



# *Satoyama-Satoumi* Ecosystems and Human Well-Being

Socio-ecological Production Landscapes of Japan

JAPAN SATOYAMA SATOUMI ASSESSMENT

Summary for Decision Makers

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Summary for Decision Makers

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## Foreword

*Satoyama* is a Japanese term for a mosaic of different ecosystem types— secondary forests, farm lands, irrigation ponds, and grasslands — along with human settlements, which has been managed to produce bundles of ecosystem services for human well-being. *Satoyama* found largely in rural and peri-urban areas of Japan is a way of life; in other word a classical illustration of the symbiotic interaction between ecosystems and humans. This concept has been recently extended to *satoumi*, which constitutes marine and coastal ecosystems. However, *satoyama* and *satoumi* have been rapidly declining due to various factors including increased rural–urban migration, land-use conversion and the abandonment of traditional agricultural cultivation. If this trend continues, vital services provided by *satoyama* and *satoumi* will be adversely affected.

The Japan *Satoyama Satoumi* Assessment (JSSA) is an assessment on *satoyama* and *satoumi* in Japan. The main objective of the JSSA is to provide scientifically credible and policy-relevant information on the significance of ecosystem services provided by *satoyama* and *satoumi* and their contributions to economic and human development for the use of policy-makers. Having prepared since late 2006, the JSSA was launched in March 2007 upon the establishment of the Board that represents key “users” including those from national and local governments, academia, and non-governmental organisations. It was designed around policy-relevant questions and users’ needs, with the focus on the changes in ecosystem services for human well-being.

The open process led to the selection of a variety of assessment sites proposed by the interested stakeholders, which were grouped into five major clusters across Japan including: Hokkaido Cluster, Tohoku Cluster, Hokushinetsu Cluster, Kanto-chubu Cluster, and Western Japan Cluster. The Western Japan Cluster involves a sub-cluster that focuses on Seto Inland Sea as *satoumi* in addition to the general assessment of the *satoyama* in the whole region. Applying the Millennium Ecosystem Assessment (MA) conceptual framework, each cluster and sub-cluster assessed the historical context, condition and trends, drivers of changes, and responses with the focus on the links between ecosystems and human well-being in regard to *satoyama* and *satoumi* in each locality. Furthermore, the national assessment was carried out concurrently to synthesise the findings of the cluster assessments and inform policy and decision making at the national level and beyond.

Six reports as a series of “Experiences and Lessons from Clusters” were prepared only in Japanese and present the findings of each cluster and sub-cluster of the JSSA. A technical volume, “*Satoyama-Satoumi* Ecosystems and Human Well-being: Socio-ecological Production Landscapes of Japan”, will be published in late 2010 in Japanese and in early 2011 in English to present the findings of the national assessment of the JSSA. This report presents a synthesis and integration of the findings from the national assessment and the cluster assessments as a summary for decision-makers.

The findings of the JSSA are expected to be used for local and national plans, strategies and policies, and various relevant activities in Japan, while they are to contribute to the international processes on environment and development. The assessment, in particular, is intended to provide substantial inputs to the *Satoyama* Initiative, which is an international effort jointly initiated by the Ministry of the Environment of Japan and United

Nations University Institute of Advanced Studies (UNU-IAS) with the aim to promote socio-ecological production landscapes — drawing on lessons learnt from *satoyama* and *satoumi* in Japan. An international partnership for the *Satoyama* Initiative is planned to be established at the tenth meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD/COP-10) to be held in Nagoya, Aichi, Japan in October 2010.

This report would not have been possible without the commitment of the more than 200 authors, stakeholders, and reviewers who contributed their knowledge, creativity, information, time, and efforts to the assessment process. We would like to express our gratitude to the members of Science Assessment Panel, Cluster Working Groups, National Working Group, and Review Panel (listed in Appendix A and the inside front cover), and appreciate the in-kind support of their institutions, which enabled their participation.

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## Background: Origins and Rationale for the Assessment

The Japan *Satoyama Satoumi* Assessment (JSSA) is a study of the interaction between humans and terrestrial-aquatic landscape ecosystems (*satoyama*) and marine-coastal ecosystems (*satoumi*) in Japan. It follows and applies the framework of sub-global assessments (SGAs) developed by the Millennium Ecosystem Assessment (MA). The MA, commissioned by the then United Nations Secretary General Kofi Annan in 2000, focuses on changes in ecosystem services and their consequences on human well-being (ecosystem *services* being defined as the benefits people obtain from ecosystems). In addition to the global assessment, the MA initiated a number of sub-global assessments to provide information at lower scales that included regional, national and sub-national assessments.



The JSSA is the first of its kind in Japan, having been planned and developed since November 2006, involving national agencies, local and regional stakeholders and various segments of the academic community. Although not included in the original set of MA SGAs, it is expected to be incorporated and contribute to the global network of the MA SGAs that have been carried out around the world, while also informing the next global ecosystem assessment that is expected to be initiated in a few years.

As the first step in the JSSA, the United Nations University Institute of Advanced Studies (UNU-IAS) and its then Special Programme, Ishikawa International Cooperation Research Centre (IICRC) organised the Design Meeting for the Sub-global Assessment of *Satoyama* on 24-25 November 2006 in Kanazawa City of Ishikawa Prefecture, Japan, to determine the architecture and process for the assessment. The meeting convened the key stakeholders from the research and academic institutions, international organisations, and the government, who discussed, clarified and determined the steps necessary for initiating the project on sub-global assessment of *satoyama*.

The Design Meeting was followed by the Users Meeting that also marked the launch of the SGA of *satoyama* and *satoumi* in Japan on 8 March 2007 in Yokohama, Japan. The Users Meeting established the Board for the SGA and represented major users including local communities, industries, local and national governments, research and academic intuitions, non-governmental organisations (NGOs) and international organisations. Some of the needs of the users who attended were discussed during the meeting, to be incorporated into the SGA as the project progresses.

An Explanatory Meeting for the SGA was organised on 7 June 2007 in order to enhance the understanding of the assessment initiative in Japan, followed by a Workshop that sought

wider consultation with users concerning the procedures of the assessment process on 27 July 2007. Upon hearing the needs from the participants in the Workshop – which if addressed could provide a wider range of stakeholder participation – the Secretariat subsequently issued an announcement for proposals for site selection for the study. This was undertaken in August and September 2007 and has resulted in proposals from nineteen interested organisations/groups.

Given that the Government of Japan will host the Tenth Conference of the Parties (COP10) to the Convention on Biological Diversity (CBD), as well as the Fifth Meeting of the Conference of the Parties serving as the Meeting of the Parties (COP-MOP 5) to the Cartagena Protocol on Biosafety in Nagoya, Japan in 2010, the SGA aims to provide inputs into this process. Furthermore, should the integrated assessments similar to the MA be repeated in five to ten years, the outcomes of the SGA are expected to inform the next MA.

## GOALS AND OBJECTIVES

The overarching goal of the JSSA is to provide scientifically credible and policy-relevant information on the significance of ecosystem services provided by *satoyama* and *satoumi* and their contributions to economic and human development for the use of policy-makers.

Specific objectives of the JSSA are:

- To improve understanding of the relationship between *satoyama* and *satoumi* with biodiversity, ecosystem services, and human well-being
- To provide policy-makers in Japan with a sound and credible scientific basis for the *Satoyama* Initiative the government intends to promote
- To establish credible baselines for a number of key ecosystem services provided by *satoyama* and *satoumi*

- To provide information of possible future trends in ecosystem services provided by *satoyama* and *satoumi* under plausible futures
- To identify sound policy responses to address the decline in ecosystem services through the use of *satoyama* and *satoumi* management in Japan
- To provide the scientific basis for the use of *satoyama* and *satoumi* in an international context, and in particular, in the *Satoyama* Initiative

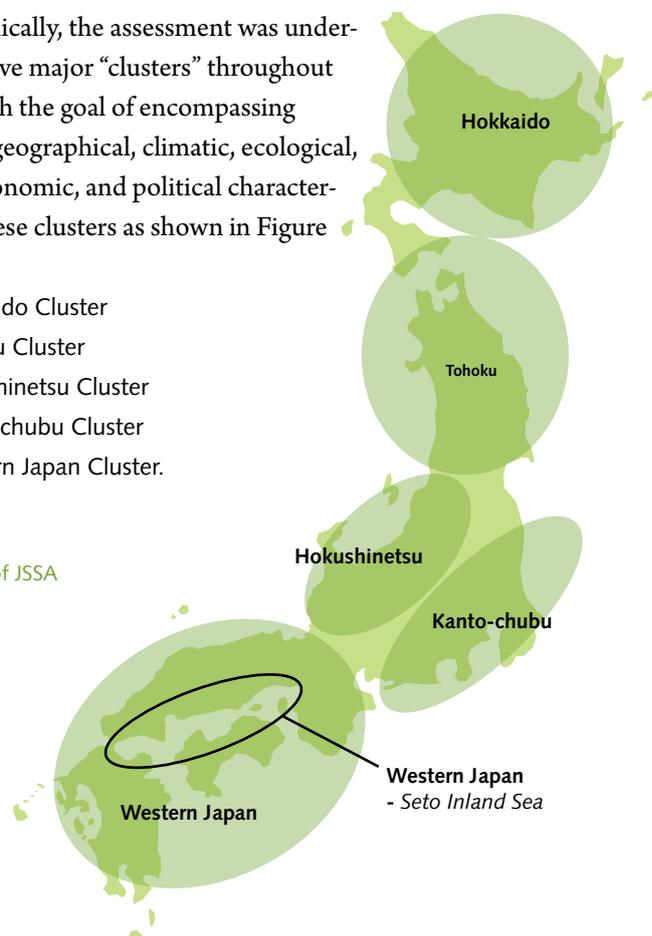
## SCOPE OF JSSA

The timeframe of the assessment is changes that have occurred in *satoyama* and *satoumi* in the last fifty years since the end of the Second World War. This was chosen because of rapid technological advances during this time, leading to economic, social, and cultural transformations as Japan has moved from a largely rural and agrarian society to a highly industrialised and urban one.

Geographically, the assessment was undertaken in five major “clusters” throughout Japan, with the goal of encompassing different geographical, climatic, ecological, social, economic, and political characteristics. These clusters as shown in Figure 1 are:

1. Hokkaido Cluster
2. Tohoku Cluster
3. Hokushinetsu Cluster
4. Kanto-chubu Cluster
5. Western Japan Cluster.

Figure 1  
Clustering of JSSA



## METHODOLOGY AND KEY CONCEPTS

The JSSA adopts the ecosystem services conceptual framework developed by the MA for the following reasons:

- The centrality of human well-being in considerations of ecosystem services
- Recognition of the interdependency, synergy, and trade-offs between ecosystem services and human well-being
- Acknowledgement of different temporal and spatial scales that impact this interdependency – for example, how the increased production of rice which occurs on a local scale, by producing methane gases impacts climate regulation services at the global level

Closely related to the notion of the interdependency of human communities with *satoyama* and *satoumi* is the concept of “biodiversity,” which encompasses the values of diversity within the same species, diversity of species, and the diversity of ecosystems. As the concept implies, there is a strong correlation posited between an increase in biodiversity, the resilience of ecosystems, and human well-being. Thus, a central focus of the JSSA study is to closely detail how changes in *satoyama* and *satoumi* in Japan during the past fifty years have occurred, what their significance is for human well-being, and, looking forward, how transformations within

the next half-century might impact the level of biodiversity, ecosystem services, and thus human well-being attainable, both in Japan and globally. Figure 2 reflects the conceptual framework adapted from the MA for the JSSA.

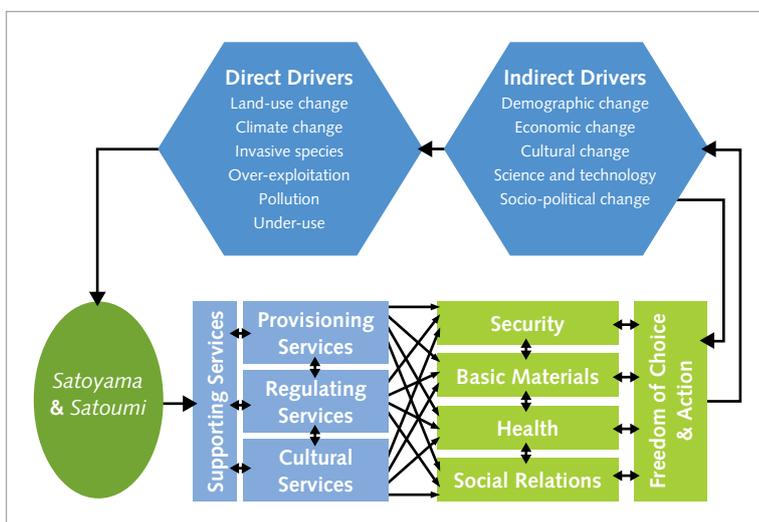
The human impact upon ecosystem services includes “direct” and “indirect” drivers. Examples of direct drivers include changes in land use, pollution, and other instances in which human action has had a clear impact on ecosystems.

Indirect drivers, as the name implies, are more diffuse and often come to light only by their impact on direct drivers. They include demographic, economic and cultural changes, as well as those brought about by technology and socio-political transformations – all of which affect ecosystems and the quality of their services.

These drivers are examined in the JSSA to see both how *satoyama* and *satoumi* have been affected in more detail, and in the construction of scenarios for four different types of futures in which the ways humans and ecosystems interact leads to different outcomes in terms of biodiversity and human well-being.

Finally, in analysing the interdependency of ecosystems and humans, the JSSA utilises a concept employed in the MA known as “interlinkage.” Interlinkage as shown in Figure 3 refers to three specific relationships within this report. First, there is interlinkage *between ecosystem services in satoyama and satoumi*. In this instance, either under- or over-use of resources (provisioning services) can lead to degradation of the ecosystem. A second interlinkage is *between ecosystems services and human well-being* – in this case, interactions between the two can lead to enhanced or degraded results for either or both. And the third interlinkage to be examined is *between space and time in satoyama and satoumi* landscapes. For example, fertiliser used to improve crop yields in *satoyama* can lead

Figure 2 Conceptual framework of JSSA



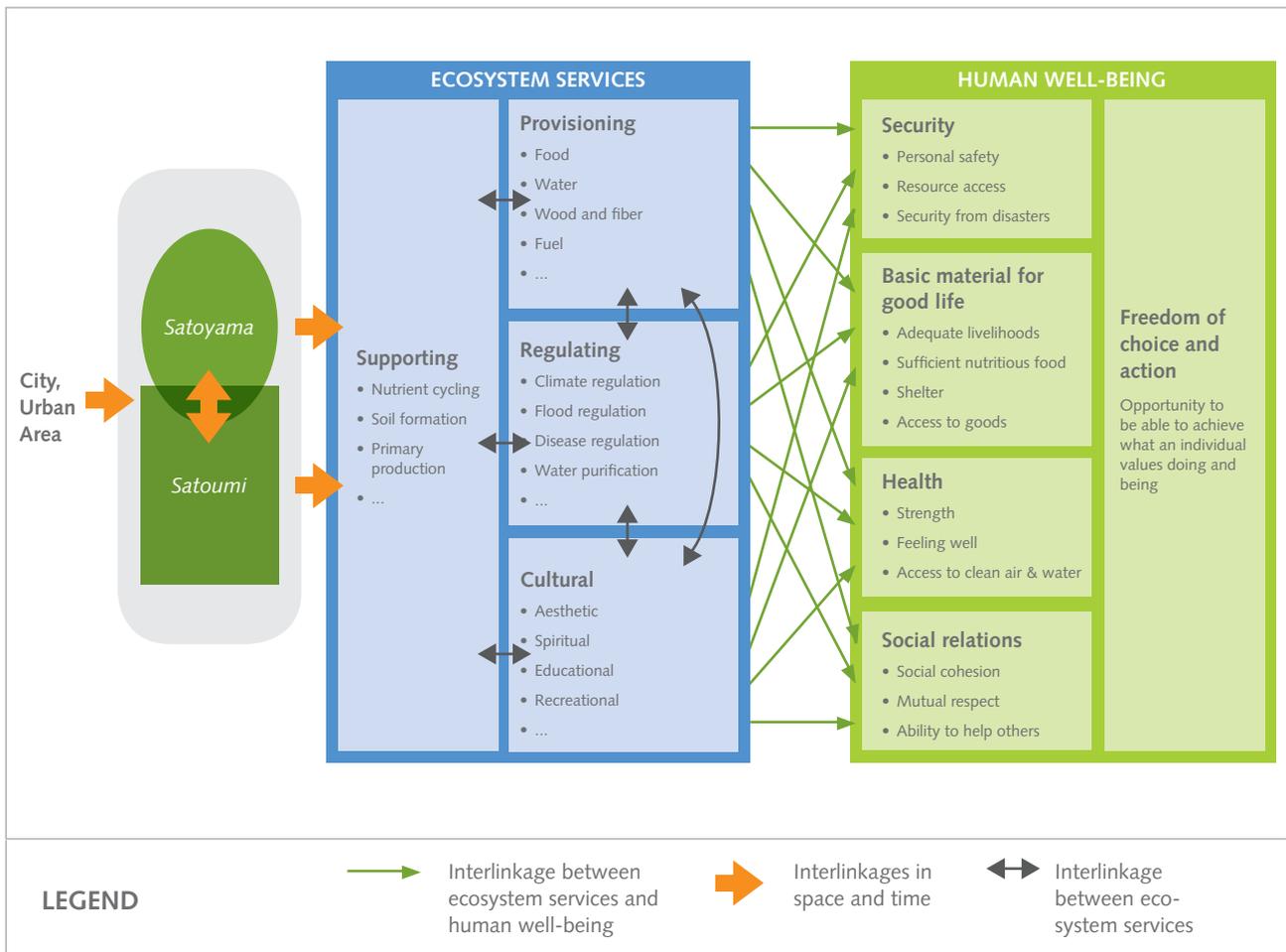


Figure 3 Interlinkage analysis for JSSA

to the downstream degradation of *satoumi* as excessive nutrient run-offs adversely affect coastal waters. This degradation does not immediately follow upon the use of commercial fertilisers, but is a result over time. Finally, as this last instance indicates, bound up with the concept of interlinkage is acknowledgement that human interactions with their environment inherently involve “trade-offs” when determining benefits. Here, the trade-off to be considered is whether improvement in crop yield due to use of commercial fertiliser is greater than the concurrent degradation of *satoumi* due to nitrogen run-offs.

The summary of the JSSA that follows is guided by six key questions that have informed the study:

1. What are *satoyama* and *satoumi* and how have they changed in the last fifty years?
2. How have biodiversity and ecosystem services changed in *satoyama* and *satoumi* landscapes, and, what are the main causes?
3. Why are changes in *satoyama* and *satoumi* a concern?
4. What has been done to encourage *satoyama* and *satoumi* systems at the national and international levels?
5. What is the future for *satoyama* and *satoumi* landscapes under plausible scenarios?
6. What has been learned from the JSSA and what are the implications for policy-makers moving forward?

# What Are *Satoyama* and *Satoumi*, and How Have They Changed in the Last Fifty Years?

## SATOYAMA AND SATOUMI

*Satoyama* and *satoumi* are Japanese concepts for long-standing traditions associated with land (*satoyama*) and more recently coastal (*satoumi*) management practices. These traditions have, in the past, allowed sustainable use of the resources encompassed by *satoyama* and *satoumi*, thus providing a historical model for environmental stewardship and resource management that contributes to human well-being. Within the context of the JSSA, *satoyama* and *satoumi* may also be understood as useful heuristic devices for better framing and analysing the relationship between ecosystem services and human well-being.

Of the two concepts, *satoyama* is the older, dating back to the Seventeenth Century. It is a term for landscapes that comprise a mosaic of different ecosystem types including secondary forests, agricultural lands, irrigation ponds, and grasslands, along with human settlements as illustrated in Figure 4. These landscapes have been formed and developed through prolonged interaction between humans and ecosystems, and are most often found in the rural and peri-urban areas of Japan.

*Satoumi*, by contrast, is a term first used in the Twentieth Century, and as illustrated in Figure 5 refers to Japan's coastal areas where human interaction over time has resulted in a higher degree of productivity and biodiversity.

Foundational to both concepts is the positioning of a relationship of interaction between humans and their environment, coupled with the notion that properly maintained the relationship is mutually beneficial. It is for this reason that the concepts of *satoyama* and *satoumi* have importance not only for national policy-making in Japan, but may be applicable at the international level as well. The chief challenge with respect to the latter is determining whether or not *satoyama* and *satoumi* can be scaled up and globalised such that they can deliver economic and human development opportunities to local communities in developed and developing countries.

## HISTORY OF SATOYAMA AND SATOUMI

As indicated above, the concept of *satoyama* predates that of *satoumi* by many centuries. First alluded to in 1661, the initial standalone use of the term “*satoyama*” occurs in 1759, when it is used to refer to “the mountain areas that enclose villages, human habitations, and houses.” Until the 1970s most definitions of *satoyama* included the notion of human habitation in proximity to mountain areas whose resources were utilised by humans (as food, fuel, or fertiliser for crops).

Since the 1970s, however, with the advent of ecological and conservation studies, the concept of *satoyama* has been expanded to include urban dwellers who reside far from forests and agrarian landscapes. This has become possible as cultural and religious dimensions of *satoyama* have become apparent in eco-tourism and social movements which have extolled its healing and spiritual qualities.



**Figure 4** Concept and characteristics of *satoyama*

“*Satoumi*,” by contrast, is a term which only came into existence in 1998 to refer to the spatial structure of coastal areas and the use and management of fisheries resources within these areas. As intended by its author, *satoumi* places emphasis upon “an enhancement in biological productivity and biodiversity through human intervention.” Specifically, the origins of the concept can be traced to the attempts by local communities to understand the relationship between human beings and the sea in the coastal areas of the Seto Inland Sea.

For the purposes of the JSSA assessment, we define *satoyama* and *satoumi* landscapes as *a dynamic mosaic of managed socio-ecological systems producing a bundle of ecosystem services for human well-being.*

The primary characteristics of these landscapes are:

1. *Satoyama* is a mosaic of both terrestrial and aquatic ecosystems comprised of wood-

lands, plantation, grasslands, farmlands, pasture, irrigation ponds and canals, with an emphasis on the terrestrial ecosystems.

2. *Satoumi* is a mosaic of both terrestrial and aquatic ecosystems comprised of seashore, rocky shore, tidal flats, coral reefs, and seaweed/grass beds, with an emphasis on the aquatic ecosystems.
3. *Satoyama* and *satoumi* landscapes are managed with a mix of traditional knowledge and modern science (reflective of the socio-ecological contexts).
4. Biodiversity is a key element for the resiliency and functioning of *satoyama* and *satoumi* landscapes.

## RECENT CHANGES IN SATOYAMA AND SATOUMI IN THE PAST FIFTY YEARS

There has been a rapid decline in both types of landscapes in the last half century. This has been brought about by a convergence of

a: coppice woodland for firewood and charcoal, b: coniferous plantation, c: red pine woods d: homestead woodland, e: bamboo grove f: grassland, g: rice paddy field, h: field, i: irrigation channel, j: irrigation pond, k: settlements, l: livestock (cattle and chicken), m: wild vegetables and mushrooms, n: prescribed burning of grassland, o: maintenance of irrigation channel p: management of coppice woodland and bamboo grove, q: management of coniferous plantation, r: collecting leaves of deciduous woodland for manure production, s: charcoal burning, t: shiitake mushroom production, u: shrine, v: northern goshawk, w: Japanese salamander, x: kingfisher, y: farmers and foresters, z: hikers



**Figure 5** Concept and characteristics of *satoumi*

a: river, b: beach, c: tidal flat, d: coral reef, e: sea grass bed, f: diverse fish and shellfish, g: plankton, h: nutrient matters and sand, i: oyster aquaculture, j: fishing settlements, k: pine trees, l: fishermen, m: sea bathing, n: shellfish gathering, o: angler, p: nature observation, q: urban area, r: *satoyama*

trends, some endemic to Japan, others global in origins.

These include rapid urbanisation within Japan resulting in a physical loss of *satoyama* landscape as woodlands became converted to other uses (e.g. housing, golf courses), and in a degradation of the landscape with the decline in a rural population base. With fewer rural dwellers, there are less people available to make *use of* as well as *manage satoyama* landscapes. This becomes apparent in *satoyama* that returns to a state of nature, characterized by unchecked growth in flora and fauna formerly held in balance by *satoyama* forest and wildlife management techniques.

Conversion to coniferous tree plantation from secondary woodland to supply Japan's construction industry has also altered *satoyama* landscapes. In many cases the monoculture plantation for timber production has disrupted key ecosystem services including adequate water supply, flood and

soil erosion prevention and a host of other, tertiary benefits bestowed by the traditional *satoyama* landscape. Moreover, the supply of cheap timber from foreign markets further exacerbated this trend, leading to the neglect and abandonment of the traditional *satoyama* landscape.

*Satoumi* landscapes have undergone similar transformations brought about by rapid industrialisation in Japan. These include a loss of seashore area available for recreational and traditional fishing activities, as well as increased pollution which has affected marine fisheries. Over-fishing, a result of increasing intensification and use of mechanised techniques, has also impacted the *satoumi* fishing communities in some regions of Japan to rely on commercial off-shore fishing for their economic survival.

## ECOSYSTEM CONCEPTS COMMON TO SATOYAMA AND SATOUMI

*Satoyama* and *satoumi* landscapes provide three key ecosystem services that may be conceptualised as: *provisioning*, *regulating*, and *cultural*.

*Provisioning* services are those resources supplied by *satoyama* and *satoumi* to human communities. *Satoyama* provisioning services include timber for construction; fuel, in the form of wood and charcoal; and food, both wild game, rice, and edible species such as mushrooms. *Satoumi* provisioning services include seafood and salt.

*Regulating* services in *satoyama* include functions such as climate control, water quality control, wildlife habitat regulation, and disaster control. Thus, they are traditional mainstays for the sustainable supply of many provisioning services.

Similarly, *satoumi* areas centered on tideland also provide regulating services in coastal water environments through removal of nutrients such as nitrogen and phosphorus. In addition, diverse biological communities in *satoumi* such as sea grass beds are equipped with high carbon dioxide fixation capabilities and provide climate control services.

Finally, *cultural* services provided by *satoyama* and *satoumi* are embedded in the very foundation of Japanese society and provide the basis for traditional *satoyama/satoumi* landscape practices, such as how rice is grown, forests maintained and fishing undertaken. Indeed, it is the myriad of practices with respect to *satoyama* and *satoumi* that to a large extent comprise and define traditional Japanese culture.

In assessing changes in biodiversity and ecosystem services in the past half century and their causes, the JSSA focuses on biodiversity (natural forests and artificial forests), provi-

sioning services (timber, charcoal, organic fertilisers, agricultural production), regulating services (water regulation and purification, soil retention, disaster management), and cultural services (sightseeing, spiritual values, eco-tourism). Also considered are changes in nature conservation policies, promotion of recycling agriculture with organic farming at its core, resource utilisation by tourism-related policies, and how generally these factors affect human well-being.

## SUMMARY

*Satoyama* and *satoumi* are Japanese concepts for traditional land and coastal management practices that have allowed the effective use and maintenance of these landscapes by the Japanese people. As used in this current study, we define them as *a dynamic mosaic of managed socio-ecological systems producing a bundle of ecosystem services for human well-being*.

Of critical importance for this study is the decline in both types of landscape since the end of World War II. Subsequent chapters will detail the root causes of this decline and possible courses of action.



# How Have Biodiversity and Ecosystem Services Changed in *Satoyama* and *Satoumi* Landscapes, and, What Are the Main Causes?

## DIRECT AND INDIRECT FACTORS IMPACTING SATOYAMA AND SATOUMI

Indirect factors examined here are economics, culture and religion, science and technology, population, and public policy. Direct factors are changes in land use (development and loss of mosaic), under-use, overhunting/overharvesting, regional/global warming (climate change), increases in non-native species, and pollution.

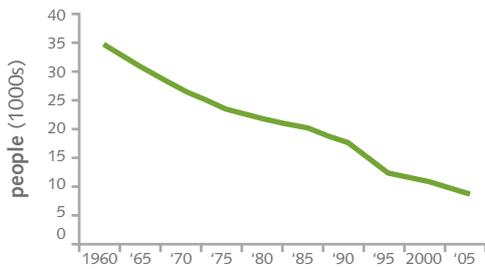
1. **ECONOMICS** – At the end of World War II the Japanese economy grew rapidly. Two chief features of this economic expansion were an increase in imports of timber and other materials, and the massive plantation of artificial forests comprised of shallow-rooted coniferous trees. As a consequence both *satoyama* and *satoumi* landscapes experienced degradation in their output of ecosystem services. In the case of *satoyama*, the reduced use of cedar and Japanese cypress due to the importation of cheaper timber from abroad resulted in abandonment of coniferous tree plantations that were converted from traditional broad-leaved forests. This, in turn, led to overpopulations of deer, and together these two factors led to degrading of

specific ecosystem services. With respect to *satoumi*, the increase in importation of products meant more ships docking in Japanese waters, and through the unloading of ballast, alien species were introduced into *satoumi* that had harmful results on the ecosystem.

2. **CULTURE AND RELIGION** – As a consequence of rapid economic expansion in post-war Japan, Japanese lifestyle and culture underwent significant changes. Introduction of Western foods led to a decrease in rice consumption, resulting in degradation of the *satoyama* landscape through under-utilisation. New forms of energy – oil and natural gas – quickly replaced wood as the traditional source of fuel, and this also led to a diminishment of *satoyama* provisioning services through abandonment. Cultural changes became evident in the transformation of much *satoyama* landscape into golf courses and other non-traditional uses.

3. **SCIENCE AND TECHNOLOGY** – Economic growth both fostered and was furthered by the development of new forms of technology which impacted both *satoyama* and *satoumi*. Small farms which had customarily used animals for ploughing fields were replaced by large mechanised farms whose tools and methods (e.g. the use of commercially produced fertilisers) replaced those traditionally employed. Thus, the *satoyama* landscape has been significantly altered, and some of its ecosystem services, such as providing potable water, were degraded by fertiliser run-off and the subsequent contamination of aquifers. In the *satoumi* landscape, technology brought about more productive means of fishing, but this in turn led to overfishing. The marine landscape was further altered as aquaculture was established as a more efficient way to produce food.

4. **POPULATION** – A fourth indirect driver impacting *satoyama* and *satoumi* ecosystems is the ageing population Japan is experiencing. This, together with the rapid urbanisation



**Figure 6** Farm household population

The statistics after 1995 only include the population of commercial farmers' households ('Census of Agriculture and Forestry', Ministry of Agriculture, Forestry and Fisheries of Japan)

tion Japan experienced since the end of the war resulting in a demographic shift from rural to urban settings, caused the abandonment of *satoyama* and *satoumi* as shown in Figure 6. Another consequence of the growth of cities was increased pollution, both through emissions from industry and the increase in sewage that had to be disposed of. *Satoumi* landscapes were also changed through population growth, as coastal areas were developed, also resulting in increased pollution to the marine ecosystem.

**5. PUBLIC POLICY** – With the growth of the factors described above, beginning in 1968 Japan began to attempt to regulate its growth in a planned manner with the establishment of the City Planning Act. The Act sought to increase the transformation of *satoyama* from farmland to residential land in designated “urban” areas, while protecting further development of *satoyama* in other areas.

In *satoumi*, fisheries regulations were enacted to stem the depletion of species through over-fishing of coastal regions of Japan, including *satoumi* areas.

## TRENDS AFFECTING ECOSYSTEM SERVICES

Transformations brought about by the five factors identified above have affected the provisioning, regulating, and cultural services of *satoyama* and *satoumi* ecosystems.

**1. PROVISIONING SERVICES** – The impact of economic growth and urbanisation has been mixed with respect to various provisioning services of *satoyama*, although overall, as noted at the outset of this chapter, this ecosystem has experienced diminishing capacity in the past half century.

Looking at food services, rice paddies have seen a reduction in total cultivated acreage, but at the same time output has remained consistent due to improved agricultural technology and methods. The major source of degraded services here results from the use of commercial fertilisers and pesticides, and their resultant pollution of streams, ground waters, and tributaries leading to the coastal *satoumi* ecosystem. Livestock production grew rapidly in post-war Japan, although it has declined somewhat in recent years.

While total forest area in Japan has remained constant through plantations and regrowth as well as land use change for development, forestry provisioning services have generally had mixed outcomes. Although the use of timber has decreased, timber supply has increased in recent years from forest plantations, but the nature and characteristics of the forest have changed from broad-leaved forests to coniferous plantations. However, the function of shallow-rooted coniferous forests in preventing soil runoff is inferior to that of the comparatively deep-rooted



broad-leaved forests. In addition, the shrub and herb vegetation in forest floors of the afforested coniferous forests are also poorer and often inferior to the broad-leaved forests in terms of the soil-formation function of *satoyama* landscape. Under-use of forest *satoyama* has also resulted in a decrease in the amount of collectable matsutake mushrooms. Although mushroom production has in fact expanded overall, this is due to intensive indoor cultivation of mushrooms which are energy and input intensive as compared to *satoyama* forests. Similarly, there has been a decreased use of trees for timber and fuel, leading to a degradation of *satoyama*, along with the transformation of much *satoyama* landscape into residential and leisure areas through the construction, for instance, of golf courses.

Overall changes in the *satoumi* ecosystem mirror those of *satoyama*. Economic development coupled with technological modernisation initially resulted in increases in fish catches. Over time, however, catches have diminished as over-fishing has reduced fish populations and the fisheries industry in Japan has fallen into stagnation. Marine coastal pollution has further depleted *satoumi* resources, although recent trends indicate an improvement in coastal water quality. Finally, climate change has had an impact as warming waters in parts of Japan have led to decreased stocks of fish such as herring and cod that favor cold waters.

**2. REGULATING SERVICES** – Regulating services denote the benefits available from regulation of ecosystem processes, including the regulation of air quality, climate, water, erosion, disease, pests, and natural hazards such as floods; water purification and waste treatment; and pollination.

Transformations in land use are the key *direct* driver in changes in *satoyama* regulating services, since they impact the ability of the ecosystem to regulate many of the factors listed above. The major changes in land use

during the past fifty years include 1- changes in *satoyama* forest from traditional secondary wood land to coniferous tree plantations brought about by the demands of the construction industry, 2- under-use of *satoyama* forest brought about by decreases in rural populace, a shift from biomass energy to fossil fuel, and importation of cheap timber, 3- loss of traditional *satoyama* as land is re-developed for residential uses, and 4- decline in farmland *satoyama* with reduced acreage available for rice cultivation. Although the relationship between land use change in *satoyama* and the occurrence of natural disasters such as floods has been never investigated at the national scale, some local reports have shown that there is a relationship between decrease in rice paddy field area and increase in flood damages.

**3. CULTURAL SERVICES** – As the *satoyama* landscape has changed since the Second World War, traditional handicrafts as an industry have declined. Contributing factors include the dwindling of a rural population which traditionally has produced handicrafts, the loss of *satoyama* resources, and the loss of local knowledge transmission which in the past provided raw material and cultural know-how for much of the handicrafts

*Beginning in 2005*, Japan began designating “cultural landscape” areas in an attempt to re-assert links between one’s geographic environment and the history of the nation. However, this attempt has been stymied in rural areas where there is insufficient population available to maintain these designated areas, which thus revert quickly to a state of abandonment.

*Satoumi* cultural services have experienced decline overall. Recreational fishing has been in decline for the past decade, while traditional activities such as shellfish gathering and sea bathing have declined as more and more beaches on the coast have been converted to other, commercial, uses and suffered from pollution.

Table 1 Changes in ecosystem services and direct drivers (cntd. on p. 20)

Ecosystem Services	Human Use	Enhanced or Degraded	Indicators and Criteria	Direct Drivers							
				Urbanisation	Loss of mosaic	Under-use	Over-exploitation	Global/regional warming	Increase in alien invasive species	Pollution	
PROVISIONING	FOOD	Rice			Crop yield, cultivated area, yield per 10a	✓		✓	✓	✓	
		Livestock	NA	NA	-						
		Matsutake mushrooms			Yield			✓			
		Marine Fishery			Catch	✓		✓	✓	✓	✓
		Aquaculture		NA	Catch	✓					✓
	FIBER	Timber			Forestry production index, standing tree store	✓		✓			✓
		Firewood & Charcoal		NA	Forestry production index	✓		✓			
Sericulture				Cocoon harvest, Mulberry-grown area			✓				
REGULATING	Air quality regulation	+/-	+/-	No./So <sub>2</sub> concentration, amount of yellow dust and endocrine disrupting chemicals	✓		✓			✓	
	Climate regulation	+/-	+/-	Changes or fluctuations of temperature and precipitation	✓		✓		✓		
	WATER REGULATION	Flood control	+/-	+/-	Area of paddy fields, number of irrigation ponds	✓	✓	✓			
		Water purification	+/-	+/-	Forest area, amount of chemical fertiliser and pesticide use, percentage of sewered population	✓	✓	✓			✓
	SOIL EROSION REGULATION	Cultivated/forests	+/-	+/-	Area of abandoned cultivated land, changes in forest type	✓	✓	✓			✓
		Coastal	+/-	+/-	Sediment supply	✓		✓			
	Pest regulation and pollination			Amount of pesticide use, area of abandoned cultivated land, changes in forest type	✓	✓	✓				

Finally, as technological forms of entertainment have increased in popularity among children, there is a corresponding diminishment in the amount of time spent outdoors playing. Thus, both *satoyama* and *satoumi* ecosystem services suffer from cultural under-use.

**SUMMARY**

During the past half century, Japan’s *satoyama* and *satoumi* ecosystems have been in decline. Indirect factors such as economic

transformation, urbanisation, technological advances, and cultural changes have contributed to this. The most significant direct factor has been the transformation in land use as a result of the importation of cheap timber, the creation of artificial forests for Japan’s construction industry, and Japan’s move from an agrarian society to a highly urbanised one. The second major factor is the rapidly ageing population which reduces the labor required to maintain *satoyama* and *satoumi* systems. Table 1 summarises the key trends in ecosystem services, and drivers.

Table 1 contd. Changes in ecosystem services and direct drivers

Ecosystem Services	Human Use	Enhanced or Degraded	Indicators and Criteria	Direct Drivers								
				Urbanisation	Loss of mosaic	Under-use	Over-exploitation	Global/regional warming	Increase in alien invasive species	Pollution		
SPIRITUAL	Religion	NA	-	Number of temples and shrines, area of sacred groves	✓							
	Festival	↘	-	Variety (number) of festivals, use of plants for flower dedication	✓							
	Scenery	↘	-	Number of applications for '100 best satoyama selection'	✓							
RECREATION	Education	→	-	Number of participants, number of NGOs working for satoyama conservation, area of activities, time to spend outdoors	✓							
	Game-hunting and fishing, Gathering clams and wild vegetables	↘	-	Number of participants (described in leisure white paper), number of facilities	✓							
	Climbing, Travel, Green-tourism	↗	-	Number of participants (described in leisure white paper), number of facilities	✓							
ART	Traditional art	↘	-	Number of professionals, production, average age (in terms of education of successors)	✓							
	Contemporary art	NA	-	Number of professionals, production, average age (in terms of education of successors)								

Backed by data	Without supporting data	KEY TO TABLE 1	
		A monotone increase (for human use column) or enhanced (for enhanced or degraded column) for the last 50 years	+/- Mixed (trend increases and decreases) over past 50 years or some components/regions increase while others decrease
		A monotone decrease (for human use column) or enhanced (for enhanced or degraded column) for the last 50 years	NA Not assessed
		No change (for both columns) for the last 50 years	✓ The direct drivers that have influenced ecosystem services

# Why are Changes in Satoyama and Satoumi a Concern?

Unless action is taken, these trends in the transformation of *satoyama* and *satoumi* landscapes over the past fifty years can be expected to continue into the future, with negative consequences for both biodiversity and human well-being.

## THE INTERLINKAGE OF ECOSYSTEM SERVICES

Ecosystems services, such as provisioning, regulating, and cultural, do not exist independently of one another, but are fundamentally interlinked. Thus, changes in the status of one ecosystem service will inevitably affect that of other ecosystem services. For ex-

ample, from the standpoint of provisioning, maximising the number of coniferous trees in a forest for timber production can lead to negative consequences in terms of the forest's ability to provide regulating services, such as soil and erosion protection.

Historically this interlinkage can be seen in the over-use of forests for production of firewood and charcoal from the period of the 1930s to the 1950s. A consequence of this over-use was denuded mountain sides that were unable to protect against soil run-off and flooding during rains. The re-growth of forests using fast growing coniferous trees, as noted above, which occurred in the building boom during post-war years, also led to degradation in the ability of *satoyama* ecosystems to provide critical regulating services, as the shallow-rooted coniferous trees are inferior to the deep-rooted broad-leaved forests for preventing run-off.

Similar issues arise in *satoumi*. Notably, in addition to fertiliser run-off pollution, with the development of aquaculture in post-war Japan, there has been an increase in marine pollution due to the accumulation of waste products on seabeds resulting from artificial feeding. Thus, the ability of *satoumi* to maintain its regulatory services affecting the health of its ecosystem is compromised.

## TEMPORAL AND SPATIAL INTERLINKAGES

In many cases the current deterioration of ecosystem services is a time-lagged response to changes that occurred much earlier. Degradation of *satoumi* due to pollution caused by the introduction of commercial fertilisers to *satoyama* landscapes (e.g. rice paddies) does not occur overnight, but only becomes manifest over many years of stream run-off containing excessive nitrogen. Similarly, the reduced ability of *satoyama* forests to guard against soil erosion did not happen



all at once, but only gradually over time as native species were increasingly replaced by shallow-rooted coniferous trees. Thus, although these interlinkages are present and critical, because of temporal and spatial gaps it can be difficult to see clear cause-and-effect relationships.

### POPULATION INTERLINKAGES

As Japan’s overall population has declined due to falling birth rates, and relatedly, as its population has become more urban-based, there has been a marked decline in rural population since World War II. With this decline, the capacity of rural dwellers both to *utilise satoyama* provisioning services (e.g. firewood) and thereby to *manage* those services has deteriorated. In consequence, many *satoyama* landscapes have become overgrown and overrun with species such as deer. This kind of *satoyama* “returning to forest” is another example of decline in provisioning and

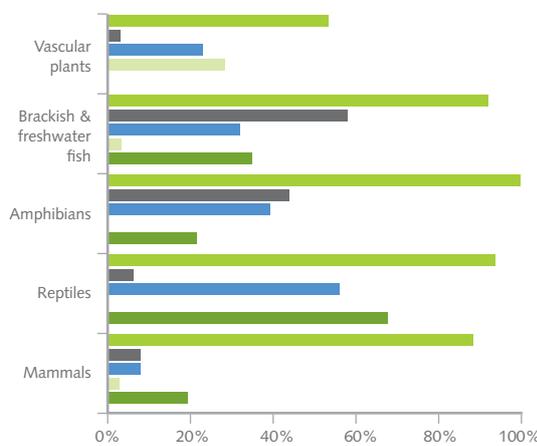
cultural ecosystem services resulting from interlinkage with other ecosystem elements. Urbanisation, of course, has produced its own impacts, as large tracts of *satoyama* landscape have been “swallowed up by cities,” thus breaking the mosaic structure which is critical for *satoyama* landscapes.

### IMPACT OF SATOYAMA AND SATOUMI ON BIODIVERSITY

Although Japan is a developed nation that has maintained a high level of biodiversity, changes in *satoyama* and *satoumi* have negatively impacted this. Habitat modifications, climate change, introduction of alien species, hunting, pollution, and under-utilisation of resources have contributed to an overall loss of biodiversity in the past fifty years as shown in Figure 7 and 8, and this trend can be expected to continue if no immediate action is taken.

**Figure 7** Drivers of decline in endangered species

The drivers of reduction of the species listed in the Red Data Book (RDB) are generally categorised into (A) ■ development, (B) ■ water pollution (including pesticide), (C) ■ Exploitation, (D) ■ Succession, and (E) ■ Invasive Species. (Ministry of the Environment, Japan, 2010).

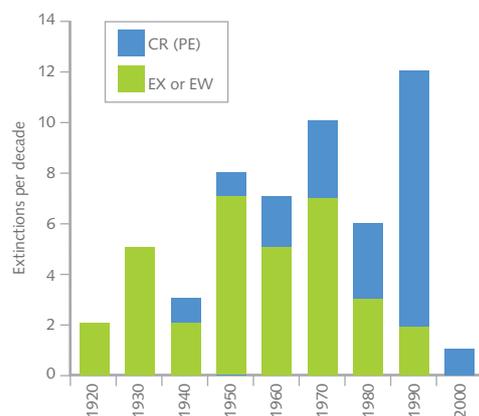


### INTERLINKAGE BETWEEN ECOSYSTEM SERVICES AND HUMAN WELL-BEING

While at first glance it might appear intuitively obvious that an increase in human well-being should be positively linked to increases in ecosystem services, this is not the case. Indeed, the relation of the two is best characterised as one of “trade-offs,” a concept introduced previously.

**Figure 8** Species extinction rates of vascular plants.

Blue bar indicates known extinctions of species (Extinct: EX, Extinct in the Wild: EW), and green bar indicates species whose survival is not confirmed (Critically Endangered: CR, Possibly Extinct: PE) (Fujita et al., unpublished).



With the fertiliser and fuel revolution following World War II, human well-being increased in Japan, but this was accompanied by a decline in *satoyama* ecosystem services as they suffered in some cases from under-use, and in others from deterioration in their ability to provide regulating services (watershed pollution from over-use of fertilisers, for instance).

In the case of *satoumi*, an increase in industrialisation brought about increased economic

opportunities in coastal areas, and was accompanied by their development and urbanisation. Yet this increase in human well-being was causally related to the deterioration of the *satoumi* landscape as coastal areas were lost to development, while marine pollution increased as a result of industrial activity and sewage from a swelling population.

This trade-off may be seen even in the case of cultural services, which are associated with spiritual aspects of human well-being. With the rapid urbanisation that occurred in post-war Japan, the Japanese people experienced not only a loss of *satoyama* and *satoumi*, but an increasing distance from them. This “separation” from nature has been negatively correlated with trends in both physical and mental health. This might have led to the increase in mental depressions as illustrated in Figure 9.

There is evidence that this trend may be reversing, however. As Figure 10 illustrates, since 1980 there has been a steady and marked increase in those who are seeking “spiritual affluence” versus “material affluence” in their lives. According to an opinion poll conducted in 2009 by Japan’s Cabinet Office, 60.5 per cent of those surveyed answered that they are pursuing spiritual richness in their future life, while just 30.2 per cent indicated that they are still pursuing material richness. Contrast this with a similar opinion poll conducted in 1972, wherein those who wanted to pursue material richness outnumbered those who wanted to pursue spiritual richness.

### LOSS OF “COMMONS” AND ECONOMIC ANALYSIS

As the examples above make clear, short-term increases in human well-being may be accompanied by degradation of ecosystem services, which, over the long-term, may have

Figure 9 The relations between natural environment and health in physical (a) and mental (b). Source: Tanaka, 2005

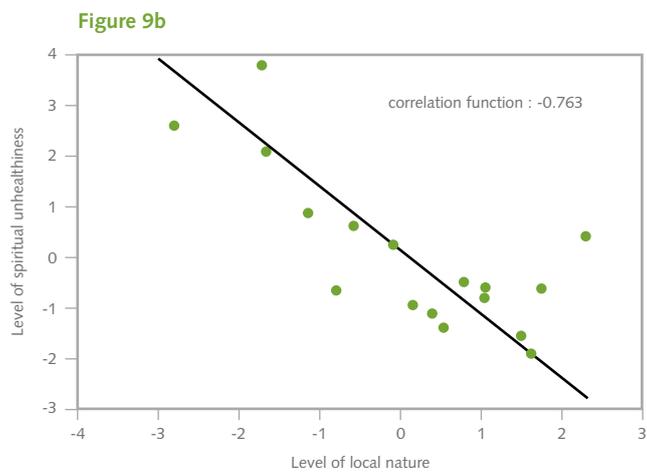
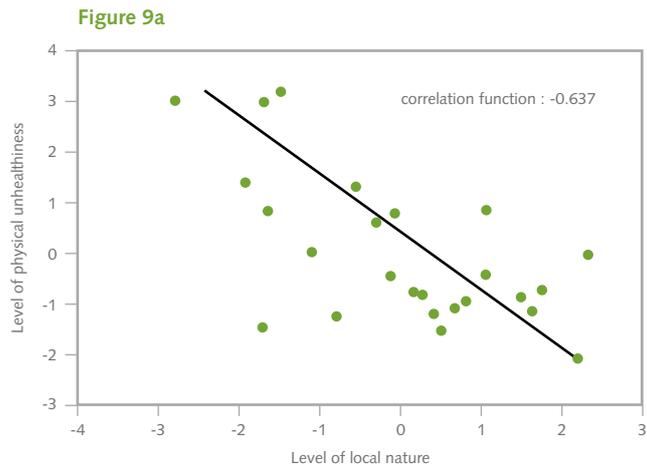
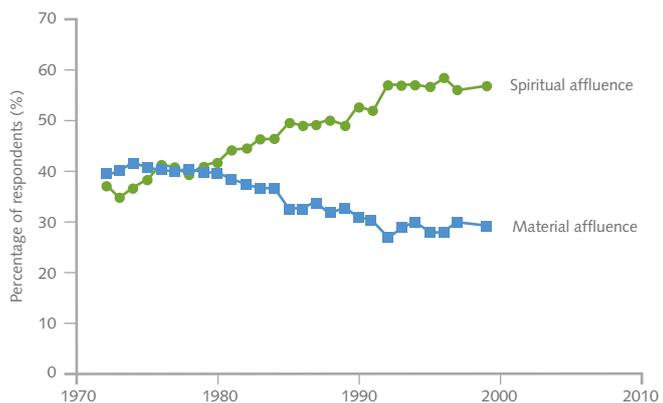


Figure 10 Aspiration for spiritual richness vs. material richness (1972-1999)



Spiritual affluence: willingness to focus on life with spiritual affluence, as material affluence has been already satisfied to some extent.

Material affluence: willingness to focus on making life materially affluent

Source: Based on results of opinion polls by the Cabinet Office, Government of Japan

negative consequences on human well-being as biodiversity is diminished.

Two factors have been critical in these win-lose scenarios between human well-being and *satoyama* and *satoumi* ecosystems. First, with the uprooting of the Japanese population in post-war years as rural populations declined and urban ones swelled, there is collective loss of connection to one's landscape. Wherein traditionally those who worked the land and the waters assumed collective responsibility for maintaining and protecting them, in a rapidly urbanised, industrialised Japan this sense of obligation to one's surroundings has been quickly lost. Thus, it becomes possible to pursue economic development that produces short-term benefits to human well-being, while simultaneously degrading the ecosystems necessary to sustain well-being over the long haul.

This loss of collective management of *satoyama* and *satoumi* landscape may be termed a loss of the "commons," in the sense that Garrett Hardin used the term in his seminal work, *The Tragedy of the Commons*. However, in contrast to Hardin's work, which identified individualistic over-use of commons as the source of its depletion, in Japan's case, the cause for *satoyama* and *satoumi* degradation is collective *under-use* of these resources.

The second critical factor has been an insufficiency/inability in studies to place an *economic* value on biodiversity. Although the significance and importance of biodiversity is acknowledged to some extent among the general public, the research on economic valuation of biodiversity has been very limited. This is simply because there are no markets for biodiversity, nor is there an established market price for it (in other words, most of the economic values in biodiversity belong to the non use-value category). It is therefore extremely difficult to evaluate the value of biodiversity.

If the current trends in decline of *satoyama*, *satoumi* and biodiversity are to be reversed, it is imperative that these two critical issues are addressed.

## SUMMARY

Critical to understanding the causes of the decline in *satoyama* and *satoumi* ecosystem services in the past fifty years is the concept of "interlinkage," which posits three distinctive relationships the JSSA has examined: 1- the interlinkage *between* ecosystem services, which examines how changes in one type of service will bring about changes in other types, 2- *spatial and temporal* interlinkages which are reflected in changes in ecosystem services over time and distance, and 3- the interlinkage *between* ecosystem services and human well-being.

Causes for the decline in services reflective of the first type of interlinkage are dominantly tied to changes in *satoyama* and *satoumi* landscape in post-war years. Examples of the second type are found in human activity whose consequences only become evident over time or distance, such as the polluting effects of fertiliser use in *satoyama* landscapes to *satoumi* through run-off. Finally, the third cause for the decline in ecosystem services is exemplified in the under-use or even abandonment of traditional *satoyama* and *satoumi* landscape, which has led to negative trends in health and overall well-being in Japan.

# What Has Been Done to Encourage *Satoyama* and *Satoumi* Systems at the National and International Levels?

Despite the decline in *satoyama* and *satoumi* ecosystems and ecosystem services in post-war Japan, a variety of initiatives with respect to the environment have been undertaken. In what follows these are examined, as well as their effectiveness to date in restoring traditional Japanese landscapes.

The framework for these types of initiatives (or “response”) is taken from the MA and includes the following types:

- Legal
- Economic
- Social and behavioral
- Technological
- Cognitive

The MA recognises that the implementation of different types of responses will affect both the relationship between direct and indirect drivers affecting ecosystem services, and the ecosystem services themselves (in terms of enhancing or degrading them).

## IMPACT OF LEGAL RESPONSES

Since *satoyama* and *satoumi* landscapes exist within national borders, most legal regulation

regarding them occurs at the national level or below. However, in recent years international laws have gained some currency, as in the case of the UN’s Convention of the Law of the Sea.

Up until the 1980s, most laws regulating *satoyama* were focused on residential and commercial land development. Since the Earth Summit in 1992, however, a series of laws has been implemented in Japan managing *satoyama* landscapes in their larger context. These include the Act on the Promotion of Nature Restoration, the Landscapes Act, and the Act on Promotion of Ecotourism.

In the case of *satoumi*, until the 1990s most legislation resembled a patchwork of regulations, dispersed among various and unconnected agencies. For instance, the Ports and Harbors Bureau fell under the aegis of the Ministry of Transport, while the River Bureau fell under the Ministry of Construction. Even with the establishment of a unified department – the Ministry of Land, Infrastructure, Transport and Tourism – in 2001, the new agency inherited this patchwork of unconnected and sometimes overlapping regulations for *satoumi* landscape.

However, beginning with a series of initiatives by the 5th Comprehensive National Development Plan “Grand Design for the 21st Century” in 1998, Japan has recognised that its coastal areas constitute a unified ecosystem and thus regulations could be developed that manage “projects, facilities, and use in an integrated manner, while formulating integrated management planning of coastal areas by local public organisations as the main participants.”

While national initiatives have emerged treating *satoyama* and *satoumi* as unified ecosystems, Japan has also seen an increase in the number of *local* and *regional* initiatives, reflecting a conscious decision at the national level to decentralise decision-making whenever possible. This in turn reflects a growing

recognition that while *satoyama* and *satoumi* are integrated ecosystems, nonetheless, they vary in important ways (types of flora and fauna, geography, etc.) as they exist in different regions within Japan.

### IMPACT OF ECONOMIC RESPONSES

Fewer economic responses, at either the national or regional level, have been undertaken as compared to legal initiatives. This is due in large part to the decline in economic value of *satoyama* and *satoumi* resources in the last half century, brought about by a decrease in resource use through importation and international trade, as well as by a declining and ageing population that has fewer material resource needs.

Taxation has been the primary form of economic regulation of *satoyama* and *satoumi*, both through taxes that penalise corporations for polluting these landscapes, and use taxes that distribute the cost of maintaining these ecosystems to those who benefit. With respect to the later, for example, the Forest Environment Tax burdens citizens of various regions with the costs of maintaining forest *satoyama* whose benefits they enjoy (whether directly, through recreation, or indirectly, through protection the forests offer to water supplies and their prevention of soil erosion).

### IMPACT OF SOCIAL AND BEHAVIOURAL RESPONSES

Citizens, non-profit organisations (NPOS), and non-governmental organisations (NGOS) contribute significantly to *satoyama* and *satoumi* management and conservation. This is yet another instance where the government has employed a strategy of decentralisation to foster regional and local initiatives which are thus more able to involve citizens and citizens' groups. Businesses have similarly

become more involved in such initiatives as ways of enhancing their public image by very visibly demonstrating corporate responsibility for the environment.

### IMPACT OF TECHNOLOGICAL RESPONSES

Technology development aimed at increasing yields of *satoyama* and *satoumi* resources (provisioning services) while simultaneously protecting those ecosystems (regulating services) is increasing. In the case of *satoyama* ecosystems, improvements in fertilisers and pesticides management have meant better yields while reducing damage to the ability of *satoyama* to provide regulating services and conserve biodiversity. Similarly, high resolution satellite images allow better forestry management; for example, by identifying areas where insect infestation threatens *satoyama* forest.

New technologies focused on *satoumi* include improved aquaculture and fisheries management techniques, which make greater production possible without degrading the *satoumi* ecosystem.

### IMPACT OF COGNITIVE RESPONSES

There is growing recognition that traditional methods as well as advanced scientific knowledge must be integrated to protect the biodiversity within *satoyama* and *satoumi* ecosystems. This is not a call for a "return to nature" but rather acknowledgment that *traditional* knowledge historically has successfully allowed for both use and protection of these landscapes, and so has much to teach us in the present.

Perhaps the most promising cognitive response has been a rediscovery of the idea of the "commons," understood both as a system of co-management of natural resources, and

the natural resources themselves. The idea of the commons, has gained new currency as an opportunity to create a “new public” which embraces decentralised, regional and local initiatives that involve government as well as private sector groups such as NPOs and NGOs.

### EVALUATION OF EFFECTIVENESS OF RESPONSE TYPES

Table 2 highlights the most effective form of responses to *satoyama* and *satoumi* degradation. Both national policy, and importantly, regional and local policies have shown the greatest impact and greatest potential. Legislation, especially at the regional and local levels has also acted synergistically with cognitive and social/behavioural responses by promoting greater involvement by citizens and non-governmental groups in aspects of planning and carrying out environmental initiatives. Indeed, citizen participation is now prescribed in many regulations passed since 2000.

Of the various responses outlined above, economic initiatives have been least successful. This is in part, as noted, due to the decline in resource usage. But more importantly, it reflects the limited ability of economic analysis to calculate non-economic use values found in *satoyama* and *satoumi*, considered either in their human interactions (e.g. for their spiritual value), or as stand-alone ecosystems which promote biodiversity (another value that lies outside of an economic calculus).

### SUMMARY

We have surveyed a number of types of responses to the decline in *satoyama* and *satoumi* in the past fifty years. Of those examined the most promising combine effective regulation through legislation, coupled with decentralised decision-making which allows greater participation by all segments of

society in policy discussions and implementation. As we have seen, while economic responses could be powerful tools to influence and inform policy, they have been relatively ineffective due to their limited ability to assign economic value to *satoyama* and *satoumi* landscapes and ecosystems.

The chief challenges moving forward then, are two-fold: 1- finding new and more effective ways to involve citizen and non-governmental participation in the re-establishment of *satoyama* and *satoumi* “commons,” and 2- creating economic incentives for protecting the non-economic values present in *satoyama* and *satoumi*.

Table 2 Responses that are relatively effective in *satoyama* and *satoumi*

1 SATO	2 MOUNTAINS	3 OCEANS
<p>(Agricultural communities &amp; lifestyles, agricultural lands &amp; rivers)</p> <ul style="list-style-type: none"> <li>Land use control (L9)</li> <li>Biomass utilisation (E1)</li> <li>System of direct payment systems to the hilly and mountainous areas (E3)</li> <li>Farm-water-environment conservation reinforcement projects (E3)</li> </ul>	<ul style="list-style-type: none"> <li><i>Satoyama</i> conservation ordinances (L9)</li> <li>Forest environmental taxes (E1)</li> <li>Forest certification systems (E2)</li> </ul>	<ul style="list-style-type: none"> <li>Law Concerning Special Measures for Conservation of the Environment of the Seto Inland Sea (L6)</li> <li><i>Satoumi</i> conservation ordinances (L9)</li> <li>Systems relating to prevention of marine pollution (L6)</li> <li>Water pollution control (L6,T2)</li> </ul>
4 BIODIVERSITY	5 ALL AREAS	
<ul style="list-style-type: none"> <li>National Biodiversity Strategy and Action Plan (L6)</li> <li>Local biodiversity strategy (L9)</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Impact Assessment Law (L6)</li> <li>Act on Promotion of Specified Non-profit Activities (S3)</li> <li>Nature restoration projects (T2)</li> <li>Scientific research by local universities and government (K1)</li> <li><i>Satoyama</i> Initiative (K1)</li> <li>Re-creation of regional cooperative bodies (New Commons) (K2)</li> </ul>	

The response typologies that are highly evaluated with respect to both the potential effectiveness to influence the driver, and the proximity to the driver (which are defined in the MA) include: L6 (domestic environmental legislation in the environmental sector), L7 (domestic environmental legislation outside the environmental sector), L9 (command-and-control interventions), E1 (incentive-based interventions), E3 (financial/monetary measures), S3 (empowering communities, etc.), T2 (restoring ecosystem services), and K2 (knowledge acquisition and acceptances). The responses that are highly valued in terms of efficiency and effectiveness, include: Direct Payment System to the Hilly and Mountainous Areas; Farm-water-environment Conservation Reinforcement Projects; Forest Environment Taxations; Forest Certification Systems; Systems Relating to the Prevention of Marine Pollution; Water Pollution Control; and Nature Restoration Projects. This table lists the recent responses that are deemed to be more effective in *satoyama* and *satoumi*, in accordance with the domains of the ecosystem services.

# What Is the Future for *Satoyama* and *Satoumi* Landscapes under Plausible Scenarios?

## SCENARIO ANALYSIS

In the MA, scenario analysis is utilised to discuss and examine diverse and various directions and possibilities of change which ecosystems might follow in the future. It is also used to discuss responses to changes. A scenario thus represents a *plausible alternative future* and indicates *the feasible consequences under a specific hypothesis*. Therefore, scenario analysis can be employed as a systematic method to creatively examine a complicated and uncertain future.

The JSSA adopts the methodology and structure of scenario analysis undertaken in the MA. It focuses on direct and indirect drivers that can bring about change in ecosystems, as well as on people’s attitudes and responses to nature and ecosystem services. In this way the JSSA has established four types of scenarios for *satoyama* and *satoumi* in 2050.

In terms of methodology, scenarios may proceed via quantitative analysis, qualitative analysis, or a combination of the two. Because of the inability at present to sufficiently understand the causal relations of various drivers impacting *satoyama* and *satoumi*, this study adopts a qualitative approach to scenario development.

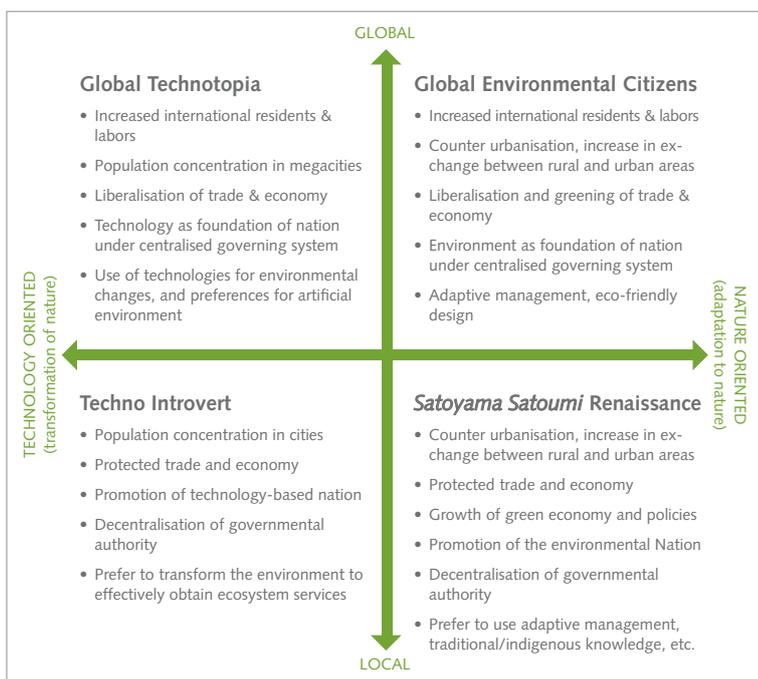
Structurally, the Assessment also adopts the MA’s use of two axes to identify possible future developments: One (the vertical axis) examines governance and economic development in terms of *localised versus globalised* approaches. The other (horizontal axis) looks at ecosystem service management as *nature oriented versus technology oriented*.

Based on these sets of axes, the JSSA has developed four distinct futures for Japan in 2050. They are: Global Environmental Citizens, Global Technotopia, Techno Introvert, and, *Satoyama/Satoumi* Renaissance as illustrated in Figure 11.

The JSSA examines four prospective scenarios for *satoyama* and *satoumi* in the year 2050. The objective is to create heuristic or analytic scenarios representing different social, economic and political arrangements which can serve as a basis for a discussion of current social choices and public policies

We begin by examining what a “scenario” is as employed in this exercise.

Figure 11 Positioning and characteristics of four scenarios in JSSA



It should be emphasised that this analysis has *not* tried to present a vision of what an *ideal* future for *satoyama* and *satoumi* would be, but merely different plausible outcomes given certain trends posited in the axes (local versus global, and, nature oriented versus technology oriented).

## GLOBAL ENVIRONMENTAL CITIZENS

In this scenario, there is expanded global migration of humans and labour forces, and emphasis is placed on the liberalisation of trade and the development of green economies. It posits a centralised governing system in which investments and political interest increases in education, social security, and the environment. In the field of agriculture, forestry, fisheries, public works, and ecosystem management, society prefers to use eco-friendly technology for food production and management of *satoyama* and *satoumi* such as low input agriculture, nature restoration, and adaptive management involving various stakeholders.



Figure 12 Global Environmental Citizens

## GLOBAL TECHNOPTOPIA

As in the former scenario, there is expanded global migration coupled with liberalisation of trade and economic policies. A centralised government promotes the development of technology and amends national policies to enhance international cooperation. However, political and social interests towards education, social security, and the environment decrease. In food production, public works, and ecosystem management, society prefers to use technological development to effectively utilise and extract ecosystem services.

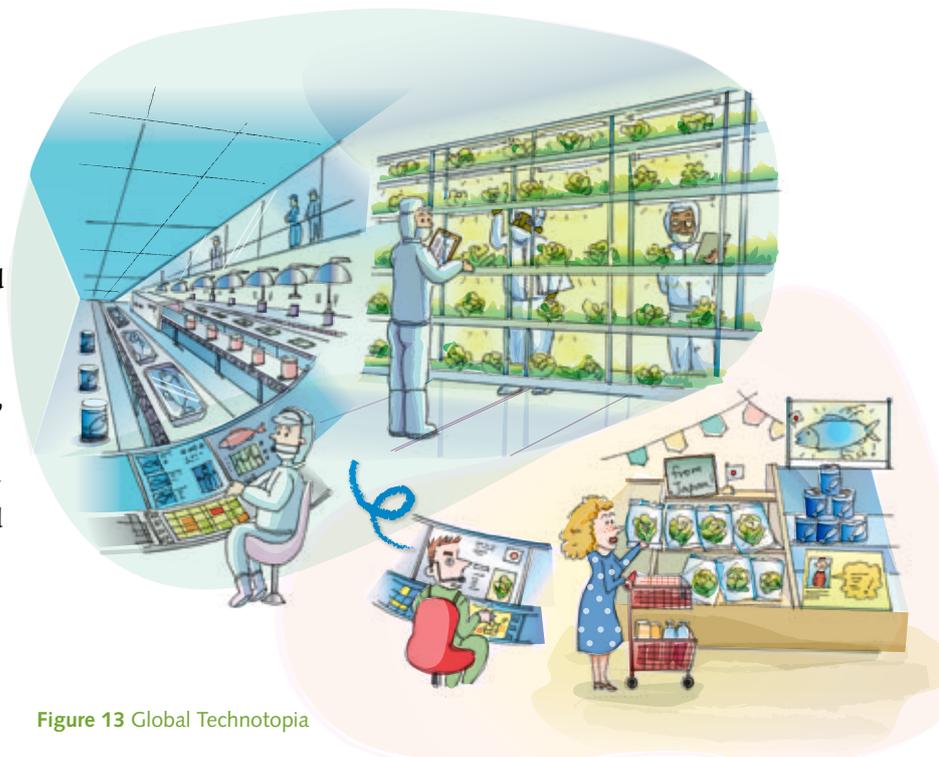


Figure 13 Global Technotopia

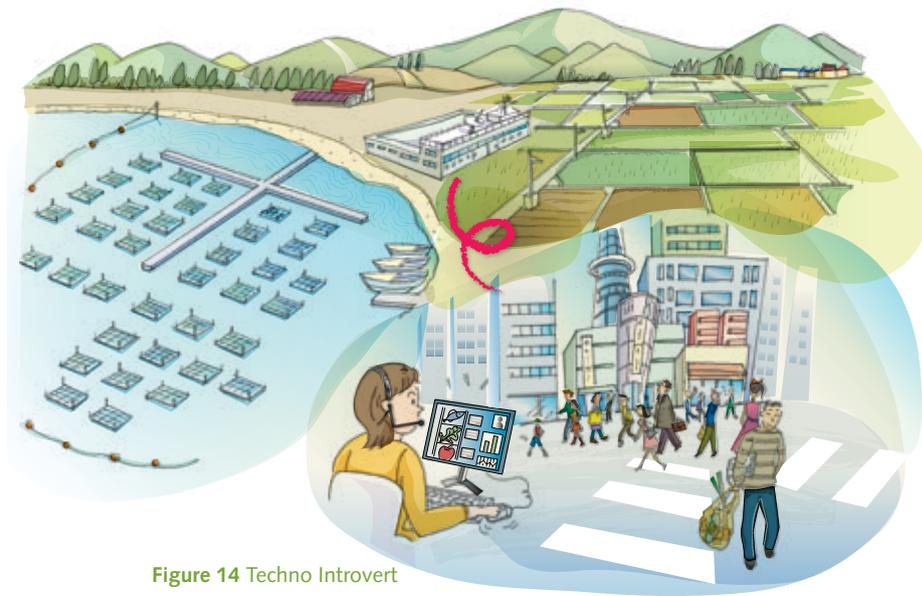


Figure 14 Techno Introvert

## TECHNO INTROVERT

In this scenario, population decrease continues nationwide while the migration from rural to urban settings continues. In trade and the economy the government adopts protectionist policies, especially in critical industries to increase self-sufficiency in food and materials. Emphasis is placed on scientific and technical knowledge over traditional and indigenous knowledge. Although administrative power is decentralised, social bonds in local communities are weakened. In primary industries, public works, and ecosystem management, society looks to technological developments to effectively utilise and extract ecosystem services such as food and water.



Figure 15 Satoyama Satoumi Renaissance

## SATOYAMA SATOUMI RENAISSANCE

In our fourth scenario, excessive population concentration in mega-cities is reversed through a counter-urbanisation movement to the countryside. This is coupled with decentralised government authority and a gradually declining population. Government adopts protectionist policies for trade and the economy, especially in critical industries to improve self-sufficiency in food and materials, while embracing the idea of a green economy. This means that in critical industries, public works, and ecosystem management, society prefers to use eco-friendly technology for food production and ecosystem management, such as low input agriculture, nature restoration, and adaptive management involving various stakeholders.

It is important to reiterate that it is very unlikely that any one of these scenarios will come to fruition as described in simple terms here. More likely is a future comprised of combinations of several or even all four.

## ASSESSMENT OF ECOSYSTEM SERVICES, BIODIVERSITY AND HUMAN WELL-BEING IN THE 4 SCENARIOS

Each of the four futuristic scenarios presented above contains implications for 1- ecosystem services, 2- human well-being, and 3- biodiversity that can be assessed in terms of the concepts of *enhanced or degraded*, and *increased or decreased*. Below is a summary of these implications.

### Global Environmental Citizens

**ECOSYSTEM SERVICES** – The globalisation of trade contributes to an increase in provisioning services as goods are exported to global markets. However, consumption of domestic provisioning services is likely to decrease, brought about by declining population and the availability of cheap imported food and material goods. Because of increased demand for environmentally-friendly produced goods and services abroad, sustainable use and effective management of *satoyama* and *satoumi* increases. However, this is somewhat offset by energy production policies which exploit the use of biomass and other renewable energy sources, potentially causing decline in some provisioning services.

**BIODIVERSITY** – The introduction of alien species through importation could result in a decrease in biodiversity as native species are pushed out by newcomers. This is offset somewhat by increases in biodiversity through efficient use of provisioning services provided by traditional *satoyama* and *satoumi* landscapes. Also negatively impacting certain kinds of biodiversity is the trend to further urbanisation to the detriment of rural areas and thus to the maintenance of *satoyama* and *satoumi* within them.

**HUMAN WELL-BEING** – Human well-being will probably decrease under this scenario. While those ecosystems producing exports will prosper, other ecosystems not employed in trade abroad will see a loss of use resulting in their degradation, negatively impacting human well-being in terms of the ability to rely upon *satoyama* and *satoumi* regulating and cultural services. International trade will lead to greater dependence on imported goods and services, and lessened job security. In both instances, the loss of basic sources of human security decreases overall human well-being.

### Global Technotopia

**ECOSYSTEM SERVICES** – in this scenario, food production increases due to globalisation of trade. Because of the high reliance on technology, this results in large-scale farming and the use of plant factories in some areas, with the result that regulating services, such as flood regulation and maintenance of traditional *satoyama* landscapes, is degraded. In the energy sector, the use of nuclear power and high-efficient thermal power generation increase, while the use of biomass and other renewable energies decrease. As the population continues to stream to urban areas, both *satoyama* and *satoumi* landscapes are degraded along with their cultural services (tourism, recreation, spiritual).



**BIODIVERSITY** – As in the previous scenario, some kinds of biodiversity could be diminished as a result of global trade and importation policies, by technological exploitation of ecosystems as high-tech farming methods are fostered, and through the abandonment of rural areas. Of the four scenarios, biodiversity is probably most diminished in this one.

**HUMAN WELL-BEING** – Increased food and material production leads to increased security and human-well being. However, counteracting this are decreased ecosystem services leading to cultural loss and perhaps job losses due to mechanisation. Coupled with competition from in-migration of labourers and increasing urbanisation, the overall result is a loss of a sense of security (in terms of job, neighbours, cultural traditions and social relations). On the whole, human well-being decreases in this scenario.

### Techno Introvert

**ECOSYSTEM SERVICES** – In this scenario, protectionist trade policies designed to foster self-reliance contribute to increased human use of ecosystem provisioning services. However, because this expansion is achieved through an increase in indoor production facilities for agriculture and aquaculture, traditional *satoyama* and *satoumi* will continue to experience a decrease in use, thus resulting as well in declines in regulating services. In the energy sector, the use of nuclear power and high-efficient thermal power generation replace biomass and other renewable energies. As with Global Technotopia, increased urbanisation leads to degraded ecosystem and cultural services within traditional *satoyama* and *satoumi* landscapes.

**BIODIVERSITY** – Similar results obtain as for Global Technotopia in terms of degraded biodiversity, for the same reasons enumerated above. However, unlike Global Techno-

topia, protectionist policies enacted under this scenario inhibit the importation of non-native species and thus serve to protect if not increase native biodiversity.

**HUMAN WELL-BEING** – Human well-being increases in some cases under this scenario as self-sufficiency leads to an increased sense of security. However, for some, job losses will result as traditional industries are replaced by new mechanised ones. As more people flock to cities, those who are left in rural areas will experience a decrease in well-being, reflecting a degraded social and cultural environment, and increased income disparity between those in cities and those in rural areas.

### Satoyama Satoumi Renaissance

**ECOSYSTEM SERVICES** – Protectionist trade policies encourage increased per-capita consumption of domestic food and materials. However, since this is achieved using traditional *satoyama* and *satoumi*, the level of provisioning services will improve or remain constant. In the energy sector the use of biomass and other renewable energies will increase. Overall this will contribute to enhanced regulating services. Finally, the counter urbanisation movement will result in increased human use of traditional *satoyama* and *satoumi* landscapes, and thus in an enhancement of their cultural and provisioning services.

**BIODIVERSITY** – Biodiversity stands the greatest opportunity to be maintained or increased of the four scenarios. Because of the emphases upon sustainability through use and effective management of *satoyama* and *satoumi*, traditional landscapes are more likely to experience an increase in human use and in their capacity to provide renewable provisioning and regulating services.

**HUMAN WELL-BEING – Protectionist trade policies combined with the encouragement of conventional means to use and maintain ecosystems leads to an increase in human well-being, both as a fruit of the security brought about by self-sufficiency and because of the benefits to be enjoyed from improved ecosystem services. However, to some extent this increase is likely to be offset as restrictions on imports lead to higher domestic prices for goods and services. As well, those rural areas which do not realise a repopulation from the counter-urbanisation movement will remain impoverished both in terms of social and cultural services, and material wealth.**

**SUMMARY**

It is unlikely that any one of the four future scenarios will come to fruition in the form outlined above. Likewise, it is unlikely that any scenario will constitute an unmixed blessing in terms of its impact on ecosystem services, biodiversity, and human well-being as shown in Table 3.

What is critical to future analyses of this sort is development of quantitative methodologies and spatial representation of potential changes that allow a better understanding of the interlinkages of *satoyama* and *satoumi*, and more precise simulations of the consequences of changes in *satoyama* and *satoumi* under different scenarios.

**Table 3** Changes in ecosystem services under scenarios

Type and Category of Ecosystem Services		Global Environmental Citizens		Global Technotopia		Techno Introvert		Satoyama Satoumi Renaissance	
		human use	enhanced/degraded	human use	enhanced/degraded	human use	enhanced/degraded	human use	enhanced/degraded
PROVISION-ING	energy	▲	▬	▼	▲	▼	▲	▲	▬
	electricity (wind, hydro)	▲	▼	▼	▬	▼	▬	▲	▼
	fishery product	▲	▲	▼	▲	▬	▼	▲	▲
	food	▬	▬	▬	▬	▼	▬	▬	▼
	vegetable	▲	▲	▬	▲	▬	▲	▬	▲
fiber	▲	▬	▼	▲	▼	▲	▲	▬	
REGULATING	atmospheric (climate regulation, air purification, etc)	▬	▬	▼	▬	▼	▬	▼	▬
	water (flood regulation, water storage, etc)	▬	▼	▼	▼	▼	▼	▼	▼
	soil (landslide, soil erosion prevention)	▬	▲	▼	▼	▼	▼	▼	▲
CULTURAL	shrines & temples, traditional knowledge	▼	▼	▼	▼	▼	▼	▬	▲
	sceneries	▲	▬	▼	▼	▼	▼	▬	▲
	recreation (festivals, eco-tourism, farming experience)	▲	▬	▼	▼	▼	▼	▬	▬
	art (traditional art, etc.)	▼	▼	▼	▼	▼	▼	▬	▲

**KEY**

- Increase in human use and enhancement of services
- Consistent use and services
- Decrease in human use and deterioration of services

- Note**
- Global Environmental Citizens and *Satoyama Satoumi* Renaissance will see increased use of biomass and other natural energy while Global Technotopia and Techno Introvert prefer to use nuclear energy and high-efficient power generation which will result in decline in the use of provisioning services of energy.
  - All scenarios but Techno Introvert could maintain current level of rice consumption either by export (rice in Global Environmental Citizens and Global Technotopia) or by increased per-capita consumption of domestic products (provision of rice in *Satoyama Satoumi* Renaissance). This will contribute to maintain regulating services of air purification in the three scenarios although regulating services of water purification will be degraded in Global Environmental Citizens and *Satoyama Satoumi* Renaissance due to increase in vegetable production.
  - While Global Environmental Citizens will bring increased visitors from home and abroad for some of cultural services such as festivals and beautiful landscape of *satoyama*, those cultural services with low profile such as invisible indigenous knowledge and nameless traditional art will not be appreciated (cultural services of Global Environmental Citizens).
  - Human use of regulating services decrease due to depopulation and rural-urban migration in Global Technotopia and Techno Introvert while increased exchange population and counter urbanisation will contribute to keep the human use of regulating services at current level in Global Environmental Citizens and *Satoyama Satoumi* Renaissance.

## KEY FINDINGS

## What Has Been Learned from the JSSA?

**1** THE CRITICAL FEATURE of *satoyama* and *satoumi* landscapes is the mosaic composition of different ecosystem types that are managed by humans to produce a bundle of ecosystem services for human well-being.

As the JSSA demonstrates, managed ecosystems such as *satoyama* and *satoumi* produce a higher level of biodiversity and ecosystem services than if they are degraded by human misuse or left to revert back to their natural conditions. Although traditional uses of *satoyama* and *satoumi* have changed during the past fifty years, there is a high potential of using these landscapes for sustainable agriculture and to counter the negative environmental externalities produced by urbanisation.

**2** SATOYAMA AND SATOUMI have undergone significant changes over the last fifty years which have caused a drop in the resiliency of the coupled socio-ecological production systems to provide a sustainable supply of ecosystem services.

Initial drivers of these changes included the creation of artificial forests of coniferous trees for the timber and construction industries, along with the importation of cheap timber that degraded regulating services of

*satoyama* ecosystems. More recent changes have been brought about by under-utilisation of *satoyama* as a result of the confluence of three factors: 1- economic globalisation resulting in greater importation of food and materials, 2- declining population in Japan, and 3- continuing urbanisation. *Satoumi* ecosystems have suffered as well through over-development, pollution, and the effects of climate change on fisheries.

**3** CONTINUED LOSS OF *satoyama* and *satoumi* landscapes has important and potentially negative consequences for human well-being and biodiversity. There is, however, still a need for more research on *satoyama* and *satoumi* and contributions they might have in the future for human well-being.

A continued loss of the resiliency of these ecosystems will force greater dependency of Japan upon global trade and the importation of food and critical materials. Although some segments of society will benefit from this trade, other segments of society will experience a loss of job security as a consequence of globalisation and their reliance on external sources for basic necessities.

A further decrease in human well-being with the continued loss of *satoyama* and *satoumi* landscapes will likely occur in the cultural arena, as increased urbanisation leads to a loss of social identity and social relations in an increasingly atomistic society removed from its historical and cultural rootedness in traditional *satoyama* and *satoumi*.

Biodiversity, while stronger in Japan than many developed countries, has suffered as well and is likely to continue to diminish, both as a result of importing non-native species which overrun traditional *satoyama* and *satoumi* or else diminish their important regulatory functions, and of the under-use of these landscapes which then deteriorate and return to a “state of nature.”

**4** UNCONNECTED AND PIECEMEAL approaches to address biodiversity change and to protect environmental resources have had only limited success. Integrated approaches including citizen participation have been used increasingly over the past ten years and show potential for reducing biodiversity loss and maintaining sustainable flows of ecosystem services.

The most successful policy that address *satoyama* and *satoumi* have been legal responses, but many of these have not been designed to address the inter-connected nature of *satoyama* and *satoumi* landscape that encompass woodlands, agricultural lands, inland waters and canals. However, with the decentralisation of legal authority beginning in the 2000s, local governments have begun to develop local ordinances and biodiversity strategies, in which they address *satoyama* and *satoumi* management explicitly. Of those attempts undertaken in Japan to reverse the trend of ecosystem services decline, the most successful have involved 1- national and regional environmental protection and regulatory laws, and, 2- a decentralised approach that emphasises regionalism, participation by both governmental and non-governmental (e.g. NPOS, NGOs) entities, and recognition of non-economic, cultural values inherent in *satoyama* and *satoumi* landscapes.

An example of one such initiative is tree planting near coastal areas by the fishing industry, in recognition of the traditional belief that fish gather where trees are reflected on the water's surface. In fact, this belief is scientifically supported by the interlinkages between *satoyama* and *satoumi*, such that the health of one can affect that of the other. For example, Miyagi Prefecture suffered from red tides from mid-1960s to mid-1970s due to environmental deterioration, and was forced to conduct mass disposal of oysters. Recognising that it is necessary to have and preserve broad-leaved deciduous forests that contain upstream rivers that flow into Kesenuma bay, plantation activity by Kaki No Mori wo

Shitau Kai (Society for Longing for Forests for Oysters) begun in 1989 under the slogan "forest is a lover of ocean." As a result, forest functions like prevention of sediment discharge and contamination of rivers, and the supplying of clean fresh water and nutrients, are being noted for their favourable effects on oceanic ecosystems.

**5** CRITICAL TO THE SUCCESS of a more integrated and holistic approach to ecosystem management is the creation of a new "commons," understood both as a system of co-management of ecosystem services and biodiversity within private and public land, and as a single system to produce a bundle of ecosystem services for direct and indirect use by society. The new "commons" could provide the basis for sustainable development in both developing and developed countries.

The term "commons" refers to a system of co-management of natural resources, or the natural resources themselves. It may be possible to form commons in various levels, from regional to global. The traditional Japanese method of management like affiliation into *satoyama*, right to water, and fishery rights in *satoumi*, are examples of sustainable management at a regional scale. In Japan, the idea of commons is positioned as a *new public*, within National Spatial Strategies of 2008. The *new public* mentioned here refers to the idea to provide societal services that best suit regional needs through cooperation of local governments and various private sector organisations like NPOS. It would be a societal system for sustaining functions that benefit the public related to ecosystem services provided by *satoyama* and *satoumi*.

This will necessitate the development of a new social contract fostering public consciousness which embraces decentralised, regional and local initiatives that involve government as well as private sector groups such as NPOS and NGOs.

## KEY RECOMMENDATIONS

# What Are the Implications for Policy-makers Moving Forward?



Below are recommended critical next steps to further both our knowledge of *satoyama* and *satoumi* ecosystems and the development of policies – at national and international levels – aimed at strengthening *satoyama* and *satoumi* landscapes in Japan and globally.

**1** DEVELOP POLICIES that take a *satoyama-satoumi* approach in managing biodiversity and ecosystem services. This approach recognises the mosaic composition of ecosystem types and their inherent interlinkages.

**2** THE DESIGN OF NEW INSTITUTIONS under the lens of landscape governance that can manage both public and private lands is needed to govern the new “commons,” allowing decentralised decision making on the use of land and water bodies within a mosaic structure of different ecosystem types.

**3** DESIGN INSTITUTIONS that complement the institutions of the new “commons”, which ensure the equitable access and use of ecosystem services provided by *satoyama* and *satoumi*.

**4** A TEN-YEAR RESEARCH PROGRAMME be established with adequate funding and human resources to gain better understanding of the dynamics of *satoyama* and *satoumi* ecosystems, their linkages, and their relationship with human well-being and biodiversity, which can provide inputs to international assessment processes like the Intergovernmental Panel on Climate Change (IPCC) and the potential new Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).

**5** COMPREHENSIVE, INTEGRATED assessments of potential *satoyama* and *satoumi* ecosystems across a number of developing and developed countries be initiated to establish baselines on ecosystem services, and to form an epistemic community of scholars and practitioners within and across countries who can continue to study and provide guidance to policy-makers on *satoyama* and *satoumi* landscapes.

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## APPENDIX B

# Acronyms, Abbreviations, Figures, and Tables

## ACRONYMS AND ABBREVIATIONS

<b>CBD</b>	Convention on Biological Diversity
<b>COP-10</b>	Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity
<b>COP-MOP 5</b>	Fifth Meeting of the Conference of the Parties serving as the Meeting of the Parties
<b>CR</b>	Critically endangered
<b>EW</b>	Extinct in the wild
<b>EX</b>	Extinct
<b>IICRC</b>	Ishikawa International Cooperation Research Centre
<b>IPBES</b>	Intergovernmental Platform on Biodiversity and Ecosystem Services
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>JSSA</b>	Japan <i>Satoyama Satoumi</i> Assessment
<b>MA</b>	Millennium Ecosystem Assessment
<b>NGO</b>	Non-governmental organisation
<b>NPO</b>	Non-profit organisation
<b>PE</b>	Possibly extinct
<b>RDB</b>	Red Data Book
<b>SGA</b>	sub-global assessment
<b>UN</b>	United Nations
<b>UNU-IAS</b>	United Nations University Institute of Advanced Studies

## CHEMICAL SYMBOLS

<b>NO<sub>x</sub></b>	Nitrogen oxides
<b>SO<sub>x</sub></b>	Sulfur oxides

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## KEY FINDINGS

- 1 MOSAIC COMPOSITION**  
The critical feature of *satoyama* and *satoumi* landscapes is the mosaic composition of different ecosystem types that are managed by humans to produce a bundle of ecosystem services for human well-being.
- 2 DROP IN RESILIENCY**  
*Satoyama* and *satoumi* have undergone significant changes over the last fifty years which have caused a drop in the resiliency of the coupled socio-ecological production systems to provide a sustainable supply of ecosystem services.
- 3 CONSEQUENCES FOR HUMANS AND BIODIVERSITY**  
Continued loss of *satoyama* and *satoumi* landscapes has important and potentially negative consequences for human well-being and biodiversity. There is, however, still a need for more research on *satoyama* and *satoumi* and the contribution they might have in the future for human well-being.
- 4 INTEGRATED INTERVENTIONS**  
Unconnected and piecemeal approaches to address biodiversity change and to protect environmental resources have had only limited success. Integrated approaches including citizen participation have been used increasingly over the past ten years and show potential for reducing biodiversity loss and maintaining sustainable flows of ecosystem services.
- 5 NEW "COMMONS"**  
Critical to the success of a more integrated and holistic approach to ecosystem management is creation of a new "commons," understood as a system of co-management of ecosystem services and biodiversity within private and public land, and as a single system to produce a bundle of ecosystem services for direct and indirect use by society. The new "commons" could provide the basis for sustainable development in both developing and developed countries.

## KEY RECOMMENDATIONS

- 1 TAKE A SATOYAMA-SATOUMI APPROACH**  
Develop policies that take a *satoyama-satoumi* approach in managing biodiversity and ecosystem services. This approach recognises the mosaic composition of ecosystem types and their inherent interlinkages.
- 2 DECENTRALISED DECISION-MAKING**  
The design of new institutions under the lens of landscape governance that can manage both public and private lands is needed to govern the new "commons", allowing decentralised decision making on the use of land and water bodies within a mosaic structure of different ecosystem types.
- 3 EQUITABLE ACCESS AND USE**  
Design institutions that complement the institutions of the new "commons", which ensure the equitable access and use of ecosystem services provided by *satoyama* and *satoumi*.
- 4 TEN-YEAR RESEARCH PROGRAMME**  
A ten-year research programme be established with adequate funding and human resources to gain better understanding of the dynamics of *satoyama* and *satoumi* ecosystems, their linkages, and their relationship with human well-being and biodiversity, which can provide inputs to international assessment processes like the Intergovernmental Panel on Climate Change (IPCC) and the potential new Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).
- 5 ASSESSMENTS WITH A WIDE SCOPE**  
Comprehensive, integrated assessments of potential *satoyama* and *satoumi* ecosystems across a number of developing and developed countries be initiated to establish baselines on ecosystem services, and to form an epistemic community of scholars and practitioners within and across countries who can continue to study and provide guidance to policy-makers on *satoyama* and *satoumi* landscapes.

The JSSA is an experimental exercise for Japanese society that includes local scientists, policy-makers, and practitioners, among others. In order to create a platform for translating scientific knowledge into policy and relevant actions at the local and national levels, it attempts to provide relevant information and useful models for ecosystem capacity assessment.

We hope that the JSSA is a useful vehicle through its findings for stakeholders attempting to promote sustainable development. It is also hoped that the outcome of the JSSA will be a base for future scientific activities that contribute to improving decisions and actions affecting ecosystems and human well-being for future generations.

"I think *satoyama* landscape is a very current concept, because increasingly the global community has been sensitised to the linkage between ecosystem services and human well-being. If you look at the ecosystem services that *satoyama* and *satoyama* like landscapes provide, *satoyama* is a very timely concept to be advanced in today's increasingly urbanized world."

**A. H. Zakri**, Science Advisor to the Government of Malaysia

(Interview conducted at the Asia Pacific Regional Workshop on the *Satoyama* Initiative concept, 1-3 October, 2009, Penang, Malaysia)

"*Satoyama* accounts for approximately 60% of Ishikawa Prefecture's land. A number of spectacular *satoyama* areas still remain in Ishikawa Prefecture. I believe that *satoyama*, as a model of coexistence between humans and nature, is a precious heritage for people in Ishikawa, Japan, and over the world, and it should be passed down to future generations."

**Masanori Tanimoto**, Governor of Ishikawa Prefecture

(Statement at the CBD/COP9 Side Event, 28 May 2008 in Bonn)



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