

Challenges for the Maintenance of Traditional Knowledge in the Satoyama and Satoumi Ecosystems, Noto Peninsula, Japan

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Abstract

This paper proposes an appropriate mechanism for the maintenance of traditional knowledge (TK) associated with wild edible plants, seaweeds and mushrooms in the satoyama and satoumi ecosystems located in the Noto Peninsula, Japan. The conceptual framework of the Millennium Ecosystem Assessment (MA) was adapted to this study to examine the impact of the drivers of change on TK and components of human well-being, changes in TK and components of human well-being, and interrelations amongst them. Relevant data were collected through conducting in-depth interviews and administering a survey. The results of the survey revealed that 46 wild edible plants, 12 seaweeds, and 19 mushroom species are widely collected for a variety of purposes in the selected sites. Unfortunately, it was determined that the current trend in the study sites is increasing erosion of traditional knowledge and relevant traditional practices due to the impacts of the drivers addressed in this study (e.g. ageing and migration). Assessment of the linkages between TK and human well-being shows that both the decline in TK and the drivers of change adversely affect five fundamental components of human well-being (e.g. health, development of good social relations, and security). Recognizing this undesirable trend, a holistic strategy was developed to sustain, use, and transmit TK as a living cultural resource in society. Within this context, a number of potential responses (e.g. economic, tourism-related, social and behavioural) and instruments (e.g. Community Development Fund) for providing benefit sharing among the target groups were developed to achieve success in the effective maintenance and promotion of TK and also to contribute to sustainable development strategies in the Peninsula.

Keywords: traditional knowledge, satoyama, satoumi, Noto Peninsula, Japan

Introduction

In all cultures, humans have gained knowledge by conceptualizing empirical observations to better understand, interpret, and predict nature (Laccarino 2003). Thus, local and traditional management practices can provide both long-term local observations and an institutional memory for understanding ecosystem change, restoration, governance, and the management of complex adaptive social-ecological systems (Berkes 1999; Berkes and Folke 2002; Berkes and Folke 2003; Folke et al. 1998; Folke 2004). Within this context, *traditional knowledge* (TK) ensures sound use and control of the environment and enables people to adapt to environmental changes.

Traditional knowledge is defined in numerous ways in discussions in the international forum over the past decade (Alexander et al. 2004). For example, Berkes (2001) and Berkes and Folke (2002) state that TK is an attribute of societies with historical continuity in resource use on a particular land, particularly in non-industrial and less technologically oriented societies. Davidson-Hunt and Berkes (2001) and Berkes (2000) emphasize that TK is a source of information to be incorporated into management practices and is an arena of dialogue between resource managers and harvesters. A few scholars point out that TK strengthens the historical identity of many indigenous and local communities with a shared cultural history (Neumann et al. 2004; Bhatti 2004; Twarog 2004). Therefore, TK is part of the cultural heritage of a society. The legally binding definition of TK is stated in the Convention on Biological Diversity (CBD). According to the CBD, the term TK refers to the “knowledge, innovations and practices of indigenous and local communities around the world [Article 8(j) and 18.4 of the Convention]. All these definitions emphasize the values of TK for humans in terms of determination of the co-viability of social and ecosystem dynamics (Gundersan and Holling 2002); the design of people-centred resource management approaches (Cunningham

2001); and playing an active role in biodiversity conservation and ecosystem management (Colding and Folke 2001; World Conservation Union 1986). In addition, TK forms the basis for decisions and strategies in many practical areas such as medical treatment and agriculture (Nakashima and Roué 2002). However, any form of knowledge makes sense only within its own cultural context (Feyerabend 1987). Consequently, TK is highly valuable for human well-being (e.g. conservation of biodiversity, socio-economic and cultural development). Therefore, local knowledge and practices have to be analyzed and understood so that appropriate management practices built on both scientific and local knowledge can be developed (Berkes et al. 2000; Berkes and Folke 2002; DeWalt 1994; Johnson 1999; Moller et al. 2004; Ticktin and Johns 2002). Within this context, the satoyama and satoumi ecosystems located in the Noto Peninsula in Japan can serve as an instructive case study.

The term “*satoumi*” refers to the tidelands with much seafood diversity, and the zones where human activities such as fishing are conducted in a sustainable manner (Yanagi 2006). The term “*satoyama*” refers to “a mosaic of ecosystems including wetlands, grasslands, woodlands, farmlands, paddy fields, and settlements” (Takeuchi 2001; Yamamoto 1999). The interaction of humans with nature has led to the emergence of these ecosystems that provide significant habitats for a great variety of wild animals and plants (Takeuchi 2001; Yamamoto 1999; Washitani 2001; Nakagoshi and Hong 2001). Thus, the interaction of humans with the satoyama ecosystems has played a vital role in biodiversity conservation, socio-economic progress, and the emergence of TK on different components of these ecosystems (e.g. wild edible plants) in the Noto Peninsula.

TK is one of the non-material benefits local people have obtained from the satoyama and satoumi ecosystems by language and practising. Characteristics of TK include information about a variety of components of these ecosystems (e.g. wild edible plants and seaweeds) and learning by doing practices (e.g. traditional rice cultivation). This knowledge has developed over centuries and has been handed down from generation to generation. Kirikiri and Nugent (1995) emphasize that such harvest practices are important social activities to help define the participants’ cultural identity and provide links to their history, ancestors, land, and environmental philosophy. In addition, some species can be culturally salient species that significantly shape the cultural identity, diet, medicine, and spiritual practices of a people. Therefore, such species become embedded in a people’s cultural traditions and narratives, their ceremonies, dances, songs, and discourse (Garibaldi and Turner 2004). For example, some species of wild edible plants, mushrooms, and seaweeds are crucial in various fields of life (e.g. traditional diet system) in

the Noto Peninsula. Therefore, these plants might be crucial as cultural keystone species, particularly in the traditional food system. However, Takeuchi et al. (2001), Fukamachi et al. (2001), and Yamamoto (1999) emphasize the degradation of the satoyama ecosystems due to abandonment, rapid urbanization, and the rapid growth of the Japanese economy. Within this context, Garibaldi and Turner (2004) point out that a decline in biological diversity often means a loss of cultural diversity. Thus, the degradation of the satoyama ecosystems might be a major reason for the erosion of TK in the Noto Peninsula as people have lost their interest in access to the satoyama ecosystems today. Processes that create and sustain TK are likely to be severely weakened—that is, putting TK at serious risk. For that reason, TK should be considered in sustainable ecological, economic, social, cultural, and human development strategies in the Noto Peninsula. Accordingly, the purpose of this study is to develop an appropriate mechanism for the maintenance of TK associated with wild edible plants, seaweeds and mushrooms in the Noto Peninsula located in the Ishikawa Prefecture, Japan. The objectives of the study include:

- to examine the drivers (factors) behind the erosion of TK;
- to examine TK based on the target plants;
- to analyze the linkages between TK and components of human well-being; and,
- to develop a number of suggestions for the maintenance and effective use of TK.

It is hoped that the results of the study will draw attention on the neglect of TK in Japan in terms of its significance for cultural heritage, revitalization of the satoyama ecosystems, sustainable rural development strategies, and the viability of traditional food systems. It is also expected that the study can contribute to better understanding human-ecosystem interaction between life and social scientists.

Methods

Selection of Study Sites

All research mentioned in this paper was conducted in the following nine villages located in the Noto Peninsula (Table 1). A series of interviews were conducted using a participatory approach with the local governmental bodies and NGOs, and the community members to sample the indicated communities. The major reasons for the selection of the indicated villages include:

- collection of the target plants is largely conducted in these villages;
- the indicated villages represent typical Satoyama and Satoumi ecosystems, relevant traditional practices, and embedded TK.

Table 1. Population of the Selected Villages

Name of City/Town	Name of Village	Total Population (in 2004)
Suzu city	Kodomari	223
	Sutta	419
Wajima city	Kanakura	164
	Nafune	271
	Monzen	7.468
Anamizu town	Ukagawa	171
	Ohmaci	1441
Noto town	Tome	294
	Miyachi	147
Total		10.598

Source: Ishikawa in Statistics 2005

Data Collection

Data collection included a series of stages presented below. I and my colleague together periodically collected the relevant data from January 2006 to March 2007 in the study sites.

Determination of the Knowledgeable Community Members

A series of pre-interviews were conducted with the local stakeholders (e.g. local governmental bodies and NGOs) and the community members using a participatory approach to choose the knowledgeable community members in each village. During the pre-interviews, a number of community members (between two and three) were introduced in each village. These individuals are those who harvest and also hold information about the target plants. TK on the target plants (e.g. mode of use, parts of plant used, and type of processing method) was used as a measure to define the knowledgeable individuals. Accordingly, the knowledgeable community members in each village were chosen. A balance between male and female individuals could not be applied due to the male-headed household structure and traditional reasons. In addition, any measures of the consistency (e.g. number and gender) were not used to choose the knowledgeable individuals in/or between villages as the number of the indicated individuals is limited in each village.

Interviews with the Knowledgeable Community Members

A series of semi-structured interviews were conducted with the knowledgeable community members in the selected villages to examine the data on the following questions: species harvested from the wild, TK on the harvested plants, drivers that adversely affect TK upon the target plants and components of human well-being, and potential solutions to maintain TK. Each interview was recorded on tape so as to maintain an exact record. The knowledgeable individuals were interviewed to learn their needs and expectations re-

garding the maintenance and promotion of TK. In addition, survey participants were chosen with the help of the knowledgeable individuals in each village. The knowledgeable individuals knew the community members who collect and use the target plants in a traditional way in their villages. Participants' consent was obtained by the knowledgeable community members in each village.

Design and Implementation of the Survey

A questionnaire form was developed based on assessment of the data obtained from the semi-structured interviews. The questionnaire was pre-tested with 20 community members in the villages of Monzen and Miyachi. Feedback from these individuals was essential to make the questionnaire clear. The questionnaire was given back to the knowledgeable individuals, who then chose the survey participants. Accordingly, a total number of 154 individuals completed the questionnaire. The questionnaire comprised both qualitative and quantitative data. The main survey questions were related to harvested species, TK based on the target plants, purpose of the collection, and appropriate solutions for the maintenance of TK. The population profile of the participants is shown in Table 2.

Table 2. Population Profile of the Participants in the Selected Sites

Population Profile	Characteristics of the Population Profile	Number of Participants
Gender	Male	82
	Female	70
Education level	Primary school	51
	High school	59
	College	41
Occupation	Student	0
	Housewife	17
	Retired	6
	Farmer	36
	Self-employed	29
	Officer	17
	Unemployed	6
Others (manufacturing, construction)	40	
Age range	Under 19	1
	Between 19-29	3
	Between 30-39	8
	Between 40-49	22
	Between 50-65	64
	Over 65	56

Assessment of Table 2 shows that most of the participants have high school degree and are employed in manufacturing and/or construction sectors. However, the results of the semi-structured interviews revealed that most of the participants employed in the indicated sectors are already retired

from one kind of job. Therefore, these individuals are often between 50 and 65 or over 65 years old. As these people continue to work after retirement, they did not mark themselves as 'retired' in the questionnaire. For that reason, the question about occupation does not reflect the exact profile of the participants.

Assessment of the Survey

The survey data were compiled in a computerized database to provide relevant information at an institutional level. The recorded data were analyzed using the Excel program. The analyzed data were evaluated by taking into account the semi-structured interviews, observations, and the Millennium Ecosystems Assessment (MA) (2005). The survey data were used to assess TK on the target plants, linkages between TK and components of human well-being, and potential solutions to maintain TK.

The Millennium Ecosystems Assessment

The conceptual framework of the Millennium Ecosystems Assessment (MA) (2005) was adapted to the study to examine the following core questions: what have caused changes in TK? How has TK changed? How have the changes in TK influenced human well-being? And what potential options exist to maintain TK and its contributions to human well-being?

The Millennium Ecosystems Assessment was launched by U.N. Secretary-General Kofi Annan in June 2001, and was carried out between 2001 and 2005. This is an international work program designed to meet the needs of decision-makers and the public for scientific information concerning the consequences of ecosystem change for human well-being and options for responding to those changes. The objectives of the Millennium Ecosystems Assessment were to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contribution to human well-being. The assessment focused on the linkages between ecosystems and human well-being, in particular, on ecosystem services. The framework of the Millennium Ecosystems Assessment includes three agents: *ecosystem services*, *drivers of change* (direct and indirect), and *constituents of human well-being* (Millennium Ecosystems Assessment 2005).

Ecosystem services are the benefits people obtain from ecosystems. These include provisional, regulatory, cultural, and support services. *Provisioning services* are the products obtained from ecosystems, e.g. food, water, and timber. *Regulating services* are the benefits obtained from the regulation of ecosystem processes, e.g. the regulation of climate, floods,

and water quality. *Cultural services* are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences, e.g. TK, recreation, and spiritual fulfillment. *Supporting services* are the services that are necessary for the production of all other ecosystem services, e.g. nutrient cycling and soil formation (Millennium Ecosystems Assessment 2005). Accordingly, ecosystem services provide numerous benefits for human well-being. For example, TK can strengthen good social relations among community members. However, ecosystem services are directly affected by a number of factors.

According to the Millennium Ecosystems Assessment, there are numerous factors/drivers that cause changes in ecosystem services. A direct driver unequivocally influences ecosystem processes and can therefore be identified and measured to differing degrees of accuracy. The major direct drivers comprise *harvest and resource consumption*, *climate change*, *external inputs* (e.g. fertilizer use), *technology adaptation and use*, *changes in land cover*, *species introduction*, and *removal*. An indirect driver operates more diffusely, often by altering one or more direct drivers, and its influence is established by understanding its effect on a direct driver. The major indirect drivers include *demographic* (e.g. migration and ageing), *economic* (e.g. trade and globalization), *socio-political* (e.g. governance), *science and technology*, and *cultural and religious* (e.g. beliefs) (Millennium Ecosystem Assessment 2005). The interaction of several of these drivers directly affects ecosystem services. For example, ageing of a society can cause the decline in TK over time. In addition, drivers of change and components of human well-being are interrelated—that is, a positive or negative change in a driver directly influences the components of human well-being. For example, the global market can adversely affect security by causing a number of problems, such as violence in a society.

Millennium Ecosystems Assessment emphasize that human well-being has multiple components, including the basic materials for a good life, good health, good social relations, security, and freedom of choice and action. The *basic materials for a good life* include adequate income, household assets, food, water, and shelter. Detailed household surveys (e.g. access to water, health care, and information about nutrition) and income level can be used to measure the dimension of this well-being. The component of *freedom of choice and action* is defined as the range of options a person has in deciding on and realizing the kind of life to lead. Citizen participation in decision-making at regional and local levels and education can be used to measure the degree of this component of well-being. Human *health* can be measured in a variety of ways, e.g., child mortality and sense/feeling of health and well-being. The component of *good social relations* is

emphasized as a state when people are able to realize aesthetic and recreational values, express spiritual and cultural values, develop institutional linkages that create social capital, show mutual respect, have good gender and family relations, and have the ability to help others and provide for their children. It is pointed out that this aspect of human well-being is not well-measured, largely because it is more difficult to observe directly. The component of *security* emphasizes personal safety. The rate of depressions, economic crises, and violence can be used to measure the dimension of this component of human well-being (Millennium Ecosystem Assessment 2005). Drivers of change and components of human well-being are interrelated—that is, a positive or negative change in a driver directly affects the components of human well-being. For example, the driver of migration can directly affect the component of development of good social relations in an adverse manner, particularly between elders and the younger generations. In addition, changes in ecosystem services directly affect the components of human well-being. For example, the decline in TK can directly affect the basic materials for a good life such as a low harvesting level of the target plants.

Through the analysis of the Millennium Ecosystems Assessment, the three elements of the study (drivers, TK and components of well-being) are analyzed below.

Data Analysis

The conceptual framework of the study was developed through the analysis of the Millennium Ecosystems Assessment (2005), a literature review, interviews, and a survey (Figure 1).

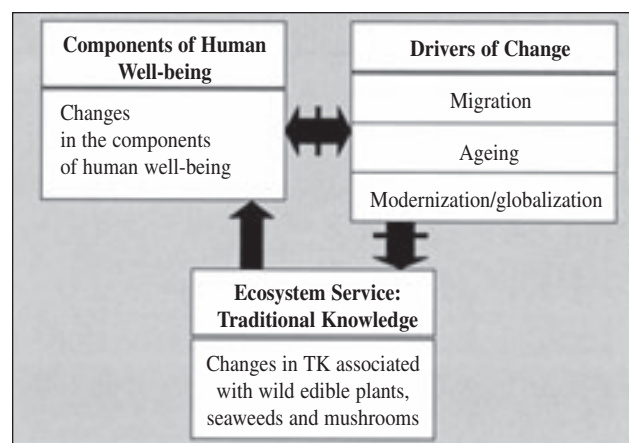


Figure 1. Method of the research adapted from the Millennium Ecosystems Assessment (2005)

Assessment of Figure 1 shows that the drivers, TK, and the components of human well-being are interrelated. For example, the drivers shown have directly caused changes in TK and the components of human well-being in the selected sites. In addition, the changes in TK directly affect the components of human well-being.

Determination of the Drivers

The major drivers that have caused the changes in TK and the components of human well-being were determined through assessment of the semi-structured interviews and the existing literature (Takeuchi et al. 2001; Yamamoto 1999; Fukamachi et al. 2001), analysis of the statistical data from 1950 to 2000 (Ishikawa Prefecture 1952, 1962, 1972, 1982, 1992, 2002), and a review of the drivers examined in the Millennium Ecosystem Assessment (2005). Accordingly, three drivers were determined to be significant: migration, ageing, and modernization/globalization.

Examination of TK based on the Target Plants

TK on wild edible plants, seaweeds, and mushrooms were examined through the semi-structured interviews with the knowledgeable community members and through the survey.

Determination of the Components of Human Well-being

The major components of human well-being were determined through assessment of the components of human well-being examined in the Millennium Ecosystem Assessment (2005), the survey, and the semi-structured interviews. Accordingly, it was determined that the five components of human well-being are affected by the shown drivers and changes in TK in the selected sites.

Development of Appropriate Responses

A number of potential responses (e.g., eco-labelling) were developed as a result of the semi-structured interviews, survey, and the responses examined in the Millennium Ecosystem Assessment (2005).

The results of the analysis related to the drivers, TK and the components of human well-being are discussed in turn below.

Drivers of Change

This part of the research provides an assessment of the three drivers (migration, ageing, and globalization/modernization) that have caused the changes in TK and the components of human well-being in the selected sites located in the Noto Peninsula.

Migration

The driver of migration was examined at the base of two major cities, Suzu and Wajima (including five target villages), through the analysis of the statistical data from 1952 to 2000 (Ishikawa Prefecture 1952, 1962, 1972, 1982, 1992, 2002), as the statistical data on the selected villages are missing (Table 3 and 4).

Table 3. Percentage of Migration in the City of Wajima between 1950 and 2000

Year	Total Population	Total Number of Migrants	Percentage of Migration
1950	40493	2036	5.028
1970	33652	1696	5.039
1980	32662	1073	3.285
1990	30164	929	3.079
2000	26381	869	3.294
Total	-	6603	-

Table 4. Percentage of Migration in the City of Suzu between 1950 and 2000

Year	Total Population	Total Number of Migrants	Percentage of Migration
1950	37537	2783	7.414
1970	29224	1681	5.752
1980	27351	1031	3.769
1990	23471	878	3.740
2000	19852	561	2.825
Total	-	6934	-

Tables 3 and 4 show that migration has declined in both cities since 1950. In addition, migration has led the communities to become smaller in the selected sites over time. The results of the semi-structured interviews revealed that the major cause of migration is the lack of economic capital (e.g. limited employment opportunities) in the Peninsula. This situation leads to the migration of the younger generations to other parts of the country seeking employment. Consequently, their children live in urban cities. Therefore, elders can not transmit their knowledge and experiences to their children and grandchildren. Within this context, migration leads to a generation gap with regard to TK due to the lack of opportunities for passing knowledge from elders to children and grandchildren. Thus, the current trend in TK is towards the decline of knowledge associated with the target plants, and changes in traditional lifestyle and diet systems.

Assessment of the components of human well-being in the Millennium Ecosystem Assessment (2005) shows that the driver of migration can adversely affect the component of “development of good social relation” in terms of low level of communication between the younger generations and el-

ders. According to the Millennium Ecosystem Assessment (2005), all components of human well-being are interrelated—that is, a negative change in the component indicated can directly affect other components of well-being in an adverse way, particularly the components of security (e.g. being more vulnerable to shocks and stresses) and health (e.g. emotionally feeling bad). Consequently, changes in these components together adversely contribute to the component of “freedom of choice and action” in terms of the lack of interest in traditions, lands, resources and culture, particularly among the younger generations and urban dwellers.

Ageing

Ageing of the population has emerged as a result of migration as well as rapid technological and economic development in Japan. Ageing of the population is a serious social problem and is common all over Japan. For example, the Ministry of Agriculture, Forestry and Fishery (1998) points out that in the 21st century Japan would be characterized by a shift to a gradual downward trend in population growth, a decrease in the percentage of young people and an increase in the ration of elderly people. Considering this trend, the driver of ageing was examined by the survey in the selected sites (Table 5).

Table 5. Percentage of the Age Profile of the Participants in the Selected Sites

Age Profile	Number of Participants	Percentage of Participants
Under 19	1	0.649
Between 19-29	3	1.948
Between 30-39	8	5.194
Between 40-49	22	14.285
Between 50-65	64	41.558
Over 65	56	36.363
Total	154	100.000

Assessment of Table 5 shows that there is an increase in the elder population while the percentage of the young population continuously declines in the selected sites. However, it should be noted that when the elder generation die, their knowledge and experiences would disappear with them. This situation may lead to the decline in the number of the knowledgeable community members that may directly cause the erosion of TK and changes in traditional lifestyle and diet systems due to the low level of harvest and consumption of the target plants.

Assessment of the Millennium Ecosystem Assessment (2005) and the semi-structured interviews show that the driver of ageing can adversely affect the following components

of human well-being in the selected sites: health, security, and good social relations in terms of the lack of communication among community members. The adverse changes in these components of well-being together can affect the component of “freedom of choice and action” in terms of powerlessness of the society such as unsustainable livelihood and human development in the Peninsula.

Globalization/modernization

The results of the survey revealed that 103 of the 139 participants are not interested in TK based on the target plants. The major reasons for lack of concern with TK were examined by the survey (Table 6).

Table 6. Percentage of the Major Reasons of Unconcern with TK-based on the Target Plants

Major Reason of Unconcern with TK	Number of Participants	Percentage of Participants
Younger generation lives in urban cities; therefore, a lack of interaction with nature has occurred	51	49.51
Younger generation is not interested in the collection of the target plants	16	15.53
Children are not mature enough to transmit TK	14	13.59
Low level of communication between the younger generation and elders	13	12.62
Younger generation prefers to buy the target plants than to collect them from the wild	5	4.85
No answer	4	3.88
Total	103	100.00

Assessment of Table 6 shows that the driver of globalization/modernization has caused the decline of TK due to the reasons indicated. Globalization/modernization has also led to the decline of TK based on the target plants and changes in traditional lifestyle and diet systems.

Assessment of the Millennium Ecosystem Assessment (2005) and the semi-structured interviews shows that this driver can directly lead to changes in the component of “development of good social relations” in terms of low level of communication, exchange of knowledge and experiences between the younger generations and elders. In addition, the driver can adversely affect the component of “freedom of choice and action” in terms of the deterioration of knowledge and traditional values attached to lands, resources, and culture. On the other hand, the results of the analysis of the statistical data and observations show that the addressed drivers have led to changes in the land use system in the cities of Suzu and Wajima. For example, the analysis of the statistical

data (Ishikawa Prefecture 1952, 1962, 1972, 1982, 1992, 2002) shows that there has been a serious decline in the size of paddy fields from 1950 to 2000 in the cities of Suzu and Wajima, and the decline still continues in both cities. In addition, the local communities emphasized the abandonment of paddy fields due to the lack of labour. However, the changes in the land use system can directly cause a decline in TK in terms of the changes in harvest and consumption levels of the target plants, composition of people’s diets (e.g. consumption of more fish and vegetables), consumption behaviour (e.g. what and how much people consume), and decline in interest for lands, resources, embedded knowledge, and traditional practices.

Assessment of the addressed drivers shows that the current trend in TK is towards the degradation of TK based on the target plants, relevant traditional practices, lifestyles, and diet systems in the selected sites. In addition, the assessment of the drivers gives us the sense that the social, economic and population dimensions (three fundamental components of sustainable development in terms of natural resource management) of the satoyama ecosystems have been neglected over the years. This finding supports Cristancho and Vining’s (2004) argument that some factors such as urbanization and industrialization have led to the separation of local communities from nature in developed countries. Consequently, social and cultural changes have occurred in the selected sites due to the indicated drivers, thus changing attitudes toward the use of TK and components of the satoyama and satoumi ecosystems (e.g. wild collection of mushrooms and traditional agricultural practices).

Traditional Knowledge Associated with Wild Edible Plants, Seaweeds, and Mushrooms

This part of the study provides a brief summary of TK based upon wild edible plants, seaweeds and mushrooms recorded by the survey in the selected sites. During the semi-structured interviews the local people indicated that they collected particular plants due to their abundance in the satoyama and satoumi ecosystems in the Noto Peninsula. Therefore, these plants play a significant role in the traditional diet system in the selected sites. The indicated plants comprise a wide range of species of vital importance for traditional food systems and nurturing people in the Peninsula. The results of the survey revealed that 46 wild edible plants, 12 seaweeds, and 19 mushroom species are widely collected for various purposes in the selected sites.

Assessment of TK based on the target plants shows that this knowledge contains three essential components of biological resources (wild edible plants, seaweeds, and mushrooms), a processing method (e.g. sun-drying), and an end

product (e.g. food and tea). For example, harvested plant material of udo (*Aralia cordata* Thunb.) is generally preserved in *miso* (fermented soybean paste), *sakekasu* (rice wine lees), or salt after boiling or sun-drying.

The results of the survey revealed that TK based on the target plants is widely shared and in the public domain—that is, no one person or social group holds the entire body of the knowledge. The local people are the source of knowledge, and the knowledge is transferred by language and practising. The knowledge is at risk of deterioration due to the impacts of the drivers addressed. These undesirable impacts have also caused the changes in the components of human well-being.

Linkages between Traditional Knowledge and Human Well-being

Linkages between TK and the components of human well-being were assessed through considering the data obtained from the survey and examining the Millennium Ecosystem Assessment (2005). Thus, the purpose of the collection of the target plants was determined by the survey (Table 7).

Table 7. Purpose of the Collection of Wild Edible Plants, Seaweeds, and Mushrooms

Purpose of the Collection of the Target Plants	Number of Participants	Percentage of Participants
Personal use	104	49.28
Income generation	19	9.00
Both personal and income generation	7	3.31
Access to clean air and feeling well	27	12.79
Development of good social relations with other community members	30	14.21
Use for religious and spiritual reason	24	11.37
Total	211	100

Assessment of Table 7 shows that the local people generally collect these plants for the following reasons: “basic material for a good life” (e.g. food and generation of income), “development of good social relations with other community members”, “good health” (e.g. access to clean air and feeling well), and “freedom of choice and action” (e.g. religious and spiritual reasons). These are the four fundamental components of human well-being examined in the Millennium Ecosystem Assessment (2005). Accordingly, the linkages between TK and human well-being are discussed in turn below.

Table 7 shows that the first reason for the collection of the target plants is to provide food and to generate income.

However, the results of the semi-structured interviews revealed that the local communities are not dependent on the target plants for providing their subsistence needs and income generation in the selected sites. Therefore, the decline in TK may not have a serious impact on this component of human well-being. Review of the Millennium Ecosystem Assessment (2005) shows that the impact of the decline of TK on the component of “basic material for a good life” can be in terms of low level of linkages to material elements of well-being such as decline in the collection of the target plants in the selected sites.

The second reason for the collection of the target plants is to “develop good social relations with other community members” through mutual aid and respect. For example, a knowledgeable community member in the village of Monzen largely collects the target plants in order to develop good social relations with his neighbours by sharing the harvested plants. Thus, he can learn some traditional uses from the elders of his community. Because TK is created and sustained by the sharing and transmission of knowledge between individuals, communities, and generations, the impact of the decline in TK on human well-being can be seen in terms of social changes such as a low level of communication between younger generations and elders and between community members.

The third reason for the collection of the target plants is “access to clean air and emotionally and physically feeling well.” According to the Millennium Ecosystem Assessment (2005), changes in TK can have strong influences on health since they affect spiritual, inspirational, aesthetic, and recreational opportunities, and these in turn affect both physical and emotional states of people. Therefore, the decline in TK may adversely affect physical and emotional states of the local people in the selected sites. For example, the results of the semi-structured interviews in the village of Kodomari show that the local people feel hopeless about the changes that have occurred in their villages due to the impacts of the drivers addressed.

Most of the local people in the selected sites can be considered part of a disadvantaged group due to the impact of ageing. Therefore, the three components of human well-being discussed above can jointly adversely affect the component of “security” (e.g. safety of person and secure access to resources). This effect can be seen in terms of increased vulnerability to shocks and stresses resulting in a breakdown and/or decline of social relations in the society over time.

The final reason for the collection of the target plants is “religious and spiritual,” which is referred to as “freedom of choice and action” in the Millennium Ecosystem Assessment (2005). Within this context, the decline in TK can cause the deterioration of knowledge and value systems attached to re-

ligion, lands, resources, traditions, and culture. Such deterioration can lead to a lack of interest in what was valued before, such as traditional agricultural practices and relevant knowledge.

The Millennium Ecosystem Assessment (2005) emphasizes that all components of well-being are interrelated—that is, a negative or positive change in one component often brings about changes in the other components. Recognizing this view, the adverse changes in the components of human well-being can lead to the powerlessness of the society in terms of unsustainable development in the Peninsula. Therefore, design and implementation of appropriate responses are essential.

Challenges for the Maintenance of Traditional Knowledge

The degradation of the satoyama ecosystems has drawn attention to the significance of these ecosystems for the conservation of biodiversity and sustainable development in Japan. For that reason, revitalization of these ecosystems has been a priority in the country recently. This positive perception was integrated into the National Biodiversity Strategy (Ministry of the Environment 2002), and also in the Law for the Promotion of Nature Restoration (came into force on 1/1/03) that gives priority to the satoyama revival projects (e.g. sustainable tourism), and maintenance of local communities. In addition, the Government of Ishikawa Prefecture has established the “Satoyama Conservation and Restoration Agreement”. Within this context, the Prefecture Government supports local voluntary groups by helping the land owners in managing their satoyama lands (e.g. paddy fields), as these people often face ageing problems. However, there is currently a lack of awareness of TK and related traditional practices in these initiatives. This situation may derive from the lack of economic valuation of the satoyama ecosystems, and awareness of the role of TK in the conservation and sustainable use of these ecosystems. In addition, low level of attention to TK in developed countries might be one of the reasons. For example, Kiene (2006) emphasizes that the international debate has focused on TK in developing countries and by indigenous people. However, it should be aware that TK and relevant traditional practices are the body of extensive understanding of the satoyama ecosystems in the context of how these ecosystems were effectively conserved and managed over centuries, as the findings of various scholars (Berkes 1999; Berkes and Folke 2002; Berkes et al. 2003; Folke et al. 1998; Folke 2004) emphasize. In addition, TK and traditional practices are historically crucial to developing cultural identity and fostering self-determination of local people. Therefore, there is a need to support and strengthen

programs that act to disclose TK, even if it is legally considered in the public domain.

Current legal and non-legal forms of protection of TK (e.g. Intellectual Property Rights (IPRs), CBD, *sui generis* systems) were examined to develop a mechanism for the maintenance of TK in the Noto Peninsula. However, assessment of the current strategies and instruments show that application of only one of these strategies may not be effective for the maintenance and transmission of TK in the Noto Peninsula due to the following reasons:

- The results of the survey revealed that TK is in the public domain in the selected sites—that is, different communities often hold similar knowledge;
- The overall objective of the study is to maintain TK in traditions over generations to contribute to cultural identity, conservation of biodiversity, and sustainable development strategies.

Only the program of UNESCO “Local and Indigenous Knowledge Systems in a Global Society”—focusing on the recognition of the value of TK as a fundamental component of sustainable development (UNESCO/Links brochure, 2002)—was linked to the objectives of the study. The program emphasizes strengthening transmission of knowledge and practices from elders to youth, and developing quality of education that contributes to this end with the aim of sustaining TK as a living and dynamic cultural resource within local communities. Review of this program assisted in developing the strategy to maintain TK in the selected sites. In addition, the community goals—expectations of the local people from the maintenance of TK—were examined through the semi-structured interviews and the survey. Ninety-seven survey participants emphasized the following two goals:

- TK and relevant experiences and practices have developed over years; therefore, they should be respected and promoted as a cultural heritage;
- Receiving financial benefit from the maintenance of TK to empower and strengthen the local people’s control over knowledge and the way it is used.

A holistic strategy for the maintenance and transmission of TK was developed by considering the community goals, assessment of the UNESCO/Link program, the Millennium Ecosystems Assessment (2005), and potential responses for the maintenance of TK that were examined in the survey (e.g. education and raising awareness, eco-labelling and green and cultural tourism) (Figure 2).

Assessment of Figure 2 shows that strength of community capitals (e.g. human, financial, physical, and social), and human capacity and institutional development are necessary to ensure the continued well-being of TK as well as to improve the local livelihoods. For example, support for human (e.g. creation of employment opportunities) and financial

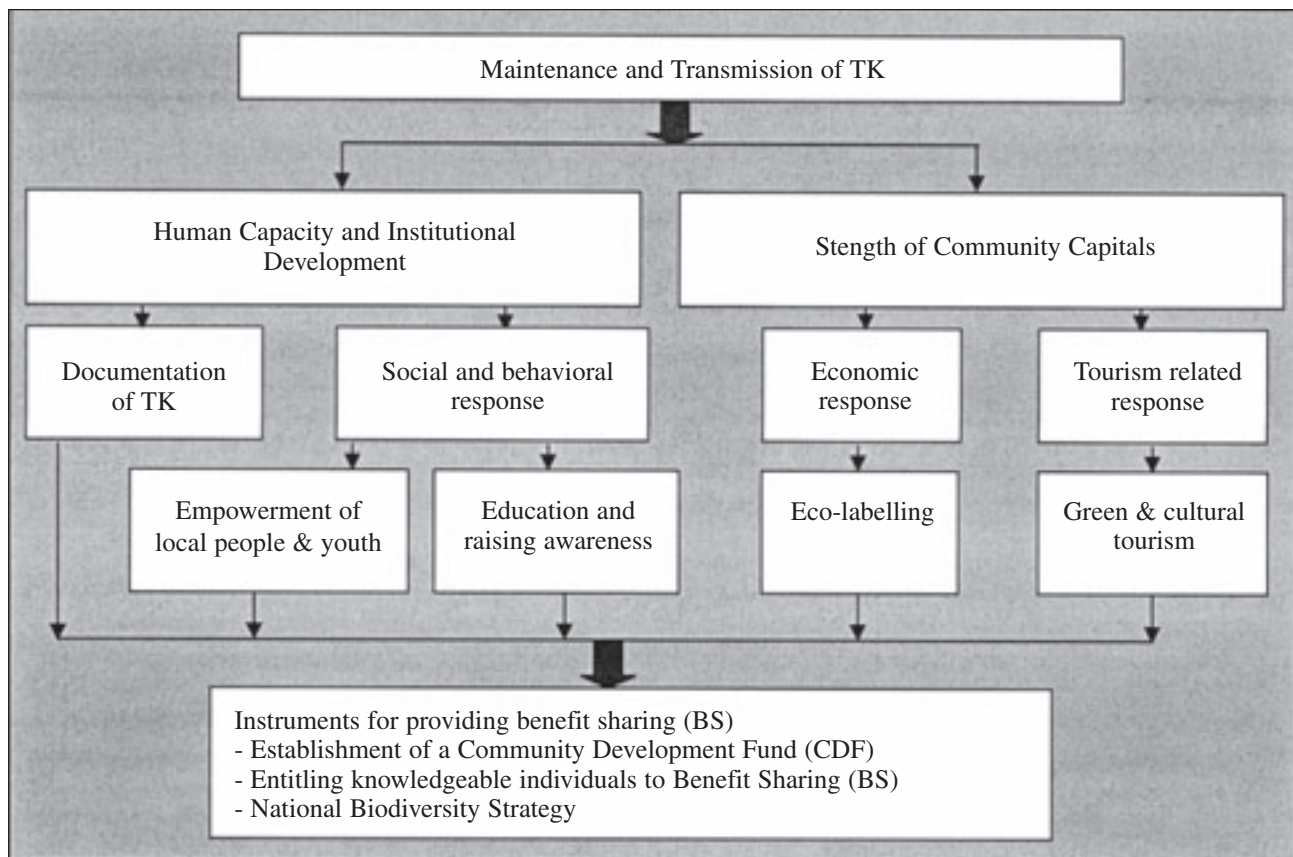


Figure 2. Holistic strategy for the maintenance of TK

(e.g. increased income) capitals could contribute to improving social (e.g. good social relations) and physical (e.g. improved infrastructure) capitals in the Peninsula. Accordingly, a range of responses (e.g. tourism-related), establishment of an institutional mechanism (e.g. documentation of TK), and instruments for providing benefit sharing (e.g. establishment of a Community Development Fund) were developed to maintain TK as a living cumulative body in the society. Relevant responses and instruments are discussed below.

Eco-labelling was determined through the self-interest of the local people and their efforts to improve their economic welfare—a fundamental component of well-being. It is thought that commercialization of TK-based products (TK is the “know-how” involved in its production) can create a positive synergy in terms of the maintenance of TK. The results of the survey revealed that wild edible plants, seaweeds, and mushrooms have tradable resource value. Therefore, eco-labelling or packages of the plant material can be a powerful instrument to inform consumers (e.g. younger generations and urban dwellers) that they made a good choice through contributing to the development of the local economy and

also the maintenance of TK in the Peninsula. In addition, successful design and implementation of eco-labelling may cause the improvement of skills and emergence of a new market in the region. However, effective implementation of eco-labelling may need the Government’s support in terms of developing a marketing mechanism, improving infrastructure, and accessing micro-credits. Such a support would contribute to creating a stable market and also ensuring the financial viability of this response.

The local people have operated green and cultural tourism initiatives to create alternative employment opportunities and also to generate income with the aim of improving their lives. Green tourism encourages visitors to work together with the local people to restore paddy fields and manage forests. Active participation of the knowledgeable community members in green and cultural tourism activities should be supported to create opportunities for the transmission of TK. Support of the Government for the design and implementation of this response may be required for capacity building (e.g. development of a marketing mechanism), and dealing with externalities (e.g. cooperation with tourism agencies).

Empowerment of the local communities and youth were proposed as a social and behavioural response. The Millennium Ecosystem Assessment (2005) emphasizes that “today’s youth are tomorrow’s leaders and local people are the experts of their environment”. Empowerment of the communities and youth can be achieved through providing active participation of the communities and youth in the satoyama revitalization initiatives and educational and awareness programs. Such a challenge can provide opportunities for a positive change, particularly in the attitudes of youth towards TK.

Educational and awareness programs can create opportunities for the transmission of TK and relevant practices through expanding knowledge and experiences of the knowledgeable community members. Within this context, raising awareness of TK should be incorporated into public education as schools may provide a system for the transmission of knowledge. Therefore, working with the school system is crucial to control the decline of TK. However, establishment of such a system requires the cooperation of local governments, as the Ministry of the Environment (2005) points out that educational programs in the field of environment for schoolchildren are directly connected to local government’s activity area. Both formal and informal educational programs may be used to ensure the effectiveness of this response. Within the context of formal education, support of the Ishikawa Board of Education can be required to develop cultural standards for schoolchildren. For example, by the time schoolchildren graduate from high school, they should demonstrate that they know and are able to practice important aspects of TK of the region. Within the context of informal education, the Satoyama-Satoumi Natural School, established by Kanazawa University recently, can play a crucial role as a training centre. Active participation of the knowledgeable community members in both educational programs should be supported to empower them and provide opportunities for the transmission of knowledge, experience, customs, and tradition to younger generations and schoolchildren.

Establishment of a database was proposed to develop an institutional mechanism for the maintenance of TK. The collected data on the target plants was stored in an Excel Program at Kanazawa University. It was thought that this is a modern-day approach to contribute to *ex situ* conservation of TK. However, the data stored should be shared with the local communities to contribute to *in situ* conservation of TK. On the other hand, a systematic initiative should be established to document knowledge (e.g. natural, historical, cultural, economic, and social aspects) in a format that is easily accessed and usable by teachers serving in schools in the Peninsula.

Design and implementation of the potential responses require a set of coordinated mechanisms. Therefore, the es-

tablishment of a cooperative process is necessary to provide and strengthen dialogue among the knowledgeable community members, policy-makers, universities, NGOs, local governments, and private sectors. Considering that governments have the widest range of responses available compared to other actors, establishment of an advisory committee under the lead role of the Ishikawa Prefecture’s Board of Education is recommended for creating an umbrella strategy at the institutional level to achieve the effective implementation of the responses.

The effectiveness and sustainability of the responses can be achieved through ensuring equitable benefit sharing to enable the local communities to continue their traditional lifestyles and practices. Within this context, establishment of a Community Development Fund (CDB) may be a crucial instrument to contribute to the maintenance of TK by supporting sustainable rural development strategies and providing monetary funds for the satoyama revitalization initiatives. For example, the results of the interviews revealed that outsiders from the cities of Kanazawa and Toyoma generate significant amounts of income from the commercialization of the target plants. Thus, the local people may insufficiently benefit from the commercialization of their local products. Therefore, the CDB may be an effective tool to control and regulate this undesirable situation as well as to contribute to the local economy. The CDB may be established in cooperation with the Directorship of Forestry to set up a regulative mechanism for the collection of wild edible plants and seaweeds from the State lands. Such a regulative mechanism currently does not exist in Japan. Deposited money by the CDB can be used for revitalizing the satoyama ecosystems and also granting the knowledgeable community members for their cooperation. The second instrument recommended for benefit sharing (BS) is to entitle the knowledgeable community members to BS to transmit TK and their experiences in terms of educational, social, cultural, and other purposes. Within this context, the target community members should be encouraged to cooperate with universities, NGOs, local governments, and other related stakeholders. The results of the benefits obtained from the BS can be expressed as earnings and increased numbers of jobs in the Peninsula. On the other hand, Japan as a contracting party of the CBD should strengthen initiatives related to the maintenance of TK in the National Biodiversity Strategy.

Conclusion

The results of this study show that TK is one of the significant cultural services of the satoyama ecosystems that have emerged from human activities. TK provides linkages between cultural identity, history, and traditional occupations

of Japanese people. Therefore, it has cultural heritage value. However, as discussed in the framework of the study earlier, the satoyama & satoumi ecosystems and TK based on the target plants have declined in the selected sites due to a number of drivers addressed (e.g. ageing and migration). Degradation of the satoyama ecosystems was emphasized by many authors (Ministry of the Environment 2002 and 2005; Takeuchi et al. 2001; Fukamachi et al. 2001; Yamamoto 1999). This is a common situation all over Japan, as the satoyama ecosystems cover more than 40% of Japan's land (Ministry of the Environment 2005). Accordingly, the degradation of the satoyama ecosystems gives us a general sense that the current trend in TK based upon the target plants is moving towards the decline of this knowledge and relevant traditional practices at the national level in Japan. For that reason, similar studies should be extended to other parts of the country to address TK on the target plants and also other culturally significant sources such as fish. However, new studies should avoid limiting research with specific sites as the indicated species are common and widely used in traditional diet systems in Japan. Results of all studies together can contribute to developing and strengthening a national policy in terms of the maintenance of TK in the country. Based upon the findings of this study, some conclusions are presented below.

The results of this study show that TK exists in Japan. Therefore, TK should be considered a cultural heritage to contribute to providing bonds with the people's historical identity linked to various components such as resources and lands and to supporting the sustainable development strategies in the Peninsula.

Assessment of the current national strategies revealed that Japan, as a contracting Party of the CBD, supports the participation of local communities to achieve the successful implementation of the three objectives of the Convention. For example, the new National Biodiversity Strategy of Japan (revised in 2002) draws attention to the reduction of human activities and changes in lifestyles in the countryside, thereby, the degradation of the satoyama ecosystems where local people maintained harmonious lifestyles with nature. However, the assessment of the drivers, TK on the target plants, and the linkages between TK and the components of human well-being shows that TK is not directly emphasized in the Strategy in terms of providing bridges between biodiversity conservation and sustainable local livelihoods. Cultures and perspectives of local communities are essential in the effort to halt the destruction of these ecosystems. Within this context, the effective participation of local communities is, more than ever, crucial to the revitalization of these ecosystems, strengthening national identity, their history, and occupation of the territory. Such a partnership may contribute to improving the conditions of the ecosystems and also human well-

being by providing an arena for dialog between policy-makers and local resource managers, as the findings of Davidson-Hunt and Berkes (2001) and Berkes (2000) point out.

Assessment of the drivers of change revealed that a national strategy for the maintenance and transmission of TK is needed. A broader approach should be developed to maintain the knowledge systems as a whole, including their cultural, biological and landscape components. Local knowledge systems, relevant traditional practices, and embedded cultures are linked with each other, and together maintain the integrity of knowledge. In addition, effective participation of the local communities in policy development is necessary to link local and scientific knowledge to contribute to revitalizing the satoyama ecosystems and maintaining TK as a living cultural identity in the society that can contribute to people's freedoms and choices, increased economy by marketing products associated with TK, improved infrastructure, and social and ecological security. This idea supports the findings of numerous scholars (Berkes et al. 2000; Berkes and Folke 2002; DeWalt 1994; Johnson 1999; Moller et al. 2004; Ticktin and Johns 2002).

The United Nations University (UNU) has launched a project "Sub-global Assessment (SGA) of the Satoyama & Satoumi Ecosystems" recently. The SGA will identify the services of these ecosystems, analyze the current conditions, trends, and scenarios, and suggest various policy options. This initiative will be the first integrated assessment in Japan where social, cultural, economic, and ecological aspects will be considered (United Nations University (UNU) 2007). The results of this study can provide a significant input to the project. Thus, a message can be given to policy-makers in terms of supporting and strengthening the active use of TK to contribute to the sustainable use of the satoyama and satoumi ecosystems while allowing people to retain their cultural identity.

Assessment of the literature (Washitani 2001; Yamamoto 1999; Fukamachi et al. 2001) shows that current studies have paid particular attention to the restoration of the satoyama ecosystems by using scientific methodologies and approaches. However, such studies have neglected the role of humans in shaping and restoring these ecosystems. This situation may largely derive from the lack of linkages between natural and social science systems. However, it should be emphasized that community resilience is crucial for both conservation and restoration of the satoyama ecosystems as the findings of Berkes et al. (2003) point out.

The satoyama ecosystems represent cultural landscapes; therefore, inter-linkages between landscapes, culture, TK, and biodiversity should be recognized. Thus, these landscapes are associated with a traditional way of life and often reflect techniques of sustainable land use systems. Considering this view, the Noto Peninsula can be designated as an area

of cultural landscapes—embracing a diversity of interactions between people and the natural environment—to contribute to the development of TK and the satoyama ecosystems through supporting local and regional economies. Support from a wide range of stakeholders should be provided to promote the sustainable development of these landscapes. Assessment of the potential responses shows that such support should be given in terms of the development of green and cultural tourism, eco-labelling, and rediscovering rural lifestyles and crafts, but this support must be socially, economically, and ecologically viable.

Assessment of the social and behavioural responses shows that the establishment of a cultural centre in collaboration with UNESCO may be a challenge for proposing dynamic and modern strategies that will involve youth in the discovery and practice of their own traditions. Such a centre could play a key role, particularly for urban people and younger generations in raising awareness and maintaining ties with their culture.

The results of the study show that both the degradation of the satoyama ecosystems and market economy due to the impacts of the drivers has led to the changes in traditional food and diet systems. However, we should be aware that such changes can have negative impacts on traditional cultural practices and even lead to the erosion of the local peoples' cultural identity.

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Endnote

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