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NATURAL FOREST MANAGEMENT AND FOREST ROAD NETWORK

A selection cutting system in a natural forest will not be successful without thought of profit. This paper shows a successful example: the natural forest management of the Tokyo University Forest in Hokkaido. The forest has gradually been improved to the high productive multi-layered forest keeping the original natural diversity and high stock volume. The management and operations of felling, planting, and tending should be done for the improvement of forest, in other words, quality, health and productivity of remaining stands must be better than before after the repetitions of harvesting. The method of natural forest management of the Tokyo University Forest in Hokkaido is called "Rinbun-segyouhou"; which means forest management based on the stand characteristics. The cutting intensity is 16 % in volume every 10 years, or it is 17% every 20 years. From 1955 forest railways were converted to forest roads, and extended to 930km in 2004. Density is 41 m/ha. By the presence of a forest road network at a high density in a natural forest management, even standing trees at a low price can be sold. All forest roads have truck transportation capacity. The forest roads are classified into three classes, that is, "main road", "management road" and "operation road". The main roads are constructed along main rivers or calm ridges and connected to public roads. In non-snow seasons, 11-ton hauling trucks are always able to pass through. The management roads are constructed through 5-6 compartments or their boundary, and connected to main roads or public roads. The operation roads are constructed in the blank space of roads and through 1-4 compartments. Roads occupy only 2.4% of the whole area of a forest, and the trees along roads grow well due to the increased photosynthesis. Cut slope sometimes provides a new environment suitable for certain rare plants.

Keywords: forest road, natural forest management, operation road, Rinbun-segyouhou, selection cutting

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Ведення лісового господарства і мережа лісових доріг

Система вибіркового рубання лісу не буде успішною, якщо не думати про майбутній прибуток. У статті наведений приклад успішного ведення лісового господарства в лісах Токійського лісового ун-ту, Ноккайдо. Продуктивність лісових масивів була поступово поліпшена із збереженням оригінального природного біорізноманіття та високого об'єму приросту. Лісогосподарські роботи з посадки, догляду та рубання лісу повинні виконуватися з думкою про здоров'я та продуктивність деревостану. Метод природного лісового господарювання Токійського лісового ун-ту в

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Хоккайдо "Rinbun-segyouhou" базується на характеристиках деревостану. Інтенсивність рубань становить 16 % об'єму кожні 10 років або 17 % – кожні 20 років. У 1955 році лісові залізниці були замінені автодорогами, густота яких у 2004 році складала 41 м/га загальною довжиною 930 км. Завдяки високій густоті лісотransпортної мережі навіть низько вартісні дерева можуть бути продані. Всі лісові дороги придатні для транспортування деревини автопотягами. Лісові дороги розділені на три класи: магістраль, відгалуження та господарська дорога. Магістралі споруджуються вздовж головних річок чи невисоких гірських хребтів і з'єднуються із дорогами загального призначення. У безсніжні роки 11-тонні вантажівки завжди можуть рухатися цими дорогами. Відгалуження споруджуються через 5-6 кварталів для з'єднання магістралей із дорогами загального призначення, а господарські дороги – через 1-4 квартали. Дороги займають 2,4 % площі всього лісового масиву і дерева вздовж узбіч добре ростуть за рахунок збільшеного фотосинтезу.

Ключові слова: лісова дорога, природне лісове господарювання, господарська дорога, Rinbun-segyouhou, вибіркове рубання

Introduction

A selection cutting system in a natural forest will not be successful without thought of profit.

Generally speaking, natural forest has many high price trees and on the other hand a huge number of low-price trees. There are many trees damaged by strong wind, snow, disease, insects, animals, and so on. If we harvest only high price trees, forest productivity, health and diversity will be decreased.

This paper shows a successful example: the natural forest management of the Tokyo University Forest in Hokkaido. We will focus on the high-density forest road network that led to successful management.

Location

The Tokyo University Forest in Hokkaido is situated in the central part of Hokkaido, 43 °N, 142 °E (Figure 1). The area covers 22,800 ha; altitude is from 200m to 1,460m, and the management area is 19,800 ha. Under the climate condition of surrounding region, agriculture is doing below 300m alt. and forest management is doing possible below 800 m alt.

Forest and flora

The forest is located in the mixed forest zone between the cool-temperate and the sub-boreal zone with coniferous and broad-leaved species such as *Abies*, *Picea*, *Taxus*, *Quercus*, *Betula*, *Fraxinus*, *Tilia*, *Acer*, *Salix* and others.

Almost of forest floor is covered with *Sasa* bamboo. *Sasa* indeed protects against soil erosion but interrupts natural regeneration of trees.

The University Forest was established in 1899, and the first forest management research plan was made in 1907. The stand volume of primeval forest was 300 cubic meters per ha, and it was recorded that the useful volume was 100 cubic meters per ha.

About 40 species are treated as valuable forest management trees. For these 100 years, the forest has gradually been improved to the high productive multi-layered forest keeping the original natural diversity and high stock volume. Now an average stand of 50 m square (0.25 ha) samples for selection cutting system has 800 trees of 20 species (DBH > 5 cm), a 250 cubic meters stand. The percentage of conifer is about 55 % in volume.

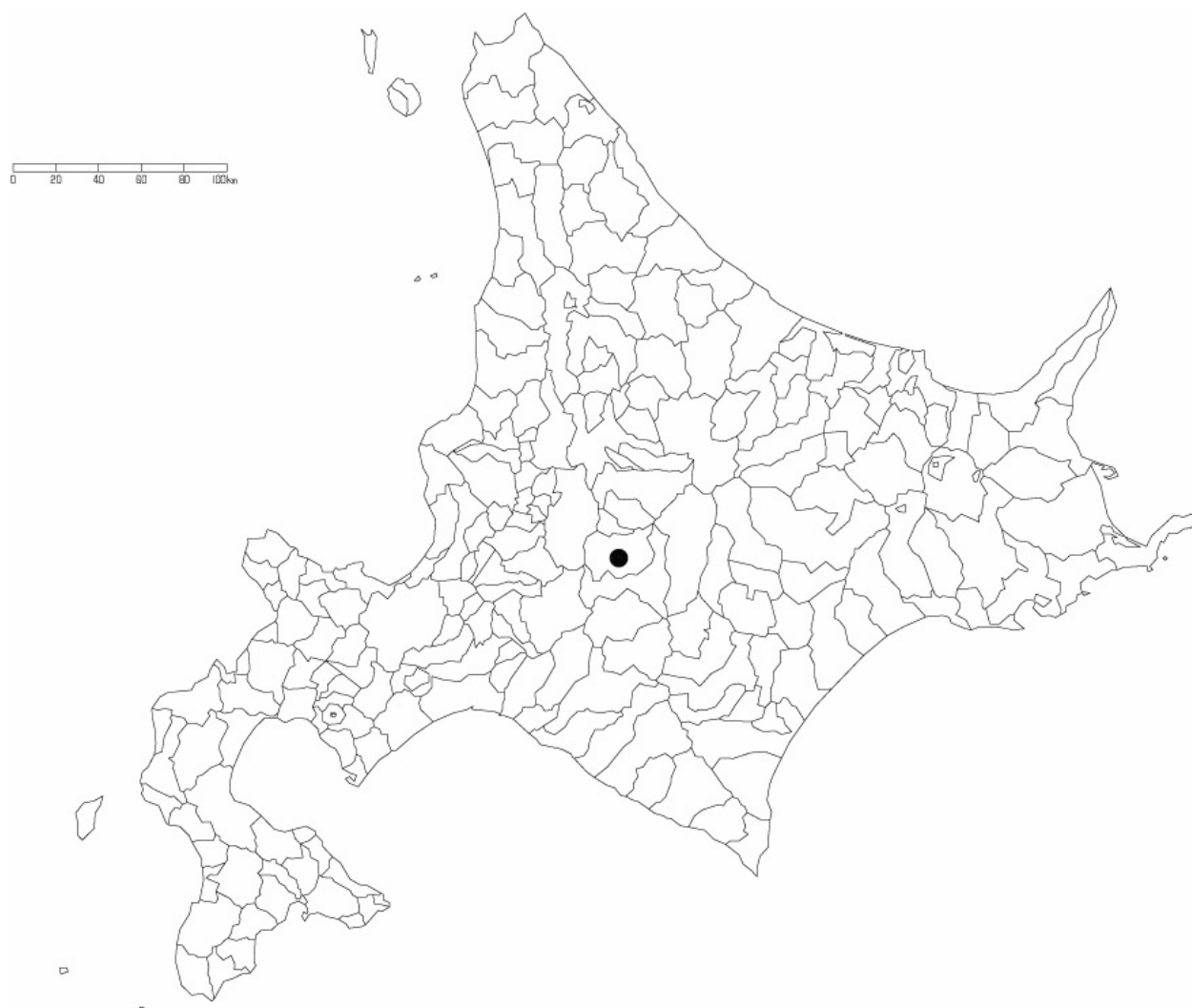


Figure 1. Location of the Tokyo University Forest in Hokkaido

In Sapporo City area (110,000 ha) and Akan National Park area (80,000 ha) in Hokkaido, 1300 and 800 species is recorded, respectively. In the University Forest area including high mountains, big rock blocks and riverside, 800 vascular species plants are distributed. The numbers of native species are 730, and that of exotic species are 70.

The main research subject of the University Forest management is how to be sustainable harvesting compatible with conservation of environment, keeping natural diversity and ecosystem.

Principle and Practice of Natural Forest Management

The management and operations of felling, planting, and tending should be done for the improvement of forest, in other words, quality, health and productivity of remaining stands must be better than before after the repetitions of harvesting.

The University Forest in Hokkaido is divided into two working sections. The 1st working section (10,700 ha) locates at the lower elevation area and the average annual increase in stand volume is 2 %. The 2nd working section locates at the higher elevation and the annual growth rate is 1 %. Both in the 1st and the 2nd working sections, the cutting volume is restricted within the growth increment during 10 and 20 rotation years, respectively.

The method of natural forest management of the Tokyo University Forest in Hokkaido is called "Rinbun-segyouhou"; which means forest management based on the stand characteristics. In this system, forest is classified into three types of stand, "selection cutting stand", "clear cutting stand" and "supplemental planting stand". The classification depends on whether natural regeneration is possible or not, and whether quality of the present trees are high or not.

In the selection cutting stand in the 1st section, the cutting intensity is 16 % in volume every 10 years, and in the selection cutting stand in the 2nd section, it is 17 % every 20 years. In the supplemental planting stand, natural regeneration is difficult, but remaining trees are good in condition, therefore group selection cutting and planting are practiced.

In the clear cutting stand, natural regeneration is almost impossible, and most of trees are bad in quality; therefore clear cutting before plantation is needed. Planting species are almost conifers growing in the University Forest nursery, whose parents are from the University Forest. In the future, these stands will be improved and admitted into selection cutting stand.

The University Forest is divided into 105 compartments, and each compartment consists of several sub-compartments according to natural topographic conditions such as, by ridges, rivers and boundary with neighbouring forest. Three types of stand are classified by the conditions of trees present and regenerated. Conceptions of division and classification are quite different.

Now the 11th University Forest Management from 1996 to 2005 is under way. From 1907 to 2003, 6.5 millions cubic meters were harvested in total, and the present total stand volume is 4.1 million cubic meters, and the annual volume increment is 70 thousands cubic meters. On the other hand, the annual planning harvesting amount planned based on the synthetic judgment that the forest has not yet recovered from the damage caused by a strong typhoon in 1981, is 40 thousands cubic meters.

The management is practiced by 30 foresters (University Forest staff).

Chart from master plan to practice

In the 11th Forest Management Plan, the annual management area is 840 ha, harvesting volume is 39,500 cubic meters and planting area is 70 ha. Annual Management area is made up of five blocks.

1. Data of about 500 plots are accumulated per year. The plot is 50m by 50m (0.25 ha).
2. On the spot of 50-60 plots, with the precise data tables, the appropriate cutting intensity, trees to be cut, regeneration system, thinning, and so on are discussed before practice. And orders of each management block are made.
3. Choosing and marking trees to be cut are carried out in each management block by a team. Each team consists of 5 staffs. About 30,000 trees are harvested per year from the natural forest. Each chosen tree has a reason to be cut. For example, root decayed, bearing mushroom on trunk, decreased leaves, fallen tip, and so on.
4. About 36,000 cubic meters are sold as standing trees. About 2,000 cubic meters are harvested by the team of the University Forest.

5. Very high price broad-leaved trees are harvested directly by the staff, and sent to "Precious Wood Market". Annual harvest is about 50 cubic meters, and this income reaches 300 thousands dollars.

Development of forest road network and maintenance system

In 1950, felling and bucking were practiced by manual handling saw, pre-hauling by man and horse especially in winter, stacking by men, and transportation by forest railways extending 80 km.

Now in 2004, felling by chainsaw, pre-hauling by small tractors and truck transportation by log buyers are practiced. The operation team of the University Forest uses a grapple skidder for pre-hauling and a grapple-saw for bucking.

From 1955 forest railways were converted to forest roads, and extended to 930 km in 2004. Now, density is 41 m/ha (Figure 2).

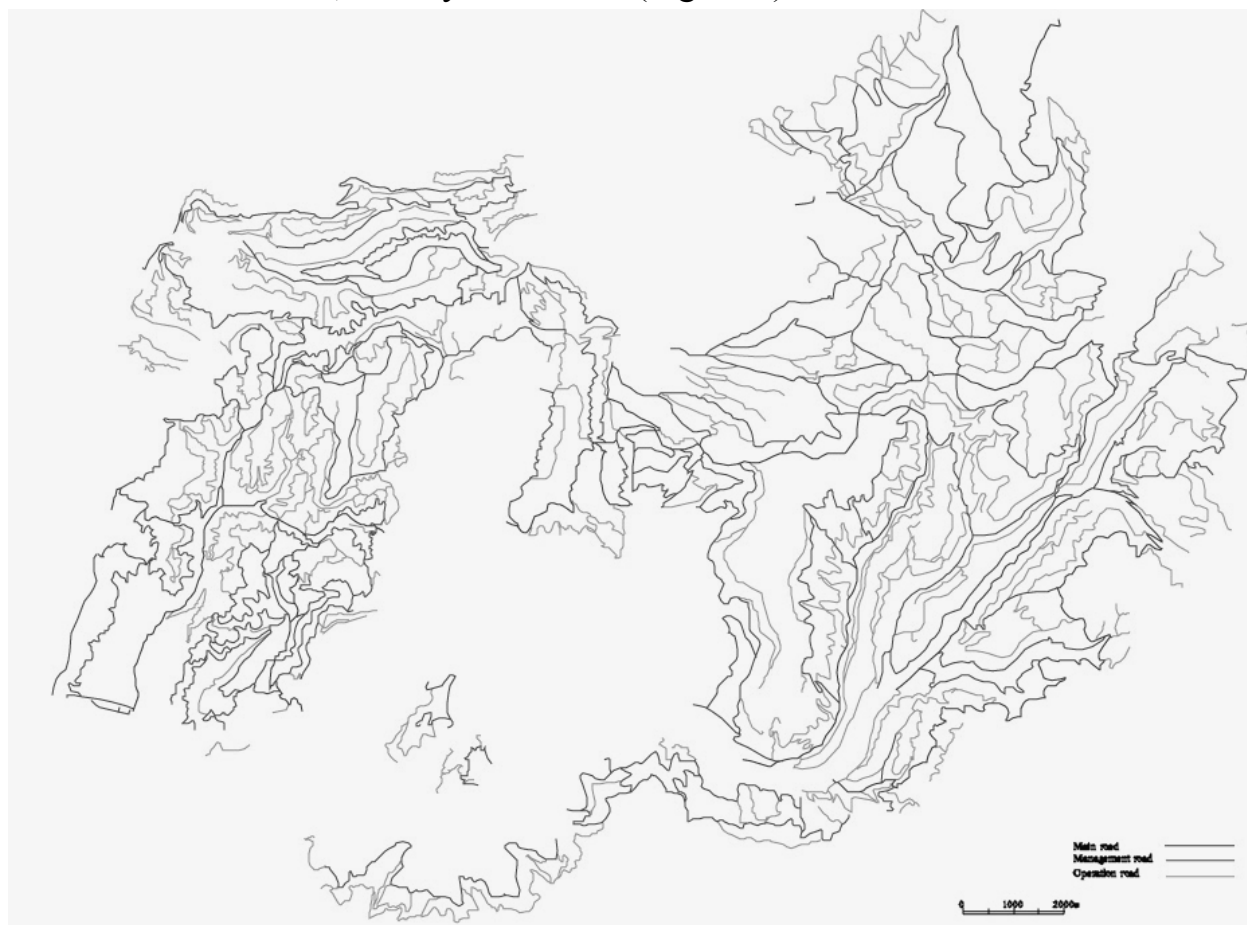


Figure 2. Forest road networks in the Tokyo University Forest in Hokkaido

"Rinbun-segyouhou", the forest management based on stand characteristics was developed together with the construction of a forest road network. By the presence of a forest road network at a high density in a natural forest management, even standing trees at a low price can be sold. All forest roads in the University Forest in Hokkaido have truck transportation capacity. The forest roads are classified into three classes by the frequency of utilization and the importance, that is, "main road", "management road" and "operation road".

The standards of these three roads are almost the same, but the function and the maintenance are different. The main roads are constructed along main rivers or calm ridges and connected to public roads. We have 11 routes of 114 km through

7-12 compartment boundaries. In non-snow seasons, 11-ton hauling trucks are always able to pass through. Weeds along roadside are cleared every year.

The management roads are constructed through 5-6 compartments or their boundary, and connected to main roads or public roads. Extension is 370 km. According to the forest management planning, about 70-80 % of them are used and weeds are cleared.

The operation roads are constructed in the blank space of roads and through 1-4 compartments. Extension is 440 km. In the 1st section (low elevation), operation roads are maintained every ten years, that is, two years before selection cutting for surveying forest resources. In the 2nd section (high elevation), the interval is 20 years. These roads are usually covered with tall weeds and bush. They are sometimes damaged by rain.

Technological and ecological discussions on the function of road network

1. Roads occupy only 2.4 % of the whole area of a forest, and the trees along roads grow well due to the increased photosynthesis.
2. Rain water stream runs slow down when across the road and ditches catch seepage water.
3. Roads provide living space and comfortable paths for big mammals and big owls.
4. On the side of the sunny roads, many plant species grow well.
5. Cut slope sometimes provides a new environment suitable for certain rare plants.

From a forest management point-of-view, the advantages of high density forest roads and the appropriate maintenance, are as follows,

1. easy to zone the forest into the suitable stands,
2. easy to obtain data on the forest,
3. easy to discuss on the spot plots,
4. easy to choose trees to be cut,
5. able to harvest, plant and thin at a low cost,
6. able to sell the standing trees at a low price because of low harvesting cost,
7. easy to access research and educational points in the deep forest.

Conclusions

Forest road networks in the Tokyo University Forest in Hokkaido play an important role in selling low price trees, and are indispensable to the intensive forest management. They also contribute to water conservation and biodiversity.

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¹ only in Japanese

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