Study about forest management planning by CSR activities: a case study of the Kishiwada Hilly Development District in Japan

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Abstract. The objective of this study was to clarify the method of forest activities of CSR for collaboration between companies and local communities, focusing on the Kishiwada Hilly Development district in Japan. The research method is mesh analysis by GIS, a questionnaire, interviews and a field survey. First, this area was subdivided as divided into 2625 meshes, and each of the meshes was evaluated via the natural conservation importance index and recreational usability index. Second, we examined the zoning estimation method based on spatial characteristics and the difference in human activities. Third, we identified the beliefs and challenges for CSR forest activities by the four companies participating in forest activities in the study area. The result was, first, bamboo forest accounts for 26.2%, such as forests without administrators. Second, suitable forests for recreation totalled 52.3%, occupies a majority of the land. Third, the purpose of participation in corporate forest-making activities varied depending on the departments. A common problem was a lack of knowledge regarding forest management. In conclusion, these findings suggest that the development of forest management plans considering the needs of CSR forest activities and the conditions throughout the region would improve the resilience and the benefits of Satochi-Satoyama.

Keywords: CSR, GIS, Kishiwada Hilly Development District

1. Introduction

Recently, regarding resilience, socio-ecological production landscapes (SEPLs) have attracted attention. SEPLs are shaped through long-term harmonious interactions between humans and nature in a manner that fosters well-being while maintaining biodiversity and ecosystem services [1][2]. Moreover, after the Natural Capital Declaration by the UNEP FI, natural environment conservation activities and community contribution activities are becoming more important for companies.

In Japan, since the 1960s, most community woodlands, namely “Satochi-Satoyama”, have faced conservational problems, such as a decrease in area and an increase in abandonment. The social background for why forests are no longer managed includes the fuel revolution, changes in industrial structure, increasing depopulated areas, and a lack of personnel that support local industries. In addition, as public eco-awareness increases, people reaffirm the importance of the environmental conservation benefits and amenity benefits that Satochi-Satoyama provides. Some companies in Japan are trying to regenerate the environment of Satochi-Satoyama as part of their corporate social responsibility (CSR) activities. Although they are aiming to restore and use Satochi-Satoyama as natural, cultural, and
recreational resources, many challenges remain for companies due to often lack the viewpoint of adaptive management of the natural environment. The objective of this study was to clarify the method of forest activities of CSR and construct a land use model for collaboration between companies and local communities, focusing on the Kishiwada Hilly Development district in Japan.

2. Material and Method
The study area, the Kishiwada Hilly Development district, is included in the hill region of the city of Kishiwada, Osaka Prefecture in Japan. The study district is about 159.0 ha and contains a housing development project district with the aim of restoring Satochi-Satoyama. In the period of high economic growth, some regional development was planned, but this business collapsed following the burst of the economic bubble. For that reason, forests and land without administrators remained. In Osaka Prefecture, the administrative and municipalities introduce groups and forest owners who want forestry activities, as the system of adopt forest. The research method was as follows. First, the study area was divided into 25 m × 25 m mesh, with 2625 meshes extracted via a geographical information system (ArcGIS ver. 10.3) [3, 4, 5]. Each of the meshes was evaluated via the natural conservation importance index and recreational usability index. Both these indices include vegetation naturalness and type, micro topographic features, slope, distance from facility, water area, mountain ridge, and view area. The collected data were reclassified through each indicator referring to previous research.

Second, we examined the zoning estimation method based on components of spatial characteristics [6, 7]. Applying the future land use plans to forest management based on the difference in human activities, four thematic maps were generated. They were based on a score from 1 to 4 points by weighting how much each indicator was overlaid. The four types of multiple forest management were recreation, environmental learning, ecological, and landscape formation. In addition, two types of land use model were developed by weighting the results of the integrated maps. Maps of the land use models were created to identify area preferences and values, from the perspectives of the conservation of the landscape and the promotion of recreational use.

Third, to identify the beliefs for CSR forest activities by the four companies participating in forest activities in the study area, a questionnaire survey was conducted. The main items in each survey were the factors for participating in CSR forest activities, form of participation, actual situation of activities, and future problems and issues. Interviews were also conducted with the company and relevant organizations, NPOs, and the local government (from 9th to 16th, November 2015). They were specifically about the needs and seeds of each stakeholder. In addition, a field survey was conducted based on the map created in the second step.

3. Result and Discussion
3.1. Evaluation of meshes via GIS (Table 1, Table 2)
The study district is located at the foot of the mountain north of Kono-yama in the city of Kishiwada, the ridges of which are seen throughout the district. The altitude, including the area around the district, is 42.5 to 295.8 m, with the high section on the south side. Regarding the area, 63.9% is sloping more than 5° (Table 1). After dividing the 29 ground vegetation zones into 11 types, bamboo forest accounts for 26.2% of this area (Table 2). Deciduous forests comprise 16.8% and evergreen forests 1.2%. The district has two main roads: one east to west and one north to south. In the entire district, a narrow path has supported the survival of Satochi-Satoyama. Ponds and waterways for agriculture comprise 17.1%.
3.2. Land use modeling

3.2.1. Evaluation of future forest type (Table 3)

A land use model was constructed by considering the current situation and future land use in adaptive management of forests. Forest for recreation was evaluated by utility and vegetation type. The utility is combining the slope and distance from facilities. A suitable recreation rank I comprised 447 meshes (17.0% of the area), which were distributed in the north and west. Rank II, which is easy to utilize for recreation, comprised 927 meshes (35.3%) and was distributed throughout the district.

Forest for environmental learning was evaluated by biodiversity and distance from facilities. The biodiversity is combining the vegetation naturalness and water area. A suitable environmental learning rank I, with high biodiversity, comprised 322 meshes (12.3%). The meshes are distributed around the valley. Rank II for environmental learning, which is easy to access and expected to improve biodiversity, comprised 583 meshes (22.2%). These meshes are distributed along the agricultural waterways and in the western part of the district.

Ecological forest was evaluated by combining the vegetation naturalness and micro topographic features. Rank I of this type, which has high vegetation naturalness and soil that is rich in nutrients, comprised 141 meshes (5.4%) and was distributed in the north. Rank II, with the prospect of recovery of the ecosystem, comprised 950 meshes (36.2%), distributed along the valleys.

Forest for landscape formation was evaluated by combining the view area, mountain ridge, and vegetation type. Rank I, such as deciduous forests that enjoy high seasonality and high visibility, comprised 426 meshes (16.2%). Rank II, of which the visibility is low but located near the ridge, comprised 1018 meshes (38.8%). Both ranks of landscape formation forest are distributed from the southwest to the north.

3.2.2. Construction of land use models (Table 4, Table 5, and Figure 1)

These results (3.1.1.) were integrated from the perspective of the conservation of landscapes and the promotion of recreational use [8], [9]. From the viewpoint of conservation, we applied the biosphere reserve (BR) of UNESCO’s Man and the Biosphere Program. The results were divided into three zones: the core zone, which is important for conserving biodiversity; the buffer zone, which surrounds the core zone; and the transition zone, which requires policies that are in harmony with environmental conservation. The core zone was composed of 380 meshes (14.5%) and located high visibility northern and valley lines, near the main road. The buffer zone included 1017 meshes (38.7%) (Table 4).

However, from the viewpoint of recreational use, emphasis was placed on the suitability for active use of the Satochi-Satoyama. The area targeting the recreation forest type totaled 1374 meshes (52.3%), occupies a majority of the land, and is distributed in a mosaic pattern throughout the entire area, including the northern part, which has high visibility (Table 5).

| Table 1. The Slope Level of Study area |
|---------------------------------------|
| degree | level (e.g.) | mesh | %    |
| 0~3  | easy to walk, cycling | 340 | 13.0% |
| 3~5  | experience and activity in nature | 606 | 23.1% |
| 5~7  | hiking, sleigh ride | 592 | 22.6% |
| 7~9  | mountain climbing | 480 | 18.3% |
| 9~11 | total | 336 | 12.8% |
| 11~13| sleigh ride | 104 | 4.0% |
| 13~15| mountain climbing | 76 | 2.9% |
| 15~17| total | 52 | 2.0% |
| 17~19| mountain climbing | 19 | 0.7% |
| 19~27| total | 20 | 0.8% |
| total| 2625 | 100.0% |

| Table 2. The Zone types of Ground Vegetation |
|---------------------------------------------|
| zone types | mesh | %    |
| deciduous forest | 442 | 16.8% |
| evergreen forest | 31 | 1.2% |
| plantation | 17 | 0.6% |
| wet grassland | 4 | 0.2% |
| drying grassland | 619 | 23.6% |
| bamboo forest | 687 | 26.2% |
| cultivated land | 419 | 16.0% |
| artificial grassland | 43 | 1.6% |
| artificial structures | 91 | 3.5% |
| bare land | 270 | 10.3% |
| waters | 2 | 0.1% |
| total | 2625 | 100.0% |
3.3. CSR Evaluation

3.3.1 Evaluation of CSR activity area (Table 6)

The K company activity area was 20.2% for slopes below 6° and 42.3% for slope of 6° to 18°. Approximately 60% are these slopes afford easy operation, so recreation is expected to be utilized. Currently, forest maintenance, such as moving and bamboo cutting, is proceeding in 46.6% of these areas. However, bamboo forest accounts for nearly half, at 47.8%. Part of the area will be utilized as managed bamboo forest; otherwise, it would be necessary to switch to deciduous forest.

The O bank’s activity area was 17.8% for slopes less than 6° and 51.1% for slopes of 6° to 18°. It accounted for nearly 70% of active slopes. Currently, forest maintenance is carried out in 42.5% of these areas. As 39.6% are vacant open spaces like those of the K Company, recreation is expected to be utilized in a wide range, mainly in the open space.

The H company activity area was 27.7% with a loose slope less than 6°. Most of it is distributed to the east side of the route and is expected to be utilized as an activity base, such as like a plaza. On the west side of the street, there were almost steep slopes above 18°. However, owing to the distribution of deciduous forests, these areas are expected to be utilized as environmental learning forest via forest maintenance and management activities.

Regarding the S company activity area, bamboo forest comprised 51.5%. To consider recreational use, it is necessary to switch to deciduous forest in a wide range. In addition, 61.2% accounted for steep slopes of 18° or more. However, it is also expected to be used as a place for environmental learning, such as by using ponds in the active area, and by improving the roadside in the forest.
### Table 6. The Evaluation of CSR Activity area

| name (sector) | area (ha) | slope | vegetation (e.g.) | recent activity (work area) | forest rank (e.g.)* |
|---------------|-----------|-------|-------------------|-----------------------------|---------------------|
| K Co., Ltd. (Other Products) | 0.89 | 6°> 20.2% bamboo | 47.8% planting, mowing, conservation b.| bamboo cutting | 6-18° 42.3% vacant (46.6%) recreation (others) |
| O Bank (Banks) | 0.8 | 6°> 17.8% vacant | 40.6% bamboo cutting, conservation b., c. | bamboo recreation activity | 6-18° 51.1% bamboo (42.5%) visibility (I, II, VII) |
| H Co., Ltd. (Other Products) | 0.84 | 6°> 27.7% deciduous | 44.0% planting, mowing, conservation b., c. | bamboo cutting | 6-18° 19.7% evergreen (23.2%) recreation IV, II, I |
| S Co., Ltd. (Pharmaceutical) | 0.45 | 6°> 11.6% bamboo | 51.5% mowing, conservation b., c. | bamboo cutting | 6-18° 18.9% deciduous (17.9%) visibility II, III |

| name (sector) | area (ha) | slope | vegetation (e.g.) | recent activity (work area) | forest rank (e.g.)* |
|---------------|-----------|-------|-------------------|-----------------------------|---------------------|
| K Co., Ltd. (Other Products) | 0.89 | 6°> 20.2% bamboo | 47.8% planting, mowing, conservation b. | bamboo cutting | 6-18° 42.3% vacant (46.6%) recreation (others) |
| O Bank (Banks) | 0.8 | 6°> 17.8% vacant | 40.6% bamboo cutting, conservation b., c. | bamboo recreation activity | 6-18° 51.1% bamboo (42.5%) visibility (I, II, VII) |
| H Co., Ltd. (Other Products) | 0.84 | 6°> 27.7% deciduous | 44.0% planting, mowing, conservation b., c. | bamboo cutting | 6-18° 19.7% evergreen (23.2%) recreation IV, II, I |
| S Co., Ltd. (Pharmaceutical) | 0.45 | 6°> 11.6% bamboo | 51.5% mowing, conservation b., c. | bamboo cutting | 6-18° 18.9% deciduous (17.9%) visibility II, III |

* c.: core zone, b.: buffer zone, t.: transition zone

#### 3.3.2. Companies recognition for CSR forest activities

In corporate forest-making activities, the purpose of participation varied depending on the departments in charge of the CSR activities. For the O bank, which had a special CSR department in charge of the activities, the purpose of participation was to raise interest in environmental problems. Regarding the H Company, whose general affairs department was responsible for their CSR activities, the purpose of participation was to improve employees' ability and welfare benefits. The General Affairs Department/Environmental Affairs Department of the K Company was in charge of the CSR activities, with the purpose of participating to improve the environmental awareness of the company’s employees and to improve the ability. Three companies other than H Company were the in-house commemoration of the founding ceremony etc. as a trigger to participate in the activity.

The reason for choosing the location of a CSR activity is that the K Company is closer to its headquarters, and the O bank is located closer to its branch offices. Besides, a roadside station (Aisai-land by Japan Agricultural cooperatives) was the base of activities. In the form of participation, the K Company established a new payment system for activities and was supporting the CSR activities. Meanwhile, the other three companies participated in in-house events and training. The O bank also saw activities by circles by employees in the company.

The current activity content was common to the four companies. It was a recreational activity with bamboo cutting and grass cutting, with assistance from NPOs. For the degree of satisfaction of the activities, the K Company and the O bank obtained the expected effect. However, the H Company had a short activity period, so the current satisfaction level was low. Future activities and future images are expected to be diversified by the recreation through the collection of fruit trees and the observation of nature. A common problem of the present situation was a lack of knowledge regarding Satochi-Satoyama and forest management. Two companies, the K and H companies, replied that they cannot imagine the future in five years or the image of ideal Satochi-Satoyama. The challenge is to share knowledge by collaborating with other companies, unifying the management goals of the district, and sharing the roles of each activity area. On the other hand, the S company is hoping for cooperation from local governments and NPOs, it was reluctant about direct interaction among companies.

Evaluation by local governments and NPOs was mentioned as a merit that local governments does not cost the administrative expense of the land, and NPOs can obtain the reward by guidance.

It can be said that forestation is an attractive activity for companies as an approach to CSR, as it can meet social needs and nurture employees through such activities. On the other hand, it is also difficult to participate without a chance. It is expected that the number of participating companies will increase by local governments positively attracting companies and creating opportunities for forest-making activities. In the future, cooperation of local governments and NPOs will be necessary to implement satisfactory forest making for both companies and regions. Furthermore, it is also vital that firms that are the subject actors focus on the future image of the forests and clarify management policy. In addition,
local governments have grasped the current state of the entire district and found that it is important to systematically implement forest making that responds to corporate intentions. In the future, as the value of CSR activities within each company is recognized, it should be said that companies actively engage in CSR activities and revitalize forests.

4. Conclusion
In this study, we tried to search for possibilities of collaboration between companies and local communities in adaptive management of forests, from the perspective of CSR activities. From the result and discussion, however there are many bamboo forests left unmanaged now, it would be possible to switch to deciduous forest. Second, from the viewpoint of conservation, the land use models was distributed combining three zoning pattern throughout the entire area. Then suitable forests for recreation totaled 52.3%, occupies a majority of the land. Third, the purpose of participation in corporate forest-making activities varied depending on the departments. Even though there are differences included the reasons for their participation and the forest types of activity areas, a common problem of forest activities was a lack of knowledge regarding forest management.

These findings suggest that the development of forest management plans and processes considering the needs of CSR forest activities and the conditions throughout the region would improve the resilience and the benefits of Satoyama [10, 11]. Furthermore, by cooperating with various management entities, both adaptive and long-term strategies should be taken in CSR forest management for the recovery of forest ecosystem services.

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