

# Conservation of *Satoyama* Landscapes for the Restoration of Ecological Integrity of Urban Areas in Japan

Yokohari, Makoto · Kurita, Hideharu · Amati, Marco

Institute of Policy and Planning Sciences, University of Tsukuba

## ABSTRACT

One of the major environmental issues Japanese cities is now facing with is the conservation of semi-natural landscapes for the restoration of ecological integrity of urban areas. The *satoyama* landscape, which includes coppice woodlands, agricultural areas and rural settlements, is seen as an indispensable semi-natural landscape, formed as a result of man-nature interactions. However, because of the loss of the economic viability they are now abandoned and in the process of losing their ecological values. Today a number of local municipalities as well as NPO groups are involved in the conservation projects of these landscapes.

Although *satoyama* landscapes are commonly believed to have maintained their character over the years, historical studies have revealed that these landscapes have experienced constant and dynamic changes due to a variation in human impacts. It is therefore understood that the conservation projects on *satoyama* landscapes should not intend to restore their past condition, but should set the goal of maintaining their dynamic character by promoting ecological roles which the landscapes may play in the contemporary world.

EXPO2005 project in Aichi Prefecture is a good example of a development project underway on *satoyama* landscapes which intend to conserve the landscapes by stimulating contemporary ecological for them. In EXPO2005 project the key issue was the conservation of semi-natural landscapes formed by constant and intensive human impacts over the centuries and thus allowing endemic and endangered species to be accommodated. The planning team proposed a scheme to restore economic viability of *satoyama* landscapes. The scheme involves re-introducing intensive human impacts through a new management system with an innovative technology. This may restore the economic viability of lumbers provided from *satoyama* woodlands. EXPO2005 is understood as a model case which stimulates contemporary ecological functions of *satoyama* landscapes by applying innovative planning concepts.

*Key Words* : *satoyama landscape, satoyama woodlands, Shifting mosaic, EXPO2005, Steam explosion*

## I. PREFACE

It has been more than 40 years since the degradation of the urban environment came to be a major public concern in Japan. Serious problems

such as air, water, and soil pollution as well as explosive growth and disordered urban developments, one of the world's most serious during the 1960s, were dramatically improved during 1970s. When observing major urban areas in

Japan today, it may be difficult to realize that lethal pollutions levels were prevalent in many areas as little as 30 years ago.

However, improvements in their environmental quality do not necessarily mean that urban areas in Japan have achieved an ideal environment. In the face of mounting social concern on wildlife and ecosystems, one of the major environmental issues Japan is now concerned with is the conservation of natural landscapes in and around urban areas. The general public used to regard natural landscapes worthy of protection to be up in the mountains covering almost 70% of the land area of Japan. There is now a realization of the importance of protecting not only such landscapes with virgin nature, but also the conservation of semi-natural landscapes in and around urban areas. *Satoyama* Landscape is one of the indispensable semi-natural landscapes that reflects the history of man-nature interactions, and can be found in and around most of urban areas in Japan.

## II. WHAT IS *satoyama* ?

The term *satoyama* was first defined by plant ecologist Tsunahide Shidei in the early 1960s as coppiced woodlands located near human settlements and maintained for harvesting litters, firewood and charcoal (Shidei, 2000). However, today, the term “*satoyama*” is commonly understood to represent not only such woodlands but also bushes, agricultural areas and rural settlements that surround the woodlands. To avoid further confusion the term “*satoyama*” in this paper is defined as follows;

1. *Satoyama* woodland: A coppiced woodland located near human settlements and maintained for harvesting litters, firewood and charcoal

2. *Satoyama* landscape: A landscape that includes *satoyama* woodlands, as well as bushes,

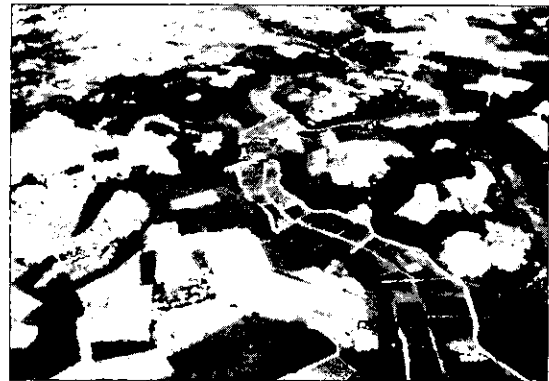


Figure 1. A typical scene of *satoyama* landscapes in eastern Japan (Kashima, Ibaraki)(© T. Okunuki)

agricultural areas and rural settlements that surround the woodlands

Figure 1 is a typical view of a *satoyama* landscape in eastern Japan. Tree species representing coppiced woodlands are deciduous broad leaf trees including *Quercus serrata*, *Quercus acutissima*, and *Carinus tshonoskii*, as well as coniferous trees including *Pinus densiflora*. In most *satoyama* landscapes trees from the coppiced woodlands were harvested every 20 to 30 years and utilized as firewood and charcoal, while litters on the forest bed were collected regularly and utilized to make leaf-based fertilizer. Such intensive use of coppiced woodlands resulted in a well-maintained landscape as seen in Figure 2. Bushes and



Figure 2. A typical scene of the interior of well-maintained *satoyama* woodland (Hiki hills, Saitama)

agricultural areas were also well maintained by undergoing intensive human impacts. It is therefore widely understood that constant and intensive man-nature interactions have created *satoyama* landscapes, and that wildlife species accommodated by *satoyama* landscapes, such as *Erythronium japonicum*, have been thoroughly dependant on human impacts (Kamada and Nakagoshi, 1996, Moriyama, 1988). Therefore, the loss of the intensive human impacts inevitably results in the loss of *satoyama* landscapes' identity.

However, because of the diffusion of fossil fuels and chemical fertilizers after World War II, *satoyama* landscapes have significantly lost their economic viability and consequently been abandoned over several decades. Today, a deteriorated landscape with illegally dumped garbage and overgrown weeds is the most commonly observed *satoyama* landscape in and around urban areas (Figure 3). Such abandonment also resulted in the deterioration of these landscapes' ecological functions. A number of plant and animal species, which characterized *satoyama* landscapes, such as *Erythronium japonicum*, are now under the threat of extinction.

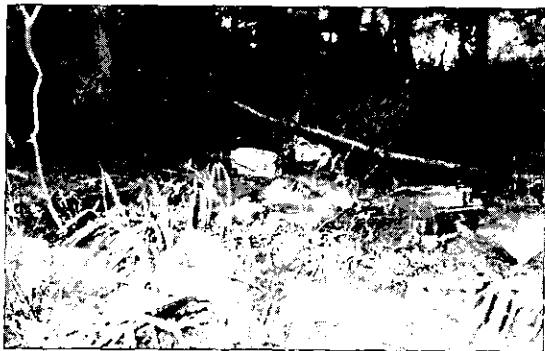


Figure 3. Illegally dumped garbage surrounded by overgrown weeds in abandoned *satoyama* woodland (Tsukuba, Ibaraki)

### III. HISTORICAL OVERVIEW OF *satoyama* LANDSCAPES

It is almost a common belief in Japan that *satoyama* landscapes maintained the same character and appearance over the centuries until they were abandoned a couple of decades ago. In fact, local municipalities and NPO groups often set the target of their conservation projects to be to restore *satoyama* landscapes as it used to be before the war, and try to 'freeze' the target landscape for as long as possible by reviving traditional maintenance processes.

However, recent studies on the history of *satoyama* landscapes have revealed their dynamic character. Tamura (1994) investigated *satoyama* landscapes in Hiki Hills, Saitama Prefecture, and identified dynamic changes both in the vegetation of *satoyama* woodlands and land use patterns. He concluded that the landscape which is generally believed to be endemic to the area over the centuries (Figure 4) was in fact formed after the Meiji Restoration and lasted only for a couple of decades until the use of fossil fuels and chemical fertilizers became diffused. *Satoyama* landscapes before the Meiji Restoration included vast bush and grassland areas for harvesting fodder and straw, while most of



Figure 4. A typical scene of the *satoyama* landscapes on Hiki hills, Saitama

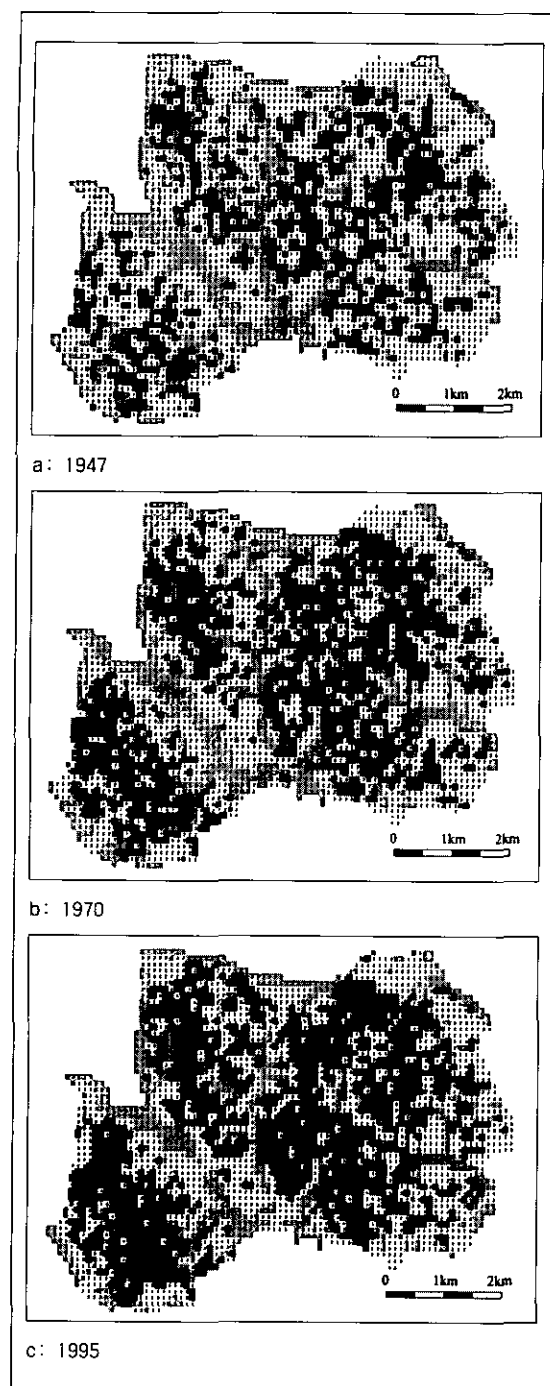


Figure 5. Land use and vegetation patterns of satoyama landscapes on Hiki hills in 1947, 1970 and 1995

Legend: **8**: dense woodland; 7: sparse woodland; 6: bush; **5**: grassland; 4: water; 3: built-up 2: crop field; **1**: paddy field

the mulberry orchards, regarded today as one of the key landscape elements of the area, were planted only after the Meiji Restoration.

Kurita and Yokohari (2001) studied the land use and vegetation changes of Hiki hills during the last 50 years by analyzing aerial photographs taken in 1947, 1970 and 1995. Figure 5 illustrates land use and vegetation patterns of *satoyama* landscapes on Hiki hills in the three time periods. In 1947 paddy fields dominated most of the valleys in the area, while a mosaic of dense woodlands, sparse woodlands, bushes, grasslands and crop fields can be identified on the hills surrounded by the valleys. The aerial photographs show wooded areas which were identified as dense coppiced woodlands characterized by *Quercus serrata* and *Pinus densiflora*. Sparse woodlands and bushes were both estimated to be patches that were dense woodland but have since been clear cut for harvesting firewood and charcoal, approximately 10 years ago for sparse woodlands, and around 5 years ago for bushes.

As Remmert (1990) and Ide (1992) note, the mosaic of patches with diverse vegetation types, shifting both spatially and periodically, is a landscape pattern that characterizes rural landscapes. The mosaic identified on the Hiki hills in the 1947 images is a typical example of such a landscape pattern.

Between the 1947 scene and that of 1970 in the Figure 5, significant differences are identified especially on the hills. First is the increase of dense woodlands, against the decrease in sparse woodlands and bushes. Because of the loss in economic viability woodlands and bushes in the study area came to be abandoned in 1950s. The absence of human impacts on the woodlands caused ecological succession to take place in sparse woodlands and bushes, and consequently turned

them into dense woodlands. The mosaic of diverse patches, which used to characterize *satoyama* landscapes in Hiki, has been significantly affected in the space of two decades by the absence of intensive human impacts.

Another significant difference between the situation in 1947 and 1970 is the increase of large grassland patches on the hills. These patches are golf courses developed mostly in 1960s. Deforestation is generally regarded to be the most negative impact on *satoyama* landscapes from golf courses. However, it is obvious from Figure 5 that golf course developments on Hiki hills between 1947 and 1970 took place mostly on the hills which used to be covered with bushes and/or grasslands. Only a limited amount of *satoyama* woodlands were part of the development sites. Golf courses on the Hiki hills, developed during 1960s did not therefore deteriorate the ecological integrity of *satoyama* landscapes through deforestation.

The changes in land use and vegetation between 1970 and 1995 are not very significant. Sparse woodlands and bushes can hardly be identified in the 1995 scene, while dense woodlands and grasslands (golf courses) dominate most of the hills. What is significant for this period is the sharp increase in urban land use. The wave of urbanization from Tokyo has finally reached Hiki hills, approximately 40km north of Tokyo, during this time.

Figure 6 is a diagram which illustrates the changing patterns of land use and vegetation in the studied area. It is obvious from the figure that dense woodlands have significantly increased (15.7% in 1947, 25.2% in 1970 and 31.0% in 1995), while other vegetation types as sparse woodlands and bushes, which used to cover the hills, have sharply decreased. This fact clearly indicates that the diversity in vegetation types decreased and thus a dominance of dense and abandoned woodland

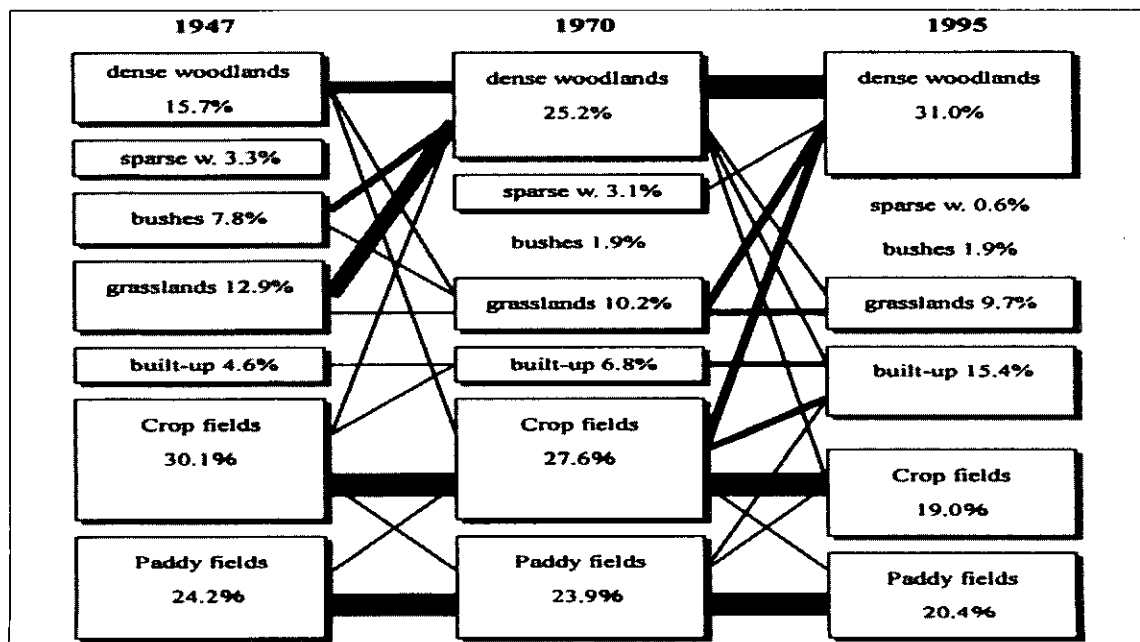


Figure 6. Changing of pattern land use and vegetation of the Satoyama landscapes on Hiki hills

◆ : 300pixels over; ➤ : 200~299pixels; ➡ : 100~199pixels; → : 50~99pixels

patches and large grassland patches -mainly golf course- were established. The diagram also indicates that the “shifting mosaic” pattern of various vegetation patches which used to be the identity of *satoyama* landscapes of Hiki hills has disappeared from the area, and that land use and vegetation has significantly stabilized.

According to the studies by Tamura (1994) and Kurita and Yokohari (2001), it may be concluded that spatial and periodic changes of diverse land use and vegetation types due to intensive human impacts have been the most significant characteristic which allowed *satoyama* landscapes to be identified. Such a diverse and dynamic character of the landscapes has almost been lost in the recent two decades because of abandonment. These studies also suggest that the conservation of *satoyama* landscapes should be based on the concept of conserving the diverse and dynamic character of the landscapes.

#### IV. CASE STUDY: EXPO2005 IN AICHI, JAPAN

Diverse and dynamic character of *satoyama* landscapes has been maintained by constant human interventions motivated by economic and social requirements. The loss of economic viability brought abandonment of *satoyama* woodlands, which resulted in the degradation of ecological integrity of the landscapes. To restore such ecologically deteriorated *satoyama* landscapes, a number of local municipalities as well as NPO groups in Japan are now maintaining *satoyama* landscapes for the sake of preservation/conservation of wildlife and ecosystems. However, no matter how active they are it is obvious that the amount of *satoyama* landscapes which may be maintained by such voluntary activities is quite limited. Most of

*satoyama* landscapes, especially those found in the fringe of urban areas, will remain abandoned and be regarded as the areas waiting for future developments. Introduction of modern economic values of *satoyama* landscapes should therefore be the key issue for the sustainable future of the landscapes. The conceptual plan proposed for the conservation of *satoyama* landscapes in the EXPO2005 site is a plan which aims to restore abandoned *satoyama* woodlands by enhancing contemporary values the woodlands may have.

#### 1. What is EXPO2005?

EXPO2005 is an international exposition which will be held in Aichi Prefecture from April to September of 2005. In total 18 million people are expected to visit the event. The proposed site for the EXPO consists of two major areas, both located on the hills with *satoyama* woodlands. The largest area, 550 ha, is commonly known as “Kaisho-no-mori (Kaisho woodlands)”, located 30 km east of Nagoya, the third largest city in Japan with approximately three million population (Figure 7).

The original plan of the EXPO, submitted in 1997, was to develop the hills for 150ha and construct a huge building complex named “Eco-city”, which accommodated exhibition arenas, bus terminals, energy generation plants, and waste treatment plants (Figure 8). However, this original plan had to be revised because the proposed site for the EXPO maintained vast *satoyama* landscapes scarcely found in the suburbs of densely populated urban areas, and thus several endemic and endangered plant species were identified in the area. The key question for the revision was the way to conserve *satoyama* landscapes with precious nature by accommodating major urban development in the area.

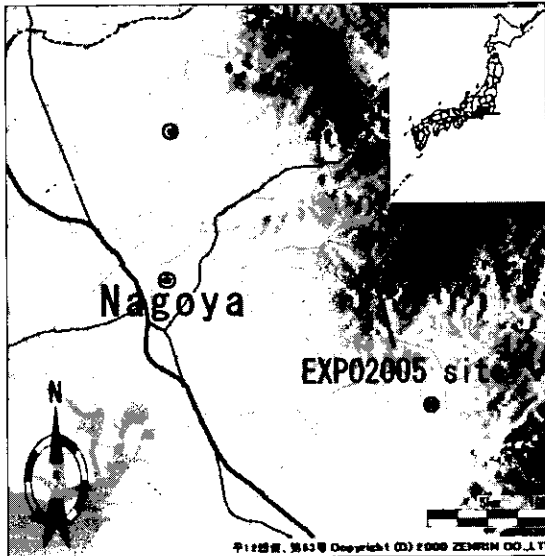


Figure 7. Location of the proposed site for EXPO2005

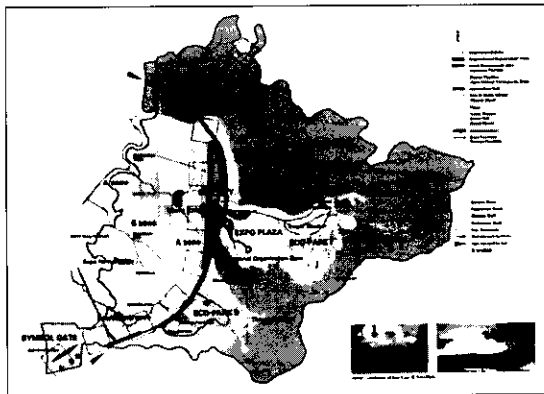


Figure 8. The original plan of EXPO2005 submitted in 1997

By reflecting extremely detailed surveys on flora and fauna, the revised basic plan, submitted in September 2000, aims to protect habitats of endemic and endangered species and minimize negative impacts on the surrounding landscapes by significantly reducing development areas in Kaisho woodlands and moving most of exhibition arenas to the area adjacent to Kaisho woods (Figure 9).

## 2. Conceptual Management Plan for the Conservation of *satoyama* Landscapes

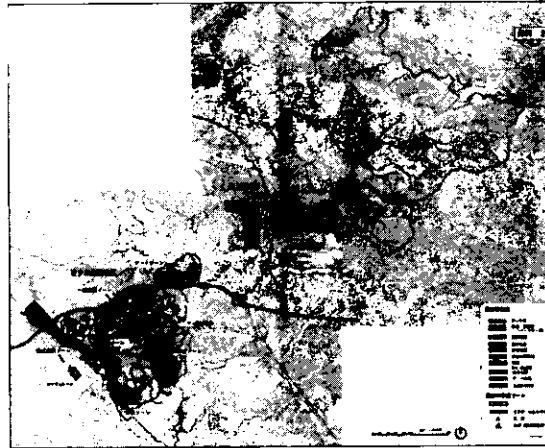


Figure 9. The revised plan of EXPO2005 submitted in 2000

*Satoyama* landscapes in the proposed site are the landscapes created by intensive and constant human disturbances including periodic clear cut of woods. Seto, the nearest city from the site, has been one of the largest ceramic industry cities in Japan since feudal era, and the industry thoroughly relied on the firewood provided from the surrounding *satoyama* woodlands until petroleum has taken over. About 50 years ago the hills where the EXPO site is planned were nearly bare due to such intensive use. However, nutrient-poor soil as a result of such intensive use and the abandonment of the area over 50 years have ironically created precious *satoyama* landscapes with marshy meadows where endemic and endangered species including *Magnolia stellata* can be found.

Referring to such history of the area, it is understood that constant human disturbances are necessary to conserve the identity of *satoyama* landscapes on the proposed EXPO site. If the landscapes will be abandoned for another several decades, soil may gradually become fertile and existing plant species shall be replaced by other species suitable for more fertile soil. However, several questions are raised regarding the

conservation of the landscapes. The most fundamental question is the concept of the target landscape. Should we refuse human disturbances and let the succession proceed until the landscapes reach their climax? Should we introduce human disturbances to maintain the existing landscapes? If there is a “third” option for the target landscape, what is it? Then, if the second or third option is chosen there will be another question; what kind of human disturbances should be introduced?

To meet these questions the EXPO planning team proposed a conceptual program which nominated a series of *satoyama* management schemes (EXPO2005 committee, 1999). The intention of the program is to let landscapes with different target images co-exist on the site so as to seek for optimum management schemes. Another feature of the plan proposed by the planning team is the introduction of a new technology called the steam explosion, which utilizes woods harvested from *satoyama*. The steam explosion is a technology, currently under experiment, that decomposes woods into tissues, and then molds them again into particleboard by carefully controlling pressure and temperature. The technology is expected to restore the economic value of thin and bent woods provided from *satoyama* which cannot be sawed up into lumbers. The program also includes volunteer-based non-profit programs, which constantly disturb wooded hills for the sake of the conservation of existing landscapes and the protection of endangered wildlife species.

### 3. Preservation of Endemic and Endangered Species

The western one third of the proposed EXPO site is on gravel sediments which have granite

bedrock as an under layer. Because of this geological formation a series of small marshy meadows, mostly around 100 square meters or less,



Figure 10. A typical marshy meadow found in Kaisho woodlands

are found in small valleys on the site (Figure 10). These meadows accommodate endemic and endangered species as *Magnolia stellata*.

However, the marshy meadows are quite dynamic in their succession process. They are formed mostly by natural disturbances including landslides caused by storm water, become habitats of species suitable for nutrient-poor wet environment, and gradually succeed toward dry meadows due to the accumulation of nutrients and sediments. Therefore, endemic and endangered species, which require nutrient-poor wet environment, can be called as nomads wandering around the site searching for nutrient-poor marshy meadows. Such species cannot be preserved simply by protecting marshy meadows in the present form.

For the preservation of endemic and endangered species the planning team is proposing to apply the concept of “no net loss”, which does not necessarily aim to protect existing plant bodies but aims to preserve the net amount of the gene of target species on the site. To realize this concept, both the conservation of “potential valleys” (valleys where



marshy meadows may be formed in the future) and the creation of nutrient-poor marshy meadows are included in the program.

#### 4. Inviting People into *satoyama*

For the sustainable future of *satoyama* landscapes not only the economic viability of the landscapes but active man-nature interactions must be restored. *Satoyama* should not be a sanctuary only for scientists, naturalists and/or bird watchers, but should be a place where ordinary citizens can also appreciate the joy of *satoyama* landscapes.

To meet such requirement the planning team proposed a network of horizontal corridors. This is a network of pedestrian trails without vertical fluctuation which may invite people into *satoyama* woodlands (Figure 11). Corridors are mostly located on the ground by following contours, while some parts are elevated, trenched, tunneled, and bridged so that visitors can enjoy the view of wooded hills from various perspectives. Corridors that continue horizontally may also ensure easy and comfortable access for handicapped and elderly visitors.



Figure 11. A network of horizontal corridors  
(© S. Miyagi)

Although the network of horizontal corridors is expected to attract visitors by providing views that cannot be experienced in their daily life or by ensuring easy and comfortable access, interpretation programs that convey the joy of wooded hills should also be introduced to enhance such attractions. The appearance of wooded hills in the proposed EXPO site is not outstanding but rather mediocre. Interpretation programs that explain what to see, what are important, and what we should/should not do to protect nature are therefore necessary. The planning team proposes to hold a series of educational programs for citizens as pre-EXPO events to inspire public interest on the EXPO, and to nominate citizens who may become voluntary interpreters during the EXPO.

#### V. CONCLUSION

Ecological and social conditions assigned to the *satoyama* landscapes, which used to exist before the war but deteriorating due to abandonment, are now re-evaluated and the need to preserve such landscapes is advocated. However, we should not forget the fact that the identity of *satoyama* landscapes is in their dynamic character. *Satoyama* landscapes constantly changed their appearance by reflecting the changes in human impacts. What people today believe as inherent and eternal is only a cross section of the history of their dynamic changes. Preserving/restoring *satoyama* landscapes, by having the landscape before the war as the target, may ensure the existence of some endangered species, but may terminate their dynamic character.

What should be discussed for the sustainable future of *satoyama* landscapes is the way to maintain their dynamic character by restoring intensive interactions between man and the landscapes. The landscapes should not be kept in the

museum as a memory of the past but should be kept alive by applying contemporary technologies and programs. Flora, fauna and the appearance of the landscapes may change. There could be a chance that some endangered species extinguish. In some cases even developments such as new towns and golf courses have to be accepted. But we have to understand that the future of *satoyama* landscapes can only be prospected by accepting such dynamic changes which reflects the contemporary roles the landscapes may play. No "win-win theory" can be applied for the conservation of *satoyama* landscapes. It is indeed a double-edged sword.

## REFERENCES

1. EXPO2005 Committee(1999) Annual report of the EXPO2005 Environment Planning Team. P. 329.
2. Ide, M.(1992) Ecological studies on the rural landscape patterns for the conservation of biotopes. Bulletin of the Laboratory of Landscape Architecture and Sciences. The University of Tokyo 11. pp. 120.
3. Kamada, M, and Nakagoshi, N.(1996) Landscape structure and the disturbance regime at three rural regions in Hiroshima Prefecture, Japan. Landscape Ecology 11(1): 15-25.
4. Kurita, H., and Yokohari, M., (2001) Ecological potentials of golf course on hills for the conservation of *satoyama* landscapes. Journal of the Japanese Institute of Landscape Architecture 64 (5): 589-594.
5. Moriyama, H.(1988) What is the activity we call nature protection? Nosangyoson Bunka Kyokai. Tokyo. p. 260.
6. Remmert, H.(1990) The Mosaic-Cycle Concept of Ecosystems -An Overview. in Remmert. H (edit). The Mosaic-Cycle Concept of Ecosystems. Springer-Verlag. Berlin. pp. 1-21.
7. Shidei, T.(2000) About *satoyama*. Bulletin of the Association of Nature Protection. Kansai 22 (1): 71-77.
8. Tamura, S.(1994) Floras of magusaba and magusaba-originated secondary forests. Bulletin of Natural History Museum of Saitama 12: 73-82.

---

Accepted August 31, 2001

Refereed by Japanese Institute fo Landscape Architecture(JILA)