



Non-market food provisioning services via homegardens and communal sharing in *satoyama* socio-ecological production landscapes on Japan's Noto peninsula



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ABSTRACT

A quantitative understanding of relations between ecosystems and human well-being is critical to a range of decisions and to communities. This study examined home food production and the sharing of food with non-market transactions and its implications for physical functioning and social relations. To characterize the quantity and varieties of non-market food consumed per household at the community level and to discover how food is shared in social relations within and beyond communities, we conducted face-to-face interviews in three communities with varying socio-geographic attributes in Japan's Noto peninsula. We found that rural households in inland and coastal communities consume greater varieties and quantities of food grown at home and/or received from others than households in semi-urban community. 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. Rural households primarily share food within their communities. Among semi-urban households, social connections beyond their communities, particularly connections to rural communities, enhance non-market food consumption. Urbanization has weakened these personal connections and sharing mechanisms. Balancing market and non-market food provisioning and connecting rural and urban areas will be key to building localized models of sustainable societies.

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1. Introduction

Since the publication of the Millennium Ecosystem Assessment (MA, 2005), the concept of ecosystem services has become important because of its linkages to human well-being. A quantitative understanding of these links is critical to a range of decisions, and the interest in assessing ecosystem services has been growing exponentially among environmental scientists and policymakers (Fisher et al., 2009). However, despite this academic progress, important issues remain unresolved. Seppelt et al. (2011) reviewed 153 publications published between 1990 and 2010 that employed the terms “ecosystem service(s)” or “ecosystem valuation” in their titles and found that less than one-third of them based their conclusions on primary data or quantitative measurements. Thus, acquiring quantitative information on a scale relevant to decision making is one of the challenges of making the concept of ecosystem services work (Larigauderie and Mooney, 2010, Perrings

et al., 2011).

Previous studies have shown that ecosystem services (provisioning, regulating, and cultural services) are linked to security, materials fundamental to a good life, and health and that they are weakly linked to good social relations (social cohesion, mutual respect, and the ability to help others) (MA, 2005). In contrast, the sociological literature reports that social capital—networks, norms, and trust that facilitate mutually beneficial coordination and cooperation (Patnam, 1995; see Adler and Kwon, 2002)—is closely associated with the sustainable use of natural capital (Katz, 2000, Buchmann, 2009, Tibesigwa et al., 2014). The Intergovernmental Platform on Biodiversity and Ecosystem Services (<http://ipbes.net>), which was established in 2012 to focus on conservation and sustainable biodiversity, human well-being, and sustainable development, proposed a framework connecting nature and people. This framework incorporates multidimensional attributes of human well-being such as OECD good life indicators, into the concept of good quality of life. The importance of social capital is becoming more evident (Diaz et al., 2015).

Food provisioning, which is a vital ecosystem service, is associated with physical production of sources of nutrition and with

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cultural identity (Nolin, 2012, Cantarero et al., 2013). Given that the world population is expected to exceed 9 billion by 2050, nations need to sustain the demand for food in a way that reduces the environmental footprint of food systems (Godfray et al., 2010, Griggs, 2013). The interest in strengthening local food production to mitigate global food instability is growing, and more attention has fallen upon homegardens and family farming as sources of sustainable and secure nourishment (United Nations, 2014). Kamiyama et al. (2014) investigated the quantities of food self-consumption via a Web questionnaire survey administered throughout Japan. They found that approximately 12% of all vegetables consumed by households are grown at home, with a higher proportion in rural and agricultural (15%) than in urban municipalities (10%). Although homegardens are integrated into local food systems and agricultural landscapes worldwide (Mohri et al., 2013, Galhena et al., 2013), few studies have investigated small-scale farming by relating quantities and varieties of home-grown food to localized geographies in the context of sustainable ecosystem services.

The custom of homegardens transmits indigenous culture and communal knowledge across generations. Home-based agriculture 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). Sharing or gifting can be defined as giving and/or receiving something in a non-market transaction (without a financial transaction) 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, sharing or gifting natural resources has played an essential role in social integration and building social capital (Nolin, 2012). Thus, homegardening substantially promotes human well-being by growing food and building social relations. However, relations between food provisioning and social integration have not been studied quantitatively, particularly in temperate regions and developed countries (Galhena et al., 2013).

Satoyama is a Japanese term for a 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). The concept of *satoyama* has been extended to *satoumi* for marine and coastal ecosystems. *Satoyama-satoumi* serves as an inspiration for integrating human activity into nature to maintain biodiversity and provide ecosystem services internationally. 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). 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). Containing nine municipalities located in Ishikawa prefecture, the Noto peninsula has retained traditional, well-managed Japanese agricultural landscapes and seascapes. Its 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). The FAO designated the Noto peninsula as a Globally Important Agricultural Heritage System (GIAHS) in 2011.

This study quantified the variety and quantity of agricultural, forest, and marine food products that households in one

municipality in the Noto peninsula acquired by non-market transactions by growing in their own homegardens or receiving from others. We conducted face-to-face household interviews in three communities with varying socio-geographic attributes in Nanao city on the Noto peninsula. We discovered how these households shared food and how sharing fostered social relations within and beyond communities. We formed the following hypotheses: (1) rural households acquire greater varieties and quantities of food by non-market transactions than semi-urban households, following a trend we found at the municipal level throughout Japan (Kamiyama et al., 2014); (2) households with more connections to other households (i.e., with good social relations) acquire greater quantities and varieties of food by non-market transactions because of the positive relationship between social capital and use of natural resources (e.g., Tibesigwa et al., 2014); (3) rural households enjoy closer social links and more sharing partners than semi-urban households do (Morton et al., 2008); and (4) households generally share food within their communities rather than outside them in cities, municipalities, or prefectures because sharing or gifting customs have been observed on smaller spatial scales (Befu, 1968). 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. In our study, it can be considered that “semi-urban” lies between “rural” and “urban.” “Community” refers to local groups of interacting people who live in the same place and share an environment or indigenous characteristics.

2. Methods

2.1. Study sites

Nanao city is the most populous city on the Noto peninsula and is located in the center of the peninsula (Fig. 1). As of December 2014, the city had 56,188 inhabitants and 22,119 households in an area covering 318.02 km². 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 three communities within Nanao city for their varied socio-geographical attributes: Natauchi, Higashijima, and Yatamachi (Table 1, Fig. 1). 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.

2.2. Sampling and data collection

Teams of two or three interviewers, including the authors, conducted field surveys from October 2013 to August 2014. To ensure participation in the survey and efficient data collection, we avoided the busy farming season (spring and autumn), local festival and shrine ritual seasons, and winter with harsh weather and snow. Table 1 describes the duration of the survey in each community. We administered structured questionnaires face-to-face at respondents' homes. Interviews ran 20 to 60 min (questions from other research projects were included).

The household was used as a sampling unit to compare food consumption among the three communities. A household 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, we randomly selected approximately 30 households from each community as a

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