human-nature interaction, which is another characteristic of this area. The current population around Mikatagoko is around 15,000 in Wakasa town and around 10,000 in Mihama town, although the population is in a declining trend in either town. Among those, about 7 or 10% of the population work for fishery, forestry, or agriculture that utilize natural resources and deliver ecosystem services in Wakasa or Mihama town, respectively. Because of the environmental changes such as eutrophication and loss of habitats and the declining biodiversity due to invasive species and loss of ecological network, significant efforts have been put into the ecological restoration in this area. According to the Act on the Promotion of Nature Restoration, Japan, the Mikatagoko Nature Restoration Committee was established in this area in May 2011, in which more than 70 people and organizations from diverse sectors and backgrounds participate. In March 2012, the overall plan of the nature restoration was decided, followed by

the implementation plan decided in March 2013. In the overall plan, 20 targets were adopted in the three themes including conserving and restoring biodiversity, revitalizing the local community by taking advantages of biodiversity and ecosystem services, and handing down local cultures and traditions for future generations. To achieve the targets, the implementation plan was adopted, and six working groups were made, including the one focusing on the local environmental education that has been conducting multiple activities such as the one described below.

In 2006, the local NGO, Hasu Project[1] conducted a questionnaire survey of the local residents covering both males and females of teens to 80s, to ask about ecosystem services provided in the Mikatagoko and surrounding area, which include food provision from the lakes and rivers, local food culture, and recreation in the lakes and rivers. The total number of respondents was 782 (43% males and 56% females). Although the respondents were very limited in 20s ($n = 1$) and relatively of a small number in 50s ($n = 26$) and 80s ($n = 10$), the survey covered a broad range of ages. The fraction of respondents who have eaten fish and others caught in the local lakes and rivers was lower in the younger ages (Fig. 5.2a). The major reasons for not having eaten the local fish and others were the lack of knowledge of how to obtain and cook them and whether they are edible and the lack of experience of tasty and safe foods locally produced (Fig. 5.2b), suggesting that the loss of knowledge and experience has been occurring in the younger ages. The fraction of respondents who have played in the local lakes and rivers during their childhood did not show a clear trend over the range of ages (Fig. 5.2c), but there was a trend of shift over the ages in the types of recreation associated with the lakes and rivers (Fig. 5.2d). The fraction of respondents who have caught fish and others was lower in the younger ages, which might be related to the loss of experience of eating them. Thus, the overall trend found in the questionnaire survey indicated the importance of sharing knowledge and experience among different ages in order to conserve the local cultural context of ecosystem services.

5.2 The Painting by Children of the Past Waterscape Program

5.2.1 Outline of the Program

The Painting by Children of the Past Waterscape Program was started by the Hasu Project in 2007. In this program, children living in the Mikatagoko area paint a scene of the past waterscape, based on interviews they conduct with a grandparent, parent, or other adult they are close to, about what life was like near the local river

[1] The Hasu Project is a local NGO that was established in 2005 and since then has been conducting various activities for the restoration of biodiversity and ecosystems and the relationship between human and nature in the Mikatagoko area. About 70 members are involved, including those both from local towns (Wakasa and Mihama) and from other towns and cities.

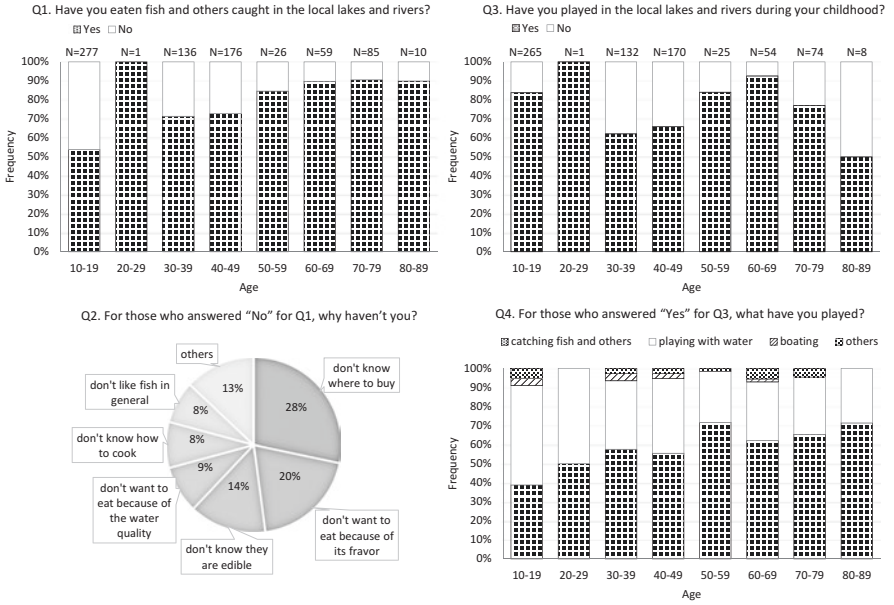

Fig. 5.2 Results of the questionnaire survey conducted by the local NGO, Hasu Project, in 2006. Q1, experience of eating local fish and others from the local lakes and rivers; Q2, reasons for not eating in Q1; Q3, experience of recreation in the local lakes and rivers; and Q4, types of recreation experienced. The total number of respondents was 782, although some questions have less due to no reply

or lake in the past, including the animals and plants that lived there and things the adults did when they were young. As a part of the program, the children also need to find out from the adult when and where the experience took place. The program is an ongoing project, and, as a part of the project's development, a system was eventually designed to make the paintings accessible to the local residents online using the information the children gather on time and place. The program is unique in aspects such as the breadth of the geographical area covered, its duration, and the ways results are made available to the local residents.

As to similar projects in Japan, the Lake Biwa Museum asked adults to draw paintings showing how they had fun in and around the lake in the past (Yuma et al. 1997), but this only involved adults reminiscing and did not directly involve children. At Lake Kasumigaura, elementary school students, with the assistance of a NPO and researchers, conducted an interview survey of adults regarding their memories of how they used to have fun in and around the lake and about animals and plants they used to see there (Ohgoshi et al. 2003). However, no information about where their experiences took place was collected because the study's focus was individuals' memories of plants and animals rather than their experiences. Moreover, the Lake Biwa and Lake Kasumigaura projects were participatory research conducted as a part of the research project, so they were not ongoing until now. On the other hand, frequently, in initiatives such as workshops for regional revitalization and other pur-

poses, local citizenry creates pictorial maps to summarize information to be shared on a single page. For example, in the bioregionalism movement, "bioregion maps" are created to show a region's natural systems (e.g., http://planetdrum.org/Bioregional Directory/Maps/Cascadia.htm). The Painting by Children of the Past Waterscape Program is different from those other programs in terms of collecting individuals' past experiences as the paintings of waterscape and using spatial information to organize the paintings.

The program started in 2007 when the Hasu Project requested elementary school students in the town of Wakasa to draw paintings during their summer break and submit them for the later exhibitions. Initially, the NGO asked the children to create something like a "picture diary" combining a painting of the past waterscape and a short text of what they interviewed the adults about the past waterscape. However, because the form of the request was not enough formal in its requirements, much of the work received consisted of paintings alone, and, when any information was included, it was of all types. Paintings received were exhibited at the Wakasa Mikata Jomon Museum and other local public facilities.

Beginning in 2009, the NGO started collaboration with researchers on a project conducted in the Mikatagoko area. A survey form was created to be submitted with each painting, and a web-based geographic information system (GIS) named "Everyone's Map of Mikatagoko" was developed to store, analyze, and display the information. More will be explained about the survey in the next section, but the survey collected information on approximately when and where the waterscape depicted in the painting took place in a structured way so it could be stored in the GIS. This, in turn, made it possible to use the paintings in community-based workshops (to be explained later).

Some of the program's results were presented in the Mikatagoko Nature Restoration Committee's 2012 Overall Plan (http://www.pref.fukui.lg.jp/doc/shizen/mikata-goko/kyogikai_d/fil/zentaikousou.pdf [in Japanese]). Consequently, starting in 2013 the committee adopted the program as one of its initiatives, and we began soliciting submissions in Mihama, another town in the Mikatagoko area. In 2015, an exhibition based on the paintings of the past waterscape was held at the Wakasa Mikata Jomon Museum (Wakasa Mikata Jomon Museum 2015). From the start of the program to date, over the 10 years from 2007 to 2017, a total of 1543 paintings have been collected (Table 5.1), of which 1325 have been collected since 2009 when the addition of the survey made data compilation possible.

5.2.2 Information Collectable from the Program

While all of the paintings drawn by the children were, of course, waterscapes, some of them contained detailed renderings of animals and plants, human activities, and even the clothing of the time. However, because the paintings showed only what could be drawn by a child, if they showed only scenery, there was even less

Table 5.1 Number of submissions of the paintings during the period of 2007–2017

Year	Number of submission
2007	69
2008	149
2009	152
2010	142
2011	180
2012	165
2013	243
2014	105
2015	193
2016	82
2017	63
Total	1543

information to interpret in any kind of detail. It was, therefore, necessary to find a way to obtain supplemental information about the content of a painting.

Since 2009, the program requires that each painting be submitted with the survey form to provide more information about it. The survey consists of questions about the child's relationship to the adult they talked with (e.g., grandfather, grandmother, father, mother, etc.); the adult's age; the names of the place and its associated village in town depicted; the location of the place on a map (a map of the area around the school ward for the elementary school participating in the program is included); the historical decade (1945–1954, 1955–1964, 1965–1974, 1975–1984, others); the adult's memories related to the scenery depicted and stories about the creatures there and which of them they ate and so on (free response); what it was like for the child to listen to the adult's stories and draw the painting (free response); and contact information in case the child is willing to participate in a follow-up survey (Box 5.1 and Fig. 5.3). Thus, the waterscape and survey show what the child took away from their conversation with an adult about their experiences in the past waterscape.

The effect of including the survey as a part of the submission process for the program was not simply that it provided more material for interpretation. The multiple choice and free responses to the questions regarding time and place made it possible to specify the approximate time (decade) and place shown in the painting. As a result, it was possible to organize the paintings in time and space (place) so the information could be stored in a GIS for analysis and display. If the survey had simply consisted of information from interviews, the raw text would have been inconsistent in how time and place were indicated. As a result, in order to use a tool such as a GIS, sentence segments would have needed to be used to structure the text by time and place, which would have been a significant amount of work. It was more effective to collect supplemental information for the past waterscapes by using this more structured approach.

Box 5.1: Survey Questions

- Name:
- School and grade:
- The person you talked to (select one: grandfather, grandmother, father, mother, neighbor, other person):
- The person's age:
- Title of your painting:
- Where is the place in your painting? Near [ ] in the village of [ ].
- Around what time in the past was the scene in this painting about (select one: 1945–1954, 1955–1964, 1965–1974, 1975–1984, other)?
- Find out more from the person about their memories of the place you drew and the creatures there! (For example, what creatures lived there, which ones they caught, what they did for fun, etc.):
- What were your thoughts as you listened to the person's stories about living near the water in the past and as you drew your painting?
- Where is the place in your picture located? Please mark it on the map as best you can. The map shows the general area around your school district. If it was elsewhere, draw a map in the space provided.

Fig. 5.3 Survey form (in Japanese) attached to a submission of a painting to provide more information about the past waterscape and experiences. English translation of the form is in Box 5.1. A map in the form can be different depending on the elementary school participating in the program

5.2.3 How Experiences and Knowledge Are Transferred in the Program

One of the defining characteristics of the program is that it is children who draw the paintings, not the adults who actually had the experiences. The children actually drawing the paintings did not have the experiences in the waterscape; they were depicting because they were far in the past. Nevertheless, the waterscapes and the surveys often include depictions of various aspects of the past, such as animals and plants, things people did, how people made their living, how land was used, and what people wore, details which must be based on the knowledge and experiences of the past. This means that to create the painting and complete the survey form, the children have to ask the adult quite detailed questions.

We know this to be the case because on October 7, 2011, we held an exercise during class time at Elementary School A, in which 6 adults of their parents' and grandparents' generations talked to 16 second graders (ages 7–8) about what life near the lakes and rivers had been like and then helped the children draw paintings. The exercise actually included a preparatory learning phase that began 10 days before, which consisted of introducing them to a number of paintings on the Everyone's Map of Mikatagoko that had been submitted about the area around their school to give them an opportunity to see how the lakes and rivers differed historically from the present. They were then given a homework assignment to talk with their families over the following week about what it had been like in and around the local lake or river in the past.

On the day of the class, for the first 45 min, we had the six adults (in their 50s–70s) talk about the creatures that lived in or near the water, what they did for fun, and what life had been like there in the past (Fig. 5.4). After that, each adult helped two to four children draw paintings (Fig. 5.5). It became obvious at this time that to draw paintings the children needed quite a lot of assistance from the adults, who showed them pictures of animals and plants in field guides and helped them depict the scenery. For example, even when told there were wooden pilings on a lakeshore, because children did not know (or did not recognize) what a "piling" was, the adult had to actually draw a picture to show them (Fig. 5.6). As a result, it took the children more than 2 h to draw their paintings. When we interviewed the adults after the class, we found that even those who lived with their grandchildren found the experience gratifying because in their daily lives their communication with children was not at the same level of intensity.

These paintings of the past waterscapes were the cumulative result of a steady, concerted effort. Of the more than 1500 paintings received in the program so far, not a few must have been painted in a similar process. In that process, adults familiar to the children did not simply pass on information about an experience that took place near a local lake or river. Rather, an opportunity was created for communication

Fig. 5.4 Children listening to a local adult talking about his experiences in the past waterscape

Fig. 5.5 Children painting the past waterscape with the help of a local adult

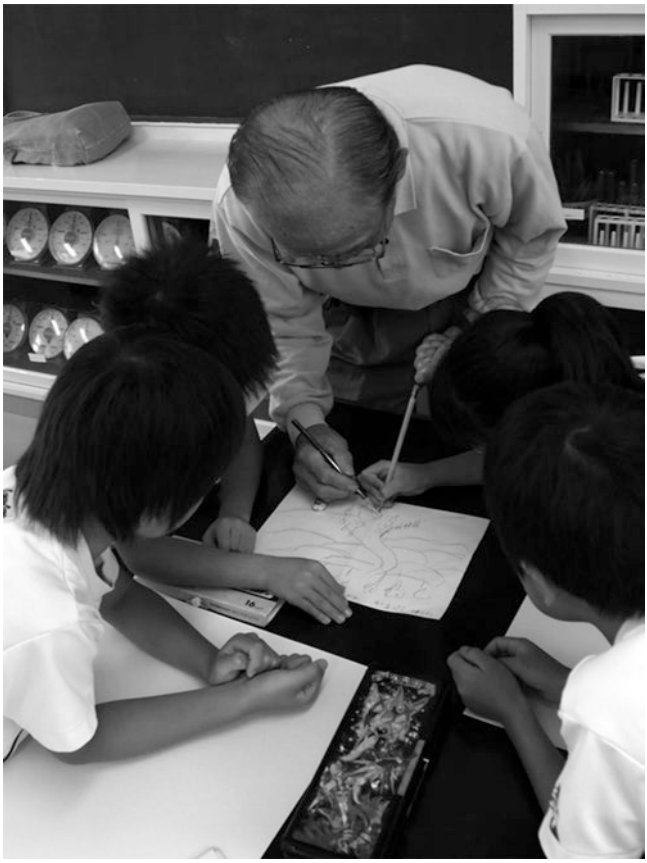

Fig. 5.6 A local adult teaching children by drawing a picture of what he wanted to tell

regarding something that had occurred in the past to take place. More generally speaking, this could be considered an opportunity for intergenerational exchange in our society.

Interviews with adult speakers after the exercise above suggested that they had no opportunities in their daily lives for this kind of communication. In the contemporary Japanese society, opportunities for intergenerational exchange may be few in general, so there would not be many opportunities for people of different generations to share experiences related to a community's lakes and rivers in the past. The process of creating a painting of the past waterscape not only enables information about past experiences to be passed on, but it may also be socially meaningful in that it provides opportunities for intergenerational communication.

5.3 Shared Experiences and Knowledge by the Program

A variety of information and suggestions can be gleaned from these paintings and survey responses as they are reflections of experiences and associated knowledge shared by an imparting adult with an inquiring child. By analyzing their contents, it is possible to know what kind of experience and associated knowledge was shared in the process of a painting's creation.

5.3.1 Shared Experiences and Knowledge

In order to know what kinds of experiences and associated knowledge were shared by the adults with the students, we analyzed 986 paintings and their survey responses collected during the 5 years between 2009 and 2014. First, we looked at what kinds of waterscape were associated with the experiences depicted and found that 59% related to rivers, 15% to lakes, and 10% to rice paddies (Fig. 5.7). The animal most frequently appearing in the paintings and surveys was the crab (Fig. 5.8). These crabs can be assumed to include Japanese mitten crab (*Eriocheir japonica*) and Japanese freshwater crab (*Geothelphusa dehaani*) which we found to be a familiar presence on all shores, upstream and downstream of rivers. As to activities, catching fish was, overwhelmingly, the most frequent, and it accounted for almost all the activities associated with catching or collecting animals (Fig. 5.9). Other activities included swimming and doing laundry.

Meanwhile, looking at the adults who imparted their experiences by gender, there were almost no gender-related differences in the type of waterscape associated with their experiences or in the activities they described. However, regarding animals, men more frequently talked about fish, including *funa* (*Carassius* spp.), eels, common carp, *ayu* (*Plecoglossus altivelis*), catfish, *hasu* (*Opsariichthys*

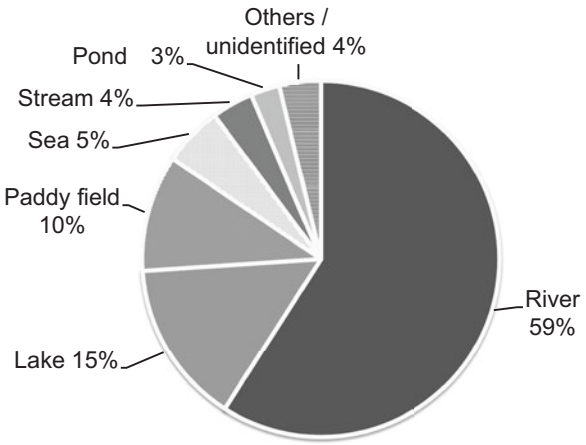

Fig. 5.7 Waterscapes drawn in the paintings (N = 986)

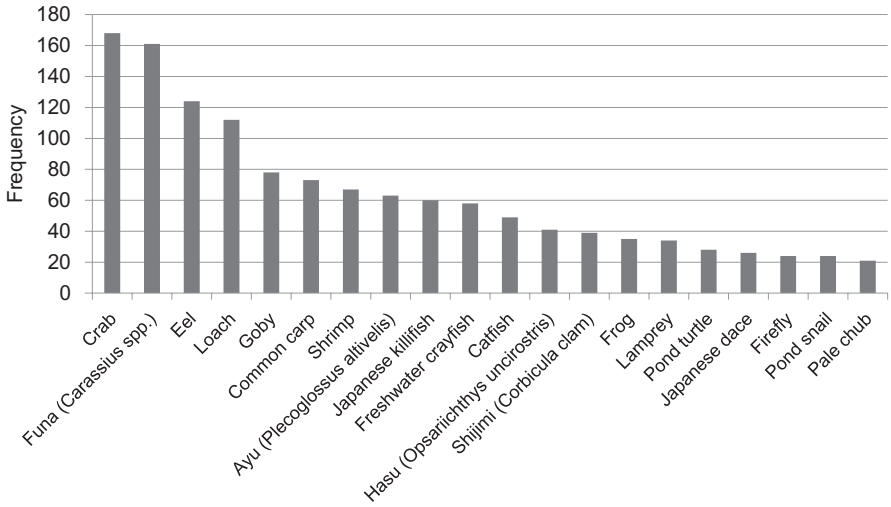

Fig. 5.8 Top 20 animals frequently drawn in the paintings

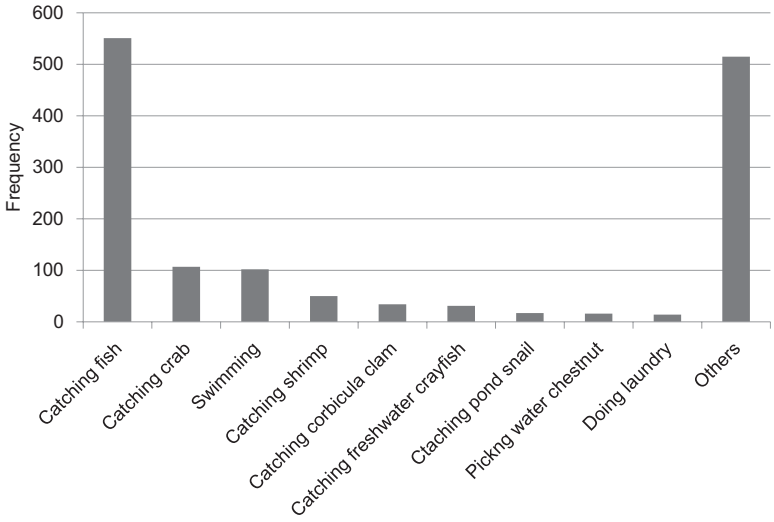

Fig. 5.9 Activities drawn in the paintings (N = 986)

uncirostris), lampreys, and pale chub. Women more frequently talked about crabs, goby, Japanese killifish, *shijimi* (*Corbicula* clams), frogs, and fireflies (Fig. 5.10).

Looking at the places where animals appeared, there were some differences. We looked at the coastal area of the Mikatagoko Lakes (Mikata and Nishita areas), the upstream area of the Hasugawa River (Misomi area), and the mid- and upstream area of the Kitagawa River (Kumagawa, Toba, Uryu, Miyake, and Nogi areas). Specifically, while the prevalence of crabs was almost identical in all regions, *funa*

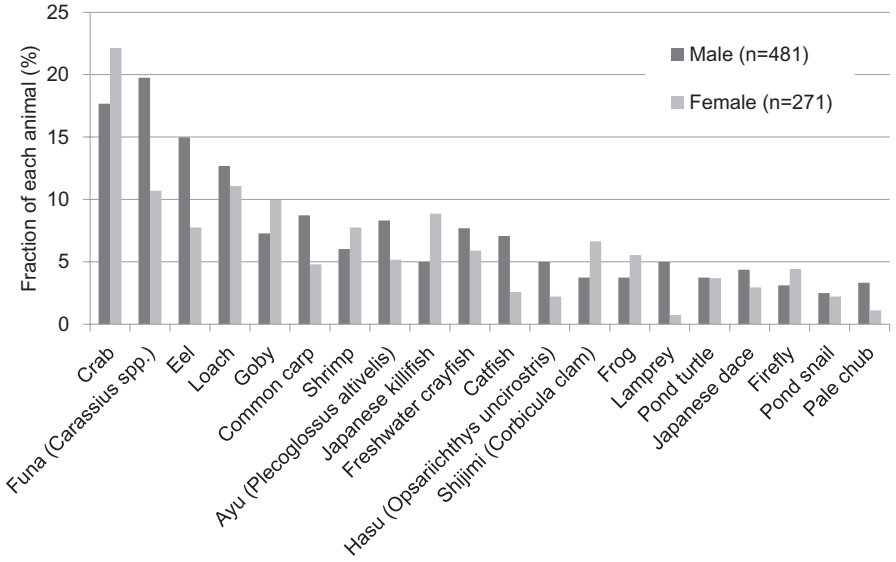

Fig. 5.10 Animals drawn in the paintings by gender of the adults imparted their experiences to children

(*Carassius* spp.), common carp, shrimp, *hasu* (*Opsariichthys uncirostris*), and lampreys appeared more frequently on the coastal area of the Mikatagoko; loach, goby, pond turtle, and Japanese dace were more frequent in the upstream area of the Hasugawa River; and *ayu* (*Plecoglossus altivelis*), Japanese killifish, freshwater crayfish, catfish, and fireflies more frequently appeared in the mid- and upstream area of the Kitagawa River (Fig. 5.11).

Meanwhile, looking at the experiences imparted by decade between 1945 and 1984, the most frequent activity described was catching fish, which accounted for 48–68% of the activities depicted for each decade (Fig. 5.12). As to other activities, catching crabs accounted for more than 10% of the activities depicted through the decade beginning in 1955 and, since 1965, around 8% (Fig. 5.13). In more recent decades, swimming, however, was ever less frequently depicted. Conversely, depictions of catching crayfish began to increase after 1975. As to other activities, catching shrimp reached a peak around 1955–1974 and then began to decrease in frequency. While infrequent to start with, the frequency of catching pond snails was almost never talked about after 1955, as was the case for doing laundry after 1975.

Looking at the types of animals that adults talked about by decade, crabs frequently appeared, accounting for more than 15% in every decade (Fig. 5.14). In comparison, although *funa*, eel, and loach appeared frequently until around 1964, accounting for more than 15%, after that the frequency dropped off. Further, decreases were seen in the frequency of appearance of Japanese killifish, catfish, pond snails, shrimp, and some other animals after 1965. On the other hand, in the more recent decades, the only increase in frequency of appearance seen was of freshwater crayfish, which reached more than 15% around 1985, when it was second to crabs.

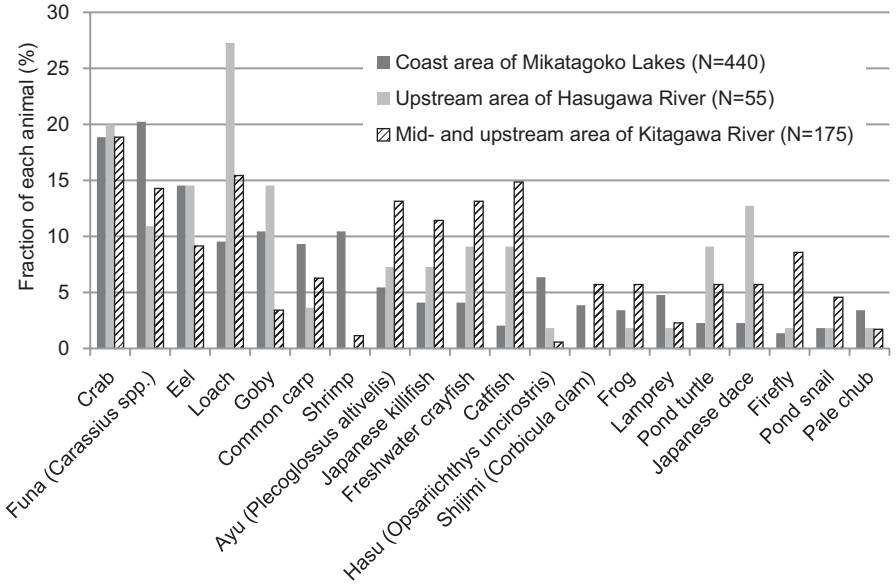

Fig. 5.11 Animals drawn in the paintings by area of the waterscapes

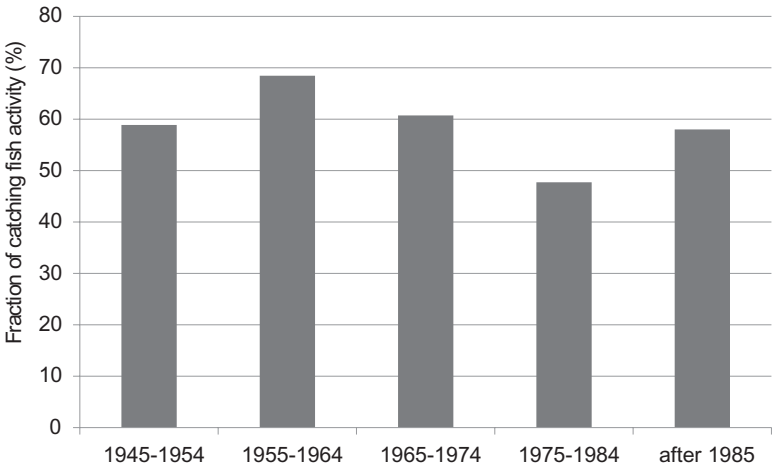

Fig. 5.12 Fraction of the paintings of catching fish activity by decade from 1945 to after 1985

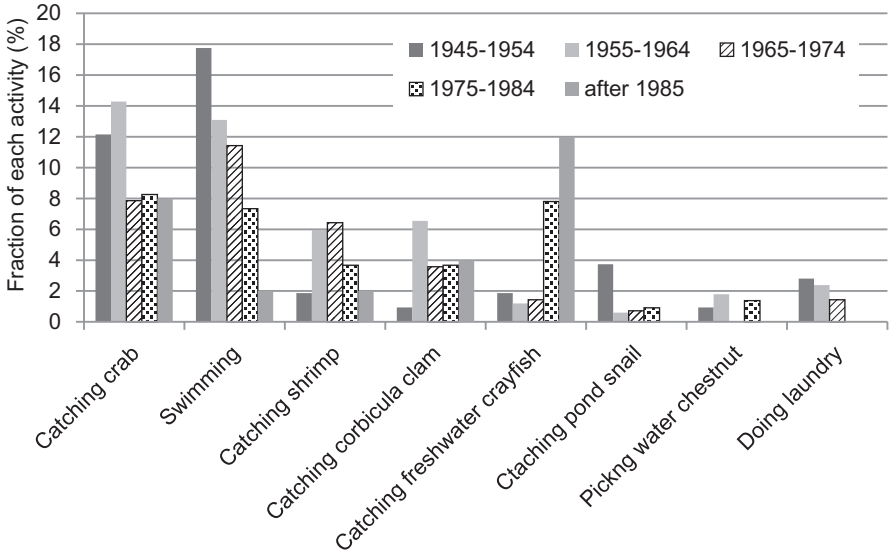

Fig. 5.13 Fraction of the paintings of each activity by decade from 1945 to after 1985

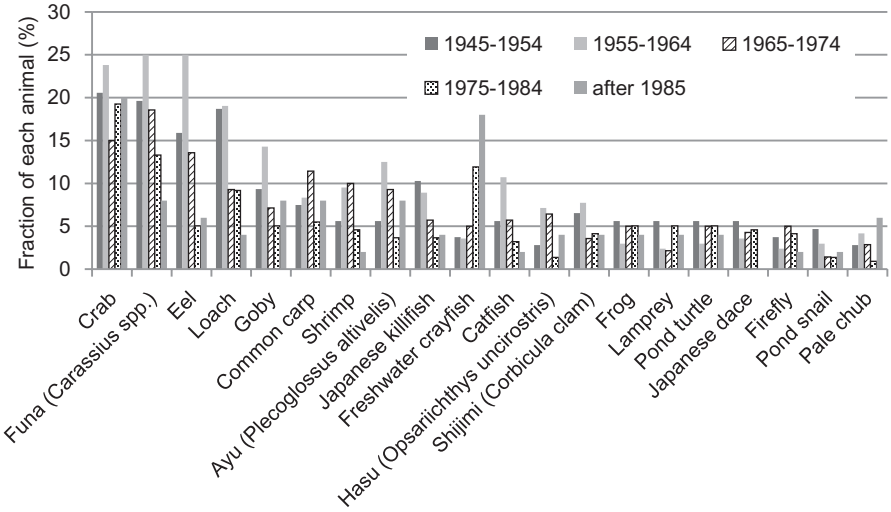

Fig. 5.14 Fraction of the paintings of each animal by decade from 1945 to after 1985

5.3.2 *Painting by Children of the Past Waterscape*

In this section, we present a few representative paintings of the past waterscapes. The descriptions are from the survey responses. In the parentheses that follow are the location and decade, age, and gender of the storyteller.

- Catching fish in a rice paddy (Fig. 5.15)

> In May it rained a lot and funa came up to spawn in the rice fields. We used a scoop net or a bucket from which the bottom was lost to trap them. (Coastal area of the lakes, 1965–1974, 73-year-old man)

This depicted the experience of catching *funa* that came upstream for spawning into the rice paddies after it rained. At the time, the rice paddies were connected to the river and lake by irrigation ditches, and people used to catch fish that came to spawn. Frequently the fish were caught for food. The clothing drawn on the figures in the painting is from that time, suggesting that the adult sharing the experience with the child also provided that details of the past experiences.

Fig. 5.15 An example of the paintings, "Catching fish in a rice paddy." Original painting is in color

- Catching rice grasshoppers and the waterscape (Fig. 5.16)

  We ate rice grasshoppers roasted on skewers or added them to the soup we got during school lunch. In the mornings grasshoppers don't fly around much, so we'd get up early every day to go catch some. That river was full of crabs and other animals. (Upstream area of the Hasugawa River, 1945–1954, 75-year-old man)

The adult talked mostly about the experience of catching and eating rice grasshoppers but also mentioned that there were crabs in the river right nearby. The high frequency of the appearance of crabs in the paintings may be because the speakers involved in various activities near the water in this way were aware of their presence. In addition, as in this example, "experiences with animals" frequently included eating them.

- Digging for *shijimi* clams and swimming (Fig. 5.17)

  We used to go to the shore of Kugushi Lake to dig for shijimi clams. I don't know the name but there were a lot of small fish swimming in the water. We swam in the lake. (Coastal area of the lakes, 1975–1984, 46-year-old woman)

Kugushi Lake is one of the Mikatagoko lakes that has brackish water and *shijimi* clams used to be abundant. While there was also commercial digging, people used to dig *shijimi* clams for home consumption. People talked about swimming at this time less frequently than previously (as noted above).

- Catching shrimp (Fig. 5.18)

  In the summer a lot of shrimp appear. When my mother was a child there were lots of freshwater shrimp but now it seems that their numbers have dwindled. (Coastal area of the lakes, 1975–1984, 39-year-old woman)

Fig. 5.16 An example of the paintings, "Catching rice grasshoppers and the waterscape." Original painting is in color

Fig. 5.17 An example of the paintings, "Digging for *Shijimi* clams and swimming." Original painting is in color

Fig. 5.18 An example of the paintings, "Catching shrimp." Original painting is in color

On summer nights, people used to scoop shrimp out of the water from the lakeshore using nets, an activity they referred to as *ebi-suki* ("shrimp scooping"). The shrimp they caught were basically for home consumption. Although these shrimp were also caught commercially, a different method was used.

- Washing laundry in the river (Fig. 5.19)

> Between the stones in the river there used to be crabs and fish. In the old days there were no washing machines so I hear that people used to wash their laundry in the river. (Coastal area of the lakes, 1955–1964, 63-year-old woman)

While infrequent, there were some experiences depicting people washing laundry in rivers. This child was able to take a fresh look at a river and accept the fact it was not only a place to play but was also a part of people's daily lives. The child wrote "I realized that in the old days, the river was a part of people's lives, a place for having fun as well as a place for doing your laundry."

- Helping with the rice harvest (Fig. 5.20)

> When my father was child, in the autumn he helped with the rice harvest. He used to help hang the harvested rice plants on the "inaki" rack to dry. Frogs hid in the shade of the rice plants and grasshoppers hurried to escape. There were red dragonflies in the sky and loaches and "gorin" (a goby fish) in the river so after he was done helping he played at trying to catch them. (Coastal area of the lakes, 1975–1984, 44-year-old man)

In this way a scene related not to "having fun" but to people making their livelihood was depicted. Agriculture at the time was not as mechanized as it is now, so children had a lot of opportunities to help out. This painting tells of experiences playing with wildlife in the fields between jobs.

Fig. 5.19 An example of the paintings, "Washing laundry in the river." Original painting is in color

Fig. 5.20 An example of the paintings, "Helping with the rice harvest." Original painting is in color

5.3.3 Children's Impressions After the Sharing of Experiences and Knowledge

In the survey form, the children wrote impressions about having an adult share past experiences with them through the waterscape painting program. Most were positive, for example, "The old days were awesome!", "I didn't know the river was clean!", "I was surprised there once were so many fish!", and "I'd like to go back to that time and see what it was like to live then!". On the other hand, while few, there were also reactions such as "Life in the old days was hard! I'm so glad I was born now!" and "People go fishing now too, so then and now are not any different."

What the impressions had in common was that the experiences imparted to them about life near the water in the past were things previously unknown to them. Whether their evaluation was positive or negative, the children perceived the adults' sharing past experiences of the water with them as something new. This means that, in daily life, the kind of communication involving the sharing of the types of experiences presented in this chapter must not take place very much. From the perspective of experience sharing, one might say that the Painting by Children of the Past Waterscape program provides children and adults with an "extraordinary" opportunity to share an experience from the past on two levels. There is the sharing of an experience related to water itself, and there is the opportunity for the adult to impart a past experience to a child. Furthermore, given the children's many positive impressions about living near water in the past, one could say that the program is creating a new appreciation of waterscapes.

5.4 Extending the Sharing of Experiences and Knowledge

The process of painting these waterscapes results in experience sharing, but only between the children participating in the program and the adults they interview. Furthermore, the information that can be gleaned from a single painting and accompanying survey about the experience depicted is limited. The painting program, as it was, was too limited to share the variety of experiences in the paintings more broadly with a larger number of people, for example, with more residents of a particular watershed. Therefore, we decided there must be easier ways, in addition to holding exhibitions of the paintings, to share these experiences and the associated knowledge with a broader range of local residents. As a result, we are trying out new ways to extend access to this information using the web-based GIS and workshops.

5.4.1 Web-Based Geographic Information System for Further Sharing

In order to share the experiences and associated knowledge, the drawn paintings have been put into the web-based GIS (geographic information system) that can be freely accessed via the Internet by local residents and anyone else (Fig. 5.21). The system is named as "Everyone's map of Mikatagoko" and can be accessed at http://www.mikatagoko.jp. Thanks to the survey forms attached to the paintings, the time

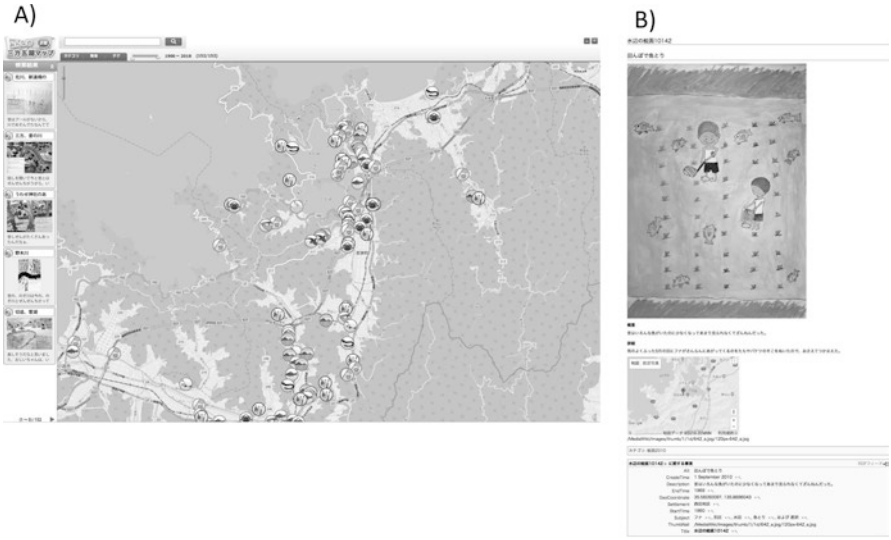

Fig. 5.21 Web-based Geographic Information System, "Everyone's map of Mikatagoko" (http://www.mikatagoko.jp). (**a**) The front page of the map. (**b**) An example page of the painting of the past waterscape and the survey results

and location of the past waterscape drawn in the paintings can be identified. Using the time and location information, each painting can be visualized in the web-based GIS to show where and when the experience drawn in the painting has happened. The web-based GIS was designed by Jun Kumagai, Masahiko Nagai, Ryosuke Shibasaki, and colleagues (Kumagai et al. 2010), in which more technical information can be found. The system is based on the MediaWiki and the OpenStreetMap (initially using the Google map, though), and the database and the mapping interface are linked in the system. This web-based GIS is designed to be user-friendly so that those who do not have the knowledge of GIS can operate the system. In the system, one can search, display, and retrieve the data of the paintings of the past and the associated survey. As of April 2018, the total number of the paintings and associated survey counts 1261, and more data are to be accumulated every year.

5.4.2 Workshop for Further Sharing

The web-based GIS made it possible to extend the scope of our outreach to people both in and outside the Mikatagoko area. On the other hand, we needed to come up with something further, because the web-based GIS alone would not enable experience sharing among people at the local community level, promote intercommunication among people sharing the same experiences, or enable people running the program to get feedback for further development of the "experience sharing" dimension of the program. To address these issues, we began holding workshops in local communities (villages in this case) throughout the area. The idea of holding workshops came to us as we were trying to arrange lectures to introduce local communities to the painting program. Since 2016, we have held these workshops in about two villages per year. We invited residents of each village where we organized a workshop by various ways including invitations through the head of a village and distributing a flyer. In the end, we usually had around 15 participants in each workshop, and they were mostly older generations.

In these community-based workshops (Fig. 5.22), we use about the first 40 min to explain how the painting program works, present the overall trends we have found, and show a few paintings depicting places near the community. After that, participants spend an hour or so talking with each other about what is depicted in the paintings and their own experiences in and around those rivers and lakes. We then facilitate a discussion using supplementary materials such as photographs and actual paintings and maps. For each workshop we select paintings from the program that are relevant to the community from the more than 1300 stored in the web-based GIS using the application's search function.

Originally, we had envisaged inviting people of all ages to participate. However, we then decided that it was too difficult to find a place and time to meet that would permit such a multigenerational gathering, given the differences between adults and children in a time and place that would work for them. As a result, most of the

Fig. 5.22 Community-based workshop held with local residents in a community

participants in the workshops have been older adults who have past experiences related to the local lakes and rivers.

In their daily lives, these older adults have few opportunities to share the experiences they had on shores of the local lakes and rivers in the past, even among themselves. These workshops give them an opportunity to reminisce about their past experiences, to confirm the experiences they had in common, and, conversely, to confirm differences in experiences due to their individual differences and small differences in age. They are also to share what those experiences meant to them: which of them had been fun and which had been hard.

During this process, the words in the local dialect "*ganta-bo*" and "*yancha-bi*" have come up, which are emblematic of the world of experience related to the local lakes and rivers. In standard Japanese, they translate as "*itazurakko*" (rascal) and "*otemba-musume*" (tomboy). It appears that many of the experiences depicted in the program were a part of the world in which those kinds of children were active, so the adults who related their experiences may have been rascals and tomboys when they were young.

These workshops gave participants an opportunity to rediscover their past experiences with the local lakes and rivers. Even if they had experiences in common with others, they had no opportunity to share them. Participants have been very gratified with the experience sharing process afforded them by the workshops, as evidenced by comments such as "This was great because generally I don't have an opportunity to talk about these kinds of things!"

On the other hand, for outsiders such as the NGO and researchers who planned the workshops, the program has provided a window of opportunity to understand

the experiences of local residents more deeply. Not only have they been able to confirm the facts about the paintings and the related lakes and rivers, but they have been able to learn what those facts have meant personally to the people who had those experiences. The local terms *ganta-bo* and *yancha-bi* were emblematic of such meaning-making. In this way, by sharing experiences in community-based workshops, we have been able to understand the subjective meanings of these experiences for the local residents, which are additional information that would not have been possible to understand from the surveys or the web-based GIS alone.

5.5 Discussion

Sharing experiences and knowledge through a series of initiatives such as the Painting by Children of the Past Waterscape program, the online GIS, and the workshops is meaningful for sustainable management of ecosystem services in two ways: knowledge is gained from what is discovered from the shared experiences themselves and from what is recognized from the act of sharing those experiences.

5.5.1 What the Shared Experiences and Knowledge Mean

As shown in Sect. 3, by compiling data on the content of the paintings and surveys, we have been able to discover trends in the experiences imparted to the children. However, when considering these trends, one needs to keep in mind that they may not be representative of overall experiences in and around rivers and lakes or of the natural environment at those times in the past. On the other hand, if one keeps that in mind and takes into account that these experiences were just things an adult told a child, there are important lessons to be learned for sustainable management of ecosystem services.

In ecosystem management, focus is often placed on conservationally important and economically important species. However, looking at the animals that appeared in the paintings and surveys, they were not necessarily either conservationally or economically important. Rather, it is clear that, for the adults, they were familiar animals at the time and they talked about them because they wanted to share them with the children. In fact, which animals were talked about differed depending on the gender of the adult, the time in the past, and the place being described. In this region around the Mikatagoko lakes, crabs appeared frequently regardless of place or time period. While crabs are not ecologically or economically remarkable, in the experiences imparted to the children, their presence has been conspicuous. Further, experiences in and around rivers were talked about more frequently than lakes that are the focus of the local tourist industry, Mikatagoko Lakes.

These facts demonstrate that there may be a discrepancy between impressions of the region's ecosystem and its ecosystem services held by outside experts and

government agencies and impressions held by the residents who tried to share their experiences of the ecosystem and ecosystem services with children. If we are trying to harness the participation and knowledge of local actors for the benefit of ecosystem services management, we need to understand the residents' Umwelt (what they perceive as meaningful in the space around them) (Uexküll and Kriszat 1934=1995). Especially considering that demand for ecosystem services is influenced by social concerns, when drawing up an ecosystem services management plan, attention needs to be paid to the potential discrepancies between the Umwelts of outsiders like experts and of local residents. That is an important reason for having a variety of actors with different viewpoints and values participate in the process.

When the frequency with which an animal was talked about differed depending on the adult's gender and the place or time period described, the significance of that difference can be different depending on whether it reflected a change in the animal itself or on a change in social context related to the animal. While many of the children who listened to a past experience might have said "I never knew there used to be so many fish!", others might have said "There are still fish in the river, so it seems to me nothing has changed!" It is impossible to know from an experience imparted in the program alone what may have happened to the natural environment at that time or what the relationship between people and the natural environment were like (although there may be clues). As a result, these paintings cannot be used to make simple comparisons between the past and present. However, by understanding the trends in the experiences described, it is possible to narrow down the changes that actually may have taken place, which may be useful when drawing up a plan for sustainable management of ecosystem services.

We found from a detailed analysis of the content of the paintings and the children's impressions that many of the experiences were not unrelated to the social context, that is, the values and social environment at the time. For example, meals at home included animals that could be caught in the rivers, lakes, or rice paddies that *could be eaten* and that *were tasty*. Those animals were not *bought* but rather could be *caught*. Catching fish during spawning season was related to how rice was cultivated. Before farming became mechanized, children helped out on the farms (helping was allowed) and so on. In other words, focusing only on the changes in activities such as catching fish or swimming as the times changed, without understanding the changes in social context as the background that created the supply of and demand for those ecosystem services, would make it difficult to sustainably maintain those services in the future. Of course, it would be difficult to restore the values and social environment of the past to change the supply and demand back to what it was, and it would not necessarily be desirable. However, for the sustainable management of ecosystem services, an important issue will likely be how a new social context can be achieved to recreate the supply of and demand for ecosystem services.

5.5.2 What the Sharing of Experiences and Knowledge Means

In experience sharing, separate from any meanings inherent in the experience, meaning can be found in the act of sharing itself. In this program, experience sharing takes place during at least two of its phases—when a painting is being created and when the painting is being viewed on the Internet or during a workshop. In the first phase, a significant amount of intergenerational experience sharing takes place between a child and an adult familiar to them. In the workshops, adults within the same community share past experiences they had on the local rivers and lakes. Experience sharing on the web-based GIS is borderless, transcending both time and place. Taking into account the impressions both of the children regarding the drawing of the painting and of the participants regarding the workshop, it is clear that both across- and within-generation opportunities for this type of experience sharing are "extraordinary" in that they not a part of contemporary daily life.

This indicates that we are in a situation in which knowledge about the supply and demand for ecosystem services generally remains within individuals, as that knowledge is not easily passed intergenerationally or shared broadly throughout society. According to the Hasu Project survey mentioned at the beginning of this chapter, experiences related to local rivers and lakes differ for different generations, and, for example, younger generations are eating ever less local fish. As to the cause, the knowledge related to the supply and demand for ecosystem services may not be transferred intergenerationally. Regardless of how abundant and diverse an ecosystem and its animal life may be, without knowledge of what services the local ecosystem can supply and without demand arising from people wanting to and knowing how to use those services, they will go unused.

In this context, because the experiences and knowledge related to the use of local rivers and lakes in the past shared through the program and its associated activities were perceived as new discoveries by children and as rediscoveries by adults, not only the current supply and demand for ecosystem services but also the potential supply and demand for services that used to exist in that place were recognized and shared in the society. Evidence of the motivation to realize those potential ecosystem services was seen in children's comments such as "I'd like to actually try that!" This suggests that gaining (or regaining) an appreciation for the value of the rivers and lakes in one's vicinity by both children and adults can create the cultural context needed to generate the supply of and demand for ecosystem services.

The Painting by Children of the Past Waterscape program and its associated activities perform the educational function of spreading knowledge about the supply of and demand for ecosystem services in a community by facilitating residents' discovery or rediscovery of those services. In addition, for the outside experts and government officials involved in this initiative, the program is performing the educational function of teaching them about the residents' Umwelt as they learn

about the experiences and knowledge the residents are trying to pass on to the next generation. By discovering words that are emblematic of local perceptions of the shared experiences, like *ganta-bo* and *yancha-bi*, they learn to "speak the local language," which is important for mutual communication. In planning for sustainable management of ecosystem services, they may learn to be able to explain why something needs to be done and what the goal is without using expert jargon like "biodiversity conservation," "well-being," or "ecosystem services." When such local terms are used among people with shared experience in a past Umwelt of local rivers and lakes, they can understand their meaning intuitively. Thus, the discovery of these kinds of emblematic words in the interactive process of a workshop had an important significance.

In conclusion, the sharing of experiences and knowledge through activities related to the Painting by Children of the Past Waterscape program in the Mikatagoko region has made important contributions to the sustainable management of ecosystem services from a variety of perspectives. This sharing program is a continuing activity of the Hasu Project and the Mikatagoko Nature Restoration Committee as we have new young generations to come even if the population is in a declining trend and this program plays a key role in transferring experiences and knowledge of local ecosystems. Not only the painting activity itself but also the following activities using the paintings such as workshops and the online GIS are important components of the whole program, although we need further elaborations in the later component as more paintings are produced in the coming years. Securing these sharing opportunities for younger generations is important for the continuing conservation and restoration of the local cultural context of ecosystem services.

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Chapter 6
Sustaining Diverse Knowledge Systems in SEPLs: Sharing Tacit Knowledge of Apiculture and Mushroom Production with Future Generations

Ryo Kohsaka, Ai Tashiro, Marie Rogel, and Yuta Uchiyama

Abstract Socio-ecological production landscapes (SEPLs) face numerous projected and unprecedented pressures amid changing social, economic, and environmental conditions. The use of diverse knowledge systems, including the transmission and sharing of traditional knowledge, to achieve mutually beneficial human-environment relationships, fosters the sustainable use of natural resources, promotes biodiversity conservation, and determines new methods to efficiently manage SEPLs, which can increase the adaptive capacity of local communities. To illustrate how the timely and regular transmission of traditional knowledge can promote the sustainable management of ecosystems and their services in complex SEPLs, this chapter presents the status and trend of the transmission and sharing of knowledge on non-timber forest products in two rural study sites in Japan. It also examines the factors, including motivations and incentives, that shape knowledge systems in these locales. The case study on apiculture in Nagano shows that beekeepers' ecological knowledge should be transformed from tacit to explicit and shared beyond the family unit for the benefit of future generations, while the case study on Shiitake mushroom production in Ishikawa reveals that farmers' traditional production knowledge and experience should be combined with modern production techniques to meet new quality standards. By understanding these elements and processes, relevant policies and activities could be developed and implemented, especially since new agents are frequently needed to increase the resilience of SEPLs.

Keywords Non-timber forest products · Traditional knowledge · Beekeeping · Shiitake mushroom · Socio-ecological production landscapes

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6.1 Introduction

The production of honey and mushroom, two examples of non-timber forest products (NTFPs),[1] is a human intervention that could aid in sustaining ecosystems and the services they provide, particularly in forest communities. By analyzing and determining the tangible and intangible contributions of apiculture and mushroom production to indigenous and local communities, the role of knowledge transmission and sharing in the successful and sustainable management of ecosystems, especially in different social, economic, and environmental contexts, can be realized and acknowledged. The role of the production of NTFPs, including honey and mushroom, in responding to biodiversity conservation problems and related environmental concerns is highlighted in both national and international arenas. The urgency of intergenerational sharing of knowledge and practices in relation to these activities is also emphasized.

Public and scientific interest in the degradation of pollination-related ecosystem services is increasing. The decline of pollinators and deterioration of pollination services are global environmental issues related to the loss of biodiversity. In 2016, the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services conveyed the growing importance of pollination and knowledge on the subject (Potts et al. 2016).

Beekeeping can contribute to the maintenance of pollination services and thus alleviate problems associated with forest management. In a study on traditional knowledge (TK) of South Korean native beekeeping and sustainable forest management, it was concluded that native beekeeping has significant social, economic, and ecological benefits and helps achieve the aims of sustainable forest management (Park and Youn 2012). The study also found that the number of native bee colonies reflects the quality of forest ecosystem management (Park and Youn 2012).

In Japan, the number of individual beekeeping hobbyists and small-scale beekeeping companies is stable, and the assortment of people and groups engaged in beekeeping means that pollinators can be introduced to locations where beekeeping is relatively new (Kohsaka et al. 2017). The genetic diversity of bees is associated with the environment in which beekeeping occurs, such as paddy fields and urban areas (Nagamitsu et al. 2016). As problems related to beekeeping, such as the scarcity of pollinators and reliance on imported honey, have diminished the resilience of agriculture in the country (Kohsaka et al. 2017), the above findings point to some of the areas that should be strengthened and prioritized. TK is central to the future of beekeeping in Japan and beyond.

The significance of fungal resources in biodiversity conservation has been widely studied, while the role of mushroom production in improving the livelihoods, health, and well-being of indigenous and local communities is increasingly being

[1] The collection, use, and commercialization (1) of the target plants have been declining, along with interest in embedded TK, practices, land, and resources, due to globalization, rapid economic development since 1950, local impacts of international trade on agriculture, more lucrative income sources, aging, and migration (Cetinkaya et al. 2012; Cetinkaya 2009).

investigated. Based on the findings of a study on integrating wild mushrooms use into a model of sustainable management for indigenous community forests, which involved a 5-year inventory of useful mushrooms in Ixtlán de Juárez, Oaxaca in Mexico, it was inferred that communities embarking on various forest activities should be familiar with the properties of ectomycorrhizal and saprotrophic fungi to understand their importance in forest management (Garibay-Orijel et al. 2009). The study, which found that among the mushroom species, 113 were edible, 38 had direct applications in forest management, 19 had medicinal properties, 12 had biotechnology applications, and 12 were toxic, shows that the numerous possible uses of these fungal resources offer a range of opportunities for the sustainable use of forest resources (Garibay-Orijel et al. 2009), provided that relevant knowledge is transmitted and shared among the actors involved.

An analysis of mushroom production in Southwest China found that both the market and the government were unsuccessful in commercializing NTFPs (He et al. 2014). In a study that evaluated and measured TK on mushrooms and edible wild plants in the Noto Peninsula in Japan, which is essential in community and landscape management in the area, the survey results revealed that majority of the collectors were retired employees from government offices who did not rely on the commercial value of the target plants (Cetinkaya et al. 2012). The collection, use, and commercialization of the target plants have been declining, along with interest in embedded TK, practices, land, and resources, due to globalization, rapid economic development since 1950, local impacts of international trade on agriculture, more lucrative income sources, aging, and migration (Cetinkaya et al. 2012; Cetinkaya 2009).

To sustain sound NTFPs production, embedded TK and practices should be shared and updated to suit present scenarios. Knowledge on NTFPs production, particularly local ecological knowledge, is transmitted through various means, in different contexts, for multiple purposes, and with varying quality (Park and Youn 2012; Kohsaka et al. 2015). The status and trend of knowledge transmission in beekeeping and mushroom production have also been overlooked, partially due to a relatively small share of products from beekeeping in the national economy in some countries. It is also difficult to capture the real economic share of beekeeping. The transmission of relevant local ecological knowledge among generations within individual regions could improve NTFPs production and increase its social, economic, and environmental benefits. As a tool to transmit local ecological knowledge, product-level and regional-level certifications can be used to share knowledge on making local products and managing landscapes in production areas in terms of regional branding (Kajima et al. 2017).

By exploring the status and trend of the transmission and sharing of knowledge on NTFPs, as well as identifying the factors and underlying issues that shape knowledge systems, in two rural areas in separate prefectures in Japan, this chapter elucidates on how the proper transmission of TK can contribute to the holistic and sustainable management of ecosystems and their services in complex socio-ecological production landscapes (SEPLs). As social, economic, and environmental conditions continue to evolve, SEPLs should be able to respond to both projected

and unprecedented pressures. New actors or agents are frequently needed to sustain SEPLs or address the underlying causes of change, which include the underuse of forest resources, including NTFPs. This is particularly urgent in Japan, where aging rates are high and the young population is low. In this chapter, the case studies focus on apiculture and Shiitake mushroom production.

6.1.1 Non-timber Forest Products (NTFPs)

NTFPs, including honey and mushroom, are produced in various socio-ecological relationships. As such, socio-ecological heterogeneity inherent to NTFPs (Zeidemann et al. 2014) should be identified. Economic evaluations that cover the biodiversity values of NTFPs, and consider the access or distance to urban areas when matching the demands of beneficiaries to supplies, should be conducted (Carrasco et al. 2014). Rist et al. (2012) reviewed 38 articles to examine the compatibility and conflicts between timber harvesting and NTFPs. They identified a lack of attention to NFTPs in certification processes or governance in general. Similarly, Illukpitiya and Yanagida (2010) examined the trade-off between agriculture and the extraction of NFTPs in Sri Lanka, where they found that NFTPs extraction was becoming less an outcome of agricultural efficiency and more a positive outcome of forest resources conversion.

Local origin and environmental friendliness are important to consumers, and it is suggested that certifying NFTPs to communicate such attributes will be a useful and supportive tool (Kilchling et al. 2009). According to Cocks et al. (2011), the cultural value of NTFPs and biodiversity, which are often primarily evaluated based on their financial returns, is now receiving greater attention in the management of changing socio-ecological systems. Indigenous and local communities worldwide rely on the extraction of NTFPs for their livelihoods (Ticktin 2004), and the utilization and selling of such forest resources are vital elements of their culture and economies (Dubey 2007). However, policies that focus on the enterprise dimension of NTFPs are deficient, such that existing policies related to these resources do not suit the local context and thus cause complications during implementation; for instance, they neglect to account for the culture and history behind NTFPs (Dubey 2007). Also lacking is investment in research and practical initiatives that would assist land managers in the sustainable management of forest ecosystems and their services as commercial demand rises (Jones and Lynch 2007). Ros-Tonen (2000) pointed out that the harvesting of NTFPs should be included in land-use planning and policy formulation; the sustainable management of NTFPs calls for identifying the purposes of their production and development; and the social, economic, and environmental contexts are essential in these processes.

Among the Nuxalk First Nations in Canada, the management and utilization of as well as values associated with forests have changed to suit modern times; while the forest ecosystems are used to obtain resources for shelter, transportation, household uses, cultural activities, and medicinal purposes, such traditional uses have

declined due to the onset of Westernization (Bull et al. 2014). The protection of forest ecosystems and their services is now pursued alongside adaptation to current social, economic, and environmental conditions, which include developing new goods and services to sustain their livelihoods, developing better housing, and using energy with minimal adverse effects on the environment (Bull et al. 2014). This example demonstrates how the combination of diverse knowledge systems can improve the effects of NTFPs production on communities and the ecosystems on which they rely on. It corroborates the need for better partnerships between and among indigenous and local communities, scientific communities, and government institutions to identify and implement effective management practices that benefit both people and the environment (Ticktin 2004).

To strengthen the resilience and sustainability of forest communities, indigenous and local communities should have substantial opportunities to participate in policy formulation and decision-making, which can lead to efficient and effective co-management (Diver 2017; Mantyka-Pringle et al. 2017). As Charnley et al. (2007) suggested, the constraints that limit the integration of local ecological knowledge in forest management should be overcome, especially since management and conservation efforts will be more successful if the holders of such knowledge are directly and actively involved. It is crucial to grasp how indigenous and local communities co-produce knowledge, explore avenues through which they can participate in science-policy deliberations by connecting their knowledge systems, and provide them with the resources they need to do so (Diver 2017). As Chirenje et al. (2013) found, the participation of indigenous and local communities was successful when the community members were involved in pertinent decision-making roles, such as natural resources managers, instead of merely being considered as cooperating users.

6.1.2 Traditional Knowledge (TK)

In existing literature, TK is often defined as knowledge transmitted through generations (Curci 2010). This broad, conventional definition pertains to knowledge that is acquired from long-established practices and traditions of particular indigenous, local, or regional communities (Finetti 2011), which should be considered in the management of different local environments (Marques et al. 2016). TK systems strive for the sustainability of resources for future generations, value the relationships among people and between people and their natural environment, uphold cultural identities, safeguard benefit-sharing among people in the community, and place restrictions on market exchange (Parrotta et al. 2016). The holders of TK, which may not be available in written form, share it among community members. However, government-established statutory legal systems have prevailed over customary laws, including those relating to TK, developed by indigenous and local communities (Chun 2014). In these systems, legal and economic evaluations of such knowledge pose complications (Van Overwalle 2005).

Academic discourses on TK and its contribution to the utilization and management of biodiversity and genetic resources have been rapidly published, particularly since the end of the 1990s (cf. Von Lewinski 2008; Talaat 2013). At the landscape level, TK plays a critical role in the management of lands, including common lands (cf. Secretariat of the Convention on Biological Diversity 2011). However, it is a highly contested concept in terms of human and intellectual property rights. Awareness on and recognition of the significance of TK, along with efforts to strengthen and preserve it (Maffi and Woodley 2010), have been increasing since the adoption of the Convention on Biological Diversity at the United Nations Conference on Environment and Development in 1992. At risk of exploitation for commercial purposes and misappropriation or biopiracy, TK should be protected because indigenous and local communities have substantially contributed to the conservation and preservation of biological and genetic resources, and their knowledge is crucial to the sustainability of such resources (Verma 2004). Hence, it is essential to properly define and classify TK and consider its legal protection (Finetti 2011).

TK may contain new content that is acquired, utilized, and transmitted through traditional means. Indigenous communities, which largely depend on land and water resources for their survival, need knowledge from a range of sources to understand changes in the environment and impede the consequences of mounting stressors on ecosystems and their services (Mantyka-Pringle et al. 2017), especially since the resilience of a socio-ecological system is based on its ability to respond to change by assimilating new information (Reyes-Garcia et al. 2014). For instance, the preservation of TK and the inclusion of modern knowledge are primary factors in home gardeners' evolving agricultural knowledge, which adapts to changes in socioeconomic and environmental conditions (Reyes-Garcia et al. 2014).

The erosion of TK threatens indigenous and local communities across the globe. It adversely affects how they manage forests and connected ecosystems, alters the ability of forests to supply goods and services, and contributes to loss in biodiversity (Ouédraogo et al. 2014), which consequently influence their socioeconomic conditions. For example, in Ifugao Province in the Philippines where the hotspots of biocultural diversity in Asia are located, the local agricultural systems are strongly shaped by the migration of females who undertake employment outside their rural communities (McKay 2003). There exists an intergenerational erosion of TK related to forests (Camacho et al. 2016). With greater and more lucrative academic and professional opportunities in urban areas, younger individuals become less interested in rice cultivation, TK, and associated practices that have benefitted their rural communities for many years (Castonguay et al. 2016). Without people to absorb and retain TK from older generations, the number of TK holders will decline, and important knowledge will eventually disappear.

The combination of different knowledge systems, such as TK and scientific knowledge, will enhance adaptation to new social, economic, and environmental stressors in SEPLs. It will also strengthen ties among different actors or agents, and in turn increase the frequency and improve the quality of knowledge transmission. Recognizing the value of diverse knowledge systems will positively influence the

application of sustainable development strategies (Cetinkaya et al. 2012). The dearth of knowledge on mechanisms to cope with new environmental pressures, despite the presence of TK, can also be detrimental to ecosystems and the people depending on their services. For instance, in the municipality of Banaue in Ifugao Province, there is limited knowledge on preventing and eradicating new invasive alien species (Castonguay et al. 2016).

TK is commonly interpreted to comprise both aesthetic and useful elements, as well as literary, artistic, or scientific creations. It includes the expression of folklore in the form of music, dance, song, handicrafts, designs, stories, and artwork; elements of language; knowledge of agriculture and forestry (the focus of this chapter); and medical knowledge (WIPO 2001; Leistner 2004; Van Overwalle 2005). Such knowledge is sometimes subdivided into three classes: traditional medical knowledge, traditional agricultural knowledge, and traditional ecological knowledge (WIPO 2001). However, some scholars reject such subdivisions because they artificially disaggregate components of a single reality (Cottier and Panizzon 2004).

Developed through trial and error in dynamic local ecosystems, TK is difficult to convey through lectures in schools or museums because the knowledge has to be dynamically changed and applied. According to Polanyi (1966), there are two types of knowledge: (1) subjective and empirical tacit knowledge, and (2) objective and theoretical explicit knowledge. The former, which is embedded in individual experience, is difficult to articulate using formal language, such as, explaining how to ride a bicycle (Byosiere et al. 2010). Considering these characteristics of TK, channels for knowledge transfer should be analyzed to identify relevant dynamic processes of transmission.

6.2 Materials and Methods

Studies conducted in two research sites in Japan will be discussed in this section: (1) a case of apiculture in Nagano Prefecture, and (2) a case of Shiitake mushroom production in Ishikawa Prefecture (Fig. 6.1).

6.2.1 Case Study on Apiculture

6.2.1.1 Research Site

Nagano is known as the largest producer of honey in Japan (Fig. 6.2). It has a diverse topography that includes mountainous areas and flatlands with rivers. The beekeepers in Nagano, who tend to live in rural rather than urban areas, are able to engage in beekeeping for a relatively long period within a year. They bring their beehives from low-lying areas to the highlands with different temperatures to find nectar sources as the seasons change.

Fig. 6.1 Research sites: Nagano and Ishikawa, Japan

Fig. 6.2 Bottled honey produced in Nagano

6.2.1.2 Methods

A questionnaire survey was used to determine the information channels and productivity of individual beekeepers. A copy of the questionnaire was mailed to each of the 280 members of an association of beekeepers in Nagano. Before the survey, the authors discussed the purpose and scope of the research with the respondents. This was done in person during the annual meeting of the association in January 2017. Upon receipt of the completed questionnaires, the responses were recorded and the results were analyzed using statistical methods, focusing on the relationship between the productivity of beekeeping and information channels. For instance, the relationship between information channels, such as parents and friends, and the number of bee colonies of individual beekeepers were examined.

Chi-square tests were performed to establish the statistical significance of the relationship between the productivity of beekeeping and information channels. To apply the chi-square test to the dataset, the respondents were categorized into two groups based on medians of indicators of productivity. The respondents with higher indicator values comprised one group, while the respondents with lower indicator values comprised another group. The indicators related to productivity were (1) number of bee colonies, (2) years of experience, (3) years after obtaining the relevant knowledge, and (4) experience of using unique ecological methods of beekeeping. For instance, regarding the number of bee colonies, one group was composed of respondents with more bee colonies than the median, and another group was composed of respondents with fewer bee colonies than the median.

6.2.2 Case Study on Shiitake Mushroom Production

6.2.2.1 Research Site

Ishikawa, which is located in the temperate zone in Japan, has a humid climate that is conducive to the growth of mushrooms (Figs. 6.3 and 6.4). Shiitake mushroom production is either raw or dry. In 2011, raw Shiitake mushroom production in the Ishikawa was 828 kg. Sawdust-cultivated mushrooms accounted for 776 kg, representing 94% of total production, while dried mushrooms accounted for less than 20 kg. In the last decade, the production of raw Shiitake has been stable at 800–900 kg annually, while the amount produced on logs decreased compared to the amount produced on sawdust. Cultivation on logs represented more than 30% in 2001, while it was less than 10% in 2011. The shift from log cultivation to sawdust in Ishikawa reflects a national trend. The prefecture is divided into five regions, with the Minami-Kaga region producing the largest share of raw Shiitake mushrooms, which are mostly shipped to Kyoto. The central region is the most productive in terms of log cultivation due to its climate. Historically, the municipality of Tsubata-cho in the central region is known for log cultivation, with its raw Shiitake mushrooms shipped to the nearby city of Kanazawa.

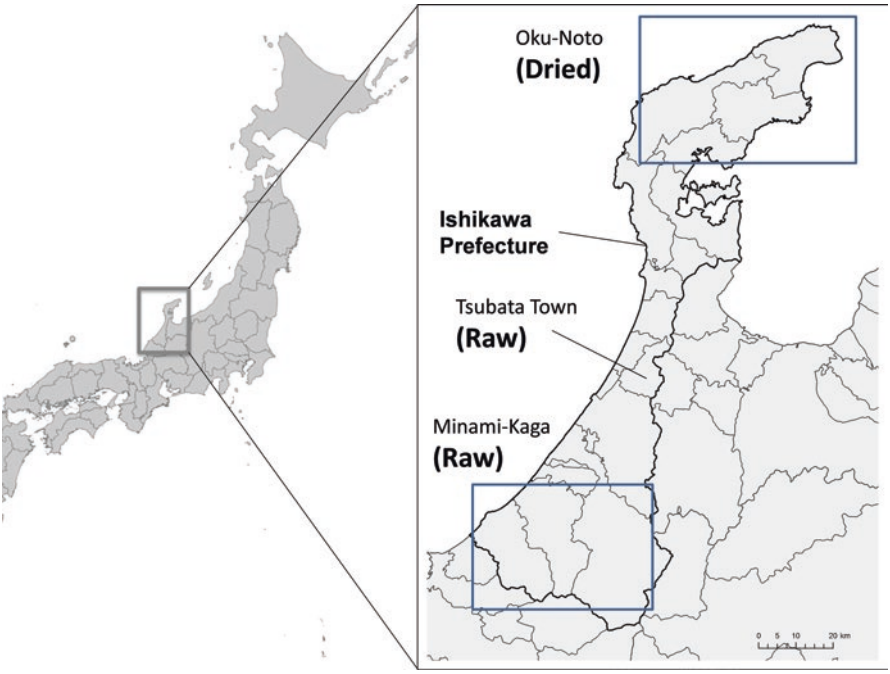

Fig. 6.3 Main production areas of Shiitake mushrooms in Ishikawa

Fig. 6.4 Shiitake mushrooms production in Ishikawa

6.2.2.2 Methods

Trends in the amounts produced by and the productivities of new and conventional farmers were investigated and analyzed to determine the baseline productivity of Noto-Temari, a new brand of Shiitake mushroom. Included in the assessment were 17 conventional farmers and 38 new farmers. The data of all 55 farmers were provided by the Oku-Noto Shiitake Promotion Group. All available datasets were analyzed. Hence, since a sample survey was not applied, the results are presented without statistical analysis.

Two sets of stakeholders were surveyed from July to December 2013: (1) the person in charge of the Oku-Noto Shiitake Promotion Group, and (2) mushroom farmers in Oku-Noto. Eight farmers, three of them new to the business and five engaged in conventional farming, were interviewed. The survey was carried out mainly to identify who taught the stakeholders mushroom cultivation methods and the techniques they used, and how many years they had been cultivating mushrooms. New skills employed to grow Noto-Temari, differences between new and conventional cultivation techniques, and methods for shipping mushrooms were analyzed based on the resulting data.

6.3 Results

6.3.1 Apiculture in Nagano

Among the 280 members of an association of beekeepers in Nagano, 153 members completed and returned the questionnaires. More than half (51%) of the respondents were above 70 years of age.

Chi-square tests showed that the percentage of respondents who obtained beekeeping knowledge from different information channels was statistically and significantly different between the higher group and the lower group for indicators 1–3 at 5% level of significance (Figs. 6.5 and 6.6). There was no significant difference between the two groups for indicator 4 at 5% level of significance (Fig. 6.6).

For indicator 1, the percentage of respondents who obtained beekeeping knowledge from parents or relatives and self-learning was higher in the higher group than in the lower group. These respondents tended to own a relatively larger number of bee colonies. On the other hand, the percentage of respondents who obtained beekeeping knowledge from friends was lower in the higher group than in the lower group, although the percentage of those respondents was relatively higher in the higher group for this channel when compared to other channels of transmission. In terms of household income share of beekeeping, the respondents who obtained beekeeping knowledge through self-learning tended to have a relatively higher share from beekeeping in their household income. This was similar to the share from beekeeping in the household income of respondents who obtained beekeeping

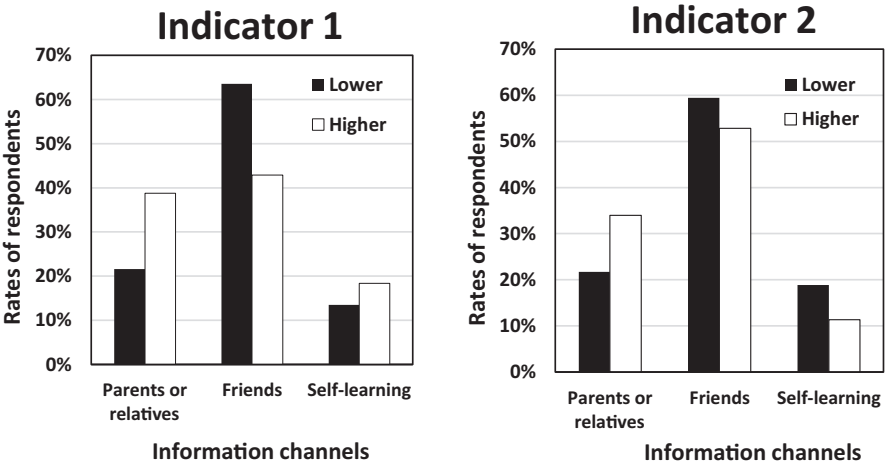

Fig. 6.5 Rates of respondents with different information channels in the higher group and the lower group for (1) number of bee colonies and (2) years of experience

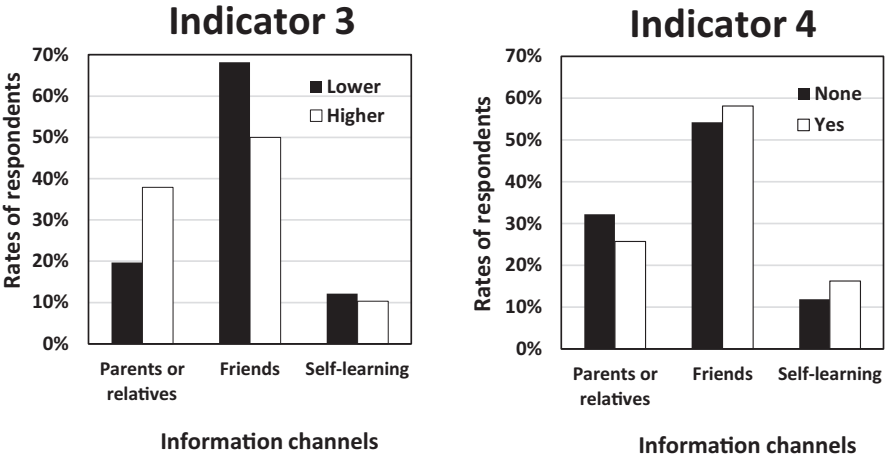

Fig. 6.6 Rates of respondents with different information channels in the higher group and the lower group for (3) years after obtaining the relevant knowledge and (4) experience of using unique ecological methods of beekeeping

knowledge from parents or relatives, in both higher and lower groups, although they had a relatively larger number of bee colonies. Hence, beekeeping knowledge obtained from parents and relatives does not automatically signify that a household will specialize in beekeeping.

For indicators 2 and 3, the results were similar. The analysis revealed that the years of beekeeping experience and the years after obtaining the relevant knowledge were not statistically independent of the information channels. The respondents

who obtained beekeeping knowledge from parents or relatives tended to have a higher number of years, both of beekeeping experience and after obtaining the relevant knowledge. These results suggest that individuals whose parents or relatives are beekeepers can acquire the relevant knowledge at a young age.

For indicator 4, there was no statistical and significant difference in the percentage of respondents who obtained beekeeping knowledge from different information channels between the higher and lower groups because the results were similar. This implies that all respondents endeavored to develop unique ecological methods for beekeeping. Regarding the question, which asked about the beekeepers' attitudes toward sharing beekeeping knowledge, the responses revealed that a vast majority (81%) of the respondents were willing to share their knowledge. This suggests that beekeepers in Nagano tended to share their experience-based beekeeping knowledge.

Overall, the results for indicators 1–4 indicate that the type of information channel through which knowledge is transmitted and shared influences beekeeping productivity, including the number of bee colonies and the household income share from beekeeping. The respondents who obtained beekeeping knowledge from parents or relatives had a relatively larger number of bee colonies, while those who obtained such knowledge through self-learning tended to have a relatively higher share from beekeeping in their household income. However, as the results suggest, all respondents sought to adhere to ecologically sound beekeeping practices.

6.3.2 Shiitake Mushroom Production in Ishikawa

Farmers and private enterprises in Ishikawa coexist in mushroom production. Dried and raw Shiitake mushrooms (*Lentinula edodes*), which are cultivated either on logs or on mushroom beds using sawdust, are sold in the market. It could be assumed that farmers of dried Shiitake mushrooms who have been engaged in the craft for a long period (hereafter referred to as "conventional mushroom farmers") are more skilled in mushroom production than farmers who are new to the process. However, as the findings of this study revealed, this is not necessarily the case. The knowledge and technique used to produce dried Shiitake mushrooms appeared to interfere with the application of new knowledge and methods to produce Noto-Temari mushrooms. The conventional mushroom farmers, who acquired Shiitake mushroom production knowledge and practices from personal experiences during the post-war period, simplified, leveraged, or skipped traditional processes to produce Noto-Temari mushrooms. The resulting Noto-Temari production knowledge includes when and how to turn the logs or plant the mushrooms.

Table 6.1 summarizes the transmission of knowledge and techniques used at different points in the cultivation of Shiitake mushrooms. Based on interviews with farmers and staff members of prefectural extension services, the conventional mushroom farmers who produced dried Shiitake mushrooms tended to apply these protocols for growing raw Shiitake based on their experience and intuition, especially in deciding which process to disregard or simplify.

Table 6.1 Transmission of knowledge and techniques used to cultivate Shiitake mushrooms (Kohsaka et al. 2015)

No.	Farmers	Person who taught the technique associated with raw Shiitake cultivation	Point during cultivation when technique is applied	Current adviser for cultivation	Logs	Years of cultivation of raw Shiitake (Years of that of dried one)
1	New	Kinoko Center	Quantity of sprinkled water	Senior farmer and Kinoko Center	1150	2
2	New	Kinoko Center	Supply bed-logs	Kinoko Center Workshop	3000	3
			Management in the summer			
3	Old	JA and Kinoko Center	Preparing bed-logs	Kinoko Center	15,000	36 (36)
4	Old	Kinoko Center		Kinoko Center Market	3000	46 (46): inherited from his father
5	Old	JA and Kinoko Center	Reserving logs	None	30,000	40 (40)
			Harvesting at the optimal time			
6	New	Kinoko Center	Transporting bed-logs	Senior farmer	4000	4
7	Old	Kinoko Center	Optimizing timing of inoculation	None	12,000	30 (30)
8	Old	–	Covering with a bag	None		(28)

For 40 years, the Japan Kinoko Research Center Foundation has been the major player in Shiitake mushroom production in the Oku-Noto region. As such, the conventional mushroom farmers had a high level of trust in the Foundation, whose advisers frequently visited them and offered advice. The findings suggest that the experience and intuition of the conventional mushroom farmers appeared to interfere with the need to follow standard protocols when producing the new Noto 115 and Noto-Temari mushrooms. In this case, the experience of previous Shiitake mushroom producers posed disadvantages to the production of the new mushroom brands. This can be attributed to differences in attitudes toward absorbing new knowledge and methods under the supervision of advisors from the Foundation. On the other hand, newcomers were better at accepting advice and following instructions since they were more open to new production technologies. This enabled them to meet the quality criteria for Noto 115 and Noto-Temari mushroom production. Knowledge and techniques imparted by the Foundation have shaped regional changes in mushroom production (Matsuo 2010).

In this case study, two types of knowledge and technology were applied in mushroom production: modern and traditional. "Modern" knowledge and technology refer to the technique of cultivating raw Shiitake mushrooms, particularly Noto 115 and Noto-Temari. "Traditional" knowledge and technology refer to dried mushrooms and the procurement of logs. However, the term "traditional" does not necessarily mean that the knowledge is old, outdated, or no longer used. For instance, the results revealed that the new farmers were eager to absorb "traditional" knowledge and technology in dried Shiitake mushroom production because such were necessary to ensure successful production. Conversely, some of the conventional mushroom farmers supervised by the Foundation were unsuccessful in producing raw Shiitake mushrooms. Among them, many had decades of experience producing dried mushrooms and were skilled at log procurement and handling dried Shiitake mushrooms.

Based on these results, "traditional" knowledge and technology appeared to interfere with the assimilation of "modern" knowledge and technology for cultivating raw Shiitake mushrooms. Conventional mushroom farmers tended to follow their own experience and intuition, especially in deciding which process to disregard or simplify. It is likely that these omissions impeded production that adhered to the quality standards of the new Noto 115 and Noto-Temari brands.

6.4 Discussion

To illustrate the transmission and sharing of knowledge on NTFPs, the utilization of which has relatively minimal repercussions on forest ecosystems and thus supports the associated ecosystem services and protects biodiversity (Ros-Tonen 2000), honey and mushroom production in unique regional environments were examined. The results of the two case studies presented in this chapter echo the conclusion of Bogale (2009) that developing the relevant socio-ecological environment is a challenge in facilitating knowledge transmission and sharing.

Local foods that depend on ecosystems play an important role in the communities where they are produced; for instance, in an ethnobotanical survey of wild edible plants in two rural areas in Cyprus, where the local communities relied mainly on agriculture and pastoralism, the transmission of TK on folk uses of plants had declined (Della et al. 2006). Hence, using the Cyprus study as an example, the transmission and sharing of TK should be prioritized to sustain beekeeping and the availability of honey. Tacit ecological knowledge should be converted to explicit ecological knowledge for the benefit of future generations. Addressing this issue has the potential to strengthen local beekeeping communities' capacity for the sustainable management of forest ecosystems and their services (Park and Youn 2012).

As the case study in Nagano showed, the type of information channel used for knowledge transmission and sharing influences beekeeping productivity. For instance, it is likely that using knowledge obtained from interpersonal information channels, such as family members, could lead to a larger number of bee colonies,

while applying knowledge obtained through self-learning could correlate to the household income having a high share from beekeeping. The transmission and sharing of beekeeping knowledge become more efficient and effective when the type of information channel used suits the current context, background, needs, and goals of the beekeeper. Developed through trial and error in dynamic local ecosystems, TK is difficult to convey through lectures in schools or museums because the knowledge has to be dynamically changed and applied. Many beekeepers rely on their TK rather than scientific knowledge to implement sustainable beekeeping in a region (Bogale 2009). However, it should also be acknowledged that the combination of TK and scientific knowledge can increase the adaptive capacity of SEPLs to a host of old and new stressors.

Regarding "traditional" tacit knowledge, tacit knowledge is embedded in a personal context and frequently transmitted informally (Huang et al. 2015; Martini et al. 2014). In the case study in Ishikawa, the conventional mushroom farmers acquired tacit knowledge through their personal experiences, such as the production of dried Shiitake mushrooms during the post-war period. Explicit local knowledge related to wild edible plants is transmitted *in situ* through oral communication, and this knowledge is rapidly disappearing due to various factors, including acculturation and degradation of ecosystem quality (Barreau et al. 2016). The resulting Noto-Temari production knowledge includes when and how to turn the logs or plant the mushrooms. The new mushroom producers' successful production of Noto-Temari, in contrast to the output of conventional mushroom farmers, shows how different knowledge systems operate. In this case, "modern" knowledge was shared to the conventional mushroom farmers, but their TK on dried Shiitake mushroom production limited their capacity to assimilate new knowledge and methods, which was disadvantageous to the standardized production of the new Noto 115 and Noto-Temari mushrooms. Such deeply ingrained TK systems can interfere with the absorption of other production knowledge systems.

6.5 Conclusion

Using two case studies on apiculture and Shiitake mushroom production, this chapter explored the status and trend of the transmission of knowledge on NTFPs in SEPLs in Japan. It also examined the factors, including motivations and incentives, which are critical in establishing knowledge systems that facilitate the sustainable management of ecosystems and their services amid changing social, economic, and environmental conditions. By understanding these elements and processes, relevant policies and activities could be developed and implemented.

The case study on apiculture in Nagano illustrated that ecological knowledge should be transformed from tacit to explicit. This can be achieved by strengthening interaction among beekeepers and encouraging them to share TK and practices on apiculture, which they presently tend to do within their respective families who have relatively large numbers of bee colonies. The case study on Shiitake mushroom

production in Ishikawa revealed a particular system of knowledge transmission in which traditional mushroom producers' production knowledge and experience limited their openness and ability to adopt new production techniques. This case demonstrated the need to combine TK and modern knowledge to help mushroom producers deliver products that meet the quality standards of the new Noto 115 and Noto-Temari brands.

Numerous studies across the globe have confirmed the erosion of TK, along with cultural identities, practices, and beliefs, due to commercialization, evolving lifestyles, changes in the natural environment, and the promotion and prioritization of modern scientific knowledge in natural resource management. In general, rural areas with high aging rates and depopulation are at risk of disappearing, threatening the existence of embedded TK. In Japan, the transformation of knowledge from tacit to explicit is a pressing concern that requires immediate action; with the country's dwindling population and aging society, knowledge sharing on NTFPs production and related ecosystem services should be emphasized in SEPLs. Context-appropriate and stakeholder-specific channels for knowledge transmission should be identified and developed to facilitate, maintain, and reinforce diverse knowledge-sharing schemes and retain the embedded TK in SEPLs.

Activities that facilitate the transmission and sharing of TK, in this case ecological knowledge on NTFPs, can help local communities adapt to changes in their environment, reduce anthropogenic pressures on ecosystems, and maintain their livelihoods. As a result, SEPLs will be more resilient to a multitude of social, economic, and environmental stressors. Sustaining diverse knowledge systems to achieve mutually beneficial human-environment relationships, prevent the overexploitation of natural resources, promote biodiversity conservation, and determine new methods to efficiently manage SEPLs is fundamental to the Japanese concept of *satoyama*.

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Chapter 7
Can New and Traditional Sharing Practices Be Integrated? The Case of Use of Natural Resources in Palau, Micronesia

Akiko Iida, Yasukazu Hama, and Christopher Kitalong

Abstract The shared economy features a wide gap between the new digital sharing phenomenon and traditional communal sharing practices. This study examines the value of traditional sharing practices and discusses how new digital technologies can harness it. The study examines the use of marine and terrestrial natural resources through subsistence activities over 10 years in the Republic of Palau, Micronesia, and compares their frequency with the use of digital devices. The results show that the frequency of subsistence fishing, farming, and collecting has not substantially changed over 10 years in either urban or rural areas and that there is no relationship between the frequency of subsistence activities and digital technology use, despite the rapid spread of mobile devices. These findings indicate that nonmarket-based subsidence economies that rely heavily on local natural resources have not been completely replaced by a globalized monetary economy. Traditional practices in Palau use common natural resources and hand down the practical and empirical knowledge required to manage them in sustainable ways. Despite the many changes brought by external influences, these traditional communal sharing practices are still rooted in Palauan culture. This culture of sharing is the medium that sustains the healthy relationships between humans and ecosystems and can play a key role in building climate change resilience. It is thus desirable to employ the new digital technologies to pass traditional communal sharing practices down to future generations rather than just use them to do what they are used for in industrialized countries.

Keywords Communal sharing practices · Natural resource · Subsistence activity · Resilience · Palau

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7.1 Introduction

Sharing resources, goods, services, experiences, and knowledge is a fundamentally human activity (Chap. 1 of this book). New sharing practices, such as Airbnb and Uber, that use information and communication technologies (ICTs) have emerged as popular social phenomena in modern industrialized countries.

In many cases, however, there is a wide gap between the new digital sharing phenomena and traditional communal sharing practices. The sharing of food is an example. Traditional food sharing involved practices such as jointly managing common natural resources, gifting or bartering foods, holding festivals to wish for a good harvest or a good catch, and inheriting knowledge and experience about the use of natural resources. Such sharing practices related to primary production are not common among contemporary urban dwellers, who instead procure almost all of their food in grocery stores or supermarkets. However, new ICT-based food-sharing activities are appearing in modern cities, such as food-sharing applications for reducing food waste and databases of community gardens that frequently utilize unused or abandoned land (Davies et al. 2017). These systems are being created to resolve modern urban challenges such as food loss and to devise new urban food systems. Despite having similar goals, there is still a wide gap between these new digital sharing phenomena and traditional communal sharing practices.

Unlike industrialized countries, developing countries may be able to create an environment where modern and traditional sharing practices coexist. Industrialized countries' sharing culture and circumstances are the result of the constant technological advances since the Industrial Revolution. In developing nations, however, some regions have gained access to the latest technologies immediately, without segueing from older technologies. In Western Europe, for example, 100 years elapsed from the invention of the telephone to the spread of smartphones, whereas in some developing nations, smartphones spread instantly to remote areas where fixed telephone lines had never been installed. This revolutionary spread of new advanced technology in developing nations is called the "leapfrog effect" (Fleming 2003). This quick introduction of technology has created a unique phenomenon: the coexistence of new technologies with traditional customs and lifestyles.

What roles do traditional communal sharing practices play in societies affected by the leapfrog effect? Would it be possible to develop an integrated sharing culture that, unlike in homogenous industrialized countries, hybridizes traditional communal practices with new ICT-based practices?

This study addresses the above questions by examining the contemporary value of traditional sharing practices, bridging the gap between new and old. This work uses a case study on ecosystem services and sharing practices conducted in the Republic of Palau, in the Micronesian island chain. The study also explores the possibility of hybridizing new digital technologies and traditional communal sharing practices to build climate resilience in the Pacific Islands, which are susceptible to climate change (UNFCCC 2005; Wang et al. 2017).

7.2 Method

7.2.1 Study Area

Palau is a small isolated island country on the westernmost edge of Micronesia in the Pacific with a population of 17,661 (according to the 2015 population census) and a total area of 456 km^2, divided into 16 states. Figure 7.1 shows the location of Palau and the stretch of the islands. Palau's climate is temperate and rainy throughout the year, with an average air temperature slightly higher than 28 °C and annual rainfall of 3800 mm, contributing to high marine and terrestrial biodiversity. Palau has over 1389 plants, including 802 native plants and at least 150 endemic plants (Kitalong 2008), as well as 130 fungi, an estimated 5000 insects, 92 snails, 46 reptiles and amphibians, 47 freshwater fish, and 141 birds (Kitalong et al. 2008). It also has about 400 species of coral reefs and more than 1200 species of reef fishes (Golbuu et al. 2005).

Palau's main local industry is tourism, which takes advantage of its rich ecosystems and biodiversity. Since Palau gained its independence from the United States in 1994, tourism has developed as the main industry. The Rock Island Southern Lagoon was designated a world heritage site in 2011 and attracted many tourists. About 85,000 tourists visited Palau in 2005; this number doubled within 10 years, to 169,000 by 2015 (Republic of Palau 2016). The flourishing tourist

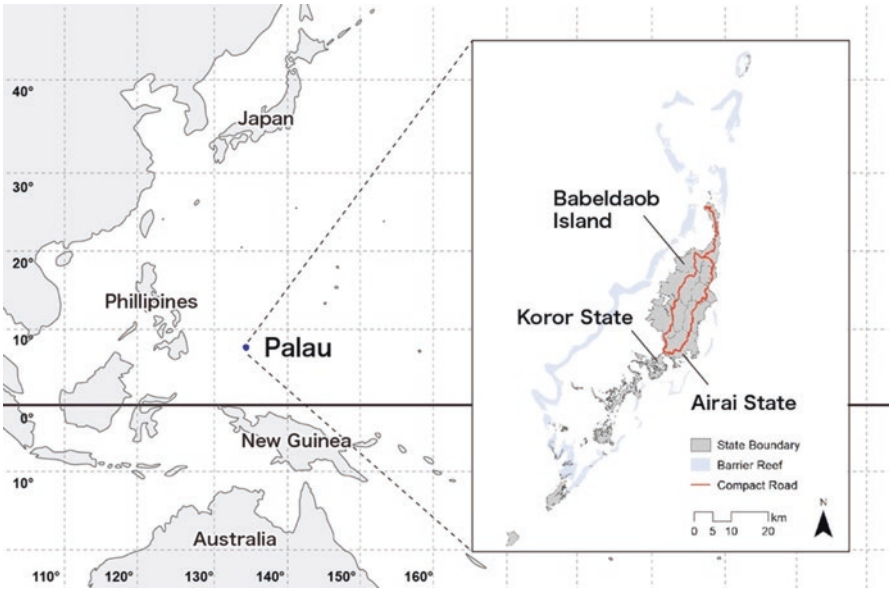

Fig. 7.1 Location of Palau

industry has been accompanied by economic growth, raising the GDP per capita from about US$10,000 in 2005 to US$14,000 in 2015, the third highest in Oceania after Australia and New Zealand (World Bank 2018). Though trade-offs between tourism development and environmental degradation are inevitable, the government has been trying to protect both marine and terrestrial ecosystems in various ways, such as collecting an environmental tax (the Green Fee) and building Protected Area Networks (Iida and Take 2015).

Among Palau's 16 states, Koror State is an urban economic center, with a population of 11,444 in 2015 (approximately 65% of the population of the country). Koror state is also the tourist center of Palau; the majority of tourists stay in the state. As shown in Fig. 7.2, Koror has the highest concentration of homes, commercial buildings, and hotels in the country. Overflow from Koror to Airai State on Babeldaob Island, linked directly by a bridge, is significant, leading to an expansion in population and urban land use.

The other 14 states comprise mostly farm villages and have populations under 500. On Babeldaob Island, the largest island in Palau, a circular highway called the "Compact Road" was completed in 2007, greatly improving access to Koror. As a result, small-scale ecotourism is now conducted in some states, and the size of the commuter community is gradually increasing. Those changes have impacted the daily lives of the residents in agricultural hamlets; however, as shown in Fig. 7.3, they are still surrounded by a natural environment.

Fig. 7.2 Urban area (*Koror State*)

Fig. 7.3 Rural area (*Ngaraard State*)

7.2.2 Survey Method

The sharing ecosystem services in Palau were initially reviewed based on previous surveys on land and natural resource use (Iida 2012). Both the marine and terrestrial ecosystems are equally important for traditional life in Palau, and the village structure is based on interconnected ridge-to-reef ecosystems. This study takes the spatial aggregation, called a "watershed," as the unit of analysis to discuss how communities utilize the ecosystem services and sharing practices ongoing in this watershed area.

Next, the study investigates the use of natural resources based on two intensive surveys conducted earlier. One survey consisted of a questionnaire about the status quo and changes in natural resource use through subsistence activities such as fishing, farming, and medicinal herb collection and their relationship with the use of new ICT. The other survey focused on the collection of medicinal herbs because it represents a unique and symbiotic relationship between humans and ecosystems (Iida et al. 2014).

Finally, the contemporary value of traditional communal sharing practices with the use of natural resources and their future prospects are discussed based on the above findings, particularly from a climate resilience point of view.

The methods applied in the two surveys on the use of natural resources are described below.

7.2.2.1 Status Quo and Changes of Natural Resource Use Over 10 Years

Large quantities of imported food products are on the market in Palau, but natural resources are still being consumed by households, even in urban areas, through fishing, farming, and collecting. This study examined the status quo and changes over the past 10 years in the use of such natural resources by households through an in-person questionnaire survey conducted in 2016 and 2017. The 10-year timeframe was used to identify the changes that occurred prior to 2007, when the Compact Road was opened for service on Babeldaob, as well as to investigate the differences that occurred after the spread of smartphones. The survey was first conducted in the urban city center of Koror from June to July 2016 and then in both urban and rural areas in June and July 2017. The results collected information from 159 households: 23 in the urban areas (two states) and 136 households in the rural areas (nine states). Of the respondents, 59 were men and 99 were women (one was unidentified). Their age ranges were as follows: 28 were 18–29, 19 were 30–39, 25 were 40–49, 38 were 50–59, and 47 were 60–69 (two were unidentified). Both surveys were conducted by Palauan high school and college students under the supervision and auspices of the Pacific Academic Institute for Research and the Pacific STEP-UP Program, both based at Palau Community College. The students used tablets and computers to input the data they collected.

The questions concerning natural resource use recorded the frequency of fishing, farming, and collecting at five levels ("Every day," "A few times per week," "About once a month," "A few times a year," and "Never"). The questionnaire was a modified version of a previous trial survey on dietary habits (Nakamura et al., in preparation). Questions were also posed about the frequency of visits to the shopping centers in Koror to purchase food items using the same five levels. Household demographics including data on home location and whether the household used ICTs such as smartphones and the Internet were recorded. The data were compiled, and a χ^2 (chi-squared) test was run to analyze the relationship between the frequency of ICT use and natural resource use. In the χ^2 test, the five levels were reclassified into three levels, for the following reason. The five-level classification did not produce statistically meaningful results because the sample size was limited and the expected frequency was less than five for 20% of the cells. The reclassification into three levels was intended to ensure accurate and meaningful results. Thus, "Every day" and "A few times per week" were combined into "Often," indicating that subsistence activities were rooted in daily life, and "About once a month" and "A few times a year" were combined into "Occasionally," indicating that subsistence activities were not conducted often but only when wanted or needed; "Never" was kept as is.

7.2.2.2 Collection of Medicinal Herbs for Ritual Ceremonies

The study also examined the collection of medicinal herbs for ritual ceremonies. This study focused on a ceremony called *Omesurech*, a Palauan ritual in which a woman giving birth for the first time enters into union with her partner through their first child. A Palauan woman living in Koror State was accompanied by a researcher in September 2010, and every medicinal herb used for her *Omesurech* was documented and georeferenced (recorded using Garmin's GPS, eTrex Legend® HCx) (Iida et al. 2014). Then, the locations where the medicinal herbs grew were investigated.

7.3 Result

7.3.1 Traditional Sharing Practices and Ecosystem Services

Figure 7.4 is a painting of a traditional Palauan village in the early twentieth century drawn by Palauan painter Ado Imetuker. The two buildings with pointed roofs located on the hilltop are interconnected *bai*, traditional meetinghouses for leaders. Stone paths extending from the *bai* connected all of the other houses. In the center of the painting is a taro patch with a stream flowing into it from a river. Starch tubers

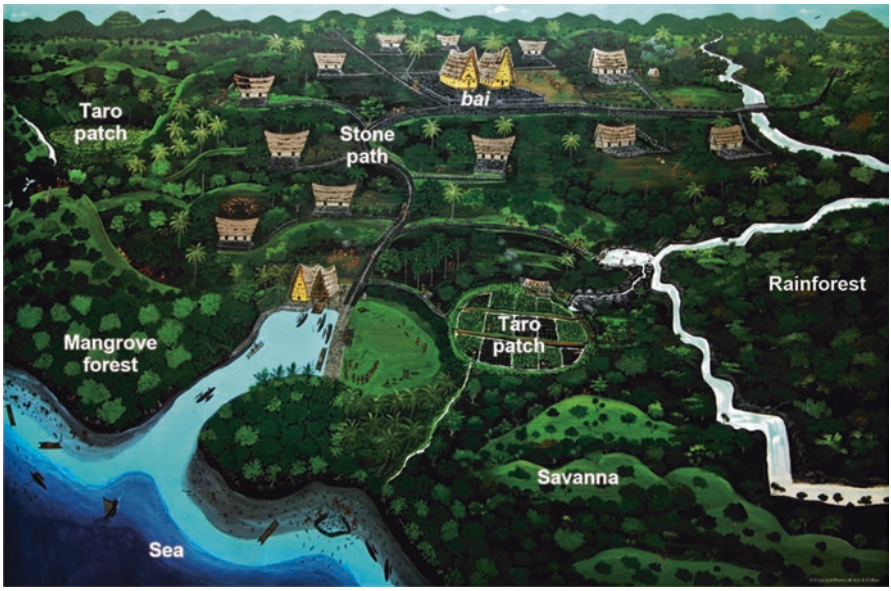

Fig. 7.4 Traditional Palauan village in the early twentieth century. (© Bureau of Arts & Culture, Palau)

were culturally important as a staple food for Palauans as well as other islanders in the Pacific. The environment surrounding the village includes hills behind the village, a shallow ocean, and a river that connects the ridge to the reef. A watershed is an area of land that drains all the rainfall and streams from the land into the ocean. This painting clearly shows that the traditional village is located within a watershed and that the watershed is central to the Palauan way of life.

Figure 7.5 shows a cross section of the watershed from the ridge to the reef and the various ecosystem services it provides. The watersheds of Palau can be classified into four zones based on their socio-ecological characteristics: the lowland forest and savanna zone located upstream; the village and agroforestry zone located downstream; the mangrove forest zone in the intertidal flat; and the coastal zone. Figure 7.6 shows the four zones.

The lowland forest and savannah areas account for more than 80% of the country and are important for bird hunters and collectors. Local communities obtain material benefits from the lowland forest and savanna zones, such as freshwater, medicinal plants, wood, and food (provisioning services). It is an important habitat for birds and insects (habitat or supporting services), and the forest prevents soil erosion and retains soil fertility (regulating services). Recently, the lowland forest, savanna, and waterfall areas have been attracting tourists seeking recreational activities such as hiking and bird watching (cultural services).

Palauans traditionally live in the villages and agroforestry zones located in downstream areas. Various types of fruit, vegetables, starches, and other useful plants are cultivated using mosaic agroforestry elements such as taro patches, home gardens, fields, and neighborhood forests based on environmental conditions such as water, soil, slopes, and sunshine (provisioning service). Domestic animals are raised around homes, and many kinds of birds and insects also live close to homes (habitat or supporting service). Larger trees planted around the houses create cool

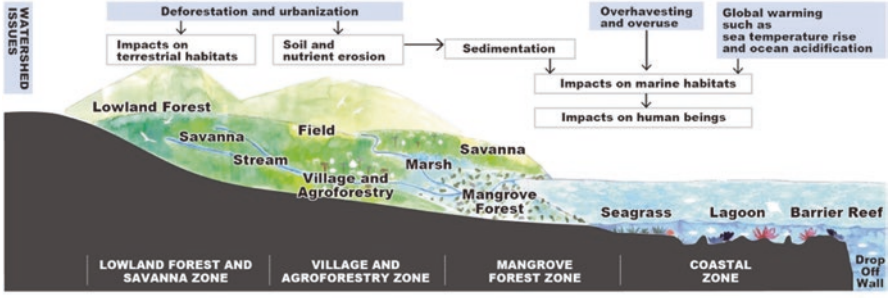

Fig. 7.5 Watershed and ecosystem services. (Iida 2017)

Fig. 7.6 Pictures of lowland forest (top left), savanna (top right), taro patches (middle left), and home garden (middle right) in agroforestry, mangrove forest (lower left), and coral reefs (lower right)

microclimates protecting homes from the strong sunshine of the tropics and also act as windbreakers (regulating service).

Mangroves grow where rivers/streams meet the seawater at intertidal zones that have varying salinity levels at high and low tides. The mangrove forest buffers the land/soil from the high tides, waves, and wind and prevents sediment flow across the reef areas (regulating service). Mangroves are used as building materials because the wood is strong and tolerant to salinity and insect degradation (provisioning service). The interlacing prop roots of mangroves are safe habitats for crabs and small

fishes, act as a nursery for juvenile fish and sea animals (habitat or supporting service), and provide seafood resources for residents (provisioning service). Nature tour experiences such as kayaking in the mangrove forest are also popular activities for visitors to Palau (cultural services).

The coastal zone has an abundant supply of a large variety of reef fishes, shells, and sea cucumbers (habitat or supporting service), and the islanders have traditionally depended on these seafood resources (provisioning service) for their primary sustenance. Barrier reefs form a living barrier that protects the island from large tidal surges, waves, and wind from the ocean (regulating services). Thanks to the barrier reefs and mangrove forests, the inland environment remains calm. The colorful coral reefs and exotic creatures in the ocean attract tourists and researchers, providing a place for recreation, education, and academic research (cultural services).

The natural resources of the lowland forest, savanna, mangrove forest, and the coastal area represent communal spaces. Community members share these natural resources and maintain them based on traditional rules called *bul* and/or legal laws. Each taro patch in the village and agroforestry zone is owned by individual females but may also be considered as a community resource, since women work together to maintain the taro patch, even while just gathering at the site and chatting. These communal activities include maintaining irrigation channels, bartering seeds, and exchanging knowledge based on experience. This traditional communal sharing of resources, goods, exercise, and knowledge is the key to sustaining health ecosystems in small islands with such vulnerable and limited resources (Ueki and Clayton 1999).

These practices have changed from their original form because Palau has experienced colonization by Spain, German, Japan, and the United States from 1885 through to its independence in 1994. The recent growth of the tourism industry has also influenced Palauan lifestyles. However, the use of natural resources through subsistence activities has not been completely replaced by the globalized monetary economy, and communal sharing practices are still evident in daily life. The next section will discuss the status quo of and changes in natural resource use in more detail.

7.3.2 Status Quo of and Changes in Natural Resource Use Over 10 Years

7.3.2.1 Comparison of Frequency of Subsistence Activities

Urban or Rural

This section focuses on the use of natural resources through subsistence activities such as fishing in the coastal and mangrove forest zones, farming in the village and agroforestry zones, and collecting medicinal herbs in multiple zones. A cross-tabulation and χ^2 (chi-squared) test of the frequency of each activity for household

consumption, resident location, use of mobile devices and the Internet, and resident age were run on the data described below. Tables 7.1, 7.2, and 7.3 show the results of these analyses.

Differences in residence (urban or rural) were found to have significant impacts on the frequency of fishing (P = <0.05), farming (P = <0.001), and shopping (P = <0.05) (see Table 7.1). Fishing and farming occurred less often in urban areas than in rural areas, replaced by a higher frequency of shopping. The impacts of differences in the surrounding environment and lifestyles are seen in Figs. 7.2 and 7.3, respectively.

No significant difference in the frequency of collecting medicinal herbs was found between urban and rural areas. In both areas, about half of the residents had never collected herbal medicines; the other half collected herbs at least a few times a year in both urban and rural communities. This means that the cultural practice of using medicinal herbs survives, even though residents can receive modern medical care at a hospital. This point is investigated in more detail in Sect. 7.3.3.

Use of Digital Devices and the Internet

No significant relationship was found between the use or nonuse of mobile devices and the Internet and the frequency of each subsistence activity, despite the rapid spread of mobile device use (see Table 7.1).

In addition, younger people were found to use smartphones more than older people ($P < 0.001$) and to tend to use the Internet to obtain information ($P < 0.001$; see Table 7.2). They were more accustomed to the modern digital lifestyle. However, there was no relationship between the frequency of each subsistence activity and the ages of respondents (see Table 7.3). As the questions on subsistence activities were about household consumption, these results do not mean that younger people were involved in subsistence activities; it is possible that their parents or grandparents were involved in them and they were not. However, subsistence activities were found to be familiar to younger people, who seemed to eat local fishes, vegetables, and fruits and use local medicinal herbs.

These results indicate that modern advances permitting the use of new digital technologies does not necessarily prevent people from using natural resources. The reasons for this will be considered in Sect. 7.4.1.

Changes over Time

Figures 7.7 and 7.8 summarize the frequencies of natural resource use and shopping over 10 years for urban and rural residents, where a significant relationship with natural resource use was found.

As stated in the introduction, over the past 10 years, the number of annual tourists has doubled, stimulating the economy of Palau. In addition, a circum-island highway opened for service in 2007, improving rural access to the urban center and urban

Table 7.1 Result of cross-tabulation analysis 1

Subsistence activities		Location of residence		χ2	Do you have a smartphone?		χ2	Do you use the Internet to get information?		χ2
		Urban	Rural	(P)	Yes	No	(P)	Yes	No	(P)
Fishing	Never	7	34	7.381	17	22	0.13	9	32	3.237
	Occasionally	11	33	$P = 0.025$	17	24	$P = 0.937$	13	31	$P = 0.198$
	Often	5	67	*	26	39		11	60	
Harvesting	Never	9	37	20.819	23	19	0.578	13	32	5.236
	Occasionally	9	13	$P = 0.000$	14	8	$P = 0.749$	7	15	$P = 0.073$
	Often	4	84	***	49	32		13	75	
Collecting medicinal herbs	Never	11	70	3.284	47	27	1.454	17	63	0.408
	Occasionally	9	30	$P = 0.194$	19	16	$P = 0.483$	10	29	$P = 0.816$
	Often	3	32		18	16		7	28	
Going to shopping centers	Never	3	6	9.475	5	3	3.84	1	8	3.995
	Occasionally	1	45	$P = 0.009$	20	23	$P = 0.144$	6	40	$P = 0.136$
	Often	19	84	**	61	34		27	75	

Occasionally = "A few times a year" + "About once a month," *Often*= "A few times per week" + "Everyday"
$^{***}P < 0{,}001$, $^{**}P < 0.01$, $^{*}P < 0.05$

Table 7.2 Result of cross-tabulation analysis 2

	Do you have a smartphone?		$\chi 2$	Do you use the Internet to get information?		$\chi 2$
Age	Yes	No	(P)	Yes	No	(P)
18–29	26	3	24.790	17	11	34.828
30–39	12	2	$P = 0.000$	4	15	$P = 0.000$
40–49	15	8	***	6	18	***
50–59	18	18		4	34	
60–	17	28		3	45	

$^{***}P < 0{,}001$, $^{**}P < 0.01$, $^{*}P < 0.05$

Table 7.3 Result of cross-tabulation analysis 3

		Age					$\chi 2$
Subsistence activities		18–29	30–39	40–49	50–59	60–	(P)
Fishing	Never	6	7	2	10	16	12.752
	Occasionally	10	3	5	13	13	$P = 0.121$
	Often	12	7	18	15	19	
Harvesting	Never	8	6	9	10	13	6.123
	Occasionally	7	3	3	4	5	$P = 0.633$
	Often	12	8	13	24	30	
Collecting medicinal herbs	Never	11	12	11	20	26	11.292
	Occasionally	13	3	7	7	9	$P = 0.186$
	Often	3	4	7	9	12	
Going to shopping centers	Never	1	0	2	3	3	14.415
	Occasionally	5	7	3	18	13	$P = 0.072$
	Often	22	12	20	17	31	

Occasionally = "A few times a year" + "About once a month," *Often*= "A few times per week" + "Everyday"
$^{***}P < 0{,}001$, $^{**}P < 0.01$, $^{*}P < 0.05$

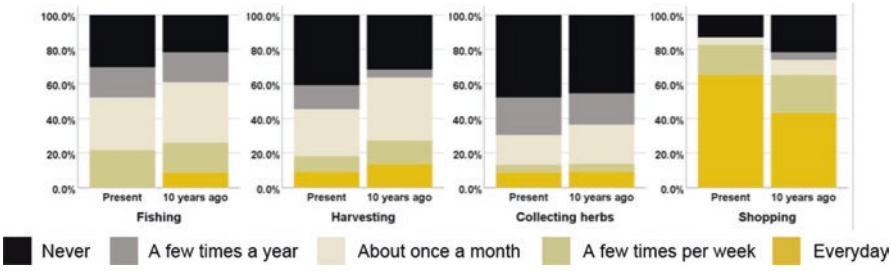

Fig. 7.7 Frequency of natural resource use and shopping in urban areas

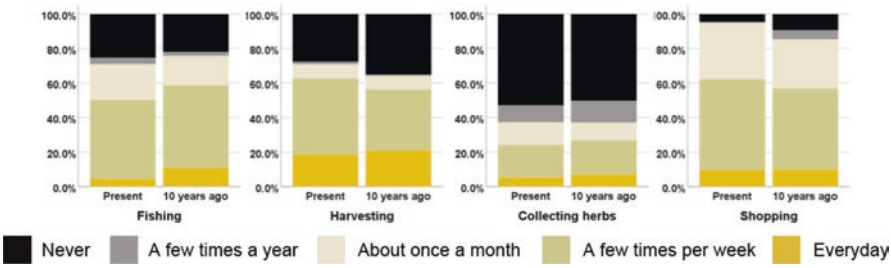

Fig. 7.8 Frequency of natural resource use and shopping in rural areas

dwellers' access to their family farmlands. In spite of such changes, no sudden change in the use of natural resources was observed in either urban or rural areas in the surveys.

A reduced frequency of fishing and farming was seen in the urban areas; however, about 20% of urban residents fished and/or farmed often ("A few times per week" + "Everyday"), and about 50% fished and 40% farmed occasionally ("A few times a year" + "About once a month"). Thus, even among those leading urban lives, a certain number continued subsistence activities for household consumption as part of their daily lives. About half of these residents did not collect medicinal herbs 10 years ago and do not do so now; among the rest, no difference was found between their current frequency and that 10 years ago. On the other hand, the percentage of residents who shop every day increased more than 20%, and they now shop more often. It was also shown, however, that more shopping did not necessarily mean fewer subsistence activities.

No great change in natural resource use was found in rural areas. Although the frequency of fishing fell slightly, about 50% of rural residents fished often, and about 25% fished occasionally. Farming tended to increase; more than 60% of residents farmed often, and 10% farmed occasionally. Medicinal herb collection was almost unchanged; 25% collected them often, 20% did so occasionally, and about half did not do so at all. Shopping frequency increased slightly, but no great difference was seen.

Residents in rural areas showed more natural resource use than urban residents: 30% higher for fishing, 45% higher for farming, and 10% higher for collecting medicinal herbs. The number of urban residents who fished, harvested, and collected occasionally was higher than that of those who did so often.

7.3.3 Collection of Medicinal Herbs for Ritual Ceremonies

This section presents a case study on the collection of medicinal herbs in a Palauan traditional ceremony called *Omesurech*. *Omesurech* is a traditional medical treatment using boiled herbs and steam to treat a young mother who has given birth for

Fig. 7.9 Pictures from the herbal hot bath called *Omesurech*
Upper left: Family member of a young mother collecting medicinal herbs for *Omesurech* in savanna. Upper right: Medicinal herbs such as the flower of *Pandanus* and pitcher plant. Lower left: Medicinal herbs for final hot bath boiled in a big pan. Lower right: Young mother standing in front of her family and relatives in a birth ceremony

the first time, as well as to celebrate the union of two families, equivalent to a marriage ceremony (see Fig. 7.9). To be cleansed and heal, the new mother sits in a room being steamed with a variety of boiled herbs on the last day of the ceremony, called *Omengat*.

The *Omesurech* this study observed continued for 10 days. The young mother and her family live in Koror state but were originally from Airai state. For that reason, the ceremony and the collection of medicinal herbs were conducted in Airai.

For the ceremony, 24 kinds of herbs were used. Figure 7.10 shows the number of medicinal herbs collected. Among the 24 herbs, only 5 were collected on private land, in home gardens in an agroforestry area (see Fig. 7.6, middle right). Three came from her family house, and two were given by a friend and a relative. The other 19 herbs were collected on common land such as taro patches in the agroforestry area (see Fig. 7.6, middle left), neighborhood forest, limestone forest, and savanna (12 herbs came from the savanna).

The home garden, taro patch, and neighborhood forest were in the village and agroforestry zone; the savanna was upstream of the lowland forest and savanna zone; and the limestone forest was on the small limestone islands in the coastal zone. Palauans utilize various environments in both the marine and terrestrial ecosystems for medicinal herb collection. Therefore, the uses of medicinal herbs reflect the intimate and symbiotic relationship between humans and their ecosystems.

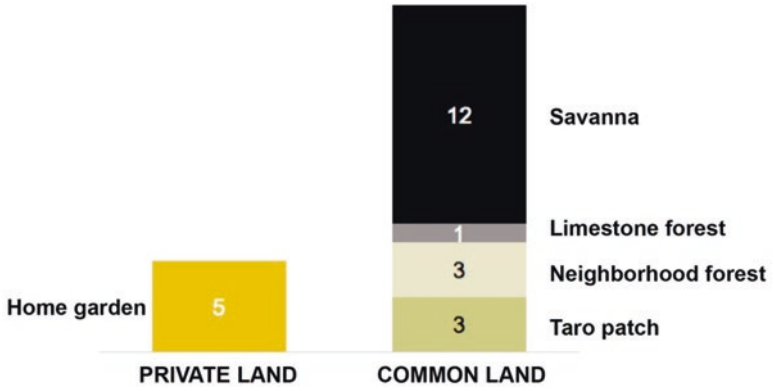

Fig. 7.10 Number of medicinal herbs collected for an *Omesurech* from different environments. (Iida et al. 2014)

7.4 Discussion

7.4.1 Continuity of Subsistence Activity

This study surveyed the use of marine and terrestrial natural resources, focusing on subsistence fishing, farming, and collecting activities in Palau, Micronesia.

The imported food consumed in Palauan households totaled US$25 million in 2007 and US$38 million in 2017 according to Palau's annual economic report. Increasing food imports are affecting Palauan dietary culture. However, this study illustrated that, even with the economic growth led by tourism, subsistence activities are changing relatively slowly in both urban and rural areas. The results showed that about 50–60% of rural residents and 20% of urban residents still fished and/or farmed at least a few times a week. The use of natural resources in rural areas is more directly linked to daily life, while urban residents fish and farm to supplement foods they buy on the market. One reason why urban residents still engage in subsistence activities might be that fish and taro are traditional food and are essential to a traditional Palauan diet but are hard to find in stores; thus, urban residents must get them by fishing or farming or by obtaining these fresh food items from relatives or friends. It is also possible that they engage in subsistence activities purely for enjoyment. Some urban interviewees told us that fishing and/or farming was simply part of life and that they liked to do it for no particular reason. Kito characterized these minor subsistence activities as being in between subsistence activities and recreational activities (Kito 1996).

In addition, it was found that, while about half of urban and rural residents never collected herbal medicines, half collected them at least a few times a year. As with fish and taro, medicinal herbs are rarely sold in stores, so those who need them have

to collect them or get them from relatives or friends. Some traditional medicinal herbs have been replaced by modern medical treatments in hospitals; however, medicinal herbs still play a culturally and socially important role in the contemporary lives of Palauans (Dahmer et al. 2012). As this study showed, for example, local medicinal herbs are essential, and not replaceable, for the *Omesurech*, which all women undergo after giving birth for the first time.

These findings indicate that Palau's nonmarket-based subsistence economy, which relies heavily on local natural resources, has not been completely replaced by a monetary economy, although Palau is highly involved in the globalized market economy. Urban and rural residents still depend on marine and terrestrial natural resources for subsistence activities performed to gain a livelihood, for enjoyment, and to sustain a cultural identity. Contrariwise, most residents in industrialized countries have abandoned subsistence activities; only a few continue them as recreational activities.

7.4.2 Coexistence of New Digital Technology and Traditional Lifestyles

The new digital technology has affected Palauan's lifestyles by reducing activity and creating a heavy reliance on communication/knowledge via handheld mobile devices as opposed to learning from elders. This study has revealed that most young Palauans use mobile devices and obtain information via the Internet rather than from their elders. However, this study also revealed that there was no relationship between the frequency of subsistence activities and the use of mobile devices or the Internet. These findings indicate that modern advances permitting the use of new digital technologies do not necessarily prevent people from using natural resources.

The interviews with local residents revealed that some of them used digital technologies and also enjoyed subsistence activities simultaneously. For instance, some people frequently enjoyed posting pictures of themselves fishing on social media. One person living in a rural hilly area went to the ocean both to fish and to access a faster Internet connection through 3G, as the reception where they lived was poor. Mothers and their relatives also enjoyed posting pictures and impressions of *Omesurech* ceremonies on social media.

The coexistence of new digital technology and traditional lifestyles is an interesting phenomenon, especially in developing nations like Palau. In both urban and rural regions, local communities have been continuing subsistence activities. They have retained their traditional lifestyle because new technologies have jumped into their lives instantly in a leapfrog effect (Fleming 2003). This is a significant difference between them and industrialized societies.

7.4.3 Contemporary Value of Traditional Sharing Practices for Climate Resilience

Subsistence activities use common natural resources. Fishing grounds, taro patches, and forests and savannas where medicinal herbs grow are all shared among communities. The people share practical and empirical knowledge concerning how to manage the natural resources sustainably (Ueki and Clayton 1999). Community members work together to maintain natural resources on land and in the sea and share the knowledge passed down from one generation to another (Kitalong 2017). As this study revealed, traditional communal sharing practices through the subsistence activities are still rooted in Palauan culture. This culture of sharing is a living heritage that has significant value in the contemporary context, rather than just being a relic of the past.

Issues related to climate change have recently become a major concern in the Pacific region. The region's islands are extremely vulnerable to climate change risks such as drought, high tide flooding, sea temperature increases, and ocean acidification. Projections of climate change risks have indicated that the Pacific islands would experience increasingly severe weather (Wang et al. 2017), reduced freshwater availability (Karnauskas et al. 2016), ecosystem impacts (Taylor and Kumar 2016), and increased health risks (Mclver et al. 2016).

These risks must be taken into account. However, climate has always changed over time, and humans have acquired experimental knowledge of how to deal with those changes. For example, Palauan women use a term when talking about taro patches near shore: *soal a daob*. This means "lover of the ocean" (according to personal communication received at Imeong Village in 2012). Some species of taros such as the Giant Taro grow on swampland next to intertidal flats, so some taro patches are affected by saltwater inundation, but Palauan women know how to manage these types of fields. When salt accumulates in a field, the women create an outlet in the field and fill it with freshwater. Salt in the soil then elutes into the water, after which the outlet is opened, and the saline water is pushed out. This increases soil fertility because of the seawater minerals, making the taro tastier. Furthermore, women used to share or barter their seedlings, which helped create new varieties tolerant to saltwater and disease.

These examples indicate that Palauan women have been sharing local knowledge in order to manage land exposed to saltwater. This could play a key role in building climate change resilience at the community level, especially to combat sea level increases and salt infiltration into farmlands.

Since local knowledge has been a central component in conservation and in maintaining the resilience of social-ecological systems (Pretty 2011), it is very important that the knowledge and experiences of traditional communal sharing practices be transferred to the next generation through subsistence activities.

7.4.4 Bridging the Gap Between the New Sharing Phenomenon and Traditional Sharing Practices

The new ICT-based digital sharing economy has spread all over the world, even reaching small islands in the Pacific. Depending on how local communities use the new technology, it can bring both negative and positive effects. On the one hand, it may cause the loss of local cultural activities; on the other, it may help younger generations inherit them.

Because the culture of sharing is the key to building a more resilient society, it is desirable to make use of new digital technologies and sharing economy concepts to pass traditional sharing practices down to future generations, rather than to just introduce them as they were designed in industrialized countries. Several studies have explored the possibility of utilizing ICTs to capture and promote traditional ecological knowledge (Stevens et al. 2013; Danielsen et al. 2017). A similar approach could be possible in Palau. It might also be interesting to integrate new digital sharing economy concepts into the promotion of traditional ecological knowledge—for example, by creating application software (APP) or an online database that local communities could use to post traditional ecological knowledge or eco-cultural tour information such as taro-patch, herbal, or cooking experiences using local foods. Then, anyone, including foreign tourists, could contact the host community and experience it through an ecotour. As tourism is the main industry in Palau, developing such a system could be worthwhile.

Exploring ways to integrate new and traditional sharing practices would create new pathways for societies where new digital technologies and traditional sharing practices coexist.

7.5 Conclusion

We examined the contemporary value of traditional communal sharing practices through a case study on natural resource use in the Republic of Palau, situated at the westernmost edge of the Micronesian island chain. The results showed that communal sharing practices related to subsistence still exist, in not only rural but also urban areas, regardless of the accessibility of new ICTs. Traditional knowledge of how to manage common natural resources has been handed down for generations through communal sharing practices. These findings suggest that such communal sharing practices can play a key role in building resilient societies. To ensure a legacy, a hybridization of new digital technologies and local wisdom is required. Future research should investigate the impact of new ICT-based sharing practices at the community level as well as the possibility of utilizing them to create a new culture of sharing.

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Chapter 8
Solidarity Economy in Brazil: Towards Institutionalization of Sharing and Agroecological Practices

Kei Otsuki and Fabio de Castro

Abstract Solidarity economy is often focused on autonomous initiatives outside the regular market system. In Brazil, the leftist national government during the 2000s has supported a number of solidarity economy initiatives by institutionalizing the ideal and practices of sharing and sustainable production and consumption within the regular market system. New actors, policies, and procedures have been instrumental in this institutionalization. However, the questions of how the actors, policies, and procedures interact and how the interaction becomes socially and politically relevant remain largely unaddressed. In this chapter we will explore implications of the interactions for the establishment of solidarity economy based on agroecological practices carried out by small family farmers in Brazil. We firstly give an overview of the national context in which the agroecological practices were linked to the practice and economy of sharing. We then analyze cases of the Program of Food Acquisition in the south of Brazil and agroforestry systems in the Amazon region in order to highlight different patterns of the involved actors' interaction and eventual articulation of solidarity economy in relation to the promotion of sustainability. The chapter concludes by discussing the linkage between actors at different levels, new institutional arrangements, and monetary and nonmonetary values added to the solidarity economy.

Keywords Agroecology · Redistribution · Sharing · Social movements · Solidarity economy · Brazil

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8.1 Introduction

In the past decade, substantial debates emerged on the need to envision a new form of economy. This trend incorporates a vision of environmental sustainability and equitable social development or a vision "to build more resilient and sustainable society in harmony with nature" (Saito, this book). Although some approaches remain "green" or "social" variants of the mainstream economic model, others offer alternatives to the much critiqued neoliberal free-market economy, associated with aggravating environmental degradation and inequality (Allard et al. 2008). In particular, sharing and solidarity economy, underpinned by the redistributive ideal, is drawing an increasing academic as well as practical attention. As McLaren and Agyeman (2015: 4) shows, "humans are natural sharers," whereas this trait was rapidly forgotten "in the face of commercialization of the public realm" under neoliberalism and free marketization. The emerging focus on the economy of redistribution will shed light on implications of tacit and everyday practices of sharing and establishment of reciprocal social relationships for realizing more resilient and sustainable society.

In fact, such a focus on sharing has been central to many of our social science disciplines. For example, in the classic social anthropology by Mauss (1990 [1950]), it was established that any society is a form of exchange, based on civic and institutionalized acts of gifting and "the obligation to return it." Graeber (2001, 2007) revisits Mauss' theoretical considerations regarding solidarity as a basis of our societies that generate redistribution effects (see also Titmuss 1970). In short, the current efforts to recover the human basic actions of everyday sharing and gifting as an academic subject indicate a recognition that we need to explore further the nature and extent of the emerging new economy, which does not rely on the dominant free market model (McLaren and Agyeman 2015).

In this context, solidarity economy emerged as a pragmatic way to reshape the conventional free market model and establish a new economy of sharing and redistribution. Such a new economy entails:

> […] new forms of value, new kinds of equivalence, new practices of calculation, new relations between human agency and the nonhuman, and new distinctions between what was real and the forms of its representation. (Mitchell 2002: 5 quoted in Otsuki 2014)

This means that the solidarity economy is not only about a cultural shift in how to value labor and products but, more fundamentally, about a political action against dehumanization of the conventional economic model. Through the solidarity economic model, citizens challenge the ultimate liberal form of exchange – price-oriented market – to justify the practice of sharing and shape a collective experience of coproducing both monetary and nonmonetary values and exchange relations.

In this collective experience of solidarity economy, the natural and social capitals become central. Sustainable production and consumption are important aspects of the new system that valorizes the natural and social sustainability. However, little has been understood about how the new forms of economic relations can be politicized and then institutionalized. In other words, we still know little about processes

by which everyday sharing practices add value to nonmonetary processes of redistribution, sustainable production, and consumption.

In this chapter, we argue that exploring the possibilities for the establishment of solidarity economy requires a close examination of relationships between various actors who collectively shape the new sustainable economy in solidarity – including governments at different levels, private businesses, citizens, and most importantly those who have been relegated into vulnerable positions in the course of economic development (Otsuki and van Helvoirt 2017). As elaborated by Karl Polanyi (2001 [1944]), emerging hybrid forms of institutional designs challenge the clear-cut division between capital accumulation by market, redistribution by the state, and reciprocity through social relations. How do the interactions between different actors take place to establish institutional arrangements for the new economy of redistribution that develops in harmony with nature? How, in turn, does this economy, supported by nonmonetary values with redistribution and sustainability effects, further become sociopolitically relevant?

We explore these questions by investigating solidarity economy experiences of Brazil based on agroecological practices. While solidarity economy is often focused on autonomous initiatives outside the regular free market system, in Brazil, a number of solidarity economy initiatives have been developed within or at least in relation to the regular market system, with an intervention by the leftist national government during the 2000s. During this period, new actors, policies, and procedures intermediated redistribution markets in order to institutionalize grassroots initiatives of cooperative production and sustainable consumption (Castro 2014). We aim to analyze these initiatives experienced by small-scale rural producers in both the south and north of Brazil. The experiences show opportunities and challenges that solidarity economy faces in the context of mainstreaming sustainable production and consumption underpinned by the practices of sharing.

In what follows, we firstly give an overview of the national context in which the intermediated institutionalization of solidarity economy has taken place, influenced by politicization of agriculture and demands for supporting small-scale family farmers and their agroecological practices. We then show two specific case studies: one on the Program of Food Acquisition practiced in the south of Brazil and the other on agroforestry systems in the Amazon region. Given that the debates on the new economy tend to center on initiatives emerging in cities of the Global North, we aim to look into the experiences of solidarity economy institutionalized in rural contexts and in the Global South and to highlight its relationship with the natural environment and the effects of political action. The case studies will be followed by a discussion on how the mechanism of institutionalizing solidarity economy could work in different social, political economic, and ecological contexts. We will conclude by exploring the linkages between actors at different levels, new institutional arrangements, and monetary and nonmonetary values added to the solidarity economy. We argue that establishing such linkages is essential towards making the new sustainable economy of sharing relevant in the Global South.

8.2 Solidarity Economy in Brazil: The National Context

Brazil is a country of contrast. This highly urbanized country, with over 85% of the population living in cities, heavily relies on the rural space for development of its national economy. Since its independence in the nineteenth century, the country has been integrated into global economy through extractivism and large-scale agribusinesses based on monocrop plantations of coffee, sugarcane and, more recently, soya. In recent years, Brazil has risen to reposition itself as an important emerging economy, mainly driven by the commodity boom in the last decade.

Brazil's current position as one of the largest world economies, however, contrasts with the persisting and acute social and economic inequality. Despite some relevant industrial development over the last half century, the commodity frontier expansion of the last decade has deepened inequality and induced deforestation and marginalization of small-scale farming in the country. The Gini coefficiency regarding the national income distribution over 0.5 contrasts with the Gini coefficient of rural land distribution over 0.8 due to land property concentration that has existed since the colonial period. For example, the soybean cultivation has become one of the main drivers of land concentration and deforestation in the Brazilian savanna.

Active contestations against this process are well known in Brazil. The peasant movements, which have been expanding since the mid-1940s to claim agrarian reform (e.g., land security, rural employment, and family farming), have been largely successful, not only in promoting land redistribution through occupations and development of agroecology among family farmers but also in influencing national politics (Welch 2009; Carter 2015). Together with other social movements, peasant movements backed the then labor union leader Luiz Inácio Lula da Silva (Lula) of the Workers' Party, in his successful presidential campaign in 2003. His predecessor Fernando Henrique Cardoso, a social democrat, had initiated social reforms in combination with neoliberal free marketization of commodities in the late 1990s, and Lula further advanced this redistributive neoliberal agenda. He did so by creating a series of institutional instruments to promote social development while economically engaging in the commodity export.

For example, Lula's government created the Ministry of Social Development by which one of the world's largest conditional cash transfer programs called Bolsa Familia was developed as a part of the Zero Hunger project (Hall 2006). This Ministry further expanded the budget scale of the government (up to 15% of the GDP) to enrich school food programs and other food security and nutrition-related programs (Otsuki 2011). The budget was allocated from the agribusinesses and the so-called neo-extractivist activities, developed based on foreign direct investments in large-scale mining and oil extraction projects (Acosta 2013; Burchardt and Dietz 2014). Finally, the National Secretary of Solidary Economy (SENES) was created in 2003 under the Ministry of Labor. Under the coordination of the academic-activist in cooperativism, Paul Singer, SENES developed a large network of initiatives to support local entrepreneurship with principles of solidarity economy with

support of the Brazilian Development Bank (BNDES). In creating the space for solidarity economy in the national government, Singer developed important linkages between politicians, researchers, and activists. He became a leading author on solidarity economy in the academic circle (e.g., Singer 2002) while playing a key role in turning the field into policy and practice (Lechat 2004).

In short, Brazil has officially developed contrasting agendas: on the one hand, it continued to engage in an active promotion of the commodity export driven by globalized economy; on the other, it advanced the socialist reform focusing on poverty alleviation and addressed inequality and needs for solidarity. At the earlier stage of Lula's presidency, these agendas made the international community hail Brazil as an embodiment of a new model of development (The Economist 2009). With the current economic downturn and the political turmoil, this model's relevance is being reexamined. Nevertheless, so far, the country has shown various possibilities to institutionalize new economy of redistribution while conventionally promoting the neoliberal economic policies. Solidarity economy emerged as one of such possibilities of institutionalization in the activism-based social-economic policy-making.

8.2.1 The Emergence of Solidarity Economy in Harmony with Nature

Originally, solidarity economy in Brazil was developed as a label of economic activities that citizens initiated autonomously in order to cope with unemployment under the neoliberal economic policies of the 1990s (Lamaitre and Helmsing 2012). Out of necessity, those unemployed citizens established self-employed small-scale enterprises and cooperatives for their survival, leading to a creation of the new economy, based on various collective arrangements of exchange. This trend officially became the solidarity economy network in 1997,[1] which aimed to bridge different societal actors and sectors and to shape a movement underpinned by political activism, practice, and research (Solidarity Economy Association 2018). After the leftist government took power in the beginning of the 2000s, many cooperatives and enterprises were institutionalized under the Brazilian Forum of Solidarity Economy (FBES), which formed the so-called solidarity economy movement. The FBES became a key collaborator of the World Social Forum that started its annual meeting in 2001 (Bowman and Stone n.d.; Fisher and Ponniah 2015). Various grassroots initiatives of small-scale production and community banking, including those whom municipal governments officially supported, emerged to advance their cooperative activities in the framework of FBES.

One of the founding members of FBES was the Landless Rural Workers' Movement, known as MST (FBES 2018). The MST is often regarded as one of the largest and, though arguably, the most successful peasant movements in the world

[1] https://www.solidarityeconomy.coop/wp-content/uploads/2017/08/declaration_lima_eng.pdf

(Hammond 1999). Emerged in the late 1970s, the movement has constituted a forefront of the Brazilian social movements, demanding agrarian reform to address social and economic inequality in rural areas (Carter 2015). Their involvement in FBES symbolizes that solidarity economy in Brazil is also a part of the political agenda for addressing rural poverty and the needs for land property redistribution.

At the same time, it also reminds us that traditional practices of building solidarity and sharing have taken place mainly in rural communities. In rural Brazil, practices of solidarity can be observed in forms of alternative education, pastoral intervention by the Catholic Church, and cooperativism, and they are concerned with ecological sustainability (Freire 2003 [1930]). In other words, solidarity economy in the Brazilian rural sphere has a clear connotation that it develops in harmony with nature. In this sense, it has been developed not only as the survival strategy for the poor to engage in alternative economic activities but also as a strategy for them to strengthen their identity and acquire and maintain the right to sustainably control the means of production and consumption.

In short, solidarity economy in Brazil is a part of recovering and recognizing the importance of everyday practices of sharing among small rural producers and consumers. We can find one of the practices leading to the solidarity economy in the theory and practice of agroecology.

8.3 Agroecology and Sharing Practices

Agroecology has its roots in various, traditional social movements, such as liberation theology movements of the Catholic Church in the 1960s–1970s and the peasant movements (including MST). These movements proposed agroecology as an alternative to transform agricultural development models from the large-scale agribusinesses to models that build on sustainable agriculture at a smaller, family-based scale (Caporal and Costabeber 2004; Altieri and Nicholls 2005). During the 1990s, when environmental concerns became widespread due to the high rate of deforestation in the Amazon region in Brazil, scholars started to recognize indigenous practices of agroforestry – plantations of various perennial fruit trees mixed with annual subsistence crops – as a valuable method of agroecology (Smith et al. 1998). Facing the widespread agribusiness development, the social movements and supporting researchers promoted agroecology as an alternative agenda for the agribusiness and mono-cropping (Altieri and Rosset 1996).

In principle, agroecology emphasizes the importance of mix-cropping in order to diversify sources of food, nutrition, and cash income for smallholders. The diversification enables smallholders to maintain their control over the production by reducing dependency on one crop as the source of income and make the small-scale agriculture socially and ecologically sustainable. The focus on maintaining control and conducting sustainable agriculture in the face of agribusiness expansion coincided with the emerging scholarly and political agenda to establish a concept and

method of food sovereignty worldwide in the late 1990s (Wittman 2009; Rosset and Martinez-Torres 2012).

While the conventional agriculture focuses on the quantity of food production to achieve food security, agroecology emphasizes that the quality of food production (and consumption at the farm level) is necessary to achieve food sovereignty. And, the scholars and activists are beginning to understand that the achievement of food sovereignty involves careful observations of farmers' everyday practices of sharing. For example, agroecological farmers usually opt to produce own seeds instead of purchasing from seed companies. The production of seeds involves exchange of seed varieties and farming practices and local ecological knowledge. They also coproduce farming services and share equipment in cooperative manners. In addition, the agroecological farmers are more reflexive on their own engagement with the natural environment and politics (Botelho et al. 2016). In other words, ensuring of sovereignty through agroecological practices has been involving exchange and sharing, leading to the ideal of solidarity economy.

At the same time, the peasant movements involved in FBES claim that consolidation of such a reciprocal agroecology as a part of solidarity economy requires basic institutional conditions to secure sustainability of production and consumption. One well-known condition for the institutionalization is collaboration between scientists and producers to evaluate sustainability of the production and ecosystems in which the production activities are embedded (Wezel et al. 2011; Petersen et al. 2013). The collaboration is also necessary for the agroecological farmers to access technical assistance, to improve soil fertility, and to enhance land productivity without relying on expensive chemical inputs. Such collaborations are known to entail political partnerships between farmers, governmental extension agencies, and non-governmental service providers (Botelho et al. 2016).

Yet, institutional conditions for opening the market for agroecological produce remain a less explored domain. As the conventional economy of scale and the logic of quantity do not apply to agroecology, such a new market involves an intermediated mechanism of redistribution and the establishment of new values and the reframed "practices of calculation" (Mitchell 2002: 5 quoted in Otsuki 2014). The creation of such a market entails planned intervention outside the operation of free market, and this involves different actors other than usual businesses and producer organizations, most notably, the governments at various levels that can shape policies for "procurement interventions" (World Food Program 2008). With a more progressive government in power, Brazil experimented such procurement interventions and created a market based on deliberate institutionalization of agroecological practices.

In what follows, we illustrate how the procurement interventions and the creation of new markets of agroecological produce can actually work, using two case studies. The first case builds on a review of the governmental program called the Program of Food Acquisition, known as PAA.

8.4 The Program of Food Acquisition (PAA)

The PAA is a Brazil's national governmental program that procures food for public institutions such as public schools and hospitals. The food procurement by the government involves a mechanism of tendering to which food producers should be able to freely apply by offering potential prices. Usually, governments choose to follow the free market logic in order to justify the so-called most economically advantageous tender, which tends to only benefit large-scale or industrial producers (Morgan and Sonnino 2007). However, in order to pursue the new economy of redistribution while guaranteeing reasonable prices, another logic to ensure the quality and affordability of redistribution must be in place. In practice, this means that small-scale food producers should be able to participate and compete in the tendering process on the basis of providing sufficient good quality food by conducting sustainable agriculture.

Therefore, food procurement in the context of promoting smallholder participation requires an enabling environment. According to the United Nations' World Food Program (2008), the enabling environment can be established through at least four dimensions of procurement interventions: (1) the creation of a market for small-scale producers, (2) the contribution to changing market structures so that a larger proportion of the market price goes to local producers, (3) the creation of a stronger role for local farmers in the supply chain through reducing the relevance of intermediaries in the purchasing process, and (4) ensuring that small producers produce a sufficient supply of good quality products to enable them to respond to market demand (Otsuki 2011: 215). The PAA was initiated in 2003 in order to promote these four dimensions in Brazil.

More specifically, the PAA emerged as a method of "direct purchase" (*compra direta*) of produce from beneficiaries of agrarian reform settlement projects. The beneficiaries who have acquired land through peasant movements or negotiations with the government are first required to organize themselves, using existing organizations or creating a new producers' association or a cooperative. They can then ask government rural extension services to assist with their application for the family agriculture credit program. While it is rare that the extension services directly instruct agroecological practices in settlement projects, farmers can use their own association or the cooperative to diversify their production in collaboration with the extension workers or researchers and practitioners from other supportive civil society, nongovernmental, or scientific organizations.

After the new sustainable agriculture is supported, the National Corporation of Provision of the Ministry of Agriculture, Livestock and Provision (CONAB) intermediates the tender published by the municipal or sometimes the state government. The government must use a certain percentage of their budget to procure local produce directly from family-based farmers. According to the 2009 law, the percentage

was set to minimum 30% (Law 11.947, 16/6/2009).[2] The procured local produce – e.g., vegetables, fruits – is then distributed among the municipal's schools and other institutions that require public food provision.

While every municipality has a different degree of engagement with PAA, the mechanism at least allows governments to open a market for small-scale producers to commercialize their produce while accessing the necessary assistance. The program also generates a broad sense of solidarity because the government is supportive of local food production and distribution and uses the produce for enriching public food provision in schools and hospitals.

8.4.1 The Campinas Experience

Among all, more than 5500 municipalities in Brazil, the municipality of Campinas in the state of São Paulo has been known for its active engagement with PAA since the program's inception. The municipality's Supply Center and Assistance Services (CEASA) is the institution that makes this engagement possible. In every major city of Brazil, CEASA operates as the principal wholesaler of food. The CEASA-Campinas is one of the largest in Brazil, with 1600 registered both large and small wholesalers and producers. Using the produce directly purchased from small farmers through CONAB, they execute the public school food program for all the 560 public schools within the entire municipality. In addition, they host the Food Bank based on donations from food industries and produce from local producers so that the beneficiaries of social program such as Bolsa Familia can receive basic food baskets each month.

In developing menus for schools, CEASA employs nutritionists who closely collaborate with the municipal's School Feeding Committee consisting of a government representative and teacher and parent representatives. These institutions further provide a mechanism to ensure the quality of food provided for the school children.

The experience of Campinas shows that the interactions between the municipal wholesalers CEASA, the municipal's school committee that include representatives of consumers, and the national program such as PAA establish an institutional arrangement that opens up the redistribution market. Such a market does not freely develop but needs to be institutionalized with procurement interventions. And, such a market is only possible as long as public services remain in the public domain: therefore the redistribution does not work in the private sphere such as private schools.

[2] Japan is another country that has the similar percentage of procurement of locally produced food to be used for school meals.

8.4.2 The Challenge

During the 2010s, the PAA model was exported to African countries at pilot scales (World Food Programme 2015). This pilot experience has so far highlighted logistical challenges surrounding tendering and the necessity of cooperative institutions for small farmers to effectively become a part of the new institutional arrangement. This shows that the model cannot be easily transferred to another social and political context or the context in which the *public* has not been developed in the same way as it has been in Brazil. Because of the history of social movements, demands for redistributive politics and existing institutional setup, the PAA has worked in Brazil. This does not readily happen in another context. Moreover, as one CEASA official has said, "school food is not an expense but an investment" which should give the country sufficient returns in the future (Otsuki 2011: 221). It is important to have the awareness that the PAA model represents such a wider moral economy perspective.

The PAA example suggests that institutionalization of solidarity economy at the national scale could be possible when governments intervene and collaborate with various actors in creating new markets for those who cannot easily participate in the price-oriented economy of quantity. In particular, when the government at municipal level is in line with the national policies, the implementation process may be highly effective as shown in the case of Campinas. But how this possibility is sustained goes back to the point of whether it has a grassroots support, stemming from existing practices of production and appreciation of sharing.

8.5 The Amazon Agroforestry

The northern part of Brazil is covered with the world's largest remaining rainforest – the Amazon. Here, agroforestry systems have a particularly relevant position for our thinking about agroecological practices and the institutionalization of the solidarity economy that also contributes to sustainability. Agroforestry is a particular agroecological practice that deliberately uses woody perennials in a productive system. Built on socioeconomic and ecological pillars of sustainability, agroforestry systems are defined as:

> …dynamic, ecologically based, natural resource management system that, through the integration of trees in farm- and rangeland, diversifies and sustains smallholder production for increased social, economic and environmental benefits. (Leakey 1996)

Due to their creativity and experimental approach to develop tree cultivation techniques and crop systems, Brondizio and Siqueira (1997) conceptualize agroforestry producers as "forest farmers." The authors argue that such a definition is fundamental to emphasize agency in knowledge production for sustainable and efficient production system.

In the Amazon, agroforestry has been common practice since pre-Colombian times (Clement 1999) and comprises a large range of crop systems, from management of single forest species such as acai palm (Brondizio 2008) to indigenous game refuges such as apetês (Posey 1985). Knowledge around new species varieties, multi-crop consortia, and management practices have been built through sharing mechanisms embedded in cultural norms and social practices such as gifts, intermarriage, and migration, among others. In the last decades, however, agroforestry has become more visible among researchers, policy makers, practitioners, and companies as a way to address biodiversity, rural poverty, and exclusion issues. In the context of reforestation and forest conservation, agroforestry has become a key added value to sustainability at local and global levels.

8.5.1 Institutionalizing Agroforestry Systems in the Amazon

In their overview on agroforestry development in the Amazon, Porro et al. (2012) describe the institutionalization of agroforestry in policies and practices developed over the last decade. In addition to the PAA program and special credit line in the national program for family farmers, governmental support to the development of agroforestry systems in the Amazon has been mainly channeled through the National Agrarian Research Agency (Embrapa) and the Commission for the Planning of Cocoa Farming (CEPLAC). Both agencies have been instrumental in promoting research, rural extension service, and network building. In particular, the creation of the Brazilian Association of Agroforestry in 2000 and biannual national conferences became central in knowledge co-production. This network has led to research outcomes across disciplines addressing both pillars of agroforestry systems – ecological (biodiversity, carbon stock, soil) and socioeconomic (food production and commercialization) in the region.

However, despite optimisms towards the potential of agroforestry to replace unsustainable land use practices in the Amazon (Trembley et al. 2015), economic and political factors limit the development of agroforestry systems to become a more subsistence supporting economic component in farmers' economy (Porro et al. 2012). For example, due to poor infrastructure and logistics, the technical assistance needed for the full implementation of procurement interventions such as PAA hardly benefits remote and small farmer communities in the Amazon. In this context, a remarkably successful case of commodity agroforestry system developed by descendent Japanese farmers in the Eastern Amazon (Yamada 1999) deserves special attention.

8.5.2 The Tomé-Açu Experience

The Agroforestry System of Tomé-Açu (SAFTA)[3] emerged as a solution to a farming crisis in the municipality of Tomé-Açu in the Eastern Amazon. Grounded in strong entrepreneurial logics, Japanese migrant farmers arrived in the region in the 1920s and engaged in a successful commodity and mono-copping production system – black pepper – in the 1950s. They were forced to design a more resilient farming system after their crops were devastated by a pest outbreak in the 1970s. Built on knowledge from traditional populations, the migrant farmers developed a commercial agroforestry system locally referred to as SAFTA. This system is based on a set of species combining tropical fruit, oil seeds, and timber that are commercialized in national and international markets such as in the USA and Japan (Figs. 8.1 and 8.2). This process has been an outcome of building and sharing knowledge among farmers, researchers, and practitioners in which a local cooperative played a key institutional role.

Founded in 1949 by the Japanese migrant farmers, the Multi-Purpose Cooperative of Tomé-Açu (CAMTA) became the connecting space for sharing knowledge and experiences among farmers and external actors. Since the 1990s, the CAMTA, rooted in strong commitment and collaborative behavior among their members, has been cooperating with researchers, governmental agencies, companies, and practitioners in order to develop further their production system, product processing, and commercialization. The SAFTA has become a driver of reforestation in the region

Fig. 8.1 Agroforestry system based on black pepper (*Piper nigrum*), banana (*Musa* sp.), and cupuaçu (*Theobroma grandiflorum*) in Tomé-Açu, Brazil – date August 2018 by Fabio de Castro

[3] From the Portuguese: Sistema Agroflorestal de Tomé-Açu.

Fig. 8.2 Agroforestry system based on black pepper (*Piper nigrum*) and acai (*Euterpe oleracea*) in Tomé-Açu, Brazil – date August 2018 by Fabio de Castro

(Batistella et al. 2013) and awarded by several prestigious national and international organizations, and their product holds eight different certification systems.

The sustainable production image built by CAMTA has opened opportunities to new markets (e.g., sustainable consumers in the Global North), new partners interested in sustainable production (e.g., the cosmetic company Natura), and new financing sources from international NGOs and bank credit. However, the most remarkable role of CAMTA has been dissemination of their SAFTA techniques to local peasants through a number of initiatives. Since 2010, they organize an annual seminar on SAFTA mostly targeted to family farmers in the region to be informed about agroforestry systems and exchange knowledge with their peers. In addition, under their "Family Farmer Support Program," they carry out regular training programs in peasant communities where farmers are interested in building their own agroforestry systems. The CAMTA has its own technical assistants who provide the farmers with information on principles and management practices developed by the SAFTA producers. The agroforestry system is then co-designed with each farmer according to their particular context (e.g., land, labor force, knowledge, and preferences). Currently, several communities are part of this program financed by NGOs, governmental agencies, and private companies.

Finally, smallholders adopting SAFTA in their production system are invited to become suppliers of the CAMTA's fruit processing plant under particular quality requirements. This way, local producers do not only benefit from the agroforestry knowledge on products of high commercial value in the conventional market shared by the SAFTA producers but also from accesses to a new and valuable market through the partnership with CAMTA. As one of the major SAFTA producers has said: "we are giving the local knowledge we used to develop our SAFTA back to the

local farmers from whom we've learned about agroforestry practices." This is the essence of the gift economy (Mauss 1990 [1950]) which seems to be remarkably relevant in the context of promoting sustainable agriculture based on the mechanism of solidarity in the Amazon.

8.6 Discussion

The two cases described in this chapter – PAA in Campinas and SAFTA in Tomé-Açu – show how the ideal of sharing and solidarity shaped a new economy as an alternative to but in relation to the conventional free market economy. In both cases, supportive policies, academic knowledge, and extension programs have been vital in the institutionalization of solidarity economy based on family and small farmers' agroecological practices and everyday sharing. They both combine science, traditional knowledge, and a variety of social and political movements that link sites of production and consumption and rural and urban spaces.

At the same time, what actor and what institutional mechanism that become central in advancing the experience may vary (Table 8.1). In the case of PAA in Campinas, the municipality's wholesale market and school meal committees act as points of redistribution of actual produce and knowledge of setting up an institution for sharing. In the case of the Japanese-migrants' cooperative in Tomé-Açu, the Japanese farmer cooperative is central to connect business partners and supportive governmental as well as nongovernmental organizations.

The involved actors are strongly committed with creating nonmonetary value of social and environmental sustainability through the involvement of smallholders and use of agroecological products. They have also facilitated diffusion of knowledge as they actively share their practices with other municipalities (in the case of PAA) or with farmers who are not necessarily the members of the cooperative (in the case of SAFTA). By the same token, outcomes of these two cases converge to generate both market and nonmarket values. In addition to the opening of new opportunities to access food market and generate income, the cases examined above created paths for recognizing often overlooked aspects of production autonomy, collective work, knowledge co-production, and forest conservation.

At this point, we come back to explore answers to our initial questions: How do the interactions between different actors take place to establish institutional arrangements for the new economy of redistribution that develops in harmony with nature? How, in turn, does this economy, based on nonmonetary values with redistribution and sustainability effects, further become sociopolitically relevant?

First of all, in answering the first question, we recognize that small producers themselves need to internalize the needs to learn from each other and to exchange knowledge, and supportive organizations such as the government agencies and NGOs as well as partnering businesses must appreciate such a process of reflexive learning and actual, often experimental, production. Then, as the case of agroforestry has shown, the existing social capital (such as the cooperative) and favorable

Table 8.1 Actors and institutionalization of sharing economy in agroecology practices in Brazil

	PAA (public food procurement)	SAFTA (agroforestry development)
Actors	Farmer (smallholder)	Farmer (migrant middle-scale farmer and smallholder)
	National government	National government
	Local (municipal) government	Business partner
	Consumer (teacher, parent, children)	NGO
	Nutritionist/researcher	Consumer
		Researcher
Institutionalization	Farmer organization (agrarian reform participation)	Cooperative
	Agrarian reform program	Embrapa – Agrarian research on agroforestry
	Rural extension	Ceplac – the Commission for the planning of farming
	Direct purchasing program	Sustainable and responsible business programs
	Wholesaler – food (re)distribution program	Credit lines
	School feeding committee	Support family farmer agroforestry program
	Participation in the school feeding committee	Sustainable consumption in the Global North
Added value	Market access	Market access
	Income generation	Income generation
	Sustainable production	Sustainable production, reforestation
	Food sovereignty	Food sovereignty
	Collective action/associativism	Knowledge co-production

ecological conditions facilitate collective action and co-production of sustainable production systems. The case of PAA has revealed that such collective action and co-production can be further integrated into national public service provisions through political engagement. In order to further sustain this local-national institutionalization, global consumer demands for sustainable products or international actors' interests in poverty alleviation become essential. The institutionalization at these different levels could keep the ideal of making small-scale agricultural production develop in harmony with nature. The interactions between these various actors across nations also make the institutional arrangement flexible, experimental, and adaptive to political economic and ecological changes and thus potentially more resilient (e.g., Peat et al. 2017).

However, at the same time, as Davies and Spicer (2014) discuss, involvement of various actors in shaping up solidarity also creates a ground for conflicts when the logistics do not work as planned or knowledge sharing is not done sufficiently or in transparent manners. This is why social movements and mobilization of people and public opinions continue to be important in order to monitor whether solidarity

economy is indeed beneficial to those who are involved. At the same time, successful experiences cannot be replicated without taking the multilevel context into account. As the PAA case in Africa has shown, the existence of and articulation between social and natural capitals must be taken into account as much as infrastructure and logistics in order to facilitate knowledge sharing and actual procurement interventions.

This leads to the second question about the social and political relevance of the solidarity economy based on agroecological practices. Once a new economy of redistribution is established, in which poverty, inequality, injustices, and exclusion are key elements to be addressed, traditional practices of sharing seeds, agricultural knowledge, plantation techniques, and materials become more visible and valued in nonmonetary terms. The visibility of agroecological practices as a sharing mechanism justifies the linkage between redistribution of nationally and globally accumulated capital and sustainability concerns. In this sense, in solidarity economy, sharing has a moral dimension which cannot be measured only in financial terms but can be accepted as a new nonmonetary value for societal and sustainable development. Combined with the mounting sustainability concerns, if we continue to prove the relevance of sustainable agriculture for solidarity economy and recognition of sharing, we will be able to make the solidarity economy socially and politically relevant.

By the same token, when interventions change priorities, the moral dimension might be exposed to cynicism. Currently, Brazil is politically going through a major backlash against the social democratic agenda of redistribution, as the new government regained political support from those who advocate more neoliberal and developmentalist agenda of accumulation. This is leading to a weakening of political support for peasant and other social movements (e.g., Motta 2017). Internationally, neoliberal forces remain strongly articulating the logic of free market, and the redistribution markets intermediated by state institutions or cooperative structures are continually exposed to the risk of budget cuts and being overridden by big businesses. Yet, experiences of sharing and its institutionalization as solidarity economy at least remain, offering possibilities for new forms of mobilization, reflections, learning, and valuation of everyday practices of sustainable production and consumption. As both solidarity economy and agroecology have gradually turned into a transversal political principle across a range of social movements in Brazil, it is possible that this perspective will play a major role in the fight against the new conservative turn.

8.7 Conclusions

This chapter has discussed the nature and extent of institutionalizing agroecological and sharing practices by drawing on the example of solidarity economy developed in Brazil. In contrast with the Northern experience of sharing economy, which has been promoted as a smart technological innovation or a new corporate and

consumer model mainly targeting urban middle class (as described in the introductory chapter of this book), the Brazilian experience first and foremost shows an importance of redistributive dimension of sharing in the context of historically evolved acute social inequality, poverty, and exclusion.

In particular, the chapter has made two main contributions. Firstly, the chapter has shown relevance of considering agroecological practices, promoted by social and peasant movements, in discussing the new economy of redistribution. The solidarity economy based on agroecology highlights that the sharing is embedded in the everyday context of sustainable food production, procurement, commercialization, and consumption and the new economy needs to build on an appreciation of knowledge that emanates from such practices.

Secondly, the chapter has discussed often overlooked issues related to institutional arrangement and transformative power of solidarity economy at a societal level. More than an "outside of the market and government" autonomous experience, the two cases of agroecology-based solidarity economy in Brazil have illustrated the close connections between governmental policies, existing market mechanisms, and a wide range of organizational and individual actors. The actors in these cases are not necessarily trying to focus on alternative markets as seen in the Global North context. Rather, they try to engage in the regular market while changing the rules of the game, involving policy interventions and cooperatives. In this respect, solidarity economy is not only an economic model but a political statement for the needs of socially inclusive and environmentally sustainable market development.

Therefore, in addition to the emphasis on citizen-driven economy, solidarity economy in Brazil and in the Global South more broadly claims for the national government to take its redistribution role to the market level. This process leads to a hybrid institutional arrangement combining market-based principles, policy-oriented supports, and socially reciprocal relations. To make the engagement sustainable, social struggles and political mobilization must be supported. The PAA is an example of how claims from social movements can be institutionalized through a very concrete policy mechanism to promote the nonmonetary value of sharing and collective action. The agroforestry systems indicate an example of how an institution of a strong cooperative can diffuse its experience in reciprocal manners.

In conclusion, solidarity economy in the Global South must be analyzed in the context of inequality, political volatility, and poverty on one side and rich resources, social capital, and agency on the other. Apolitical sharing experiences may, in fact, deepen inequalities in the Global South if the access to means of production, infrastructure, and market remains in the hands of elite groups. Moreover, we need to explore how consumers in the Global North can become in solidarity in the southern, small-scale producers who daily struggle for their land and commercialization opportunities. Therefore, the institutional support to solidarity economy, involving various actors at different levels, has a particular relevance in highly unequal societies for imagining our future resilient and sustainable society that develops in harmony with nature. Its power of mobilizing a wide range of actors and creating nonmonetary values itself becomes an important capital for promoting farming in

ecosystems whose sustainability is continually threatened. Observing experiences in Brazil, we further need to think about how to sustain the necessary interventions and infrastructure in order to institutionalize the ongoing and mundane sharing practices.

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Chapter 9
Sharing Knowledge and Value for Nurturing Socioecological Production Landscapes: A Case of Payment for Ecosystem Services in Rejoso Watershed, Indonesia

Beria Leimona, Francesca L. McGrath, and Ni'matul Khasanah

Abstract Socioecological production landscapes (SEPLS) are multifunctional and substantially contribute to biodiversity conservation and ecosystem service provisions. Payment for ecosystem services (PES) is a policy tool that incentivizes landholders in production landscapes through voluntary and performance-based conservation contracts towards creating SEPLS that benefit all societies living within landscape. The design of PES covers explicitly defining ecological baselines of targeted landscape, calculating conservation opportunity costs, customizing contract agreement and payment modalities, and targeting agents with credible land claims and threats to ecosystem service degradation. Reverse auction represents a method to efficiently allocate contracts for the provision of ecosystem services in PES schemes. The PES gains allocative efficiency as contracts are allocated to the lowest-cost providers of ecosystem services through competitive bidding. In the context of developing countries, conservation contracts of PES scheme are mostly assigned to farming groups. Thus, a group-level auction was organized to accommodate collective decision-making in payment level for the scheme. This chapter is to discuss how group-level auctions enhance allocative efficiency due to sharing process during the auctions compared to the individual-level auction. A group auction allows exchanging and sharing knowledge, information and conservation values among farmer group members. The analysis shows that by allowing the group members to communicate with each other, sharing knowledge and value happened. This knowledge and value sharing encompasses how they understand the competitive bidding process, how their bids can influence the overall outcomes of winning or losing the conservation contracts, and the most importantly, how farmers share

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their conservation values as agricultural conservation efforts of PES not only benefit the external actors but also co-benefits themselves. This chapter presents the results from a PES pilot in Rejoso watershed, Indonesia, where smallholders in the up- and midstream are contributing to better watershed services, i.e. water infiltration and sedimentation reduction, to benefit downstream domestic and industrial water users.

Keywords Sharing knowledge · Sharing value · Reverse auction · Payment for ecosystem services · Group contract · Indonesia

9.1 Introduction

Socioecological production landscapes (SEPLS) – landscapes where people and nature co-evolved as interlinked societies and ecological systems – have been increasingly recognized in the roles to contribute to halting the loss of biodiversity and ecosystem services as committed by the 20 Aichi Biodiversity Targets. This global priority in integrating conservation across all sectors in natural resource use and management – agriculture, forestry, fisheries and others – is essential as land becomes progressively scarcer as a resource. Thus, landscapes that are able to fulfil an increasing number of functions, to satisfy a broader range of stakeholders with divergent interests, are urgent (Roderick and Chavez-Tafur 2014).

SEPLS denote a landscape with multiple functions that can support human production activities, livelihoods, and well-being by providing diverse bundles of ecosystem services – the material and nonmaterial benefits that people obtain from nature. However, as agriculture and other kinds of production have shifted away from traditional practices towards more environmentally destructive ones, the systems that have supported socioecological production landscapes in many places have deteriorated. On the other hand, cases from Asia show that effective incentives for sustainable ecosystem goods and services can revitalize and sustain landscape with multifunctionality (Leimona et al. 2015b).

The provision of ecosystem services from production landscapes might require landowners living in the proximity of the ecosystem to undertake or not to undertake certain activities. To complete these tasks in the absence of regulatory provision, the communities need incentives, both financial and nonfinancial. The payment for ecosystem services (PES) is the mechanism that governs these incentive systems. The monetary value of PES varies widely based on the opportunity cost and willingness-to-accept of providers to enter contracts with ecosystem service beneficiaries and on the amount of available conservation funds, and more importantly on the intrinsic motivations and notions of local ownership towards landscape stewardship, which can strengthen community in governing public goods (Ostrom 1990; Agarwal 2010; Muradian et al. 2010).

PES have become a policy means to simultaneously incentivize biodiversity conservation and rural development (Calvet-Mir et al. 2015; Leimona et al. 2015b). The external interventions as parts of rural development, such as government develop-

ment programmes and market economy might induce social changes among community members and influence their culture and practice of sharing among rural societies. For example, cases of hunter-gatherer communities in Ecuador and Indonesia show that sharing practices shift depending on the level of participation of the community and the type of products being shared. However, sharing is relatively stable when the practice aims at reducing collective risks[1] and involves nonmarket products[2] (Franzen and Eaves 2007; Napitupulu et al. 2017). In the case of PES, the main target is to collectively produce nonmarket products, i.e. regulating ecosystem services (such as increased water quantity and quality, reduced floods, increased carbon stock and sequestration). Thus, a landscape stewardship practice, in this context, payment for ecosystem services, requires strong social collectiveness in producing such public goods and, to some extent, altruism that guarantee the importance of stable sharing practices along its process. Furthermore, knowledge interfacing and sharing enhance effectiveness of PES negotiation between potential sellers and buyers of ES (Leimona et al. 2015a). Finally, a landscape with high capacities to regenerate and supply ecosystem services improves people's livelihood and buffers the risks of being vulnerable, thus enhances sustainable rural development.

Among the many stages of PES negotiation, information of willingness-to-accept of landholders as ES providers and to whom conservation contract allocated efficiently and effectively are basic. Reverse auction is a method to elicit the willingness to accept of landholders and efficiently allocate contracts in PES scheme that has proven to be practical in many PES cases around the world (Latacz-Lohmann and Schilizzi 2005; Ajayi et al. 2012; Leimona and Carrasco 2017; Whitten et al. 2017). In the context of Asian developing countries, conservation contracts of PES scheme are mostly assigned to farmer groups. Thus, a group-level auction is relevant to accommodate collective decision-making in payment level for the scheme. A group auction allows exchanging and sharing knowledge, information and conservation values among farmer group members.

Sharing is 'a complex social phenomenon that makes rather specific requirements in regard to bodily co-presence, relatedness, and interaction' (Widlok 2013). Sharing knowledge and value is a process of sociocultural service co-production at the communal level as suggested by the framework of sharing paradigm by McLaren and Agyeman (2015). In the PES case of Rejoso watershed, intangible products are exchanged and shared: knowledge and value. The Rejoso watershed is a degraded and pressured watershed located in Pasuruan District, East Java Province of Indonesia. This chapter discusses how group-level auctions enhance allocative effi-

[1] The effect of market access on sharing behaviour in two Huaorani communities in the Ecuadorian Amazon reveals that hunters share mainly to reduce food risk.

[2] The practice of sharing among a contemporary hunter-gatherer society, the Punan Tubu from North Kalimantan, Indonesia, shows that sharing behavior is not directly related to individual levels of integration in the market economy nor to participation in national development programs, and changes in practices of sharing may occur as market food products are shared differently from nonmarket products, including meat, wild edibles, and/or cultivated food.

ciency due to a sharing process during the auctions when compared to the individual-level auctions. Knowledge sharing among participants in a group reverse auction comprises auction procedures and cost and benefit the farmers gain when they win the binding conservation contract. Further, value sharing may involve collectively understanding pro-environmental behaviour for long-term financial and nonfinancial benefits and practising sustainable agricultural practices for both maintaining and forming a socioecological production landscape.

The Rejoso case presents the prospects of smallholders in the upper and midstream to contribute to better watershed services, i.e. water infiltration and sedimentation reduction, to benefit downstream domestic and industrial water users. The focus of PES in Rejoso watershed is at the upper and midstream clusters. Smallholders' practices in this production landscape influence the flow of ecosystem services (ES) utilized in the downstream clusters. In the upstream and midstream cluster, the pressure to intensify agricultural practices and convert to monoculture farming systems is high. Increased water infiltration and reduced soil erosion are two important watershed functions that can be generated from both clusters to improve the quality of the watershed in general and, particularly, the downstream water supply. Prospective actions to improve those two functions are (1) upstream, increase numbers of trees on smallholders' horticultural farms and deploy simple soil and water conservation techniques, i.e. bench terracing and vegetative strips, and (2) midstream, maintain and increase density of agroforestry practices and deploy simple soil and water conservation techniques, i.e. sediment pits and bench terracing.

This chapter contributes to understanding various forms of sharing practices for creating SEPLS by smallholders, in particular, knowledge and value sharing in the context of PES and sustainability. The next sections describe in detail the concept of PES and reverse auction as the basic scheme for this empirical case. Then, the context of the case study and the results of reverse auction are presented. The final section of discussion explores the potential of the sharing paradigms to be applied broader in the case of PES in SEPLS of developing countries.

9.2 Payment for Ecosystem Services

Evolving out of a new wave of modern environmental economics, PES has become a widely used conservation mechanism (Pattanayak et al. 2010). PES allow for the combination of both social and ecological goals, where they can improve/protect natural systems whilst also improving social conditions (Schröter et al. 2018) and livelihoods (Liu and Kontoleon 2018). Broadly, PES are defined as using performance-based incentives (e.g. money, in-kind benefits) to directly provide financial and nonfinancial 'payment' and reward or compensate ecosystem service sellers for their conservation stewardship, which subsequently provides different ecosystem goods and services. One crucial component of PES is that the benefits to the participants outweigh the costs; otherwise, the programme risks negative

outcomes or unintended feedbacks, such as noncompliance or not achieving the intended outcomes. PES can be organized as either public or private initiatives, whereby public PES often use taxes or fees, or other fiscal instruments for end users, whilst private PES are customized and arranged to fit local cultures and practices (Ezzine-de-Blas et al. 2016).

PES has been applied in a multitude of temporal and spatial scales across both developed and developing settings. The application of PES within developing countries faces numerous challenges, from issues with corruption, transparency, and weak governance. However, despite a wide breadth of challenges, there have been successful PES schemes at various stages as the scheme has stratified conditionality to determine its success (Van Noordwijk and Leimona 2011). Examples of Indonesian cases range from upscale and continued contractual PES agreements between a hydropower company and farmer groups in Sumberjaya, Lampung Province (Leimona et al. 2015a; Amaruzaman et al. 2017a), and between an industrial water company and farmer groups facilitated by a provincial watershed forum (Leimona et al. 2010; Lapeyre et al. 2015; Amaruzaman et al. 2017b).

9.3 Reverse Auction

Reverse auction (or conservation auction) is a method for identifying the lowest cost ES supplier where participants bid the lowest amount they would be willing to accept to participate in a conservation programme. Reverse auction is an efficient way of identifying participants and has been solidified as a robust, practical policy instrument (Whitten et al. 2017). This is one of ideal methods for PES to ensure that the scheme is equitable, fair, and just for all involved (McDermott et al. 2013; Pascual et al. 2014) as the implementation process and identification of participants are surrounded by potential negative consequences. For example, the case in Cidanau, West Java Province, found that farmer group leaders displayed disproportionate power of decision, whilst individual farmers have a low level of understanding of the PES programme, and concluded that the PES impacts depend on how the economic signal is transmitted to decision-makers of the scheme (Lapeyre et al. 2015). Furthermore, implementers must ensure that all potential participants have been identified; otherwise, the PES risks leaving out the more marginalized community members. Importantly, reverse auctions with closed bidding are seen as fair as they are not impacted by power or village hierarchy (Leimona and Carrasco 2017).

Reverse auction can either be held at the individual or group level. Individual level auction is currently the dominate procedure; however, group-level auction is increasing, particularly within developing country settings (Whitten et al. 2017). The preference for the auction level depends on the institutional context of the community at hand, for example, in some forest-based communities, due to the shared resources, they prefer a group-level contract (Mahanty et al. 2013). Furthermore, contracting at the group level can reduce transaction costs, acknowledge shared tenure and allow for groups to self-organize the bidding process (Engel and Palmer

2008; Narloch et al. 2017). Building on this, effective ecosystem service provision can be ensured across a landscape when groups are coordinated (Prager et al. 2012).

If the reverse auction has multiple bidding rounds, the participants have the opportunity to learn and adjust their bids. Furthermore, the use of preparatory bidding rounds has found to increase the learning and efficiency of the participants whilst also increasing the communication and trust (Leimona and Carrasco 2017; Whitten et al. 2017). Information plays a key role in reverse auctions. Information asymmetries can negatively impact PES schemes through potential overcompensation and adverse selection of participants (Lundberg et al. 2018). Using reverse auctions can help to reduce the efficiency loss due to these asymmetries (Lundberg et al. 2018). This is due to the assumption that the participants have an informational advantage over the organizers as they know the true opportunity cost for their own land (Ferraro 2008). The quality of information given to auction participants is also crucial in increasing perceived fairness/satisfaction whilst also ensuring minimal community social impacts (McGrath et al. 2017).

9.4 Rejoso Watershed: A Production Landscape Providing Watershed Services

The Rejoso watershed (62,773 ha), covering 16 sub-districts, is located at the foothill of Mount Bromo, Pasuruan District, East Java Province, Indonesia, and is a sub-watershed of Welang-Rejoso watershed. The Rejoso watershed is classified into eight clusters in three geological elevations – upstream, midstream, and downstream – that reflect the distinctive socioecological characters of each area (Fig. 9.1). This cluster classification is an important step for further planning, assessment, evaluation and management of a landscape as a dynamic, complex, spatial system. The classifications are based on several factors: elevation (upstream, midstream, downstream), dominant land cover and farming systems, rocky outcrops, farming practices, tenure status and poverty status (targeting low-to-middle incomes), sources of income, ethnicity, and culture.

Along with population growth and economic pressure, conversion of the forest into tree-based systems (agroforestry) and non-tree-based systems (horticulture) or conversion of tree-based systems into non-tree-based systems (sugarcane, paddy field) in the period of 1990–2015 has caused dramatic changes in the Rejoso watershed (Amaruzaman et al. 2018; Leimona et al. 2018). The land use and land cover changes have been gradually affecting the watershed's function of maintaining good quality and quantity of water sources. The most common environmental issues related to water sources are floods, reduced water discharge, reduced soil infiltration rate, soil erosions and sedimentation, water pollution due to chemical fertilizer and pesticide applications and landslides (Amaruzaman et al. 2018; Suprayogo et al. 2018).

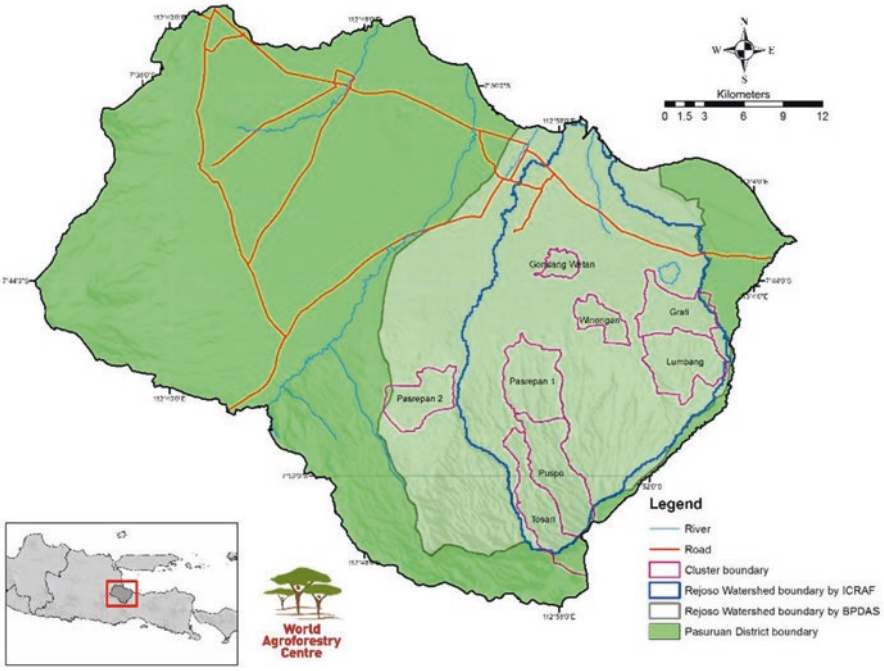

Fig. 9.1 Map of Rejoso watershed, Pasuruan District, and its landscape clusters where pilots are prioritized

The Rejoso watershed was categorized as a critically degraded watershed by Indonesian government with 2145 other degraded watersheds in Indonesia. Although it is not one of the priority degraded watersheds that will be restored and rehabilitated listed in National Medium-Term Development Plan (*Rencana Pembangunan Jangka Menengah Nasional*) 2015–2019,[3] preservation of the Rejoso watershed is important. This is given that the watershed has the Umbulan spring in the midstream area which functions as the source of clean water for not only Pasuruan District but also its surrounding districts and city such as Sidoarjo District, Gresik District, and Surabaya City – the metropolitan capital of East Java. The Umbulan spring is one of springs with the highest discharge in Java Island which is constantly decreasing in the period of 2007–2014 (Leimona et al. 2018).

Moreover, the Rejoso watershed provides a vital livelihood source for communities from the upstream to the downstream. The upstream area is characterized by smallholders practising intensive horticulture on undulating lands with relatively high incomes from selling commercial annual crops (potatoes and spring onion) and also

[3] Fifteen degraded watersheds which will be restored and rehabilitated within 2015–2019 by the National Medium-Term Development Plan are Citarum, Ciliwung, Cisadane, Serayu, Solo, and Brantas (Java); Asahan Toba, Siak, Musi, Way Sekampung, and Way Seputih (Sumatera); Moyo (West Nusa Tenggara); Kapuas (Kalimantan); and Jeneberang and Saddang (Sulawesi).

local tourism businesses near the Bromo Mountain (Fig. 9.2a). The horticultural land use to be pine forest or complex agroforest. The midstream area is dominated by tree-based farming systems and complex agroforestry practices (Fig. 9.2b), where smallholders plant and combined timber (sengon/*Paraseriathes falcataria*), fruit (mango/*Mangifera indica*, durian/*Durian zibenitus*) and commercial perennial crops such as coffee and clove in their single plots. In the last decade, stone mining has gradually become an alternative source of income for the communities in the midstream area. The downstream area is relatively diverse dominated by rainfed and irrigated paddy fields, complex agroforest, with sugarcane and other annual crops (Table 9.1).

Having both strategic and vital functions, integrated and sustainable watershed management by involving multi-stakeholder: local government, NGO, private sec-

Fig. 9.2 Landscape portrait of the Rejoso watershed. (**a**) Potatoes and vegetable gardens at the upstream watershed. (**b**) Agroforestry practices in the midstream watershed

Table 9.1 Landscape and socioeconomic characteristics from upstream to downstream of the Rejoso watershed

	Downstream	Midstream	Upstream
Livelihood sources	Paddy (lowland and upland) and other annual crops (maize, ground nut, sugarcane)	Fruit trees (mango, durian), timber (sengon), paddy (upland) and cows (dairy and cattle), stone mining	Horticulture (potatoes and vegetable), other annual crops (maize) and cows (cattle and dairy), tourism sector
Dominant land use	Paddy field and sugarcane	Agroforestry and sugarcane	Horticulture, agroforestry and pine forest
Income per capita per day	No data available	IDR 23,000,- – IDR 30,000,-	IDR 60,000,- – IDR 80,000,-
Arable land	Private and *Perhutani* (a timber state forest company)	Private (1–1.5 ha)	Private (1–1.5 ha)
		Perhutani (0.1–0.5 ha)	*Perhutani* (0.1–0.3 ha)
Tribe	Madurese, Javanese	Madurese, Javanese	Tengger, Javanese
Water shortage	Yes (partial)	Yes (partial)	No
Source of water	Artesian and surface wells	Springs and rain water	Springs and rain water

tors, and local communities (farmers) through a PES scheme, is a watershed management option that can be applied to the Rejoso watershed to avoid further watershed degradation in the future. In this case, farmers (both managers and landowners) in the upstream and midstream areas of the Rejoso watershed are ecosystem service providers who manage their land in an environmentally friendly way, and therefore, the Rejoso watershed is improved and beneficial for downstream communities as the ecosystem service beneficiaries.

9.5 Method

The Rejoso Kita initiative is collaboratively implemented by a consortium coordinated by World Agroforestry (ICRAF), Social Investment Indonesia Foundation, CK-Net, TNC and partners supported by the Danone Ecosystem Fund. The primary data collected for the preparation of this chapter originated from research coordinated by ICRAF. The reverse auction research and implementation is a part of the development of the Rejoso business case (Leimona et al. 2018). The business case presents the benefits of applying innovations in setting the PES pilot that enhances participation and inclusiveness of smallholder farmers in the programme, links scientific approaches to on-the-ground actions and, ultimately, ensures that the programme is cost-efficient and effective in restoring and maintaining watershed functions compared to 'business as usual'.

Figure 9.3 describes the stages of PES implementation in upstream and midstream area of the Rejoso watershed. A series of focus group discussions (FGD) collect data and information on the characteristics of the landscape and socioeconomic conditions in the Rejoso watershed prior to the stages described below (Fig. 9.3) led by the ICRAF research team. This process of data gaining and capacity strengthening covers three main topics: (1) land-use and land-cover (LULC) change as well as community's perception on the drivers of change; (2) water resources and their management, covering their potentials and problems, knowledge and community practices on water and soil conservation, as well as adaptation and mitigation

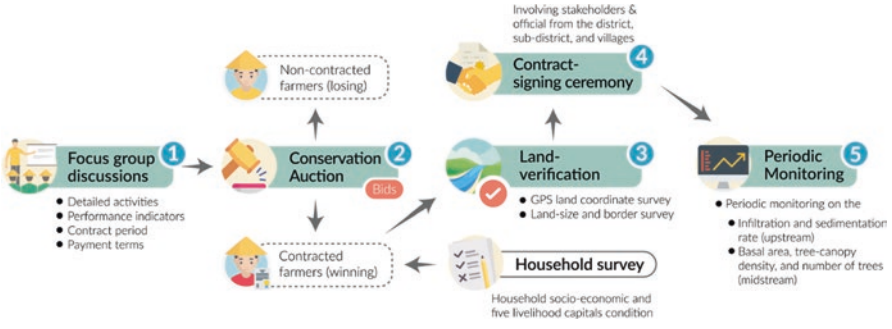

Fig. 9.3 Stages of payment for ES in upstream and midstream area

strategies for water resource issues; and (3) livelihood strategies and challenges related to the agricultural sector, including farming practices, extreme events affecting farming, as well as tree selection criteria and tree commodity preferences.

1. *Focus group discussions (FGDs)* were attended by farmer group representatives, village heads, and farmer extensions to discuss the environmentally friendly agricultural practices including the options of conservation activities and identify elements of contract, performance indicators, and payment terms suitable for farmer in upstream and midstream of the Rejoso watershed. The participants of the focus group discussions agreed on the conservation activities, land management (Table 9.2), and payment and monitoring modalities for each term (Table 9.3). In upstream area, conservation activities to be carried out within 1-year period of contract were (1) planting 300 cemara (*Casuarina junghuhniana*) trees per ha and (2) planting strip grass along the drainage channel and parallel with the contour, minimum 50% area, whilst in midstream area were (1) planting/maintaining at least 500 fruit or timber trees per ha, with maximum of 50 trees of *Paraserianthes falcataria*, and (2) making 200 sediment pits per ha, with the size of 50 × 50 × 40 cm, or making terrace with vegetative strips minimum 50% of area. In both the upstream and midstream, payments were made through farmer groups.
2. *Conservation reverse auctions* were attended by 150 farmers in the upstream and midstream, aiming to determine the value of the conservation contract with proxy 'willingness to accept' from farmers and was conducted in two stages: (1) individual auctions and (2) group auctions. Individual auctions consisted of six

Table 9.2 Conservation activities and management in upstream and midstream area of Rejoso watershed for 1-year PES contract

Landscape	Conservation activities	Management
Upstream	Planting and maintaining 300 cemara trees per ha (*Casuarina junghuhniana*) distributed evenly on farms	1. Allowed to clean weeds
		2. Not allowed to clean litter
		3. Allowed to prune trees as a plant maintenance
	Planting strip grass along the drainage channel and parallel with the contour, minimum 50% area	4. Dead trees must be replanted
		5. Not allowed to cut trees: if the farmer want to cut the tree, they must report to village head and maintain the minimum tree density (300 trees per ha)
Midstream	Planting/maintaining at least 500 timber or fruit trees per ha, with maximum 50 trees of *Paraserianthes falcataria*	1. Allowed to prune trees for productivity maintenance
		2. Allowed to clean weeds
		3. Not allowed to clean litter
	Making 200 sediment pits per ha, with the size 50 × 50 × 40 cm or making terrace with vegetative strips minimum 50% of area	4. Dead trees must be replanted
		5. Not allowed to cut trees: if the farmer want to cut the tree, they must report to village head and maintain the minimum tree density (500 trees per ha)

Table 9.3 Payment modalities

Payment term	Amount (%)		Liability	
	Upstream	Midstream	Upstream	Midstream
Term I	40	30	Contract signing	Contract signing
			Develop group working plan and approved by group member	Develop group working plan and approved by group member
Monitoring I	–	–	Planting strip grass (100%)	Making 100 sediment pits
			Establishing cemara nursery	Planting/maintaining 300 trees per ha
Monitoring II and term II	30	30	Planting strip grass (100%)	Making 200 sediment pits
			Planting cemara minimum 240 cemara per ha (80%)	Planting/maintaining 500 trees per ha
Monitoring III and term III	30	40	Planting strip grass (100%)	Making 200 sediment pits
			Planting cemara minimum 300 cemara per ha (100%)	Planting/maintaining 500 trees per ha

rounds, whilst group auctions consisted of four rounds. The last round of group auctions was the result of the auction, and the previous rounds were considered as the learning and decision-making processes for farmers. In each stage and round, the winners were announced by mentioning individual ID or group ID without mentioning the bid value. The number of winners was determined by making a trade-off between the 'uniform' price based on the submitted bid price and availability of the conservation fund.

3. *Land verification* was conducted prior to the signing of contracts and payments for contracted farmers. The size of verified land was smaller than the size of submitted land during reverse auction; therefore, the contract was also offered to the other group members that did not join the auction but willing to do the conservation activities. In total, 106.6 ha were verified from 176 farmers in upstream and downstream area.
4. *Contract signing ceremony* was attended by various relevant stakeholders from village, sub-district, and district.
5. *Monitoring activities* of ES performance through proxy infiltration rate, sedimentation, and quality and quantity of agroforestry system in upstream and midstream.

9.6 Result

To determine and elicit the conservation contract values, the research team conducted two conservation auctions. Due to the upstream and midstream having different conservation contract arrangements, two contract values were required. The

reverse auction method mimics market transactions and negotiation techniques to elicit the willingness-to-accept of smallholders. The conservation cost for each individual is private. The auction process aims at increasing farmers' awareness of the benefit of conserving their farm land, at least in the long term, and allows discussion among farmers and facilitators.

In Rejoso, the team conducted the auction at both the individual and group levels as group contracts were preferable and reflect grassroots' collective actions. The group auction resulted in more realistic and efficient bids compared to the individual ones. We assumed there was a more effective information exchange among smallholders. Figure 9.3 shows the complete process of the auctions starting from focus-group discussion, auction, land verification for the winners, contract signing and periodic monitoring. Results from the two conservation auctions are presented at individual and group levels in the upstream (Table 9.4) and midstream (Table 9.5).

Table 9.4 Individual and group auction results for upstream

Component	Unit	Individual	Group
Total participants	Persons/groups	70	7
Total submitted land	Hectare	39.925	39.82
Total bids	IDR	6,200,600,000	579,423,500
Bid per hectare			
Average	IDR	15,365,028	3,937,652
Median	IDR	6,000,000	3,000,000
Min	IDR	200,000	1,701,743
Max	IDR	140,000,000	12,000,000
Total winners	Persons/group	25	4
Total winning land	Hectare	16.22	25.94
Cut-off price	IDR/hectare	4,511,500	3,196,347
Total contract value	IDR	91,416,800	94,725,926

Table 9.5 Individual and group auction results for midstream

Component	Unit	Individual	Group
Total group	Persons/group	135	11
Total submitted land	Hectare	119.46	123.38
Total bids	IDR	542,500,000	257,902,050
Bid per hectare			
Average	IDR	5,295,305	2,273,083
Median	IDR	2,976,190	1,470,899
Min	IDR	200,000	976,190
Max	IDR	50,000,000	5,000,000
Total winners	Persons/group	54	5
Total winning land	Hectare	50.67	64.40
Cut-off price	IDR/hectare	2,000,000	1,470,899
Total contract value	IDR	96,340,000	100,500,000

Fig. 9.4 Situation during reverse auction in the midstream villages (left, farmers register their lands; right, farmers communicate and discuss in groups)

In the upstream area, the cut-off price[4] was IDR 4,511,500 per hectare for individual auction and IDR 3,196,347 per hectare for the group auction. In the midstream area, the cut-off price was IDR 2,000,000 per hectare for individual auction and IDR 1,470,899 per hectare for the group auction. Cut-off prices of group auction are decreased by about 30% in the upstream and 26% in the downstream compared to the ones of individual auction. The group auction proves to be able to increase the efficiency of conservation costs compared to the individual one.

The analysis shows that by allowing the group members to communicate with each other, sharing knowledge and value happened. At the group level, with interaction among farmers' group members, the bidding levels decreased, compared to the individual auction, as farmers started to understand the auction process and the benefits of conservation activities (Fig. 9.4). This knowledge and value sharing encompasses how they understand the competitive bidding process and how their bids can influence the overall outcomes of winning or losing the conservation contracts. Most importantly, incorporated is how farmers share their conservation values as agricultural conservation efforts of PES not only benefit the external actors but also co-benefit themselves.

9.7 Payment for Ecosystem Services and Sharing Paradigm: A Discussion on Future Potential

PES is a prospective policy tool for production landscapes to contribute to ES provisions and broader conservation agenda by creating socioecological systems. Whilst claimed as a market-based approach, PES constitutes a complex socioecological systems (Muradian et al. 2013), beyond financial transaction between ecosystem service providers and beneficiaries. The design of payment schemes, shaping their

[4] Cut-off price is the price paid by the auctioneer after cumulatively summing up all the bids offered by the participants, just above the conservation budget runs out. In this case study, the cut-off price is determined using the sealed-bid second-price method or Vickrey auction.

effectiveness, and distributional outcomes are mostly influenced by social processes (Boyce 2002; Corbera et al. 2009; Muradian et al. 2013) involving various stakeholders. With the perspective that to develop and sustain a PES scheme form social interactions, in which individuals and groups interact and establish social relationship, natural sharing occurs repeatedly in various forms at each PES stage.

McLaren and Agyeman (2015) introduce a broad concept of a sharing paradigm that includes multiple dimensions based on (1) objects to be shared (sharing things, sharing services, and sharing activities or experiences); (2) subjects involved (between private individuals, among collective groups of community members, or state provisions of resources and services of sharing); (3) nature of shared objects (material/virtual, tangible/intangible); (4) economic activity (production, consumption); (5) temporal (simultaneously, sequential); and (6) nature of consumption (rivalrous, non-rivalrous). Based on these dimensions, McLaren and Agyeman (2015) mapped the sharing paradigm into four different contrasting quadrants: (1) the sharing process that includes existence of intermediary and the ways sharing is organized (i.e. sociocultural or informal through natural evolving process versus (inter)mediated sharing through learning process) and (2) the rationale and motivation of sharing (i.e. extrinsic, commercially driven, and intrinsic motivation based on a sense of community). Based on this classification, we suggest the sharing process at various stages of PES development (Table 9.6) and highlight that each matrix quadrant is not a binary entity but a gradation process.

The sharing process in PES and relevant rural development to PES covers both tangible and non-tangible objects and covers only production activities in land-based agricultural sectors. The empirical cases show that mostly sharing process on PES is under the domain of sociocultural sharing with intrinsic motivations from the PES participants. This characteristic is relevant as PES itself is dominated by prosocial components and altruism behaviours towards contributing to common resources (Villamor and van Noordwijk 2011; Van Noordwijk et al. 2012; Muradian et al. 2013). 'Peer-to-peer' sharing might happen as the role of intermediary is dominant in PES. Intermediated capacity building and training are in the form of sharing that often becomes a sharing media among participants that may also involve nonparticipants. These activities can be part of ensuring a success performance of PES and becoming options for nonfinancial or in-kind rewards of PES.

Commercial sharing exists in rural areas of developing countries recently, which may be outside, but relevant to, the PES schemes. Similar to their urban counterparts, under the concept of 'sharing economy', the main purpose of this sharing process is to enhance the efficiency of their economic activities or even become a new business opportunity. Tools rented in rural areas, for example, are tractor, water pump, rice growing machine, rice threshing machine, rice mill, and pest spray. Expensive farming equipment, lack of or ineffective subsidy from the government, and underutilized farming tools due to urbanization are reasons for this sharing in Indonesian cases.[5] In India, a company called 'Farmringg' supports smallholders

[5] https://www.bisnisjasa.id/2017/06/jenis-usaha-persewaan-yang-cocok-di-desa.html accessed on May 7, 2018.

Table 9.6 Key dimensions of the sharing paradigm for payment for ecosystem services

	(Inter)mediated sharing (learned)	Sociocultural sharing (evolved)
Communal sharing (intrinsically motivated)	'Peer-to-peer' sharing, mostly enabled by not-for-profit organisations	The 'collective commons'
	Farmers' school	Understanding on auction process, components of contractual agreements, PES concept (design stage)
	Facilitated trainings supported by intermediary of PES as parts of implementations	
	Adoption of conservation techniques by nonparticipants (post-implementation stage)	Information sharing on agricultural and conservation techniques and skills (design and implementation stage)
		Information sharing on farmer group management (implementation stage)
		Rotating labour sharing (*arisan kerja*) within farmers' group (implementation stage)
Commercial sharing (extrinsically motivated)	The 'sharing economy' in the broader rural development sphere	The 'collective economy' of co-production
	Agricultural tools and equipment renting	Overall PES scheme for co-production of ES when integrated into rural development
	Joint nursery	
	Joint online platform for agricultural commodity marketing	

The framework of key dimensions of the sharing paradigm provided by McLaren and Agyeman (2015)

who face difficulties in investing in modern farm tool and 'farm equipment goes Uber way'[6] collaborating with start-up business companies.

Finally, the perspective of sharing from PES can broaden towards a commercially or extrinsically motivated sociocultural sharing. This is when PES has been well integrated into rural development initiatives, which reflects the concept of multifunctionality of production landscape. Sociocultural sharing will dominate the practice of (agro)biodiversity conservation and ecosystem service provisions as parts of voluntary and prosocial activities towards broader societies' benefits. Simultaneously, this farming practice may produce green commodities that, with the current trends of environmentally and socially friendly consumptions, induce premium quality of products and prices.

[6] http://img1.wsimg.com/blobby/go/e09fa362-46ae-437b-981a-029676824808/downloads/1bpqjvkib_49047.pdf accessed on May 7, 2018.

9.8 Conclusion

Creating socioecological production landscapes (SEPLS), where people and nature can co-evolve as interlinked societies and ecological systems, is contingent on the sharing practices of the society at hand. In the case of Rejoso watershed, we find that using reverse auctions at the group level allows for more realistic and efficient bids, compared to those at the individual level. We hypothesize that these bids are more realistic and efficient due to knowledge sharing and communication between group members. Having realistic bids is important for PES organizers due to the availability and restrictions found within conservation funding. We discuss the results within the context of a sharing paradigm. This sharing paradigm is a currently underutilized concept within PES research and practice, whereby it can help ensure the success of PES outcomes and even be considered as a nonfinancial or in-kind reward. This chapter represents a step forward within PES in understanding socioecological production landscapes, knowledge sharing, and contracting at the group level using reverse auctions.

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Chapter 10
Sharing Place: A Case Study on the Loss of Peri-urban Landscape to Urbanization in India

Mrittika Basu, Osamu Saito, Shizuka Hashimoto, and Rajarshi Dasgupta

Abstract Peri-urban landscapes are fast changing with the loss of its own characteristics and transforming into a new landscape with new mosaic set of characteristics that are strikingly different from the previous. There is an increasing trend across the world to transform these peri-urban areas, just outside the periphery of bigger cities, into satellite towns so that they can accommodate the city's increasing population as well as be a development hub attracting more business and development for the area. In this study, a survey was carried out with the local communities inhabiting in village pockets inside a newly developed satellite town in the peripheries of Kolkata, one of the four metropolitan cities of India. The study enquired how the local communities perceive about sharing their land with the new residents living in high-rise apartments and how the change in the status of home gardens and sharing of its produce has changed the social relationships in the area. Majority of the respondents were found to be not happy and/or satisfied about sharing their place with the new residents as land acquisition to develop the city has resulted in loss of livelihood and income for them. The difference in sociocultural aspects was also found to be major contributor behind the gap between new and old residents in the area. The home garden status of the area has also significantly changed as most of the households have lost their property. The sharing of produce among neighbors, family members, and others in the community has also declined that results to loss of social relations.

Keywords Sharing place · Urbanization · Home gardens · Social relation · Peri-urban

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10.1 Introduction

Conversion of land from rural to urban use is considered an inevitable result of industrialization and urbanization across the globe. Land conversion is generally defined as "a process characterized by the transference of land from one type of use and user to another" (Quang Phuc et al. 2014). Out of the various land conversion types, agricultural land conversion is found to be significantly predominant in most parts of the world, thus leading to formulation of country and/or region-specific actions and laws for the swift transfer of rights and ownership. The demand for conversion of agricultural land to industrial/residential uses is mainly predominant in developing countries (Azadi et al. 2010) as urban development on agricultural lands are considered as less cost intensive by the governments (Azadi et al. 2010). The driving factors may be different, but countries like India, China, Vietnam, Indonesia, Brazil, and vast stretches of Africa are facing similar conditions, and the consequences are mostly alike. This fast-evolving development creates opportunities, challenges, and risks. Macro-level benefits (GDP growth and government revenues) are derived through increased investments and opportunities develop for raising local living standards. For poorer countries with relatively abundant land, incoming investors may bring capital, technology, know-how, and market access and may play an important role in catalyzing economic development in rural areas. On the other hand, large-scale land acquisitions can result in local people losing access to the resources on which they depend for their food and livelihoods. Not only livelihood, but conversion of landscapes within and around peripheries poses serious sustainability risks. In case of agricultural landscape, studies have shown that fragmentation of agricultural landscapes by urban land use reduces carbon storage functions and changes surface albedo, evapotranspiration, soil structure, and soil biodiversity. Local residents may be directly dispossessed of the land they live on, often their long-standing heritage. More indirect impacts may also be of major significance, though these are often more difficult to measure. They include loss of social and cultural values, social relationships, increasing crime rates, etc. "It is not only the land acquired that is affected" (Cotula et al. 2009). Consequences are imparted in other parts of the country or in the region, as local users pushed from higher-value lands encroach upon more marginal lands and as poorer people are priced out of the land market. Impacts may also be multiplied where land acquisitions are accompanied by accelerated policy reform to attract investment.

Urban peripheries are the most preferred sites to accommodate the expansion of cities. Peri-urban areas are generally defined as transitional areas between urban use and rural use (Winarso et al. 2015). In addition to instrumental benefits like nutrient cycling, urban peripheries provide a wide range of cultural landscape services and functions. However, agricultural values and functions of peri-urban areas continue to grab attentions (Dossa et al. 2011; Padgham et al. 2015). With increasing urbanization, agriculture in the periphery is bound to decline, and sustainability effects of this process include urban heat island, depletion and pollution of water resources, increased greenhouse emissions, biodiversity loss, social inequality, and increasing

poverty (Buyantuyev and Wu 2010; Zana Naab et al. 2013). The boundaries of peri-urban areas are usually diffused, and many peri-urban activities move outward as the city grows. These areas eventually acquire a mosaic pattern of growth with new residents and new activities mingled with old land uses, including farms, villages, forest patches, etc. (Douglas 2006). As a physical phenomenon, peri-urbanization involves the conversion of agricultural land, pastures, and forests to urban areas. As a social phenomenon, peri-urbanization involves cultural and lifestyle adjustments of agrarian communities as they become absorbed into the sphere of the urban economy.

Across last three decades, peri-urban spaces have been the focus area for special economic zones (SEZs) and new town development in several parts of Asia (Farole and Akinci 2011). New town is basically a planned community typically constructed in a previously undeveloped area (Wang et al. 2010). Developed as a necessary step to balance urbanization in metropolitan cities, a new town can function both as a new development center and destination for investments and house population that may spill from a nearby metropolitan center. Development of new towns has started since in 1970s around the big cities in Asia. For urban peripheries, challenges are directly related to their highly heterogeneous mosaic of physical environments (with different densities and land uses), fast-changing social and cultural structures, and diverse forms of governance that encompass several institutional regimes at different administrative levels (Friedmann 2016).

In reference to Chap. 1 of this book, sharing economy and its role in attaining sustainability is well explained. Belk (2007) suggests that sharing involves "the act and process of distributing what is ours to others for their use and/or the act and process of receiving or taking something from others for our use." A more compact definition is provided by Benkler (2004) who sees sharing as "nonreciprocal pro-social behavior." Sharing is carried out for functional reasons like survival or as an act of courtesy or kindness to others (Belk 2014). Traditionally and even recently, sharing is more likely to take place within family, close kin, and friends than among strangers. When sharing is an inclusive act that is likely to make the recipient a part of a pseudo-family and our aggregate extended self, it can be described as "sharing in" (Belk 2010). On the other hand, "sharing out" is when sharing involves dividing something between relative strangers or when it is intended as a onetime act such as providing someone with spare change, directions, or the time of day. There is also distinction based on ownership – non-ownership sharing and the transfer of ownership and reciprocal exchange that are involved in both gift-giving and marketplace exchange (Belk 2014; Hamari et al. 2016).

In lieu of the abovementioned concepts of "sharing in" and "sharing out," the current study presents two cases from a peri-urban production landscape that is facing rapid transformation due to urbanization. Sharing of natural resources has been an age-old tradition and is mainly through informal gifting and/or giving among family, friends, neighbors, and close relatives, usually non-ownership-based sharing except in case of inheritance along family line. Home garden produce is a typical example of this kind of sharing. As per the definition by Belk (2010), this can be considered as an informal practice of "sharing in" which is carried out of courtesy,

good social relations, and/or kindness and usually without any transfer of ownership. With land acquisition and development, home gardens are also getting lost. Hence, sharing of home garden produce is hypothesized to have significantly decreased. This may have considerable impact on social relations as home gardens are related to various social mechanisms and resilience strategies (Howard 2006; Alayón-Gamboa and Gurri-García 2008).

To carry out the development, land was acquired from the local inhabitants. The acquired land is then developed, and ownership is transferred to the new residents who come and start living in high-rise and gated residential complexes. As the local inhabitants give away their land to complete strangers with a transfer of ownership in exchange of a compensation, it is significantly similar to the "sharing out" mechanism. "Sharing out" mechanism is more prominent when the local inhabitants live in the same developed area, but mostly in the confined old settlements and could witness the developments going on lands which once belonged to them. This kind of sharing of place is significantly different from Airbnb, Turnkey, HomeAway, etc. where personal space is rented out in exchange of economic transactions on a short-term basis.

With respect to the abovementioned concepts, firstly, the current study attempts to evaluate the changes in home garden status and sharing of its produce among the peri-urban communities and impacts of these changes on social relationship. Secondly, the study taps into a different concept of sharing places where emotional attachment of people to place is evaluated with respect to dispossession of their land. The study aims at understanding the perception of local inhabitants about sharing their lands with new residents and how it has resulted to societal changes in the study area. The findings will significantly assist in understanding how the sharing practices are changing due to urbanization and its impact on social relationships of peri-urban communities.

10.2 Study Area

Kolkata city is one of the megacities in the world and third most populous metropolitan city in India (UNDESA 2016). The city, under the jurisdiction of Kolkata Municipal Corporation (KMC), expands across 185 km^2 and a population of 4.5 million people (GOI 2011). It is considered as the commercial, financial, and cultural center of east India and northeastern states. This densely populated city had been originally wetland, which over the decades was reclaimed to accommodate the city's increasing population. The city has undergone tremendous growth during the last 300 years which has led to major land use and land cover transformations in the surrounding regions (Chatterjee et al. 2006; Sen 2011). To release the population pressure over the city, the New Town project was initiated in the early 1990s in Rajarhat which is in the periphery of the city (Fig. 10.1).

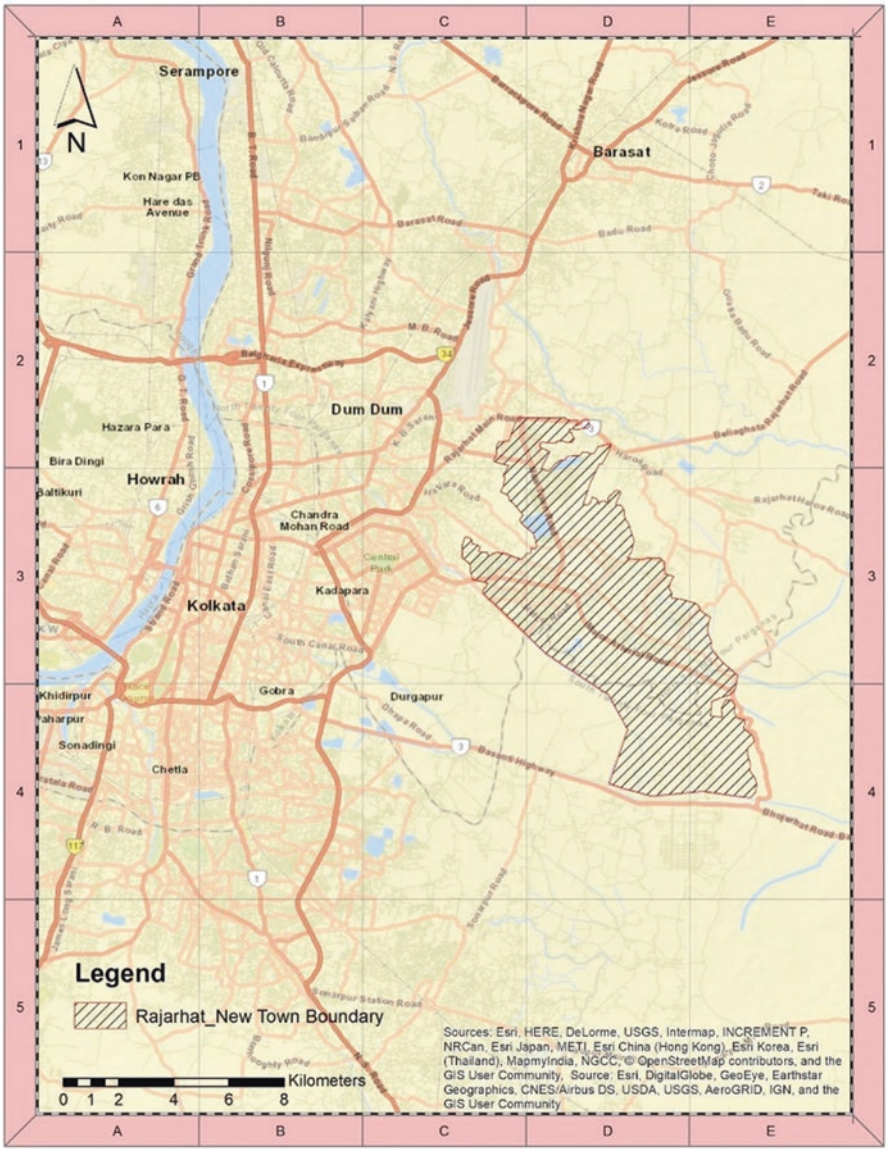

Fig. 10.1 Location of New Town, Rajarhat

10.2.1 Development of New Town, Rajarhat

The Rajarhat area in the wetlands has aquifers crucial for water recharge and for the hydrological equilibrium of the watersheds in the area. Furthermore, this area is a site of immensely rich biodiversity that urbanization only threatens to destroy

(Banerjee 2012). This site was particularly characterized by innumerable marshes and paleo-channels (De 1994). According to Ghosh et al. (2000), the New Town project area of 3075 ha had been completely rural prior to land acquisition. There was no forest or culturable waste land within the project area. The land was predominantly cultivable with large number of water bodies including ponds and canals. More than two-third of the area acquired for the project had been under agriculture. Agriculture and fishery were the main livelihood of the local inhabitants.

Prior to the land acquisition, Rajarhat area recorded a population of 163,193 in 1981 and 258,358 in 1991 censuses by the Govt. of India (Paul 2012). By 2001, census figures indicate that the population of Rajarhat had dropped by 49% (GOI 2001). This could be attributed to the already started land acquisition process in the area which would have resulted in dispossession of land and movement of people from the area to outskirts or outside the area in search of alternate livelihoods. The 2011 census by the Govt. of India reports a population of 189,893 for the Rajarhat area including both the rural and urban areas located inside its boundary (GOI 2011). However, the current population size of New Town is yet to be published.

Owing to the huge stretch of marsh lands and agricultural lands, land filling was carried out to make it suitable for residential, industrial, and commercial purposes. This degraded the land to the extent that it was no longer arable, contaminating surrounding paddy fields with silt, draining and filling local fish ponds, and more generally forcing local communities to either give up their land and livelihood or acquiesce to the government's land acquisition demands. The acquisition of land was carried out in different phases over a period of 13 years from 1996 to 2009 (Roy 2014) from villages located at distance of mere 10 km from the boundary of the city. Except for the old village settlement area, all the land and water bodies has been acquired. In some areas, the settlements are moved and rehabilitated after acquisition. This has resulted to a mosaic pattern of habitation in the area with old village settlements interspersed between newly developed infrastructures that includes highly gated residential complexes, shopping malls, working spaces, etc. (Fig. 10.2). These village settlements are referred to as "service villages" as the people residing in these villages are considered to provide various "services" to the newly developed area (Roy 2005). The "services" range from working as security to new offices and residential complexes, office and household cleaning staffs, electricians, plumbers, etc. Though the land acquisition is claimed to be voluntary by the government, i.e., with the willingness and consent of the local dwellers, studies report that land has been acquired forcefully in the area (Roy 2014; Dey et al. 2016). This resulted to many conflicts across the area between the local inhabitants and government. Currently, New Town, Rajarhat, has been divided into three action areas (AA) and one central business district (CBD). The action areas are mainly occupied by high-rise and gated residential complexes, shopping malls, high-end hospitals and schools, urban parks, etc. The area has also attracted various information technology companies who built up their offices that also pulled a large percent of residing as well as floating population.

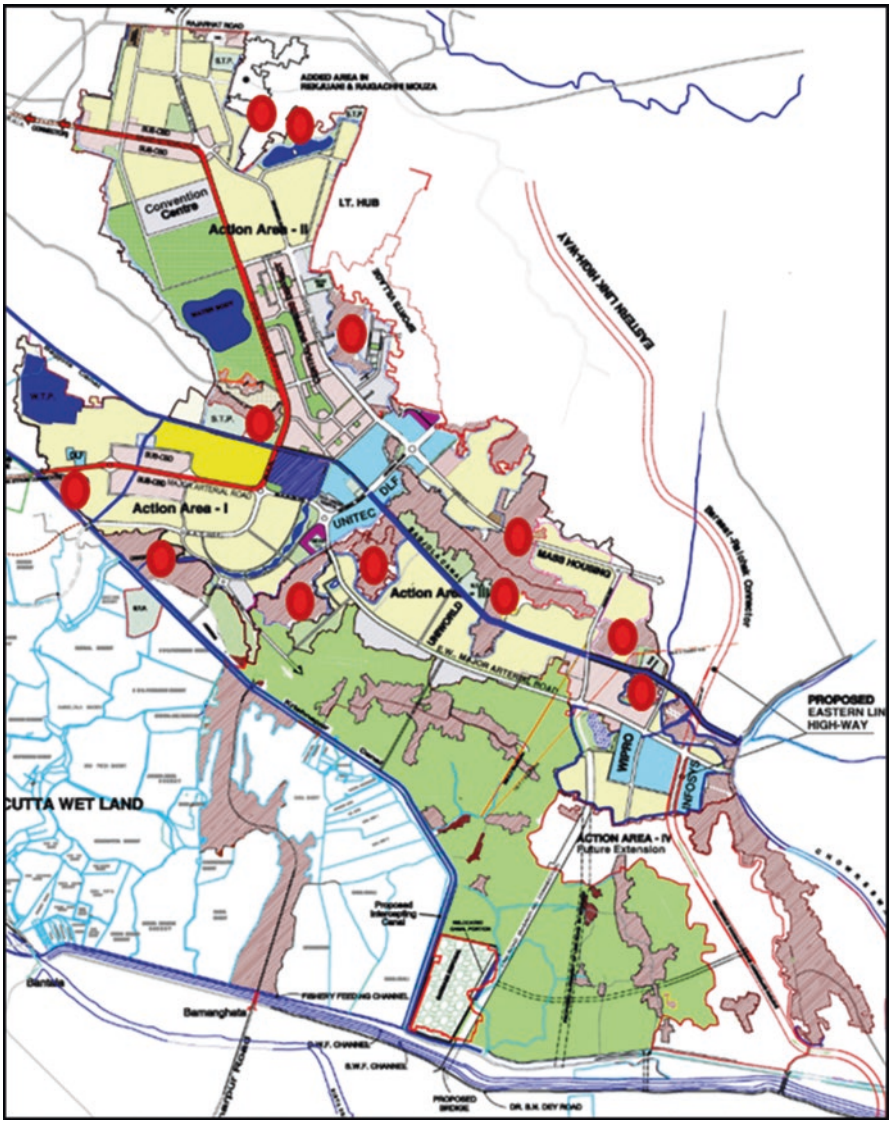

Fig. 10.2 The location of the surveyed village settlements (marked as red) inside New Town, Rajarhat. (Source: Master Land Use Plan WBHIDCO 2000)

Due to the abovementioned mosaic design of New Town, Rajarhat, it makes them a unique case of urbanization where old village settlements, not slums as in other cities, live inside the boundaries of the newly developed area (Fig. 10.2). This mosaic pattern of development makes them an ideal case study to be evaluated for traditional sharing practices like home gardens and a new form of "sharing out" in terms of place sharing with new residential population.

10.3 Data Collection and Analysis

A face-to-face questionnaire survey was carried out with old inhabitants from 209 households across 12 villages (total number of households in 12 villages is approx. 20,000) in the study area during July–August 2017. It was made sure that the selected villages are spread across different action areas in the study. Random sampling was carried out to select the households for survey based on their agreement to participate in the study. As there is a persistent conflict on land acquisition between local inhabitants and government, many of the approached households didn't agree to participate in the survey. The household head was mainly approached to provide responses in a Likert Scale to the questions on change in ownership of home gardens, sharing their produce and its impact on changing social relationships in the area. The respondents were also asked about their perception ("Are you satisfied on sharing your land with the new inhabitants in the area?") on sharing their land and the detailed explanation behind their responses. The questionnaire survey was carried out in the local language *Bengali* and took around 15–20 min. Simple descriptive analysis is carried out to analyze the results. A narrative approach is also adopted to understand the responses of the participants. Spearman's correlation analysis is conducted to evaluate the relation between perception on sharing of place and other factors like age and education of household head, perceived changes in social relations, household residential years, and change in place attachment. Place attachment was mainly assessed using four statements: (1) "The village and surrounding area mean a lot to me"; (2) "My attachment to the village and the surrounding area weakened after the project"; (3) "I have fond memories of the place and is emotionally attached to this area"; and (4) "I want my future generation to be grown up in this place." The responses were recorded in a 5-point Likert scale, with "4" being measured as "strongly agree" and "0" as "strongly disagree," except for the second statement where inverse scaling of responses was used.

10.4 Results and Discussions

10.4.1 Demographic and Livelihood Characteristics

Table 10.1 shows the demographic characteristics of sampled households under study. A higher percentage of male-headed households (77%) than female-headed households (23%) were found to participate in the questionnaire survey. A higher percent (60%) age of surveyed household heads was found to lie between 41 and 60 years. Household size in the study area is found to be high with an average size of six members per surveyed household. The literacy rate was predominantly low in the study area with 42% of the respondents being illiterate, and only 7% was found to have studied beyond junior high school level.

Table 10.1 Demographic characteristics of the sampled households in the study area

Variables		Variables	
Household head age (years)	% respondents	Household head educational status	% respondents
a. 20–30 years	3	Illiterate	42
b. 31–40 years	14	Literate (nonformal)	8
c. 41–50 years	29	Elementary education	21
d. 51–60 years	31	Junior high school	22
e. 61–70 years	18	High school	4
f. 71–80 years	4	Graduate	3
g. >80 years	1	Postgraduate and beyond	0
Household head sex		Household size	Number of members
a. Male	77	Average	6
b. Female	23	Maximum	20
		Minimum	2

Because of land dispossession, there has been significant change in household livelihood status in the study area. Out of the total surveyed households, 77% (161 number of households) had to completely change their livelihood, and 18% (37 number of households) have partially changed their main source of income. Livelihood transition has been mainly from primary sector like agriculture and allied sectors to secondary and tertiary sectors like security guards, local vendors, small businesses, etc.

Prior to the development, the maximum household land holding size was 5.36 Ha. The maximum holding size post land acquisition was only 1.61 Ha. The lowland holding size demonstrates the higher percent of marginal farmers in the study area. More than 50% of the farmers in the study area were found to be marginal farmers prior to land acquisition and development. Out of the studied households, there were no large farmers (≥10 ha), and the land holding size of only one farmer was between 4 and 10 ha. Considering the lowland holding size of the households in the study area, the impact of land dispossession is more severe and widespread. Percent of households with no land holding increased from 27% to 93%, before and after the land acquisition and development.

10.4.2 Changes in Sharing of Home Garden Produce

Home gardens are considered as small-scale socio-ecological systems embedded in larger socio-ecological systems and reflect the role of nature in human life (Berkes et al. 2003). The multifunctional properties of home gardens in urban, peri-urban, and rural landscape have gained widespread attention (Mohri et al. 2018; Kamiyama et al. 2016; Galhena et al. 2013; Galluzzi et al. 2010). In particular, home gardens

are reported to enhance social relations in subsistence societies through gift-giving, reciprocity, and barter of resources (Howard 2006). Hence, this section attempts to understand whether changes in home gardens have specific impact on social relations among the old inhabitants in the study area.

Out of the total studied households ($N = 209$), 72.7% households had home gardens before the land acquisition started for New Town development. The home gardens were usually attached to the houses and fenced. As responded by the interviewees, some home gardens were also located by the canal and riverside and attached to agricultural lands. The respondents also pointed out that the home gardens mainly included leafy vegetables, vegetables, and fruit trees like mango, banana, jackfruit, coconut, etc. Bamboo, coconut, and areca nut trees were also very common components of home gardens in the study area. Approximately 10% of studied households reported that they used to sell the home garden produce to local markets in addition to their own consumption. Coconuts, areca nuts, bamboo, and banana were the main home garden produces sold locally as a supplementary household income. Similar to the study by Kamiyama et al. (2016), neighbors, friends, and family were also identified as main sharing partners in the study area.

In addition to home gardens, ponds were found to be an integral part of home garden system in the study area. Almost 32% of the studied rural households owned ponds inside the premises of the house. The pond water was usually used for household purpose and for growing fish. Though the produce were mainly consumed by the household, surplus was sold in local markets and often shared with neighbors, friend, and family.

Most households (61%) in the present study agreed that home gardens played a significant role in maintaining and improving social and personal relationship in the study area. The respondents agreed that home gardens helped in building up social cohesion where one household thought of well-being of the other in the community and maintaining cordial gestures. The reciprocity in sharing the produces strengthened their common identity on belonging to the same socioeconomic status and belongingness to a common place. This sharing also helped in building and maintaining a personal support system inside the community that would help the household in times of crisis and/or emergency situations. A few studies reported similar findings where giving or gifting without any monetary transaction often involves reciprocal relationships that plays an important role in building social relationship, social integration and social capital (Nolin 2012; Morton et al. 2008; Lee et al. 1994).

As the landscape underwent transition, due to urbanization-led development in this case, home gardens get transformed or lost (Kamiyama et al. 2016; Mohri et al. 2018). In case of the present study, nearly 76% of surveyed households with home gardens responded to have lost them and 21.4% had to shrink the size of the gardens. Almost 3% of the households, mainly from action area III, are found to still maintain home gardens as infrastructural development has not yet started in this area (Fig. 10.3). During the survey, the households were asked about their satisfaction with the change in home gardens, in terms of their size, composition, and produce. Out of the households who faced changes in their home garden status, more than 70% perceived that they are not at all satisfied. In the process of land acquisition, the government has acquired home gardens when and where needed, and the house-

Fig. 10.3 Existing small home gardens in the study area attached to respective houses which are mostly comprised of leafy vegetables and vegetables

holds are only left with the land on which the house is present. As perceived, loss of home gardens has significantly reduced the availability of different types of food that were available earlier. This has not only reduced the level of household food security but also the necessary nutritional requirements. The surveyed households unanimously agreed that loss of home gardens has significantly contributed in hampering the social relationships and cohesion in the study area. Before the development took place, all the community members were of similar socioeconomic status with everyone working as farmers. The land acquisition has resulted in inequality in the community with larger landholders being suddenly richer. This has incurred jealousy among different community members. With common identity as well as home gardens being lost, there are a limited number of ways the communities can mend their relationships. Food producing and/or sharing is reported to strengthen personal support social capital (Kamiyama et al. 2016). Hence, with loss of home gardens, personal support network is perceived to be severely threatened in the study area. Though 8.6% of households responded that they are little satisfied, nearly 18% were found to be satisfied with loss or transformation of home gardens. With loss of livelihood and influx of labor from outside to work in the construction site, renting out house is a viable way to earn livelihood. Hence, many households preferred to build an extension of the house in the home garden to rent it out. Only three households were found to build new small home gardens after the land acquisition. These households are found to be in the rehabilitated sites in the study area. The displaced households are provided land and monetary compensation for their resettlement. While building house, these households kept small spaces for home gardens.

10.4.3 Sharing of Place and Its Perceived Impact

Studies have revealed how change can modify the bonds between person and place, resulting in emotional responses such as anxiety and loss (Fried 2000), and a sense of displacement that can lead to psychiatric trauma (Fullilove 1996). Changes in place or "place disruption" affects not only the physical aspects of places but also

the social networks that are sources of support to individuals, particularly in low-income communities (Fried 2000). Multiple drivers are identified that lead to disruptive changes including influx of unwanted "outsiders" into a place (Dixon and Durrheim 2004). In case of the present study, land is acquired, and land use has predominantly changed from a natural landscape to a built environment. New residents have come in and started living in high-rise residential complexes which are built up on the land once used for agriculture and owned by one or more local rural households. The old inhabitants, still residing in the village pockets inside the Newtown boundary, were enquired about their feelings on sharing the places with new residents. Most households responded to feel very bad (43%) and bad (22%) about sharing place with new residents. Nearly 20% of households pointed out that they do not have any feeling, whereas 15% of households feel good about sharing their places. It is difficult for the old inhabitants to interact with new residents as there is a huge gap between their socioeconomic and cultural identity which restricts community-level relationships and interactions. As responded by one of the farmers in the study area who lost his land to infrastructural development, "It feels awkward. The present Greenfield residential complex stands on the land owned by our household. Now, it is highly gated and guarded by security personnel. We can't even go near the land and if we say that this land belonged to us, they think I am mad. The land where once we could freely roam is now restricted." Land dispossession has led to loss of livelihood. Several women from the old settlements work as household helps or maids in the newly built residential apartments to earn a living. This created a social gap among the old and new inhabitants based on their socioeconomic status. Also, a majority of the old inhabitants belong to Muslim community and as responded by one of the villagers, "There are huge cultural differences between our societies. The women in our society don't go outside the home without a veil. But the modern women living in these apartments are destroying these cultures and now, the women from our society also want to be like them." Various studies have reported similar findings where place change results in feelings of grief or loss (Chow and Healey 2008) and diverse coping responses, including denial of change or denying the possibility of negative impacts, as a form of protection against negative consequences (Bonaiuto et al. 1996) like in the present study where some respondents are found to have no feelings or feeling good toward sharing places. Table 10.2 demonstrates the factors that significantly influence the feelings of old inhabitants toward sharing of place in the study area.

The results show that feelings toward sharing place are significantly related to the age and educational level of household head. The older people are found to be more reluctant in sharing the resources and land with the new community. This can be also attributed to their higher attachment to the place, demonstrated by the significant relation between age of the household head and their place attachment. Existence of social and/or personal networks ($p = 0.08$) as well as their perceived importance is found to significantly impact respondent's attitude toward sharing their place in the study area. However, perceived importance of social relations is found to be inversely related to place sharing ($p = -0.17$) attitude which indirectly explains that better social relations may change the current attitude of respondents

Table 10.2 Summary of results of Spearman's correlation analysis to assess the relation between sharing of place and other factors

	HHHAge	HHHEdu	SocRel	SocRelImp	PlaceShare	HHRes	PAI	PAII	PAIII
HHHEdu	−0.20*								
SocRel	0.04*	0.06**							
SocRelImp	0.003*	0.03*	0.15						
PlaceShare	0.05**	0.03*	0.08**	−0.17*					
HHResYrs	0.69	−0.06*	0.05**	0.02*	0.08*				
PAI	0.07**	0.13	0.01*	0.04*	−0.15*	0.17			
PAII	0.13*	0.04*	0.05**	0.04*	0.03*	−0.34*	−0.19*		
PAIII	0.09**	0.11	−0.07*	0.01*	−0.18*	0.17	0.32	−0.35*	
PAIV	0.04*	0.03*	0.01*	0.14*	0.22	−0.16*	−0.10*	0.37	0.03*

HHHAge household head age in years, *HHHEdu* household head educational level, *SocRel* existence of social and/or personal networks, *SocRelImp* importance of social and/or personal networks, *PlaceShare* feelings on sharing of place, *HHRes* number of residential years of the household in the place, *PAI to PAIV* place attachment statements

Level of significance – $p < 0.05^{*}$; $p < 0.1^{**}$

toward sharing of place (Table 10.2). Household residential years in the study is found to directly influence their perception of place sharing. Responses on three of the four place attachment statements, namely, "the village and the surrounding area mean a lot to me" (PAI), "my attachment to the village and surrounding have weakened after the project" (PA II), and "I have fond memories of this place and is emotionally attached to it" (PA III), were observed to significantly influence place sharing attitudes of the respondents. Devine-Wright (2009) formulated a multistage framework to demonstrate the dynamic nature of individuals and their responses to place change over time. The framework starts from identification of the change, interpretation of the change by creating and adopting symbolic meanings, evaluating place change by judging it to be positive or negative with emotional and attitudinal responses, and finally, coping by accepting or denying the change and act accordingly. The local inhabitants witnessed place disruption through various changes around them including changes in home garden and change in the home garden-based sharing practices, as evaluated in this study. Then, they react to the place disruption through various emotional and attitudinal responses like sharing of the place that once belong to them, as studied in the present research. This study suggested that place-related sharing played a significant role in explaining levels of acceptance for the urbanization-led infrastructural development.

10.5 Conclusion

This study aimed to deepen understanding of the impacts of urbanization-led development on a traditional form of sharing of natural resources through home gardens as well as a new form of sharing that is derived from the concept of "sharing out." Sharing of place, as assessed in this study, is a more emotional and attitudinal concept resulting from land dispossession. The studied sharing concept significantly differs from the economy-oriented sharing concept that is evolving across the world, especially Global North. The home gardens played a significant role in maintaining social equilibrium in community through reciprocal sharing that also signified the belongingness to place. In the study area, the home gardens underwent significant changes over time due to the pressures from urbanization. The social cohesion, personal social network, social relationships, etc. have deteriorated leading to unsustainable urban development in the study area. The study suggests that by capturing the symbolic meanings associated with places proposed for development, a better understanding can be obtained of public responses. As reciprocal sharing declined, the local inhabitants were forced into sharing their resources, including land and water, with strangers who are the new residents of the place. The present study can draw inferences from previous studies on place disruption and indicate how urbanization threatened place attachment for those individuals with a strong emotional bond to the place, leading to negative attitudes toward the development and oppositional behaviors.

With widespread peri-urban-focused urbanization across India and similar countries, the study emphasizes on the need to focus on planning practices that reflect on and respect local environmental, cultural, and social values of landscapes to ensure achieving the sustainable urban peripheries in the emerging economies. Project developers can seek to anchor and objectify change in such a way as to enhance rather than threaten place-related continuity, distinctiveness, self-efficacy, and self-esteem.

Since the data collected was not longitudinal, the responses cannot be evidenced, and it is therefore a limitation of the study. Nor can causal relations be interpreted from qualitative data or predominantly modest correlations. This suggests the value of future studies adopting longitudinal or experimental designs, to more precisely elucidate patterns of cause and effect between place attachment, place sharing, and responses to development projects.

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Chapter 11
Cow Sharing and Alpine Ecosystems: A Comparative Case Study of Sharing Practices and Property Rights

Katharina Gugerell, Marianne Penker, and Pia Kieninger

Abstract Sharing is a trending issue, and there is a swiftly growing interest in the sharing paradigm, sharing economy and its various opportunities, challenges and impacts. While new sharing practices mediated via Internet platforms are already established in urban contexts, discussions and practices in rural, landscape and ecosystem contexts are still in the very beginning. This chapter analyses a particular type of sharing, i.e. web-mediated cow sharing in the European Alps, which are hotspots of diverse and vulnerable ecosystems. We compared 60 cow-sharing arrangements from Switzerland, Germany, Austria, France and Italy based on the conceptual models of sharing and property rights. They constitute new farmer-consumer relations mediated via digital platforms. Usually in exchange for a payment, farmers share different rights to individual cows with consumers, such as rights to consume their products (i.e. milk, cheese, meat), rights to cow-related experiences (farm and cow visits, exploring Alpine pastures, milking a cow) or other intangibles (i.e. tacit knowledge, learning about Alpine farming and nature). Consequently, the farmers involved are sharing cow-related access and withdrawal rights, but usually not management, exclusion or alienation rights or risks, such as a cow's illness or death. The analysis illustrates that cow-sharing practices can contribute to the delivery of provisioning services (food with identity and traceable origin) and cultural ecosystem services (recreational and learning experiences, conservation of traditional breeds). We conclude that cow-sharing activities might hold the potential for establishing new forms of direct producer-consumer relations

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promoting adaptive and conscious production and consumption practices. So far, however, it is too early to draw final conclusions as to whether cow sharing actually contributes to the conservation of Alpine ecosystem services or whether it is rather a commercialization of consumers' concerns regarding animal welfare and sustainable food production via new web-based direct marketing channels.

11.1 European Alpine Agroecosystems and Their Services

The Alps, covering eight European countries and several bioclimatic zones from the valleys up to the glaciers with the highest peaks of 4800 m above sea level, are hotspots of biological and cultural diversity (Fischer et al. 2008; NORDREGIO 2004). Alpine ecosystems provide important ecosystem services, such as drinking water, renewable energy, food, recreation, identity and spiritual experiences for both mountain dwellers and people outside the Alps (Huber et al. 2013). Alpinists, nature conservationists and tourists cherish the traditional mosaic landscape of grasslands, pastures, hedges, forests, villages and single farms. The image of cows grazing on Alpine pastures is at the core of Alpine identity, as shown on many traditional paintings, clothes or packages of cheese or milk chocolate.

Land use and climate change endanger the capacity of mountain ecosystems to provide key services (Huber et al. 2013; Schirpke et al. 2013). Steep slopes that cannot be cultivated with machines, harsh climate conditions, poor soil quality and long distances to markets explain the classification of Alpine agricultural land as less-favoured areas. Despite special compensation payments for these less-favoured areas, many Alpine regions face a decreasing and aging farm population and land abandonment. Land abandonment can be conceptualized as an attractive option for secondary wilderness. In most parts of Europe however, land abandonment generates landscape and biodiversity-related concerns among the public and in the scientific community (Navarro and Pereira 2012; Pereira and Navarro 2015), which is also expressed in the European Landscape Convention (Antrop 2005). Reviews of land abandonment literature identified negative consequences such as biodiversity loss, increase of fire frequency, soil erosion, loss of cultural and/or aesthetic values, reduction of landscape diversity and reduction of water provision and an overall undesirable effect on the environment (MacDonald et al. 2000; Rey Benayas 2007; Beilin et al. 2014). Alpine regions are also among the most vulnerable to climate change, which occurs there both earlier and more extreme (Auer et al. 2007; Ingold et al. 2010). Land abandonment, climate and demographic change and globalization jeopardize the long-term provision of ecosystem services.

A number of policies and strategies focus on the valuable and threatened ecosystems of the Alps. The Alpine Convention is an international treaty between eight Alpine countries and the EU on the sustainable development and conservation of the Alps. The EU-financed Alpine Space programme facilitates cooperation between Alpine countries and the EUSALP (EU Strategy for the Alpine Region); it is a strategic agenda that should guide relevant policy instruments at EU, national and regional level. Nearly a quarter of the European Alpine area is covered by a dense

network of protected areas, such as national park, biosphere reserve, nature park or world natural heritage site (Bender et al. 2017). Agroecosystems, specifically, are addressed by the common agricultural policy (CAP) and other European policies such as the European Biodiversity Strategy (European Commission 2011) or Forest Strategy (European Commission 2013). The concept of ecosystem services however is not well embedded in these rather strict EU policies, and the monitoring and evaluation of stock/flow of ecosystem services remain very limited (Bouwma et al. 2018). Major explanations given by Bouwma et al. (2018) are strict policy silos in EU policy-making and related financial instruments that are jeopardizing the delivery of ecosystem services and the cross-sectoral management of trade-offs between ecosystem services.

A more recent approach is 'animal-sharing' (see Fig. 11.1) initiatives (sheep, goats, bees, cows, pics, etc.) that have popped up over the last decades in different areas worldwide and can also be found in the European Alpine regions. These small and disperse sharing initiatives in the Alps complement EU agricultural policies, however play a very minor role compared to the number of farms supported by the CAP and the money flows involved. These first-generation volunteers rent or share a cow for a certain fee in order to gain milk, dairy products and/or meat from the cow. Additionally, they can visit 'their cow' and/or can care for it and help on the Alpine farm.

Fig. 11.1 Cow sharing Collonges: the family Marjolaine and Steve Mottiez with their Holstein Friesian cattle in Collonges (Wallis/Switzerland)

As these manifold cow-sharing approaches have not been systematically analysed yet, we aim to identify different cow-sharing systems to understand their organization and practices.

Specifically, we want to answer the following questions:

- Which motivations drive cow-sharing arrangements from the provider perspective?
- Can we distinguish different types of cow-sharing initiatives regarding the object of sharing?
- How can cow-sharing contribute to the provision of ecosystem services?

11.2 Conceptualization of Sharing Concepts and Property Rights

11.2.1 Conceptualizing Sharing

All societies, irrespective of time or place, have attached importance to food sharing and have pooled available food resources (Masson et al. 2018). Although animals have mostly belonged to individual peasant farms, reciprocal exchange of animal power, pooling of animals in common herds, herding on common pastures and communal decision-making have been important patterns for the survival of past and contemporary peasant communities in different continents (Ebersbach 2012).

The 'newfound' sharing is a trending issue, and there is swiftly growing interest in the sharing paradigm and sharing economy concepts. A broad variety of practices, overlapping terms and a multifaced academic discourse makes it difficult to provide a general definition of the so-called sharing turn (Grassmuck 2012; McLaren and Agyeman 2017) or sharing economy (Price and Belk 2016). Despite the celebration of the renaissance of 'sharing' as a disruptive and almost revolutionary practice, sharing resources has in fact been a long-standing and ubiquitous practice, while 'exclusive possession and use of resources has always been relatively rare' (e.g. Rudmin 2016: 199). Sharing is the either simultaneous or sequential use of goods or resources (i.e. cows, water, food, cars), spaces (i.e. gardens, forests, meadows) or intangibles (i.e. experiences, knowledge, skills) by more than one individual (Belk 2007; Price and Belk 2016; Rudmin 2016; Milanova and Maas 2017). It can be a single, permanent or recurring practice, either in a community setting ('sharing in', i.e. a peer group, family or friends) or among strangers ('sharing out') (Milanova and Maas 2017; Parente et al. 2018). Traditionally, sharing excludes forms of market exchange (Martin 2016), but more recent research emphasizes that sharing and market-based exchange practices are not mutually exclusive antagonists. Instead, there exists a broad variety of hybrids as well as co-existence of multiple formats of exchange. Sharing practices are emerging on the interstices of market and non-market economy (Jenkins et al. 2013; Scaraboto 2015; Price and Belk 2016).

Prior research stresses the importance of sharing practices establishing social ties, connecting individuals and groups (Godelier 2011; John 2013; Böcker and Meelen 2017). The cultural meaning of sharing is dependent on a society's or community's perception on the value, distribution and access to resources (Bardhi and Eckhardt 2012; Price and Belk 2016). Thus, sharing includes an immensurable dimension of socio-collective meaning (Rosenbaum and Massiah 2011), including fostering relationships, establishing and improving links and trust between providers (producers) and users (consumers) and developing a sense of community with the opportunity for environmental friendly practices and behaviour (Albinsson and Perera 2012; Zhang et al. 2018). Collaborative user-provider networks and conscious consumption practices are characteristics for the sharing turn and considered as novel consumption practices and novel pathways to sustainability (Lozano 2007; Scaraboto 2015; Martin 2016). While sustainable forms of consumption, social and environmental values and justice as well as sustainability transitions are 'bottom-up' sharing narratives that are especially emphasized by grassroots initiatives and niche actors, the perspective from the regime level (top-down) mainly emphasizes commercial terms, economic opportunities and less regulated marketplaces (e.g. Uber, Airbnb, TaskRabbit) (Martin 2016). Those two perspectives might be conflicting ones, especially since the grassroots narrative is critiquing that the sharing turn has commercialized and commodified aspects of life that were initially not in reach of increasingly unregulated marketplaces with adverse social effects (Mozorov 2013; Martin 2016; Murillo et al. 2017).

Transactions and interactions between the involved actors are mediated by digital platforms. The proliferation of the Internet has opened up novel opportunities and possible benefits to integrate online and traditional formats of collaboration (Michelini et al. 2018), economic activities and connectivity that reach beyond traditional geographic and territorial settings. A wide range of digital commercial and non-profit platforms are facilitating the exchange of users and providers but also intermediaries. One major advantage discussed is the matching aspect of those digital platforms, where users (consumers) and providers (producers) find their appropriate counterpart. Technology has been utilized by grassroots initiatives and commercial parties with very different interests (Martin 2016). Sharing practices can be allocated along two axes (intermediated versus sociocultural; communal/intrinsic versus commercial/extrinsic) (McLaren and Agyeman 2017).

11.2.2 Sharing Property Rights

As cows in cow-sharing systems can be conceptualized as a common pool resource belonging to a network of shareholders consisting of providers and users, who are sharing different property rights on goods, resources, spaces or intangibles, such as the withdrawal of some of the limited amount of the cow's milk or meat, we use property rights as second theoretical lens. We want to understand how the rights to

Table 11.1 Categories of analysis and their assumed relations towards sharing and ecosystem services

Property rights	Sharing	Ecosystem services
Withdrawal	Sharing goods/ resources	Provisioning services
Access rights	Sharing experiences	Cultural ecosystem services, such as recreational experiences, education, learning on social-ecological processes and systems
Management, exclusion, alienation	Sharing intangibles	Management decisions resulting in different outcomes of supporting, regulating, provisioning and cultural ecosystem services

these resources and related duties are shared by several people. Schlager and Ostrom (1992) differentiate property rights systems as containing bundles of rights:

- *Withdrawal* – the right to harvest specific products from a resource (milk, cheese, meat, etc.)
- *Access* – the right to enter or access a specified property (face-to-face visit, web-cam and other ways of enjoying 'non-harvesting' benefits from the cow for a certain period of time)
- *Management* – the right to transform or regulate the resource (making decisions on the cow)
- *Exclusion* – the right to decide who will have access, withdrawal, or management rights
- *Alienation* – the right to lease or sell any of the other four rights

Access rights allow for the sharing or experiences, awareness raising and learning on social-ecological processes and systems (see Table 11.1). Provisioning services are shared via withdrawal rights. Management, exclusion and alienation rights are about sharing decision-making rights and thus intangibles, which however can have material impacts on all types of ecosystem services. Sharing agreements do not only regulate rights, but can also allocate duties, such as work (in the case of cow sharing: milking, cheese making, Alpine pasture mowing/willowing), costs (e.g. for fodder) or risks (e.g. illness of death of cow). Which rights and duties are shared among whom, and for what time can be defined in a written or oral contract?

11.3 Material and Methods for the Comparative Cow-Sharing Analysis

We aim to understand the cow-sharing initiatives and which potential they hold for ecosystem service provision by comparing different cow-sharing schemes across the Alpine range. When the available data is limited, a case study approach remains the only viable option for empirical field-based research (Poteete et al. 2010). According to Yin (2009), the case study method is the preferred strategy when the

following three conditions are fulfilled: 'how' or 'why' questions are being posed, little control over behavioural events and a focus on a contemporary phenomenon within a real-life context.

11.3.1 Case Selection Criteria, Data Mapping and Database

Following the consideration of the sharing paradigm that new sharing initiatives are often facilitated via web-based platforms, the case selection and data collection occurred on digital investigation (September to December 2017). The case selection was facilitated via different web search engines (Google, Bing, Yahoo) using language-specific keywords: Germany, Austria, Lichtenstein, German-speaking regions of Switzerland and Italy (Kuh + mieten, kuhforyou, Kuh + Patenschaft, Kuh + Leasing, Crowd Cow, Crowd Butchering); Italy and Italian part of Switzerland (Adottare una mucca, Adozione a distanza); France, Monaco and French part of Switzerland (Parrainage de vache, Devenir parrain d'une vache); and Slovenia (deliti si kravo, najeti kravo, lizing krave). In Slovenia, Monaco and Lichtenstein, no cow-sharing platforms were identified. The cases identified were included if they were located in the area of at least one of the three European Alpine policies: (1) Alpine Space, (2) Alpine Convention or (3) EUSALP (see Fig. 11.2). Inactive or dormant initiatives were excluded from the sample, as well as initiatives that advertised themselves as sharing imitative but turned out to be fundraisers for animal sanctuaries. In the end, 60 schemes offered by 26 farms or intermediaries (such as tourism- or crowdfunding platforms) were listed in an excel database. The data

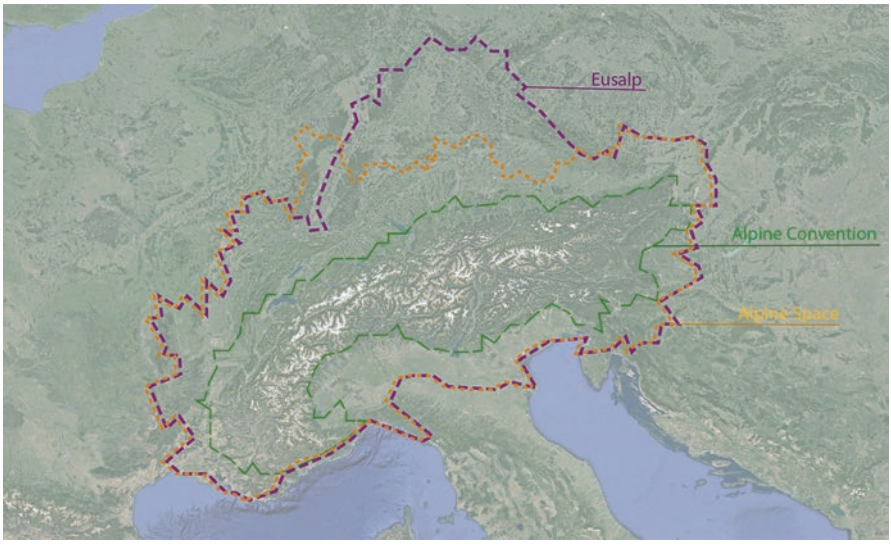


Fig. 11.2 Case study area in the European Alpine Region

collection was performed from a user perspective and included two steps: (1) collection of data that were offered by the provider via the web platform including (a) general data (i.e. cow-sharing system, contact details, year of foundation, motivation for foundation, source of information (websites)), (b) providers' motivations for engaging in sharing networks, and (c) property rights, divided into access, withdrawal, management, exclusion and alienation and (2) all 26 farms and intermediaries of the sample were contacted in the individual language via the platform or email and asked to share a contract or general terms that structure and organize the sharing arrangement. The return flow was insignificant: 11 answered our email of which 3 provided the requested information, while the rest only referred to the information provided on the web platform.

The mapped data were transferred into descriptive tables and in a second step translated into contingency tables, which were used twofold: (i) for pivot tables and frequency calculations and (ii) to manually cluster the different sharing initiatives along their commonalities. Subsequently results from clustering and pivot tables were triangulated and discussed against the background of property rights and sharing theory.

11.4 Cow-Sharing Arrangements and Their Underlying Motivations

The 60 cases identified are allocated across Switzerland (21), France (14), Austria (11), Germany (8) and Italy (6). The motivations range from food quality to conservation and awareness raising and learning (see Fig. 11.3). The provision of high-quality goods, animal welfare or the contact between consumers and producers motivates sharing initiatives in all five countries. Other motivations are more context specific. France stands out with motivations such as source funding for technical machinery or 'slow food'. Slow Food is a social movement that promotes local

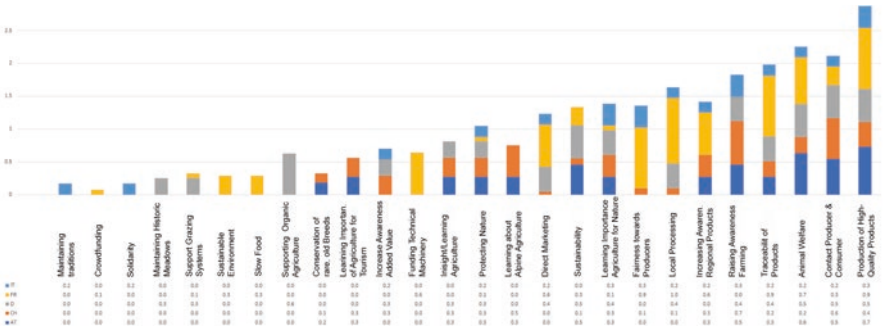


Fig. 11.3 Motivations of providers to engage in cow sharing (relative numbers)

food and traditional cooking. It was founded by a group of food writers and chefs in a small town in Italy in 1986 and has since spread worldwide.

Most cases are motivated by the provision of high-quality products via direct interaction between farmers and consumers, who pay in advance for a share of cheese, other dairy products (e.g. milk, butter, yoghurt) and meat and/or farm visits. The focus is on the sharing of withdrawal and access rights (Schlager and Ostrom 1992) (see Fig. 11.4). The farmers in our sample do not share management, exclusion or alienation rights, i.e. share-takers do not have any say in how the cow is fed or treated, who else is allowed to access or use the cow or when the cow is slaughtered or sold. Nevertheless, we see intermediaries, such as a butcher, a dairy company or an agricultural marketing organization bridging farmers and consumers. The dairy company addresses selected high-end restaurants and provides them with a voucher for a cow adoption and local dairy products if they agree to exclusively use the products of the local dairy and communicate this to their customers for 1 year. The marketing organization case is a quiz-based competition, where consumers can win a cow for adoption and a farm holiday weekend to visit 'their' cow.

All cases use web platforms for establishing sharing relations among strangers (Milanova and Maas 2017; Parente et al. 2018) and thus can be classified as intermediated (McLaren and Agyeman 2017). This of course might result from the Internet-based search method, however also highlight the nature of sharing relations between people who would not know each other and would not have interacted without the platform. All cases are commercially/extrinsically motivated (McLaren and Agyeman 2017) and apart from the marketing teasers are based on a financial compensation or investment by the share-takers. Conscious consumption practices are emphasized by motivation, such as animal welfare, conservation of meadows or sustainability, and might be seen either as novel pathways to sustainability or as a commodification of aspects of life that were initially not in reach of marketplaces (Lozano 2007; Martin 2016).

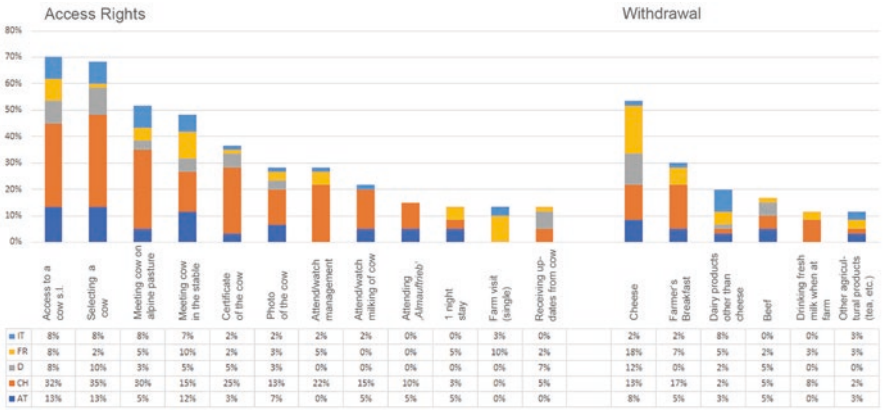


Fig. 11.4 Access rights and withdrawal, threshold 5% for appearing in the illustration

11.5 Types of Cow-Sharing Arrangements

All 60 cases were sorted according to the rights shared and the motivations stated on the websites. Fifty-nine cases could be grouped in two major types, which are described below (see Fig. 11.5). The Italian case 'Adotta un Mucca APT Trentino' did not fall into either of the two types, as it is fragmented in its characteristics and can't be associated with the rest of the sample. In the clustering two main groups occurred: Group I *exchange-focused cow sharing* and Group II *crowding arrangements*. While exchange-focused sharing arrangements are characterized by a solid set of access and withdrawal rights, crowding-related cow-sharing arrangements offer a closer proximity to equity- or reward-based crowding models.

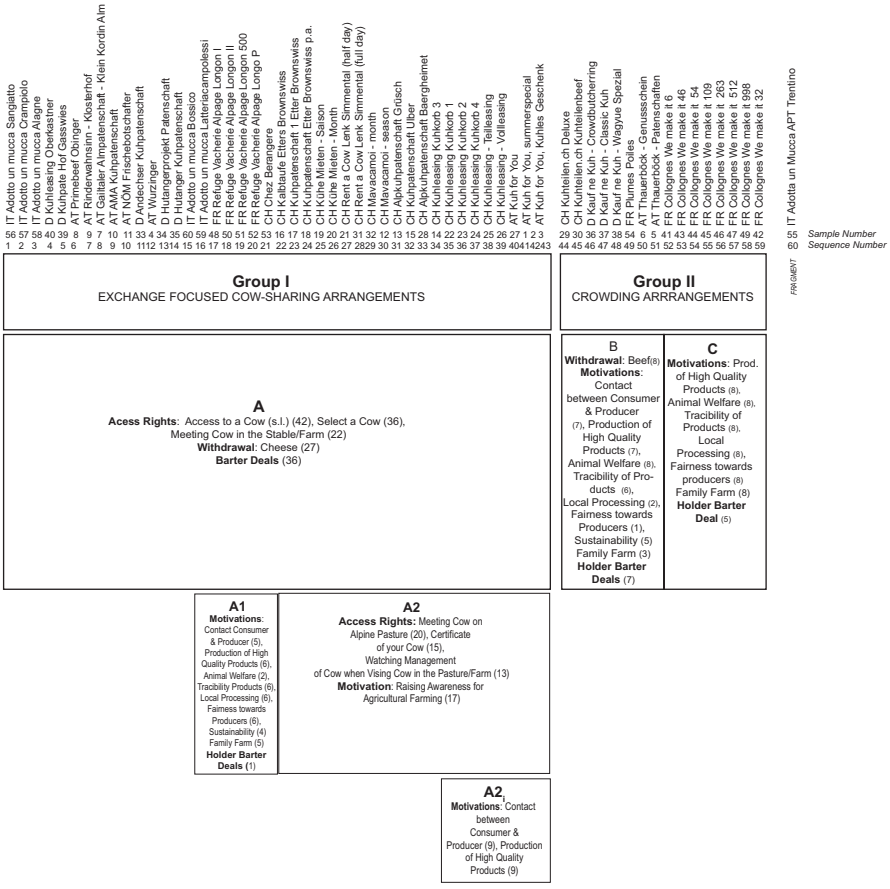


Fig. 11.5 Systematic overview of cow-sharing arrangements

11.5.1 Group I Exchange-Focused Cow-Sharing Arrangements

Group I consists of 43 cases covering Germany, Switzerland, France, Austria and Italy (Fig. 11.5). The group is characterized by a set of access rights that provide the users access: users can choose and select the cow, whereby sequential and simultaneous sharing occurs. Simultaneous cow sharing takes place when two or more users are sharing the same cow over the same time period, while with sequential cow sharing, the cows are shared consecutively, and the users can choose the duration of the individual sharing period. Consequently, the users are also sharing goods that are provided by the cow, in almost all cases at least cheese. However, the amount of cheese the user receives is determined in advance and is not dependent on the health or productivity of 'their' specific cow. Thus, shareholders do not share production risks with farmers, who have to deliver the cheese even in case of casualties or fatalities. Access rights such as the opportunity to visit the cow in the stable offers the opportunity not only to share resources (cow) and goods (cheese) but also offers the chance to share experiences (intangible) and to get in direct contact with the producer (provider) but also with other users (i.e. open days, farm visits).

Two subgroups can be illustrated: Subgroup A1 (sequence number 1–21) shows a distinct group of French, Swiss and Italian sharing initiatives characterized by motivations revolving around the topics of high-quality and traceable products, animal welfare and fairness towards producers. The French cases signal motivations such as 'slow food', sustainable and environmentally friendly production and sharing of dairy products other than cheese, such as yoghurt or butter.

The second Subgroup A2 is characterized by the management condition of 'Alpine pastures' (sequence number 22–43) and is mainly occurring in Switzerland and Austria. In that subgroup a more diverse set of access rights and motivations are occurring than in A1: users have the opportunity to visit the cow(s) on the Alpine pasture and/or attend or participate in the management of the cow, which resonates with the motivation of the providers of awareness raising for agricultural production. The set of motivations and access rights is more varied than in sub-subset $A2_i$ (sequence number 35–43), including consumer-producer relationships, raising awareness for high-quality and/or regional products, learning on the importance of Alpine agriculture and its relevance for nature, protecting nature and increasing added value in the region. Those motivations are complemented by access rights such as attending the annual *Almauftrieb* and *Almabtrieb* (festive, traditional event at the beginning and in the end of the grazing period on the Alpine pastures, cows are decorated and embellished and are guided in a festive procession to and from the pastures) and milking the cow. In this arrangement the sharing arrangements are organized via the farming communities as intermediary actor between the user and the provider of the cow.

11.5.2 Group II Crowding Arrangements

Group II consists of 16 cases (sequence number 44–59, see Fig. 11.4) from France, Germany and Austria. It is characterized by its proximity to crowdfunding and crowdsourcing schemes. In Subgroup B individuals are crowdfunding a cow, which is only butchered if the entire cow and all its part are funded and allocated to different share-takers. In that the access right to select a cow (similar to Group I) still prevails. Other sharing arrangements, like in one French case (Nr. 54), also include the withdrawal right of annual interest which illustrates some proximity to equity-based crowdfunding schemes. The Subgroup C illustrates an even stronger emphasis on collaborative sourcing of financial funds and commercial aspects regarding the setup and equipment for a sustainable, resource-oriented production of high-quality and regional agricultural products.

The motivations of Group II are contact between producers and consumers and the production of high-quality, traceable products, animal welfare and fairness towards the producers, sustainability and local processing and fairness towards the producers. Subgroup C differs significantly from Subgroup B in the availability of the shared resource, limited to the lifespan of the cow. The withdrawal of meat makes it inevitable that sharing remains a single act, due to the discontinued availability of the cow. The connection of users and providers is mediated via a web platform that is hosted by an intermediary company. The intermediary posts the offer on the platform, and the potential users/customers can check the offer. The analysis shows that the platform is providing this matching function of finding the appropriate counterpart for a particular good (i.e. 'Deluxe' beef, organic beef). The matching function is one directional; the users just receive information. While here the motivations resonate with the first group (I), access rights are already limited to selecting the cow, from which the meat is to be shared. While the set of shared motives is establishing the group affiliation of Group II, Subgroup C illustrates an even greater fragmentation of property rights (i.e. access rights). In particular, the limitation of access rights is impacting the delivery of cultural ecosystem services based on personal experiences taking place in particular landscapes. However, cultural ecosystem services, such as supporting the maintenance of rare/old breeds or the upkeeping of traditional pasture system might be supported by crowdfunding schemes too.

However, the research suggests that here the sharing is taking a backseat, while the sourcing of resources is more in the driver's seat. Hence there might be a stronger proximity to models such as reward-based crowdfunding (peer-to-peer lending) in which actors are receiving a reward, i.e. goods, services or 'experiences' (such as a day on a farm).

11.5.3 Cow Sharing Within the Sharing Paradigm

The research illustrates that cow-sharing practices align with the current discourse on sharing and the sharing turn (Belk 2007; John 2013; Price and Belk 2016; McLaren and Agyeman 2017). 'Sharing' (e.g. resources, knowledge, skills) in the

context of rural communities was traditionally a non-commercial exchange, and reciprocal support is here complemented or replaced by a commercial and financial background. All sharing relationships are based on a financial contribution by the users to enter the sharing arrangement. The analysis shows that in the cow-sharing types analysed, sharing is limited to access and withdrawal rights, while sharing management, exclusion and alienation are very limited to non-existent. This limitation might emphasize the commercial exchange character of the sharing types, since users do not have access to decision-making regarding management and accessibility of the resource or the right to sell or lease one of the other rights. Communication technologies and web-based platforms are mediating direct transactions and interactions between user and provider. Facilitating digital platforms allows to connect and establish user-provider networks that reach beyond traditional territorial scales. However, those digital platforms do not provide the users the opportunity to connect and share (i.e. experiences) related to their cow-sharing arrangement, which might be of importance due to the trans-regional scale. Nevertheless, cow-sharing arrangements that include access rights such as visiting ones' cows at the farm or Alpine pasture or at open days do offer the opportunity for users to get in contact with the producer and with other cow-sharing users (Godelier 2011; Scaraboto 2015; Martin 2016; Michelini et al. 2018).

11.6 Cow Sharing and Ecosystem Services

Vulnerable agroecosystems (see Table 11.2) in the Alps threatened by land abandonment and climate change encourage rural actors to experiment with new food provisioning systems that are adapted to local constraints and assets and intentionally use and preserve ecosystem services, such as local breeds, quality food,

Table 11.2 Ecosystem services provided by sampled cow-sharing initiatives in the Alps

Property rights	Sharing	ES	Case study
Withdrawal	Sharing goods/ resources	Provisioning services	Meat, milk, cheese, yoghurt, raw milk, yoghurt drink
Access rights	Sharing experiences	Cultural ecosystem services recreational experiences, education, learning on social-ecological processes and systems	Farm visits, recreational experience, education and learning on the importance of agriculture for nature, learning on the importance of agriculture for tourism, raising awareness for regional products and mountain agriculture, agriculture in general, maintaining traditions
Management, exclusion, alienation	Sharing intangibles	Management decisions resulting in different outcomes of supporting, regulating, provisioning and cultural ecosystem services	The sharing partners are not involved and have no rights regarding decision-making regarding management of the cows, feeding or farming, etc.

recreation or social-ecological system learning. The analysis illustrates that sharing of property rights to Alpine cows is limited to access and withdrawal rights. In this case study, no cow-sharing arrangements formally involved the individuals in decisions regarding the management, feeding or farming. Table 11.2 shows that cow-sharing arrangements are focused on linking provisioning and cultural services by connecting individuals via food and agricultural products (i.e. cheese, yoghurt, meat) to the producers, farms and production landscapes. Those mainly web-based cow-sharing arrangements might offer a low-threshold entry point for reconnecting individual consumers with producers. Cow sharing starts on web-based platforms offering an initial connection between consumer and producer with little responsibilities for share-takers; if interest and curiosity get triggered, share-takers can extend their engagement and participate at farm activities, learning and engaging with the landscape, people and animals. Thus, we add to the current discourse (e.g. Martin 2016; Michelini et al. 2018) a possible combination of online and offline linkages and interactions in user-provider networks. However, it remains as yet unclear if those arrangements are indeed establishing sustaining collaborative networks that are supporting the long-term provision of ecosystem services in the Alpine regions or if they are restricted rather to short-term exchange.

The analysed sharing arrangements do not formally involve the shareholders in decisions regarding the management of the cow. However, since the share-takers are usually located in a trans-regional distance and the significant number of offered cow-sharing options, it might be considered that share-takers consciously opt for a particular cow-sharing offer that is aligning with their personal values (i.e. ecological values, animal welfare). However, other projects show that this limitation is not mandatory. The 'Hutanger Project' ('Hutanger' are pastures that are used as 'commons' by the village community) at the 'Hersbrucker Alb' (Germany, Nürnberg, outside the case study area) involves the share-taker in the care and management of the cowherd (e.g. share-takers must take care and feed the herd, check the fences, etc.) and is also involved in the decision-making on the management of the resource. Such a sharing community must be local to provide the tasks and meet the regular work responsibility. Thus, sharing remains to a 'local' scale in terms of manageability of work and exchanges within the network, while sharing out appears rather difficult. This project is not rooted in an agricultural narrative as in the examined cases but is specifically targeting the conservation and maintenance of the *Hutanger* pasture system.

Crowding arrangements (Group II) provide less often access rights (such as visiting the cow, participating in farm day) than 'exchange-based' arrangements of Group I. Hence, the delivery of cultural ecosystem services as human-nature (animal) interaction will remain limited. Other cultural ecosystem services like the maintenance and upkeep of historic pasture systems, preservation of rare or indigenous breeds (see Fig. 11.6) that are better fitting to Alpine pasture systems than high yielding breeds (Marsoner et al. 2018) or learning about and acting on sustainable consumption and indirectly supporting Alpine landscapes are possible too. Looking at the geographical location of cow-sharing initiatives, which list photos of traditional breeds or emphasize traditional breeds elsewhere on their website, they

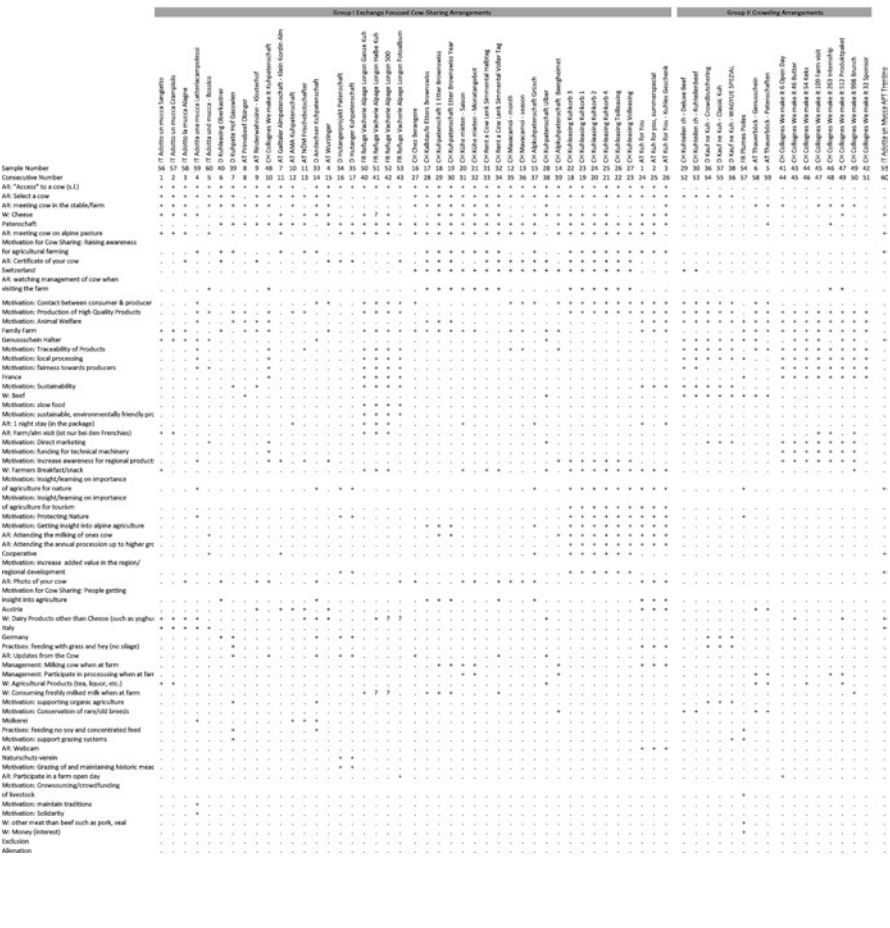
Fig. 11.6 Initiative *Alagna* in Italy offering traditional breeds such as Grigio alpina (Tyrol Grey) and Bruna alpina (Braunvieh, brown cattle) on the web-based platform. (Photo credit: Agriturismo Alagna)

match the hotspots of breeding and thus cultural benefits in the eastern Alps (Marsoner et al. 2018). If cow sharing can actually contribute to the survival of farms and their local breeds, this probably can be the most tangible benefit for ecosystem services.

11.7 Conclusions

The survival of Alpine farming practices and their associated agroecosystems will depend on producer-consumer relations and their willingness to learn and capacity to innovate with new food provisioning systems. Cow sharing that emphasizes animal welfare, ecosystem conservation, solidarity and fair consumer-producer relations can become an interesting complement to other alternative food networks. As this study was restricted to motivations and impacts stated on cow-sharing websites, more research is needed to scrutinize the actual consumer-producer relationships, associated learning processes and the ecosystem services provided by the farmers participating in cow-sharing initiatives. So far, it is too early to draw final conclusions as to whether cow sharing actually contributes to the provision of Alpine ecosystem services or if it is rather a commercialization of consumers' concerns regarding animal welfare and sustainable food production.

Appendix: Characteristics of Investigated Cow-Sharing Arrangements



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Chapter 12
Synthesis: Can Sharing Enhance the Sustainability and Resilience of Our Society?

Osamu Saito, Yaw Agyeman Boafo, and Manosi Abe

Abstract This book has extended the scope of the sharing paradigm (McLaren and Agyeman, Sharing cities: a case for truly smart and sustainable cities. MIT Press, Cambridge, MA, 2015) beyond urban governance, filling the knowledge gap between sharing economies (which have been increasingly studied in recent years) and sociocultural communal sharing practices (which are less well understood). Previous chapters have provided a wide range of sharing case studies from around the world. This chapter revisits and summarizes all case studies from Chaps. 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 and identifies the positive and negative effects of sharing practices on sustainability and resilience. It also proposes three key approaches toward a sustainable and resilient future: (1) combination of traditional knowledge and scientific knowledge/technologies; (2) coexistence of market and nonmarket sharing mechanisms; and (3) new normative metrics for measuring the multiple values of sharing. Along with new information and communication technologies, web-based platforms, and smartphone applications, the sociocultural communal sharing and exchanging of goods and capital can enhance the mutual satisfaction of people's interests without compromising the sustainability and resilience of social–ecological systems (SES).

Keywords Sharing · Sustainability · Resilience · Ecosystem services · Future · Transformation

> Our terms "present" and "gift" do not have precise meanings, but we could find no others. Concepts which we like to put in opposition—freedom and obligation; generosity, liberality, luxury on the one hand and saving, interest, austerity on the other—are not exact and it

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> would be well to put them to the test. We cannot deal very fully with this; but let us take an example from the Trobriands. It is a complex notion that inspires the economic actions we have described, a notion neither of purely free and gratuitous prestations, not of purely interested and utilitarian production and exchange; it is a kind of hybrid. (p. 70)
> Marcel Mauss (1923–1924) *Essai sur le don*. Available in English as *The Gift: Forms and Functions of Exchange in Archaic Societies*. Translated by Ian Cunnison. Cohen & West Ltd, London, 1966.

12.1 Summary of the Case Studies in This Book

Table 12.1 summarizes the case studies discussed in Chaps. 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11. Chapters 2, 3, 4, 5, and 6 covered various case studies in Japan, and Chaps. 7, 8, 9, 10, and 11 considered cases in Micronesia Asia, South America, and Europe. The sharing of nonmarket homegrown food is a very common sociocultural practice in Japan and non-negligibly contributes to people's well-being and social relations (Chaps. 2, 3, and 4). Sharing food provisions directly and indirectly sustains and enriches the ecosystem services in socioecological production landscapes and seascapes (SEPLS). As a part of SEPLS, Chap. 5 derived the waterscape changes in the Mikatagoko area, of Japan, from paintings collected by the intergenerational sharing program and highlighted the intra- and intergenerational sharing of experiences associated with the waterscape. Chapter 6 explored how tacit knowledge of apiculture and mushroom production is shared among producers. Chapters 5 and 6 focused on the knowledge and knowledge transfer mechanism behind the provisioning and cultural services.

Chapter 7 examined the contemporary value of traditional communal sharing practices in a case study of natural resource use in the Republic of Palau. The authors showed that despite the accessibility of new information and communication technologies (ICTs), communal sharing practices related to subsistence still exist, not only in rural areas but also in urban areas. Traditional management of common natural resources in Palau has been handed down for generations through communal sharing practices. Chapter 8 highlighted two cases of agroecological produce sharing and its associated knowledge and experiences among farmers in Brazil, with emphasis on institutionalization and policy support. Chapter 9 examined a payment for ecosystem services (PES) scheme in Indonesia. By virtue of the sharing process, group-level auctions achieve higher allocative efficiency than individual-level auctions. The PES scheme was further explored through the lens of the sharing paradigm (McLaren and Agyeman 2015). Chapter 10 discussed the perceptions of local communities in the peri-urban area of Kolkata, India, who share their land with new residents in high-rise apartments. It also discussed how the dynamic status of home gardens and produce sharing influences the social relationships in the area. Using conceptual models of sharing and property rights, Chap. 11 compared 60 cow-sharing arrangements in Switzerland, Germany, Austria, France, and Italy. Cow-sharing activities might inspire new forms of direct producer–consumer relations, promoting adaptive and conscious production and consumption practices.

Table 12.1 Summary of the case studies in this book

Chapter	What is shared (type of ecosystem services)	Who shares it	Where	How	
				Intermediated/sociocultural	Communal/ commercial
2	Homegrown food (provisioning and cultural services)	Household residents	Throughout Japan (both rural and urban areas)	Sociocultural	Communal
3	Homegrown food (provisioning and cultural services)	Household residents	Noto Peninsula, Japan (mainly rural areas)	Sociocultural	Communal
4	Homegrown food (provisioning and cultural services)	Household residents	Hachijo Island, Japan (mainly rural areas)	Sociocultural	Communal
5	Traditional and local experiences and knowledge associated with waterscapes (cultural services)	Children	Mikatagoko area in Fukui, Japan	Intermediated by environmental educational program	Communal
6	Local ecological knowledge of apiculture and mushroom production (provisioning services)	Producers of non-timber forest products (honey and shiitake mushroom)	Two rural areas in Japan (Nagano and Ishikawa)	Both intermediated and sociocultural	Communal and commercial
7	Fishing, farming, and collecting herbs (provisioning, regulating, and cultural services)	Urban and rural residents	Palau, Micronesia	Sociocultural	Communal
8	Agroecological produce including agroforestry produce and knowledge and experiences among farmers (provisioning and cultural services)	Small family farmers, researchers, policy makers, companies	Brazil	Intermediated by the procurement interventions and the creation of new markets	Commercial
9	Knowledge and conservation values for nurturing socioecological production landscapes (provisioning and regulating services)	Farmer groups of smallholders in upper and midstream	Rejoso watershed in Indonesia	Sociocultural	Communal (extendible to commercial)[a]

(continued)

Table 12.1 (continued)

Chapter	What is shared (type of ecosystem services)	Who shares it	Where	How	
				Intermediated/sociocultural	Communal/ commercial
10	Land and home garden produce (provisioning and cultural services)	Peri-urban new town residents (old residents)	Peri-urban landscapes in Kolkata, India	Sociocultural	Communal
11	Cows, dairy produce, meat, cow-related experience, and other intangibles—tacit knowledge and learning alpine farming and nature (provisioning and cultural services)	Farmers and consumers	European Alps (Switzerland, Germany, Austria, France, and Italy)	Intermediated	Commercial

[a]Chapter 9 argued that when a PES scheme has been well integrated into rural development initiatives, sharing from a PES perspective can be extended to commercially or extrinsically motivated sociocultural sharing, reflecting the concept of multifunctionality of production landscapes

These cases demonstrate an important role for commercial and communal sharing in social–ecological systems (SES) undergoing rapid changes due to globalization and industrialization. Moreover, these roles are observed in both developed and developing countries, although the level of contribution of the sharing practices and their forms have changed with advances in ICT and developmental policies.

The case studies in this book are summarized in Table 12.1. All chapters relate to the sharing of food and the associated knowledge/experiences gained from socio-ecological production landscape and seascape (SEPLS). Michelini et al. (2018) reviewed 55 food sharing (FS) cases from around the world using three categories of models: the "sharing for money" model, which is primarily a business-to-consumer for-profit model that reduces food waste and generates revenue; the "sharing for charity" model, in which food is collected and donated to nonprofit organizations; and the "sharing for the community" (peer-to-peer) model, in which food is shared among the consumers. Sharing for money, sharing for charity, and sharing for the community accounted for 28.8%, 40.4%, and 30.8% of the 55 cases, respectively. Food sharing through food banks and other charitable activities is not covered in the present book but is an important agenda for enriching the sharing paradigm in future study (Box 12.1).

Box 12.1: Food Banks in Japan: Creating a Sharing Society

Food banks[1] have emerged as an increasingly important resource in the response to wasteful food practices and growing food poverty in first world nations (Riches 2002). They act as mediators by redirecting food that is safe to eat but would otherwise be discarded to households and people in need (Bazerghi et al. 2016). Often perceived as a "win-win" proposition, food banks not only make an important social impact by redirecting potential food waste but additionally help reduce negative impacts on the environment. Some estimates suggest that one-third of the food produced globally is wasted (FAO 2011). Food waste is not only an indirect form of losing land, water, energy, and labor resources required to produce food but also accounts for approximately 3.3 billion tons of greenhouse gases generated from disposal in landfills and exhaust from incineration, among others (FAO 2013).

(continued)

[1] Food banks are charitable organizations that collect food from retailers and distribute it to the needy at no cost to the receivers (Teron and Tarasuk 1999). In particular, they are intermediate agents that raise in-kind and cash contributions from companies, individuals, and governments, handle and store them, and deliver them to charitable organizations that distribute food or prepare meals to feed the poor (beneficiaries) (Gentilini 2013).

Box 12.1 (continued)

Although current global food production is enough, one in nine people in the world faces hunger (World Food Programme 2018). The Food and Agriculture Organization of the United Nations (FAO) estimated that redirecting just 25% of wasted food to those in need would solve global hunger (FAO 2016). Food banks are employed as a method of implementing this recommended solution and increasing people's access to food, thereby strengthening one of the four pillars[2] of food security.

According to the Global FoodBanking Network (GFN) (2018), food banks have expanded across 31 countries, serving approximately 7.8 million people. Food banks are considered effective as they are local solutions to local needs. They are typically grassroots organizations, existing in communities where people take direct action to address food-related issues. Additionally, they connect public and private sector institutions by serving as focal points catering to specific geographic regions, securing donations from food companies, grocery stores, wholesale companies, packers, farmers, government agencies (GFN 2018), and private citizens (usually monetary). This donated food is then distributed directly to people or to welfare organizations, such as child cafeterias and community kitchens (Kimura 2018).

Although not typically associated with first world nations, poverty rates and hunger in Japan have been garnering increased attention among researchers and the media. Japan, along with the United States and the United Kingdom, collectively represents the largest amount of food wasted globally, each discarding 30–40% of their annual food production (Melikoglu et al. 2013). Japan's Ministry of the Environment (MOE) estimated food loss and waste to be approximately 6.46 million tons in 2015 (MOE 2018), which is equivalent to 41 kg/person. Further exacerbating the problem is Japan's heavy dependence on imported food (61% calorie-based dependency), resulting in one of the lowest food self-sufficiency rates in developed countries (Barrett and Notaras 2012; Sudou and Hishida 2016).

Japan's complex relationship with food can be best understood by considering the postwar food transition—changes in food habits characterized by a higher meat consumption (Gadda and Gasparatos 2010; Smil and Kobayashi 2012; Sudou and Hishida 2016), in consumer habits such as choosing products based on appearance (Second Harvest Japan 2013), and

(continued)

[2] The FAO identifies the four pillars to achieving food security as availability, access, utilization, and stability.

Box 12.1 (continued)
in food prices that fluctuate with global oil prices (Barrett and Notaras 2012). Subsequently, societal changes have taken place, and poverty rates remain relatively high compared with other developed countries, and along with associated social stigmas, a narrative of "self-responsibility" (*jiko seki-nin ron*), and the resulting shame associated with the inability to fulfill these responsibilities, isolation is commonly chosen over asking for help (Allison 2013), thus increasing barriers to accessing the "third space,"[3] which is generally defined as public places where people meet as a community, which form complexities particular to Japan.

"Turning *Mottainai* into *Arigatou*"

Mottainai is a Japanese word which roughly translates to "what a waste!" and represents a sense of guilt or regret for having wasted something. Combined with *arigatou* or "thank you," a phrase which means "turning regret of wastefulness into gratitude" is quickly finding favor as a way to describe food banks in Japan to change perceptions.

While food banks were first used in the 1960s, Japan's first food bank was established almost 40 years later in Tokyo in 2002. Second Harvest Japan (2HJ) has since become the only nationwide food bank catering to the needs of over 320 welfare organizations in 2013 and continues to expand (Fig. 12.1). MAFF identified a total of 73 registered food banks in 2016, which is twice the number registered in 2013, with a majority being regionally based. Each food bank further conducts different activities and at different scales (Yoshida 2016).

Similar to a financial bank, food banks would ideally act as a storage for "deposits" where people can pick up or "withdraw" the money that they need. Unlike savings deposits at a financial bank, deposits are typically made as donations mainly from retailers and manufacturers who are able to reduce costs related to the disposal of food, and at the same time, they engage and promote the concept of corporate social responsibility. However, utilizing food bank services in Japan often comes with a social stigma and a sense of shame for a person relying on food bank assistance for "burdening" society and failing to keep up social appearances. This complicates the distribution of food surplus generated in the industry from a supply and demand perspective and creates barriers to improving access.

(continued)

[3] Where the "first place" is the home, the "second place" is the workplace, and the third is critical to community life and encourages engagement in society (Oldenburg 1989; Putnam 2000).

Box 12.1 (continued)

Fig. 12.1 Volunteers at Second Harvest Japan pack delivery boxes and prepare to cook

In 2015, the government began trying to reduce food surplus, which was highlighted through food bank activities, by relaxing and extending expiration dates for 1,320 products and committing to further review an additional 587 products (MAFF 2017). Other sources of unused food surplus are associated with faulty or damaged packaging, mislabeling, limited edition or discontinued products, overproduction, and product samples.

Arigatou

According to Japan's Ministry of Health, Labour and Welfare (2015), the relative poverty rate for Japan stood at 15.6%, where child poverty was 13.9% and single-parent households (especially single mothers) accounted for 50.8%. Research finds that there are several complexities regarding poverty in Japan, but, more significantly, a majority of those in financial difficulty go on to face social exclusion (Abe 2009). Some even decline social aid or fail to use social welfare programs (Ryall 2016).

(continued)

Box 12.1 (continued)

Although food banks aim to reach people in need, along with the government, they find it difficult to identify such people who are often called Japan's "invisible poor" (Sekine 2008). Thus, outreach predominantly expands via word of mouth or through social networking sites. Additionally, food banks attempt to provide support onsite or through deliveries to certain types of people, such as the elderly, people unemployable due to injuries, and orphanages. Deliveries are typically essentials and dependent on donations, with some food banks also delivering other items, such as diapers for babies, baby foods, and other essentials for recipients who require them.

Indeed, food banks in Japan are extremely careful and sensitive to their recipients' needs. Food Bank Yamanashi shifted from hand delivering donations in trucks which had their organizations' logo and name to a postal system after a recipient expressed that the use of a highly visible system of delivery drew negative attention in their opinion. In affluent neighborhoods such as Bunkyo Ward in central Tokyo, local groups cooperate with the government to identify people in need. They provide aid in a more subtle and covert manner which puts recipients at ease. Over half of the project recipients are single-parent households, and such projects sometimes uncover a deeper problem of domestic abuse.[4] The ward's mayor acknowledges that fear of social stigma leads to stress among many households. Therefore, to prevent stigmatization, he offered support in a "closed, invisible way" (Nohara 2018).

The Third Space

Another form of aid that depends on overt participation is children's cafeterias (*kodomo shokudō*). Most cafeterias provide meals to children for free and at nominal prices for adults, usually around 300 yen, while also offering more than food in many cases. They offer important social capital for those burdened in society. Putnam (2000) discusses the declining trend in the use of the third space and subsequent decline in citizen participation, resulting in a decay of social capital. The sudden rise in children's cafeteria operations in Japan (Yoshida 2016) is an indication that efforts are underway to increase community awareness and participation. The opportunity to interact, cook, eat warm food, and simply provide children with the attention they need is proving valuable (Fifield 2017). Some cafeterias such as the Tochigi Volunteer Network also offer tuition to help children with their studies (Fig. 12.2).

(continued)

[4] Tokyo Metropolitan Government reports in 2004 indicate 32% of 1447 child abuse cases occurred in single-parent household, while 31% occurred in households facing financial difficulties (Nohara 2018).

Box 12.1 (continued)

Fig. 12.2 Example of activities undertaken by Tochigi Volunteer Network in its various extensions (Source: Tochigi Volunteer Network n.d.). Edited with permission for brevity and adding translation

Commercial actors like convenience store franchises such as FamilyMart are also beginning to play a role in these efforts (Suezaki 2019).

A survey conducted by the Committee to Enhance Safety of Cafeterias for Children has located 2286 child cafeterias across the country (The Japan Times 2018). Makoto Yuasa, head of the Committee, believes that children's cafeterias have increased to create spaces for interaction, not only for children but for adults and the elderly as well. However, there are limitations, such as availability of space, funding, irregular operational days, and proximity to homes (carrying stigma).

(continued)

Box 12.1 (continued)

"App-propriate" Technology

As various models of food distribution and sharing emerged, research conducted by Michelini et al. (2018) analyzed these models and their ability to tackle food waste and sustainability challenges. They categorized food sharing (FS) models in Italy (such as food banking, child cafeterias, and community spaces) into three types: (1) sharing for money, (2) sharing for charity, and (3) sharing for community (considered ideal). These models are enhanced further by developments in information and communications technology (ICT).

While similar research has yet to be conducted in Japan, food banks and cafeterias fall into the latter two categories. However, ICT does not play a major role in existing FS models. 2HJ began using QR code tracking to improve convenience and efficiency with respect to receiving and delivering donations in 2013. Websites such as *kodomo shokudō network* were created to help users locate the closest cafeterias via Google Maps and redirect them to specific children's cafeteria websites. In Denmark and the United Kingdom, mobile apps such as "Too Good To Go" are prominent. The app connects users to partner retailers which sell food that would otherwise be wasted at low costs.

Perhaps the development of ICT in FS models in Japan could increase efficiency. More significantly, it could potentially alleviate the social stigma and shame associated with food- and poverty-related issues. While retailers could gain public approval for their commitment toward solving food-related issues, users could have the anonymity required in the early phases of introducing a new concept.

Sharing Solutions

Winne (2008) pointed out that FS services such as food banks are not a panacea to food-related issues. He argued that increasing codependency between donor organizations and food banks could end up being counterproductive. Despite commendable citizen action, this codependency allows state institutions to accept FS models without critically questioning whether these methods are correct or even effective at addressing issues associated with food and ignore the possible underlying problems. He emphasizes that FS services fail due to a lack of a "meaningful connection to public policy" (Winne 2008), and it is important to note that legal definitions and administrative frameworks to support children's cafeterias in Japan are currently nonexistent.

(continued)

Box 12.1 (continued)

Although rising numbers of FS services are an indication that greater needs are being met, for people interested in social causes, it also presents a conundrum—that underlying problems in society continue to exist, thereby creating such needs. To develop a sustainable system that ensures food security would require communities to evolve, including the promotion of community-based food supply systems (Philip Ackerman-Leist 2013). Food banks are especially unified in requiring citizen participation, which includes volunteers who help cook, collect, pack, deliver, and conduct food drives, awareness campaigns, and more. Yet, they also express a collective hope—a time when food banks will no longer be needed, when they will be replaced instead by a more sustainable, community-based lifestyle of sharing, where no one is left behind.

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12.2 How Can a Sharing Society Improve Sustainability and Resilience

Sustainability is an overarching goal to lead the global, social, and human systems to desirable states. Sustainability science adopts a holistic approach to identification of problems and perspectives involving the sustainability of these global, social, and human systems (Komiyama and Takeuchi 2006). A core concept of sustainable development is resilience, which is often emphasized in the relevant discourse (Xu et al. 2015). It has been argued that resilience is one of the key approaches to meet the challenges of sustainable development (Chelleri and Olazabal 2012; Elmqvist et al. 2013). Resilience refers to "the capacity of … systems to cope with a hazardous event or trend or disturbance" (IPCC 2014). Although resilience is a crucial pillar of sustainability science, academia has barely attempted to link sharing with the resilience of a society. In resilience-based sustainability studies, the system must move from a desirable into an undesirable state (Carpenter et al. 2001; Derissen et al. 2011). In the context of urban transformation, Elmqvist et al. (2019) explained that sustainability is a normative concept, representing the vision for society to manage all resources in ways that contribute to the well-being of current and future generations and that ensure distributional equity, while resilience is nonnormative and an attribute of the system that is applicable to various subsystems. Xu et al. (2015) explored the links between resilience and sustainability and summarized

some similarities and differences between the two concepts (Table 12.2). To build sustainability resistance in the foreseeable future, the important foci are "increasing co-management by engaging stakeholders, linking social networks and enhancing social mechanisms by emphasizing local and scientific ecological knowledge, facilitating social learning and establishing flexible institutions" (Xu et al. 2015).

Biggs et al. (2015) proposed a resilience approach and principles that sustain the ecosystem services in a social–ecological system (SES). They focused on the resilience of ecosystem services; i.e., "the capacity of SES to continue providing some desired set of ecosystem services in the face of unexpected shocks as well as more

Table 12.2 Similarities and differences between resilience and sustainability

	Sustainability	Resilience
Similarities		
Objective	In the strong definition of sustainability, the natural capital stocks must be maintained at or above the existing threshold levels for human well-being	In the event of perturbations and shocks, a desirable ecological resilience can sustainably supply sufficient resources and maintain its functions to meet the demands of social and economic well-being without shifting the regimes
Dependency relationship	The sustainability of a system relies on its own resilience; meanwhile, resilience depends on a wide range of properties that provide ecosystem services to the system	The basic ecosystem functions should not be affected by human activities or other disturbances beyond their thresholds, and the socioeconomic systems should not collapse under changes in the states of ecosystems (precondition of sustainability)
Differences		
Intergeneration equity	Intergenerational equity is the core concept of sustainability	Resilience thinking does not conceptually emphasize equity, meaning that the resources for the next generations are not less than those of the current generation
Desirable state	Sustainability is interested in the desirability of any current state of the system and how it transitions to another more desirable state	Resilience thinking does not explicitly specify the desirability of a particular state
Culture emphasis	A strong body of sustainability research acknowledges culture as the fourth pillar and capital, distinct from the natural, physical, and human capitals	Culture is considered as part of the social mechanisms
Methodological approach	Sustainability relates to the evolution and coevolution of complex systems embedding natural, social, and environmental components and dimensions	Resilience relates to responses to external factors

Modified from Xu et al. (2015)

gradual change" (Biggs et al. 2015, p. 17). Through a literature review, mock-court workshops, and the Delphi process, they also identified seven generic principles for enhancing the resilience of ecosystem services in socioecological systems: (P1) maintain diversity and redundancy, (P2) manage connectivity, (P3) manage slow variables and feedbacks, (P4) foster complex adaptive systems, (P5) encourage learning and experimentation, (P6) broaden participation, and (P7) promote polycentric governance systems (Biggs et al. 2015). Saito et al. (2018b) identified a similar set of seven principles for enhancing community resilience against climate and ecosystem changes in semiarid Africa. Their study forms part of the "Ghana Model," which emphasizes social and institutional processes as well as a community-based approach to building resilience in the vulnerable context of semiarid Africa.

As indicated in Chap. 1, sustainability remains under-explored in sharing-related academic research. A sharing economy can be considered as a new and sustainable form of consumption in which individuals access rather than own goods and resources. Sharing empowers individuals, creating economic, social, and environmental value and enabling innate "sharing" practices. It thereby improves the efficiency of resource utilization (Martin 2016).

In other studies, the sharing economy is framed as a disruptive business model, posing serious threats to both young and established businesses (Kathan et al. 2016). Frenken and Schor (2017) pertinently questioned whether the socially progressive feel-good rhetoric surrounding the sharing economy is hiding a "predatory business model that will ultimately appropriate value to investors and founders, once the market develops and users are locked into the platforms" (Frenken and Schor 2017, p. 3). They further asked "will the platforms ensure widespread access—by expanding their user base beyond the mostly white, highly educated, able bodied urbanites?" (Frenken and Schor 2017, p. 3).

Table 12.3 summarizes the positive and negative effects of sharing economy and practices on sustainability and resilience, based on a literature review and the case studies explored in this book. Sharing enhances sustainability by effectively managing the multiple ecosystem services (Chaps. 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11), providing economic savings and variety (which improves consumer welfare) through food sharing (Chaps. 2, 3, and 4), delivering food sovereignty (Chap. 8), imparting positive redistributive effects, alleviating poverty, and encouraging social interactions such as meeting people, making friends, and getting to know others. Sharing may also compromise sustainability by increasing income inequity, negatively impacting on other markets (e.g., Airbnb vs. hotel business, Uber vs. taxi services), disturbing the peace and possibly the safety of neighbors, and encouraging peer-to-peer discrimination.

As reported in Table 12.3, sharing enhances resilience by increasing the adaptive capacity of local communities (Chap. 6), preparedness for extreme events (Chaps. 4 and 10), and adaptation to climate and ecosystem changes (Chap. 7). It also diversifies the food sources of individuals, increasing the nutritional intake and income of households and smallholders (Chaps. 4, 8, and 10); providing a sense of attachment to nature and ecosystem services (Chaps. 5 and 10); mobilizing and revitalizing the locally available idle goods, skills, knowledge, and assets across

Table 12.3 Positive and negative effects of sharing economy and practices on sustainability and resilience

	Sustainability	Resilience
Positive effects (opportunities)	Effective management of multiple ecosystem services (Chaps. 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11)	Sharing ecological knowledge can enhance the adaptive capacity of local communities (Chap. 6)
	Economic savings of food sharing (Chaps. 2, 3, and 4)	Preparedness for extreme events (Chaps. 4 and 10)
	Economic benefit (e.g., lower cost than owing products, additional revenues by goods lending)	Improved adaptability to climate and ecosystem changes (Chap. 7; Mohri et al. 2013; Boafo et al. 2016)
	More variety of food (Chaps. 2, 3, and 4) and goods (electric cars, clothes, etc.), which improves consumer welfare	Diversity and redundancy (Biggs et al. 2015): diversification of sources of food, nutrition, and income for households and smallholders (Chaps. 4, 8, and 10)
	Food sovereignty (Chap. 8)	Land sharing with lower use intensity and diversification of produced ecosystem services
	Promotion of local food production and distribution (Chaps. 3, 4, 8, and 10)	Sense of attachment to nature and ecosystem services (Chaps. 5 and 10)
	Efficient resource use and waste reduction (e.g., food waste)	Mobilization and revitalization of locally available idle goods, skills, knowledge and assets across generations (Chap. 5)
	Reduction in CO_2 emissions by car sharing (Chen and Kockelman 2015; Nijland et al. 2015)	Building of new social networks (e.g., TaskRabbits; Fitzmaurice et al. 2016)
	Positive redistributive effects by expanding sharing opportunities	Strengthened neighborhood networks and social relations (Chap. 10; Botsman and Rogers 2010)
	Poverty alleviation (e.g., food banks and social supermarkets)	Sense of community (Chaps. 3 and 10; Michelini et al. 2018)
	Social benefits: meeting people, making friends, getting to know others (Fitzmaurice et al. 2016)	Sense of solidarity (Chap. 8)

(continued)

Table 12.3 (continued)

	Sustainability	Resilience
Negative effects (challenges and concerns)	Increased income inequity (Schor 2017)	As more people participate in sharing platforms for economic reasons, social interaction will decline (Feenken and Schor 2017)
	Indirect negative effects on other markets (e.g., Airbnb vs. hotel business, Uber vs. taxi business)	Sharing platforms may weaken social cohesion (Frenken and Schor 2017)
	Neighbors of house sharers experiencing nuisance and feelings of stranger danger (Frenken and Schor 2017)	Potential discrepancies between outsiders' and local residents' perceptions of ecosystem services (Chap. 5)
	Peer-to-peer discrimination (Frenken and Schor 2017)	Mismatches between providers and consumers
	Increased risk of accidents (e.g., traffic accidents by bike and car sharing)	

generations (Chap. 5); and instilling a sense of community (Chaps. 3 and 10) and solidarity (Chap. 8). On the downside, sharing can compromise resiliency by weakening social cohesion, creating potential discrepancies between outsiders' and local residents' perceptions of the ecosystem services (Chap. 5), and forging mismatches between providers and consumers.

Resilience has been much less explored than sustainability in previous sharing research. This book highlights some important insights and implications of resilience (Table 12.3). For example, home gardens can enhance the resilience of households by increasing food security, individual empowerment, social relations, marginalization resistance, community development, and cultural identity. Home gardens also promote ecological processes, biodiversity, and conservation (Chap. 2; Taylor and Lovell 2014; Mohri et al. 2013). Nonmarket food provisioning has played multiple roles in both daily life and emergency situations (such as natural disasters) in Japan's remote islands and rural peninsulas (Chaps. 3 and 4). A food sharing culture in SEPLS can enhance resilience against future socioeconomic changes and natural disasters (see Box 12.2). Therefore, measuring and monitoring the current status and dynamics of sharing practices in different landscapes are crucial.

Box 12.2: Provisioning Ecosystem Service Sharing Practices in Semiarid Ghana

Introduction

In Ghana, economically poor and natural resource-dependent communities and households in the Guinean savanna agroecological zone are already feeling the effects of unprecedented levels of climate variability and change. In the past three decades, climate-related disasters such as floods, drought, and bushfires have increasing and negatively been impacting livelihood systems and the integrity of the savanna ecosystem (Armah et al. 2011; Acheampong et al. 2014). Added to this are the local-scale pressures of migration, conflicts, cultural degradation, and rural neglect, which directly affect the supply, utilization, and management of ecosystem services. Studies have shown the high reliance of communities and households on, and the lack of substitutes for, vital provisioning ecosystem services (provisioning ESs) including food, freshwater, fuelwood, medicinal plants, and bushmeat (Boafo et al. 2014; Jasaw et al. 2017).

The quest for strategies to enhance coping strategies and adaptation to present and future impacts needs to take into account local and traditional community customs and practices. Therefore, this case study assesses the practice of provisioning ES sharing (giving and receiving) as a means to cope with changes in supply and access and to enhance redistribution among selected peri-urban and rural households in the Tolon district of the Northern Region of Ghana. Specifically, three sites, Nyankpala (peri-urban), Fihini (rural), and Daboshe (rural), were used as case study areas (Fig. 12.3). These case study sites were focal areas for the international collaborative project "Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa" (CECAR-Africa) (Saito et al. 2018b).

The data for this study were collected between August 2015 and February 2016 via face-to-face interviews using semi-structured questionnaires targeting household heads at the community level (Boafo et al. 2014, 2016). Questionnaires were designed to capture information on provisioning ES sharing patterns, motivation for sharing, and barriers to sharing. The study organized focus group discussions composed of between eight and ten household heads within each of the studied communities to investigate the practice of sharing, patterns of provisioning ES sharing, and motivations for sharing.

Provisioning ES Sharing Patterns and Motivations for Sharing

Overall, the study findings show sharing to be a widely used practice in rural and peri-urban households as a means to gain access to critical provisioning ESs (Fig. 12.4). The sharing pattern shows that sharing is more prevalent in rural households, as shown by the majority participating in the sharing of all provisioning ESs being assessed. Within the rural communities sur-

(continued)

Box 12.2 (continued)

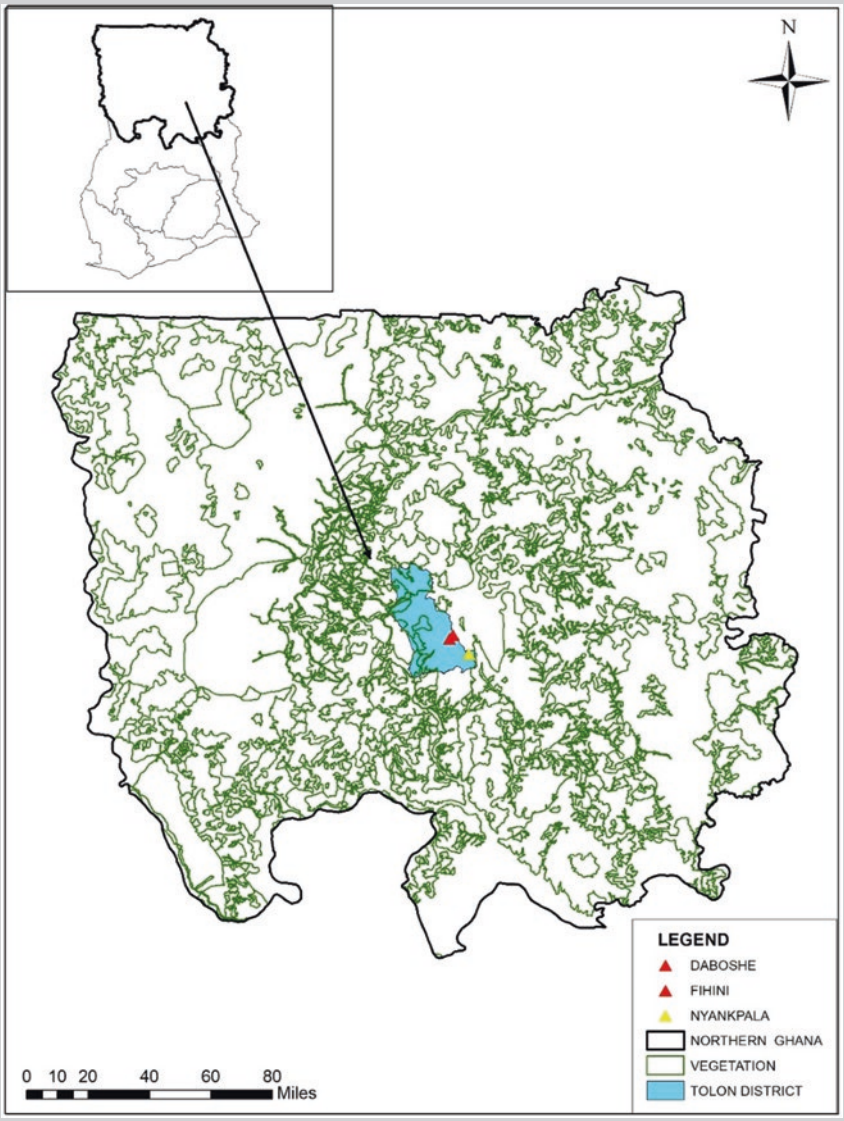

Fig. 12.3 Location of the study sites in northern Ghana

(continued)

Box 12.2 (continued)

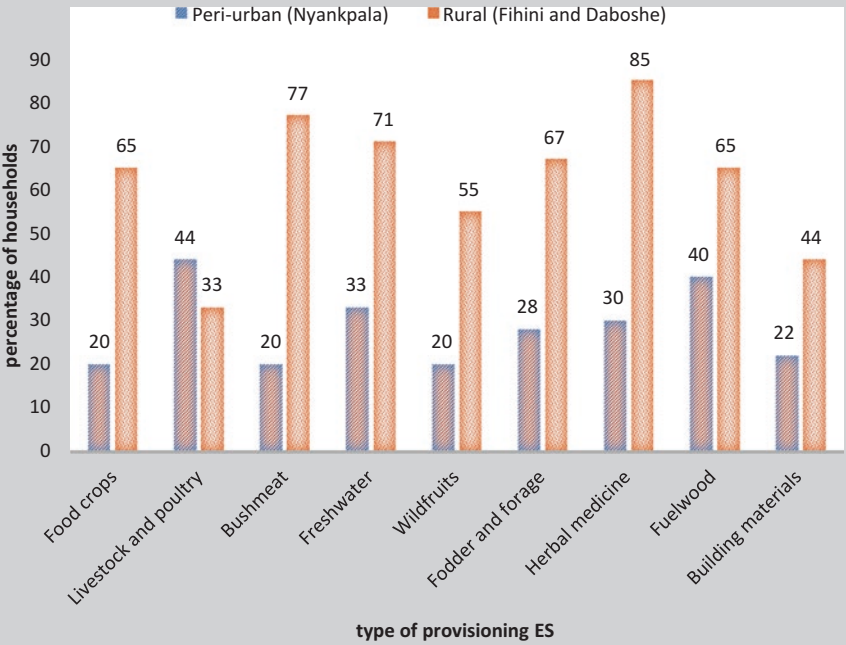

Fig. 12.4 Pattern of sharing of provisioning ESs between households.

veyed (Daboshe and Fihini), the provisioning ES most shared by households is herbal medicine (85%). A significant number of households also share bushmeat (77%) and freshwater (71%). In the peri-urban community of Nyankpala, livestock and poultry (44%) and fuelwood (40%) are among the most shared provisioning ESs (Fig. 12.4).

Studies have shown that seasonal cycles play a key role in the use of livelihood activities in rural households across Africa (Thornton et al. 2006; Boko et al. 2007). The findings from this study show that the majority of the sharing occurs in the dry season, which has become prolonged due to climate variability and change (Acheampong et al. 2014). Bushmeat, freshwater, fuelwood, and wild plants are among the most widely shared resources. This dry period in rural semiarid regions is marked by a high incidence of food insecurity (WFP 2009). In the wet season, when most households cultivate and harvest their crops and vegetables, sharing is done either as payment for labor,

(continued)

Box 12.2 (continued)

Photo 12.1 Roasted grasscutter (*Thryonomys swinderianus*), a bushmeat popular among households

seedlings for replanting, or the fulfillment of a customary agreement for land use (sharecropping) (Photo 12.1).

The interview results indicate that the motivations for provisioning ESs can be classified under sociocultural and environmental considerations (Table 12.4). Socioculturally, respondents perceived sharing to be significant in linking individuals to the broader social structure and culture, therefore enhancing social cohesion (Wittel 2011). The social structure or network, made up of family, friends, neighbors, and others, can be an important asset to be used in times of need (reciprocal assistance). Sharing is considered to be a normal obligation of the "haves" (Table 12.4). In the study area, some provisioning ESs such as shea nuts (*Vitellaria paradoxa*) and bushmeat are harvested collectively (Jasaw et al. 2017). It is therefore required that the proceeds from such efforts be distributed based on an equitable-sharing arrangement among the participants in the collection. Environmental considerations from the responses in this study may point to the locals' acknowledgment of the negative effects of climate variability and changes in their ecosystems.

(continued)

Box 12.2 (continued)

Table 12.4 Respondents' stated motivations and incentives for participating in provisioning ES sharing

No.	Motivations and incentives for sharing	Respondent's demographic
1	I share to help minimize the misuse of scarce resources like fuelwood	Female, 55 years old
2	If your neighbor is starving, you need to share when you have some	Male, 48 years old
3	To motivate others especially young people to cultivate their own farms	Male, 58 years old
4	It's a practice inherited from our father because we are all one big family	Female, 37 years old
5	It is a religious duty	Male, 40 years old
6	It is customary to offer food to neighbors and sometimes strangers who pass by the farm at harvest	Female, 33 years old
7	Show of neighborly love	Male, 23 years old
8	Sharing is a show of kindness to neighbors and respected people in society	Male, 38 years old
9	Sharing food and freshwater helps build strong relationships	Female, 43 years old
10	Pests and diseases destroy other people's crops, so we need to share with them	Male, 35 years old
11	Drought and bushfires have been destroying the food crops, so we have no choice but to share	Female, 30 years old
12	Our environment cannot support the needs of all, so we share to reduce pressure on the goods provided by nature	Female, 46 years old
13	God provides for us, so it is our duty to share with other people	Male, 41 years old
14	As an herbalist, I treat everyone with herbs provided freely by nature	Male, 69 years old
15	I share because bushmeat is scarce and not everyone can harvest	Male, 27 years old

Source: Field survey, 2015

Practical Implications

This study provides useful insights into locally derived coping and adaptation strategies and reveals that sharing is considered to be both a reactive and proactive coping and adaptation strategy for enhancing resilience to shocks caused by humans and nature. Within the social and cultural context, the traditional practice of sharing provisioning ESs, though not new, continues to be

(continued)

Box 12.2 (continued)

widely used by rural households to ensure access to, and the redistribution of, resources. The survey reveals the low level of the peri-urban households' participation in sharing compared to that of rural households (Fig. 12.3). In peri-urban settings, social cohesion may not be as strong as it prevails in many rural areas. The present findings may be corroborating other empirical studies and anecdotal evidence showing the rise in commercial sharing practices within the urban economy (Boyko et al. 2017). In the case of rural communities, the short-term benefits of participation in communal sharing cannot be overlooked. Exploring pragmatic ways to encourage and sustain communal and commercial sharing practices could be an effective coping mechanism to minimize resource overuse while strengthening resilience against climate and ecosystem changes.

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(continued)

Box 12.2 (continued)

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12.3 Transformation Approaches Toward Co-designing Sustainable and Resilient Future

Based on all case studies in this book and a literature review of relevant sharing studies, we can recognize three key approaches for building a sustainable and resilient future: (1) combination of traditional knowledge and scientific knowledge/technologies; (2) coexistence of market and nonmarket sharing mechanisms; and (3) new normative metrics that measure multiple values of sharing.

12.3.1 Combining Traditional Knowledge and Scientific Knowledge/Technologies

As emphasized in Chap. 6, combining traditional knowledge with scientific knowledge can increase the adaptive capacity of SEPLS to a host of old and new stressors. ICTs and digital platforms expand the forms and boundaries of sharing practices. Chapter 5 presented a unique example in which web-based geographic information systems facilitated the sharing experiences associated with local waterscapes across and within generations. In the cow-sharing arrangements in Europe (Chap. 11), communication technologies and web-based platforms mediate the direct transactions and interactions between users and providers. Digital platforms allow the establishment and connection of user-provider networks beyond traditional territorial scales. However, users are not necessarily able to connect and share experiences related to their cow-sharing arrangement through a digital platform. Whether sustained sharing networks can support the long-term provision of ecosystem services for economic benefit or are restricted to short-term exchanges remains largely unknown (Chap. 11).

The Palau residents continue to use natural resources for subsistence despite the extensive use of new digital technologies (Internet and smartphones) (Chap. 7), although most residents of industrialized countries have abandoned natural subsistence activities. In this sense, new digital technology coexists with sharing practices not only in commercialized sharing but also in sociocultural and communal sharing. As proposed in Chap. 7, new digital-sharing economy concepts might promote traditional ecological knowledge. For instance, local communities can post traditional ecological knowledge or eco-cultural tour information (such as taro patches, herbal information, and local cuisine) on dedicated application software (app) or an online database. Visitors can then contact the host community and experience this knowledge through an ecotour. If further explored, such a novel integration between sociocultural communal sharing and ICT-based commercial sharing promises the co-design of sustainable and resilient societies.

12.3.2 Coexistence of Market and Nonmarket Sharing Mechanisms

As demonstrated in Chap. 10, sociocultural communal sharing practices through home garden produce (provisioning services) have dwindled as a result of urban development. Sociocultural communal sharing has declined in both developed and developing countries (Boafo et al. 2016; Saito and Kamiyama 2016; Saito et al. 2018a) but (as shown in this book) continues to play multiple and significant roles in many countries.

With the rapid expansion of sharing economies (commercial/market sharing), some of the existing nonmarket sharing practices, such as the sociocultural communal sharing of food, may be substituted by e-commerce (e.g., Amazon) and other commercial food distribution systems. Therefore, we need to explore how market and nonmarket sharing can coexist and the extent to which a sharing economy can expand without destroying the nonmarket sharing. “There is a degree of commercialization which destroys the community itself. But between these two extremes lies a middle ground in which, sometimes, *eros* and *logos* may coexist” (Hyde 2007, p. 358). How can we find such a middle ground? The sharing paradigm of McLaren and Agyeman (2015) categorizes sharing into four types: commercial-intermediated sharing (sharing economy), communal-intermediated sharing (peer-to-peer sharing), commercial sociocultural sharing (collective economy), and communal sociocultural sharing (collective commons). These forms are not mutually exclusive and can coexist or be combined into new sharing platforms involving nonmarket and market sharing. A middle ground might be created by institutionalizing a solidarity economy (Chap. 8), expanding payment for PES schemes (Chap. 9), and examining the sharing arrangements between providers and consumers (Chap. 11).

Along with ICT developments, web-based networks create new spheres of non-market sharing, enabling the de facto demonetizing of previously market-based activities or a dual system that delivers the same contents in both market and nonmarket transactions through exchanges between individual peers (Aigrain 2012). "Scientific publishing is an example of a domain which is in the process of becoming entirely non-market on the access side, even though some publishers still cling to the belief of remaining monopoly dealers" (Aigrain 2012, pp. 130–131). In this sense, the boundary between market and nonmarket sharing will change in the future, creating a new form of sharing beyond the current sharing paradigm.

The two cases described in Chap. 8—the PAA in Campinas and the SAFTA in Tomé-Açu, Brazil—combine science, traditional knowledge, and various social and political movements that link production and consumption sites. The same movements link rural and urban spaces by institutionalizing a solidarity economy based on family and the agroecological practices and everyday sharing of small farmers. By exploring ways of integrating new and traditional sharing practices within a globalized market economy regime, we can create new pathways for sustainable and resilient societies that harmonize with nature.

12.3.3 New Normative Metrics for Measuring Multiple Values of Sharing

Above, we highlighted the positive and negative effects of sharing on sustainability and resilience (Table 12.3). However, we should acknowledge that the economic, social, and environmental effects of sharing economy platforms are largely unknown (Frenken and Schor 2017). The large volume of monetary transactions delivers direct economic benefits, but the distributional effects of monetary transactions (inequality, inclusiveness, and discrimination) are less straightforward and difficult to measure (Frenken and Schor 2017). Car sharing and ridesharing confer environmental benefits such as CO_2 reduction, but the overall environmental effects of sharing economy platforms may be offset by an increase in the overall consumption volume (Khazzoom 1980; Kathan et al. 2016; Frenken and Schor 2017). To determine the full carbon and eco-impacts of a new sharing practice, we must analyze all changes in the system resulting from the new practice (Schor 2014; Frenken 2017).

Normative implications for sustainable production and consumption, social and environmental values and justice, and sustainability transitions are "bottom-up" sharing narratives driven by grassroots initiatives. Meanwhile, the regime-level (top-down) approach emphasizes the commercial terms, economic opportunities, and less regulated market platforms (e.g., Uber, Airbnb) (Martin 2016). To transform sharing initiatives into a sustainable and resilient paradigm, we require an intermediate approach between the bottom-up sharing initiatives and the regime-level norms and rules. For this purpose, we must identify/invent a set of normative metrics that measure both the monetary and multiple nonmonetary values of sharing. Also, it

should be noted that in solidarity, economy sharing has a moral dimension (a shared/social value) which cannot be measured in financial terms but has a nonmonetary value that contributes to societal and sustainable development (Chap. 8).

The following insight of Botsman and Rogers (2010, p. 221) consolidates this idea:

> We believe Collaborative Consumption is part of an even bigger shift from a production-oriented measurement system that just gauges the amount we sell to a multidimensional notion of value that also take into consideration the well-being of current and future generations. Just as individuals are beginning to rethink the dichotomy between self-interest and collective good, some governments and businesses are starting to rethink their own metrics that have prioritized certain forms of progress. The consideration of a more holistic understanding of well-being and success is now taking place on a macroecnomic level, leading to a global movement away from what has been labeled 'GDP fetishism'. Gross domestic product (GDP) allows economists to plot and compare our national economy's growth, disparities, ranking and power.

Kenter et al. (2015) reviewed a wide range of monetary and nonmonetary techniques that elicit different types of shared and social values to varying degrees, including deliberative monetary valuation, participatory multi-criteria analysis, citizen juries, deliberative fora and polls, in-depth discussion groups, participatory modeling and mapping, interpretive techniques such as media analysis, and psychometric approaches. Deliberative monetary valuation can elicit a pre-aggregated, social willingness to pay (WTP), which measures social welfare through debate and negotiation rather than by aggregating individual WTPs (Kenter et al. 2015). The *value intention* dimension assesses values as self-regarding or other-regarding (altruistic values outside the concerns of neoclassical economists) (Kenter et al. 2015). In the total economic value (TEV) framework (Pearce and Moran 1994), the personal satisfaction gained by altruism is considered as a value. As indicated in Chap. 9, participatory and deliberative processes such as debate and negotiation facilitate the integration of "transcendental, other-regarding and cultural values in relation to the different components of TEV, as well as rights, duties and virtues" (Kenter et al. 2015, p. 94). Communal and transcendental values can be extracted by interpretive methods (e.g., media analysis and desk-based cultural history study) and narrative-based methods (e.g., psychometric survey-based methods and interviews), whereas larger-scale societal and cultural values can be assessed through ethnographic methods and textual methods such as discourse analysis (Kenter et al. 2015).

The inclusive wealth index (IWI) is a stock-based comprehensive indicator of sustainability. The IWI is based on the wealth of both regions and nations (Dasgupta et al. 2015; Ikeda et al. 2017; Yoshida et al. 2018) and more accurately reflects social well-being than the GDP or the adjusted GDP indicators. In the inclusive wealth approach, well-being is evaluated using observable stock-based data from flow-based data (Ikeda et al. 2017). The IWI measure determines the monetary capital (e.g., investment, economic output), human capital (e.g., educational attainment, working population, and shadow price of an individual derived from the expected working life and average compensation per person), and natural capital (e.g., farmland, forest, fisheries catch). However, as the local data for computing the IWI

are usually deficient, the IWI has limited ability to capture the assets essential to the long-term well-being of a society (Yoshida et al. 2018). Nonmarket food production and voluntary labor, cultural ecosystem services, and social capital are often context-specific (Eastwood et al. 2016) and are largely missed in present IWI measurements (Yoshida et al. 2018). Future research should be directed toward identifying the social value of sharing ecosystem services and the factors contributing to the greatest societal benefits (Michelini et al. 2018).

The Sustainable Development Goals (SDGs), adopted in the UN's General Assembly resolution "Transforming Our World: The agenda for Sustainable Development" in September 2015, have been universally accepted among the UN member states. These goals are intended to promote global sustainable development based on universal principles of international cooperation (UN General Assembly 2015). Resilience is a crosscutting and often emphasized concept in the SDGs. Although resilience can be measured by many conceptual frameworks and models (e.g., Folke 2006; Walker and Salt 2006; Saito et al. 2018b), it must be localized, downscaled, and customized to particular local contexts in SDG evaluation, mainly because the local conditions do not match the theory-driven indicators (Yohenara et al. 2017). Implementing the SDGs for a more sustainable and resilient society requires the continuous intervention and monitoring of new indicators, and the evaluation of intervention strategies, while engaging and collaborating with different stakeholders.

As we mentioned in Chap. 1, sharing studies started including the term "sustainability" in their keywords more frequently after 2015, when the SDGs were adopted. This suggests that more and more sharing studies will be conducted to meet global needs in order to achieve the SDGs. The sharing of homegrown food in Japan (Chaps. 2, 3, and 4), Palau (Chap. 7), and India (Chap. 10) provided the baseline empirical data and evidence needed to improve food security (SDG-2), with particular attention given to small-scale food producers and social networks as well as to good health and well-being (SDG-3). Chapter 5 introduced an innovative environmental education program that can contribute to promoting quality education (SDG-4) locally and demonstrate best practice for other areas. Chapter 6 presented useful case studies (apiculture and mushroom growing) in making consumption and production more responsible (SDG-12) by combining local ecological knowledge and experience with modern production techniques. Brazil's solidarity economy (Chap. 8) provided a practical policy package to promote multiple SDGs, such as SDG-1 (no poverty), SDG-2 (zero hunger), SDG-3 (good health and well-being), SDG-4 (quality education), and SDG-15 (life on land). Chapter 9 introduced a case study showing that payment for ecosystem services can be an effective policy tool for conserving production landscapes (SDG-14) by sharing knowledge and values associated with watershed services among farmer group members. Cow-sharing in Europe (Chap. 11) indicated that unique business models can contribute to responsible consumption and production (SDG-12) without sacrificing local landscapes and Alpine ecosystem services (SDG-15).

12.4 Afterword

We started this book by asking what and how are we sharing, identifying the key research gaps in sharing paradigm studies, and highlighting the potential contributions of sharing to sustainable and resilient societies (Chap. 1; Ryu et al. 2018). Botsman and Rogers (2010) stated that we are in the middle of a revolution or transformation toward "a sustainable system built to serve basic human needs—in particular, the needs for community, individual identity, recognition and meaningful activity—rooted in age-old market principles and collaborative behaviour" (pp. 224–225). McLaren and Agyeman (2015) stressed that "the sharing paradigm is the single most important task for urban governance and urban futures in the twenty-first century" (p. 317). Inspired by this paradigm (McLaren and Agyeman 2015), we here extended the scope of sharing beyond urban governance and provided a wide range of sharing case studies worldwide. In this undertaking, we hoped to fill the gap between sharing economy studies (which are well understood) and sociocultural communal sharing practices (which are less well-studied). This final chapter revisits and summarizes the case studies from Chaps. 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 and identifies the positive and negative effects of sharing on sustainability and resilience (Table 12.3). It also proposes three key approaches toward a sustainable and resilient future: (1) combination of traditional knowledge and scientific knowledge/technologies; (2) coexistence of market and nonmarket sharing mechanisms; and (3) new normative metrics for measuring multiple sharing values.

We must also acknowledge the many remaining tasks to be undertaken. Frenken and Schor (2017) posed five research questions for the assessment of sharing economy:

(Q-1) What types of sharing economies have historically existed across cultures and epochs?
(Q-2) What is the relative importance of trust-generating mechanisms on sharing economy platforms?
(Q-3) How can we analytically conceptualize and empirically assess the various impacts of the sharing economy platforms in terms of sustainability (people, planet, and prosperity)?
(Q-4) How can we explain and evaluate the variety of regulatory responses of governments from local to global levels?
(Q-5) What alternative governance schemes for operating a platform are being employed?

This book provides some useful empirical evidence for answering these questions, particularly Q-3 and Q-5, but further research is required to investigate the remaining questions. We believe that sharing practices contain intrinsic value that has not been fully elucidated, but has played an essential role for human society. For example, shadow prices, shadow works, multiple functions, externalities of sharing practices, and the underlying themes of market and nonmarket sharing transactions need further investigation. A credible evidence base for demonstrating the importance of

shared and social values in these different sectors and spheres is also required. With such a tool, we could assess the many diverse shared social values of natural and derived ecosystem services (Kenter et al. 2015).

Mauss (1923–1924) concluded that "societies have progressed in the measure in which they, their sub-groups and their members, have been able to stabilize their contracts and to give, receive and repay" (p. 80). New ICTs, web-based platforms, and smartphone applications can supplement sociocultural communal sharing of goods and capitals, contributing to the mutual satisfaction of people's interests and defining them without resource to arms (Mauss 1923–1924) and without compromising sustainability and resilience (Table 12.3).

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Correction to: Sustaining Diverse Knowledge Systems in SEPLs: Sharing Tacit Knowledge of Apiculture and Mushroom Production with Future Generations

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