

A case study of treating on an abandoned coppice of a local hospital to rehabilitate and recreation purposes

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Abstract: This paper shows a case where a hospital-owned secondary forest of broad-leaved trees, which had been abandoned for more than 30 years, was developed for patients' rehabilitation and recreation at a regional hospital in Tokyo. The survey site is Ongata Hospital and its forest (approximately 6 ha) located in suburb of Hachioji City. The owned forest is mainly a secondary forest of broad-leaved trees. The tree layer consists of trees such as *Quercus serrata*, *Q. acutissima*, and *Castanea crenata*, as well as *Zelkova serrata*, *Celtis sinensis*, and *Magnolia obovata*. The forest floor is thriving with *Sasamorpha borealis*. As of September 2020, the tree density before maintenance was around 4,000 to 6,000 trees per a ha, and the average relative light intensity in the forest was around 5%. Clearing and thinning work on this forest block began in October 2020 and continued until September 2022. The tree density decreases to 1,500 trees/ha in 2021 and to 300 to 500 trees per a ha in 2022. The average relative illuminance improved to around 15 to 30%. The number of confirmed tree species on the forest floor was around 40. The thinned wood was used to create rest benches, walking paths and occupational therapy of patients.

Key-words: secondary forest, thinning, *Sasamorpha borealis*, forest therapy, Hachioji City

地域病院所有の広葉樹二次林を保健休養目的に整備した事例

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要旨: 本研究は、約30年放置されてきた病院所有の広葉樹二次林に数回の間伐を実施した結果、どのようにその森林環境が変化し、保健休養の環境として提供できるかを調べることを目的におこなった。調査地は、東京都八王子市に位置する恩方病院とその所有林（面積約6ha）である。同林は、広葉樹二次林が主体であり、高木層はコナラ、クヌギ、クリ、ケヤキ、エノキ、ホオノキなどで、林床にはスズタケが多く繁茂していた。2020年9月時点での整備前の立木密度は4000~6000本/ha前後、林内の平均相対照度は5%前後であった。同林において除伐および間伐作業を2020年10月より開始し、2022年9月まで行った。立木密度300~500本/ha程度まで除・間伐をおこなった結果、平均相対照度は、15~30%前後となり、林内では約40種の樹種が確認された。間伐された材は、休養ベンチ、散策路、作業療法の資材に活用された。

キーワード: 広葉樹二次林、間伐、スズタケ、森林療法、八王子市

I Introduction

Currently, so-called "abandoned forests", which are not properly cared for, are increasing in various parts of Japan. This applies not only to artificial coniferous forests such as cedar and cypress, but also to secondary broad-leaved forests that used to be central to *Satoyama* (1). However, on the other hand, the need for health and recreation utilizing forests has been increasing. This is more noticeable in medical, welfare, and educational settings, and has taken on even more concrete meaning in recent years due to the outbreak of pandemics on a global scale (2, 3). Therefore, this research focused on a

secondary forest of broad-leaved trees owned by a regional hospital in the suburbs of the city, and aimed to develop it for rehabilitation and recreation, and to present an example of abandoned forest maintenance. The location is the Ongata Hospital of Eijukai Medical Corporation in Hachioji, Tokyo. Figure 1 shows the forest stand condition in September of 2020, before thinning cutting. There were some fell down and hanging trees, shrubs and bush covered the floor.

The forest maintenance that was the subject of the research was carried out at the request of the hospital. The forest area is about 6 hectares. When the hospital first opened in 1965, the area

around the hospital was surrounded by thickets, mainly woodlands and coppice forests. However, the forest stand has been abandoned for more than 30 years without appropriate treatment. The hospital and forest now are surrounded by residential area. In these circumstances, the hospital has made three requests: consideration of fallen leaves and shadows on nearby houses, reduction of fallen tree damage caused by typhoons, and improvement of the scenery from the ward. . In September 2020, I reconfirmed the hospital's request before starting forest maintenance. To summarize their requests, it needs to maintain forests to prevent landslides and flood damage during heavy rains. This abandoned forest had a possibility to create a space that can be used not only by patients but also by hospital staff. However, they didn't know what it would be like, so the first three points were to create a trial space that would make patients and hospital staff understand what is forest therapy.



Figure 1 The condition of forest stand in September 2020

図 1. 2020 年 9 月の調査地の状況

First of all, I did a reconnaissance in the same forest. The reconnaissance was conducted together with Tokyo Chainsaws Co., Ltd. (Representative: Mr. Ryosuke Aoki), which is in charge of forest maintenance. Based on the reconnaissance, through this development, I reported on the current state of the forest at Ongata Hospital and the trees and plants in the forest. The hospital should first create a space that can be used as a place for medical treatment and health and rest for patients, a space that can be used as a place for rehabilitation and rest for medical staff and a trial space for them. In addition, the guideline for the forest maintenance method is to start by clearing fallen down trees, hanging trees, and dead trees, to open up the space in the forest to form a space for health and

recreation, and to clean up shrubs and vines to significantly lower the forest density,

As a guideline, I decided to set a target value of 30% or more relative illuminance in the leafing period, and to retain useful broad-leaved trees and medicinal plants used for health and recreation.

Forest maintenance was started in September 2020 and was almost completed in October 2022. The maintenance work was commissioned to Tokyo Chainsaws Co., Ltd. with subsidies from the Tokyo Metropolitan Government's afforestation subsidized project. The contents of the maintenance are cleaning, thinning, and construction of walking paths.

II Methodology

This research surveyed the changes in the tree density, relative illuminance, tree height, trees stories, stand condition, and vegetation in the forest. I set 4 surveying plots (10 meters × 10 meters) in the forest.

Before clearing and thinning, the tree density was around 4,000 to 6,000 trees per hectare and the average illuminance was around 5 %.

Forest maintenance started in September 2020 and it was almost completed in October 2022. The maintenance work was commissioned to Tokyo Chainsaws Co., Ltd. with subsidies from the Tokyo Metropolitan Government's afforestation subsidized project. The contents of the maintenance are cleaning, thinning, and construction of walking paths.

III Results and discussion

1. Changes in tree density and relative illuminance After the first clearing and thinning in October 2021, the tree density was 1,500 to 2,000 trees / ha, and at the end of the work in September 2022, it was 300 to 500 / ha. The average relative illuminance in the forest improved to 15 to 30 %, about twice as much as before the thinning cutting. Figure 2 shows the changes of landscape of the stand.

2. Investigation of vegetation in the forest Already abandoned for more than 30 years, the forest was in a chaotic state, but there were many places where the *Sasamorpha borealis* were particularly luxuriant. They had a density of 50 to 70 stocks per a square meter (Figure 3).

The tallest trees in the forest were *Quercus serrata* and *Zelkova serrata*, both of which were around 20m in height. Next, *Quercus acutissima* and *Castanea crenata*, the average tree height was around 18 m. Many straight individuals were

seen, and as of September 2020, there was almost no damage from the *Platypus quercivorus*. Next was a mixture of *Celtis sinensis* and *Magnolia obovata* at a height of 12 to 14 m. In addition, about 60 % of *Quercus serrata* were sprouted.



Figure 2 Changes of forest landscape before and after thinning at same site.

(Top) September 2020 (Bottom) October 2022

図2. 同一地点における間伐前後の森林景観の変化
(上) 2020年9月 (下) 2022年10月



Figure 3. *Sasamorpha borealis* were seen on the forest floor (September 2020). They were growing at a density of 50-70 plants per square meter.

図3. 林床にみられるスズタケ (2020年9月).
50~70本/m²の密度で繁茂していた.

It suggested that it was once used as a coppice forest and as a *satoyama*. On the forest floor, there were mainly *Quercus* nuts, but also acorns and seedlings of Fagaceae trees. More than 40 species of tree species have been confirmed on the forest floor every year since thinning in 2020. Several types of medicinal trees such as *Smilax china*, *Lindera umbellata* have also been identified. Table 1 summarizes the tree species in the tall tree layer, sub-tree layer, shrub layer, and forest floor. From the vegetation of the shrub layer and the forest floor, it can see the tree species ranging from pioneer tree species to shade trees (Fig 4). It suggested that the forest was in the process of succession from deciduous broad-leaved trees to evergreen broad-leaved trees.

Sasamorpha borealis had grown thick in various places were cut down all at once. After clean-cutting, along with the reduction in the density of standing trees, new seedlings, mainly intolerant and pioneer species such as *Wisteria floribunda*, *Alaria elata*, *Rhus javanica*, and *Morus australis*, have sprung up on the forest floor due to buried seeds and natural scattering by wind and animals. can be seen. Also, due to neglect for more than 30 years, lignified *Wisteria floribunda* can be seen at many places in the forest. Also, many individuals have reached the tree canopy and are growing in hypertrophy. In addition, the number of *Platypus quercivorus* damaged trees such as *Quercus serrata* and *Q. myrsinifolia* which could not be confirmed visually at first, increased significantly from the spring of 2022, and by September of the same year, more than 60 damaged trees were confirmed in the entire forest. The damaged trees are felled and placed on the side of the walking path (Figure 5).



Figure 4. The tree layer is composed of zelkova serrata and Quercus serrata. Other species mixed in include *Magnolia obovata*, *Carpinus tschonoskii*, and *Castanea crenata*.

図4. ケヤキ, コナラなどで構成される高木層. そのほか, ホオノキ, イヌシデ, クリなども混交している.

Table 1 Tree species of forest stand of this research

表 1. 調査対象地の樹種

< **High story** >

Quercus serrata, *Q. acutissima*, *Castanea crenata*,

Zelkoba serrata, *Celtis sinensis*, *Magnolia obovata*

< **Sub-High story** >

Carpinus tschonoskii, *Cerasus jamasakura*, *Cornus kousa*,

Quercus myrsinifolia, *Q. glauca*

< **Lower story** >

Stylax japonicus, *Morus australis*, *Eurya japonica*,

Aralia elata, *Ilex macropoda*, *Clethra barbinervis*,

Aucuba japonica, *Carpinus laxiflora*

< **Floor vegetation** >

Mallotus japonicus, *Callicarpa japonica*, *Albizia julibrissin*,

Neillia incisa, *Smilax china*, *Dendropanax trifidus*

Symplocos sawafutagi, *Toxicodendron vernicifluum*,

Viburnum dilatatum, *Kalopanax septemlobus*,

Euonymus sieboldinus, *Hydrangea hirta*, *Thus javanica*,

Acer crataegifolium, *Zanthoxylum piperitum*,

Lindera obtusiloba, *Fatsia japonica*, *Lindera umbellata*,

Elaeagnus umbellata, *Ilex crenata*, *Ardisia crenata*,

Viburnum phlebotrachium, *Acer palmatum*, *Abies firma*,

Nandina domestica, *Pieris japonica*, *Euonymus oxyphyllus*,

Osmanthus heterophyllus, *Aralia elata*, *Castanopsis sieboldii*



Figure 5 Damaged trees and set on the side of path

図 5. 被害木と歩道脇に置かれた伐採木

3. The other features of the forest Soil of the forest stand was brown forest soil, the A layer was about 20 cm thick, and the B layer underneath was clayey soil (Figure 6). The average pH of the soil was around 5.2.



Figure 6. Soil profile of the survey area. The A layer was about 20 cm deep, and below that was clay soil.

図 6. 調査地の土壌断面。A 層は 20 cm ほどで、その下は埴土であった。

In the wild, several species of mammals inhabit or use the site, and more than 10 badger (*Meles anakuma*) nests were found in the colony (Figure 7). In addition, the footprints of deer and wild boars can be seen even after the maintenance.



Figure 7. Badger (*Meles anakuma*) nests found in multiple locations in the forest

図 7. 林内で複数箇所みられたアナグマの巣

4. Proposing ways to create and utilize a resting space and use of felled trees

In November 2020, the first year of work, I set up a trial space for forest therapy for patients and medical staff (Figure 8). Locations were selected that were close to the ward and visible from each other. Dead trees and hanging trees were used to create the benches in this space.



Figure 8 Trial space for forest therapy
 図 8. 森林療法のための空間

Logs of oak trees damaged by *Platypus quercivorus* were used for earth retaining of walking paths, fragrant felled trees such as cherry trees are used as wood chips, and vines of *Wisteria floribunda* are used as materials for occupational therapy for patients, such as making Christmas wreaths. The walking path was created with a width of 2.0 to 3.0 m and the gradients was lower than 5 % (4). This width was requested by the hospital so that two wheelchairs could pass each other (Figure 9). Totally more than 400 meters long path was constructed. Patients are expected to enter the forest in both wheelchairs and motorcars.



Figure 9 Walking path of width 2.0 to 3.0 meters
 図 9. 幅 2.0~3.0 メートルの散策路

IV. Conclusion

This research worked to create a space for health and recreation by maintaining a secondary broad-leaved forest that had been abandoned for more than 30 years. Results showed it could change the abandoned forest condition to rehabilitate and

recreational environment with keeping diversity of tree species by thinning cut (Figure 10). After treatment, hospital staff planned that occupational therapy using the trees in the forest (making Christmas wreaths, and so forth.), and walking and counseling using the recreation space in the forest. The main target participants will be dementia patients and mental disabled patients such as depression.



Figure 10. The rehabilitation course was built in a hospital forest that had been abandoned for over 30 years. This is what it looked like after thinning.

図 10. 30 年以上放置されていた病院林の中に作られたリハビリテーションコース。間伐後の姿である。

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