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**The Developing Process of Hokkaido's National Forests
after World War II and Some Problems
in their Managements***

by

Shigeru SHIMOTORI**

戦後における北海道国有林経営の展開過程とその問題点*

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I. Introduction

This manuscript traces the developments in national forest management in Hokkaido after World War II. The special characteristics of this analysis are first, showing the relationship between the timber market and changes in modes of management and second, demonstrating the relationship between the introduction of various types of machinery in both logging and reforestation operations in rationalization of management and the changes in the labor structure. And finally, as a conclusion, the author examines the problems in the "New Forest Practice" policy for national forests followed since 1973 and, at the same time, explains how to gain a unified grasp of forestry management which would both preserve forests and result in a high production potential.

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What should be emphasized here is that the nationally-owned forests in Hokkaido can be said to have a more modern capitalistic form of management compared to other districts. The reason is that directly-managed manufacturing operations tend to employ a regular year-round labor force and, while the labor force tends to be concentrated in the building section, directly-managed operations also partly sub-contract production, thus relying on both direct and sub-contracted production, the same pattern of "reduced management" as large corporations in slow-growth economic situations.¹ For that reason, the analysis of Hokkaido's nationally-owned forests has many points which should be helpful in giving an overview of the future by which problems of "modern large scale forestry management" can be examined.

II. "National Forest Management Regulations" and Trends in Management Systems

The development of national forests in Hokkaido can be divided and commented upon in three different periods.

Period One: After the War, national forests began in 1947 under the indirect influence of two large changes in the system. One of these was the "Unification of Forestry Administration" wherein what had formerly been the Imperial Forests, national forests belonging to the Ministry of Agriculture and Forestry in the southern islands of Japan and national forests under the control of the Hokkaido Government were all three unified under the Forestry Agency of the Ministry of Agriculture and Forestry. The other one was the adoption of a "special system of accounting which would help attain a good grasp of the results of national forest management and the current situation in finances, increase the efficiency of operation and provide a guide to rationalization of management."²

Added to this, in 1948 the "National Forest Regulations" were revised completing the Postwar structure for nationally-owned forests. Normal growing stock stipulations were eliminated from these regulations, the Kameraltaxe Method was adopted for regulation of felling and yield control and the final felling age was regulated through rotation cutting.³ Until the management system based on these regulations was propagated nation-wide a "Provisional Working Law" was put into force.

The damage from the two typhoons of the spring and fall of 1954 was the occasion of a big change in Hokkaido forestry. The damage from these two typhoons extended to over 14 percent of the total forest area of Hokkaido amounting to over 27 million cubic meters of timber, approximately three times the average total yearly cutting at that time. The damage was particularly large in national forests which accounted for 87 percent. At that time the Ministry of Agriculture and Forestry issued instructions for a special temporary three-year "Felling and Reforestation Plan" by which the problem of disposing of the damaged trees was largely met.

Period Two: Apart from this exceptional situation in Hokkaido of disposing of fallen trees, there was also the chance to rationalize the management of national

forests presented by the increase of almost 100 percent in demand for timber compared to Prewar demand during the rapid recovery of Japan's economy in the ten years after the War. Thus, in order to revise the basic problems in the method of developing management plans, which should form the basis for the prosecution of the rationalization process, in 1958 there was a revision of the National Forest Management Regulations. Especially characteristic of these revised regulations was the adoption of the directive of flexibility in cutting whereby was formed a long-ranged outlook. Accordingly the "strict sustained yield system" which had limited annual cutting to the amount which was equivalent to annual growth in a so-called "everlasting conservation" system was rejected. In other words, it was here that national forests moved into a type of "company management."

What came out of this revision of the National Forest Management Regulations was the "Government Forestry Production Capacity Increase Plan" which resulted in a plan projecting forty years into the future from 1958. This plan called for actively turning the over-ripened old forests into man-made forests and directed the cutting of all the forests under 600 meters above sea level in order to raise productivity. This plan changed the direction of cutting from selected felling to large area clear cutting and pointed toward the planting of quick growth Japanese larch away from, for example, Sakhakin fir which matures in fifty to sixty years, and Yezo spruce which matures in sixty to seventy years. Further, in 1960, the "Timber Production Increase Plan" which was developed from the report of the Board of Inquiry on Agriculture and Forestry increased the yield and reforestation volumes to 18 percent and 2 percent respectively over the amount designated in the previously mentioned "Production Capacity Increase Plan."

In 1964 the "Basic Forestry Law" was enacted and in the following year the Central Forestry Council published its findings on "The Role and Method of Management of National Forestry" and on the basis of these findings the management regulations were again revised in 1969. Among the sections revised there was reflected the increased demand for recreational use and operations were begun in response to this. This in turn led to the "New Forestry Practice" policy of third period.

Period Three: In December, 1972 the Forest Policy Council which is an advisory organ of the Prime Minister published a report on "The Improvement of Operations in National Forests." The findings of that report can be summarized thusly:⁴ On one hand, there was a definite attitude of reduction in operations in answer to both attaching importance to forestry as having an important public service function and as a reconsideration of previous indiscriminate cutting; on the other hand there was a definite turn toward rationalization of management in order to control the minus income management of national forests.

These two directions seem, at first glance, to be contradictory because there had been a consistent policy of increased cutting in the name of servicing the requests of the people ever since the 1958 Production Capacity Increase Plan. If there were still losses in national forest management in spite of this, it may be

Table-1 Standard

Type of work	Clear cutting	Preregeneration cutting	
Cutting method	(1) Clear cutting	(2) Preregeneration cutting	(3) Selective cutting 1
Regeneration method	Planting	Natural 2, Natural 1	Natural 1, Natural 2
Subject stands	Used with stands where the natural conditions (i. e. climate, land features, elevation, soil, etc.) are such that the successful creation of artificial forests is certain and, further, where increased forest productivity through artificial afforestation can reasonably be expected.	Stands of the following types with which stand content is such that preregeneration-cutting work is possible, uniform-forest type and two-storied forest type development can be induced, and with which productivity of approximately the same level as with planted forests can be anticipated are used. (1) Stands where the lower story is formed by young, small-diameter trees of principally a single species, being sakhalin fir, Yezo spruce, or a broad-leaved species, and where growth is being inhibited by large-diameter trees in the upper story, and stands where the forest crown of the upper story is open and competition among young, small-diameter trees has begun (two-storied forest type). (2) Stands (as if) of single strata of coniferous trees which are growing like planted forests.	Stands of the following types with which increased forest productivity through the carrying out of vigorous selective-cutting work can be anticipated are used. (1) Stands where the current volume or the amount of growth is large and where the stand species content and natural regeneration are good. (2) Stands where the natural conditions and current stand content are poor, but which can be made into superior stands through the active effectation of selective-cutting work.
Additional notes	(1) Stands where clear-cutting/planting are to be carried out must meet the following conditions in addition to the general standards. 1) The location must have a warmth index of 45°C or above (generally, an elevation of 600 meters or less). 2) The future productivity of the forest land at the site must be greater than 5 m ³ /hectare annually. 3) The slope of the land at the site must be less than 35 degrees. (2) In cases where clear cutting is to be effected in the future, but (only) selective-cutting or thinning work, etc. carried out for some time, these stands may be classified as "Clear cutting 2".		(1) "Selective cutting 1" may be subdivided, according to the natural conditions and content of the stands into "Selective cutting 1-1" and "Selective cutting 1-2". (2) With future forestland productivity of approximately 3.8 m ³ /hectare annually as a target, on subdividing, the following are had. Selective cutting 1-1Approximately 4.5 m ³ /hectare/year Selective cutting 1-2Approximately 3.3 m ³ /hectare/year (3) There is a tentative cutting-cycle standard of twenty years. (4) According to the conditions of each stand, either single-tree cutting or group cutting is employed as the selective-cutting method.

Footnote: Referred from "Summary of Forestry Work in the National Forests of Hokkaido

of working systems

Selective cutting		Unspecified
(4) Selective cutting 2	(5) Selective cutting 3	(6) Cutting prohibited, etc.
Natural 2 (Natural 1)	Natural 2 (Natural 1)	Unspecified
<p>Stands of the following types which accompany clear-cutting stands are used.</p> <ol style="list-style-type: none"> (1) Shelter-belt stands which have been established for the protection of new stands and where selective-cutting work will be carried out in the future as well. (2) Shelter belts which have been established for the purpose of landscape maintenance. (3) Shelter belts established for the preservation of forest land. 	<p>Stands of the following types are used, these being stands where active selective-cutting work cannot be carried out on account of their being managed as stands for the maintenance or improvement of the public-use functions of forests, or their being stands located where the natural conditions are harsh and on low-productivity forest land.</p> <ol style="list-style-type: none"> (1) Stands where limitations on cutting, etc. are necessitated from the standpoints of such public-good functions as places for rest and the preservation of the environment. (2) Stands where such disaster-prevention functions as the conservation of forest land are particularly important. (3) Low-production stands, such as sub-alpine zone stands, etc., where the natural conditions are severe and increased forest-land productivity cannot be anticipated. 	<p>These are stands where work has been deferred indefinitely on account of natural conditions and/or stand content which would make cutting and afforestation work extremely difficult, or where laws and/or regulations prohibit cutting.</p> <p>Examples:</p> <ol style="list-style-type: none"> 1. Nature parks, special protection zones, and Type 1 special zones. 2. Soil conservation forests. 3. Locations in wash-out prevention forests where it is necessary that cutting be banned. 4. Historical and scenic natural monuments. 5. Locations in scientific-reference protection forests where it is necessary to ban cutting in order to facilitate the objectives of said forests. 6. Wind-beaten sites, sites where regeneration is difficult. 7. Sites where work is difficult. 8. Other.
<ol style="list-style-type: none"> (1) Shelter belts are established in response to various objectives, but mainly for protection against meteorological damage to newly planted man-made forests. For this purpose, the main tactic is to position the belts on important ridges, etc. The width of a shelter belt is determined according to such conditions as land features and stand content, but is generally approximately sixty meters. (2) Cutting is carried out at opportune times, fitted to final-cutting or thinning work in peripheral stands. The cutting method is, as a rule, single-tree cutting. 	<ol style="list-style-type: none"> (1) Stands where multiple-purpose use is possible and active selective-cutting work can be carried out, even though subject to legal and/or regulatory restrictions from the standpoint of public-use functions, are classified under "Selective-cutting 1." (2) Cutting is carried out to the extent necessary to maintain a stand by eliminating damaged or otherwise enfeebled trees. 	

difficult to understand how a reduction in cutting would lead to turning red ink into black. However, there is really no contradiction at all. This is because the measures that were taken for this rationalization included the separate special budget for public service function sections, the consolidation of the management organization and the selection of cutting districts based on selective investment and rationalization in the various sections directly connected with operations.

Based on this rationalization the directive, "Future Forestry Operations in National Forests" was put out in March, 1973 wherein there was a fundamental change in previous forestry operations. 1) There was a major reduction of areas subject to clear cutting with a corresponding large increase in selective cutting areas and cutting-prohibited areas. 2) In the new planting of areas to be clear cut, they were to be scattered and the size limited (five hectares or less for protection forest and twenty hectares or less for forest to be cut), shelter belts were directed (thirty meters or more for level areas, forty or more for slopes), and clear cutting of useful residual natural young trees was restricted to areas below six hundred meters in altitude. 3) In the regeneration of forests by natural seedings, the auxiliary planting of seedlings was directed as needed when the natural seedings did not reach a density of five to ten thousand. 4) When an actual stand of trees did not attain a cutting-forest configuration, then an adjustment period was provided with a limit of twice the regular cutting cycle. 5) The mechanism of selective cutting operations included a twenty-year cutting cycle, a cutting rate of 24-26 percent, an expected growing stock of 280-300 cubic meters per hectare and an expected annual growth of 3.3-4.1 cubic meters per hectare. The "Future Forestry Operations" directly caused a great change in the direction of forest clear cutting and man-made reforestation, which had been the practice since the Production Capacity Increase Plan to natural forest practices with selective cutting and regenera-

Table-2 Forestland area classified by working system of national forests in Hokkaido

Working System	Surveyed on April 1st in 1972		Surveyed on April 1st in 1983		Difference ①-②
	Forestland area (thousand ha) ①	Per- centage	Forestland area (thousand ha) ②	Per- centage	
Clear cutting system	1,031	36	769	27	-262
Prereneration system	102	3	32	1	-70
Selective cutting system	Type one	—	1,009	35	—
	Type two	—	273	10	—
	Type three	—	288	10	—
	Total	1,302	45	1,570	55
Cutting-prohibited area	457	16	487	17	30
Total	2,892	100	2,858	100	-34

Footnote: The figures are arranged by Hokkaido Regional Forest Office.

tion by natural seeding.

Table-1 shows the standard of working systems of national forests in Hokkaido, and Table-2 shows the forestland area classified by working systems in 1983 in comparison with 1972 belonging to Period Two.

III. Trends in Operations and Rationalization of Management

1. Characteristics of cutting operations

1) Cutting amounts increased dramatically after the great numbers of typhoon windfallen trees in 1954, reaching 8.4 million cubic meters in 1956, and this trend continued on into the second period, maintaining an amount of around eight million cubic meters until 1966. With a peak in the second period of 8.6 million, however,

Table-3 Annual cutting volume classified by selling method
(Unit: stumpage volume 1,000 m³)

Year	Amount volume			Coniferous tree			Broad leaf tree		
	Total	Sale on standing tree	Sale on log	Total	Sale on standing tree	Sale on log	Total	Sale on standing tree	Sale on log
1984	4,557	3,338	1,219	2,273	1,447	826	2,284	1,891	393
49	4,591	3,484	1,107	2,409	1,565	844	2,182	1,919	263
1950	4,113	2,821	1,292	2,216	1,280	936	1,897	1,541	356
51	4,860	3,404	1,456	2,621	1,613	1,008	2,239	1,791	448
52	5,129	3,456	1,673	2,707	1,596	1,111	2,422	1,860	562
53	4,913	3,443	1,500	2,332	1,389	943	2,581	2,024	557
54	6,368	4,454	1,914	3,383	2,052	1,331	2,985	2,402	583
1955	6,989	3,723	3,266	3,992	1,526	2,466	2,997	2,197	800
56	8,365	5,351	3,014	5,007	2,745	2,262	3,358	2,606	750
57	8,480	6,047	2,433	5,084	3,291	1,793	3,396	2,756	640
58	7,865	5,615	2,250	4,061	2,729	1,332	3,804	2,886	918
59	8,154	5,891	2,263	4,213	2,926	1,287	3,941	2,965	976
1960	8,002	5,673	2,329	4,045	2,710	1,335	3,957	2,963	994
61	8,638	6,232	2,406	4,476	3,073	1,403	4,162	3,158	1,004
62	8,279	5,996	2,283	4,217	2,900	1,317	4,062	3,096	966
63	8,192	5,916	2,276	3,988	2,724	1,264	4,204	3,192	1,012
64	7,785	5,504	2,281	3,618	2,326	1,292	4,167	3,178	989
1965	8,106	5,822	2,284	4,129	2,832	1,297	3,977	2,990	987
66	7,938	5,597	2,341	3,997	2,692	1,305	3,941	2,905	1,036
67	7,524	5,137	2,387	3,626	2,303	1,323	3,898	2,834	1,064
68	7,239	4,771	2,468	3,475	2,105	1,370	3,764	2,666	1,098
69	7,138	4,720	2,418	3,324	1,996	1,328	3,814	2,724	1,090
1970	7,228	4,656	2,572	3,349	1,980	1,369	3,879	2,676	1,203
71	7,195	4,588	2,607	3,437	1,982	1,455	3,758	2,606	1,152
72	6,773	4,225	2,548	3,324	1,903	1,421	3,449	2,322	1,127
73	6,220	3,972	2,248	3,101	1,848	1,253	3,119	2,123	996
74	5,740	3,733	2,007	2,868	1,748	1,120	2,872	1,985	887
1975	5,659	3,586	2,073	2,897	1,675	1,222	2,762	1,911	851
76	5,311	3,316	1,995	2,629	1,483	1,146	2,682	1,833	849
77	5,363	3,378	1,985	2,670	1,532	1,138	2,693	1,846	847
78	5,184	3,225	1,959	2,574	1,471	1,103	2,610	1,754	856
79	5,084	3,131	1,953	2,490	1,415	1,075	2,594	1,716	878
1980	4,905	2,984	1,921	2,506	1,433	1,073	2,399	1,551	848
81	4,821	2,965	1,856	2,502	1,471	1,031	2,319	1,494	825

Footnote: Arranged by statistical yearbook of national forest management activities published by Forestry Agency.

Table-4 Annual timber production classified into direct governed and contracted works in national forests in Hokkaido(Unit: 1,000 m³, %)

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Production under direct governed	1,233	1,372	1,415	1,394	1,229	1,129	1,077	1,054	1,046	1,036	1,041	1,032	975
Production under contracted works	<29> 508	<26> 481	<25> 469	<25> 472	<26> 427	<23> 346	<20> 440	<28> 418	<29> 433	<30> 453	<30> 454	<31> 456	<32> 460
Total	1,741	1,853	1,884	1,866	1,656	1,475	1,517	1,472	1,479	1,489	1,495	1,488	1,435

Footnote: 1. The figures are arranged by Hokkaido Regional Forest Office.

2. The figures in brackets show the rate of production under contracted works.

there was a gradual decrease and by 1974 in the third period it was down to five million cubic meters (Table-3). 2) The period of eleven years from 1956 through 1966 which saw cutting amounts of around eight million cubic meters was one in which the increase in production was sought through the cutting of broad leaf trees (Table-3). 3) Looking at the ration of logs sold "on stump" and cut logs sold under government management, the "on stump" sales of timber were higher in any comparison of stumpage volume in any year, making up 61-76 percent of the sales; in the years when the windfallen trees were being disposed of, however, the sales of standing stock were relatively lower, being for example, only 53 percent in 1965 (Table-3). 4) Logging under direct government management achieved increased productivity through the introduction of machinery and improved methods during the second period and a corresponding increase in production volume. But with a peak of 1.88 million cubic meters in 1971, the volume began to level off, and entering into the third period with the increase in selective cutting and workers designated as suffering from Reynaud's disease, productivity fell off and volume decreased (Table-4). 5) The method of logging under direct government management underwent a great change on the occasion of the disposal of windfallen timber. That is, it changed from what had been winter production to summer production and the reliance upon human muscle power and horse power turned to machinery, and further, there was a substantial introduction of sub-contracting to private logging producers. By the way, taking a look at the statistics the author sees that, while summer production accounted for only 37 percent of the production in 1953, it was 61-70 percent in the years from 1955-57 and logging production through sub-contracting which had been only 12 percent in 1953 rose to 38-41 percent in the period from 1955 to 1957. The ratio of logging production through sub-contractors for the period from 1976 through 1983 has remained, namely at a level of 28 to 32 percent (Table-4).

2. Characteristics of reforestation operations

1) Man-made forests make up 21 percent of the 3,097 thousand hectares of national forests. Among the planted species, Sakhalin fir is most numerous making

up 67 percent of the total, Japanese larch 18 percent, Yezo spruce 11 percent while white pine, Japanese cedar, and other coniferous trees as well as broad leaf trees make up about one percent each (Table-5). 2) The annual forestation area increased satisfactorily after the War, reaching 20 thousand hectares in 1957 after the typhoon windfalls and 30 thousand hectares in 1961 of the second period, maintaining this level until 1971 with a peak of 3.3 thousand in 1971. At the end of the second

Table-5 Annual plantation areas classified by tree species (Unit: ha)

Year	Japanese larch	Sakhalin fir	Yezo spruce	others	Total
1948	457	1,944	195	58	2,654
49	714	1,930	208	188	3,040
1950	4,045	3,074	383	811	8,313
51	4,685	4,612	169	835	10,301
52	7,687	4,102	577	638	13,004
53	6,791	4,463	660	534	12,448
54	4,763	7,047	360	800	12,970
1955	3,330	9,504	536	577	13,947
56	3,587	12,386	1,039	448	17,460
57	6,921	13,000	1,096	913	21,930
58	10,449	11,313	1,430	1,121	24,313
59	9,228	12,354	1,966	688	24,236
1960	11,229	15,396	2,022	771	29,418
61	11,415	15,721	2,200	737	30,073
62	12,179	15,773	1,878	1,522	31,352
63	11,187	17,012	2,074	1,373	31,646
64	9,260	17,357	1,793	1,753	30,163
1965	7,087	19,784	1,440	2,278	30,589
66	5,628	21,470	1,693	3,519	32,310
67	3,523	21,711	2,703	3,912	31,849
68	4,416	20,874	2,899	3,190	31,379
69	4,504	22,498	2,731	3,009	32,742
1970	3,918	21,364	3,631	2,276	31,189
71	3,175	21,642	3,772	1,837	30,426
72	2,181	15,895	3,994	1,275	23,345
73	2,035	17,439	4,009	1,316	24,799
74	1,314	17,631	3,709	775	23,429
1975	1,325	18,530	3,098	422	23,375
76	1,129	14,525	3,420	289	19,363
77	910	12,563	2,904	133	16,510
78	537	12,519	3,037	99	16,192
79	622	11,986	3,804	63	16,475
1980	500	12,271	4,145	135	17,051
81	678	11,976	3,432	227	16,313

Footnote: Arranged by statistical yearbook of national forest management activities published by Forestry Agency.

Table-6 Area of silvicultural activities classified into direct governed and contracted works of national forests in Hokkaido

(Unit: 1,000 ha, %)

Kind of silvicultural activities	1975			1976			1977					
	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)			
Land preparation	56	<74> 158	214	48	<69> 105	153	46	<68> 99	145			
Planting	53	<75> 158	211	50	<71> 124	174	40	<73> 107	147			
Weeding	396	<79> 1,510	1,906	386	<80> 1,527	1,913	360	<81> 1,511	1,871			
	1978			1979			1980			1981		
	(A)	(B)	(C)									
	45	<66> 89	134	46	<68> 100	146	46	<68> 100	146	46	<68> 96	142
	40	<71> 98	138	43	<69> 95	138	42	<70> 100	142	43	<69> 95	138
	346	<81> 1,447	1,793	331	<81> 1,400	1,731	332	<80> 1,339	1,671	336	<79> 1,302	1,638

Footnote: 1. The figures are arranged by Hokkaido Regional Forest Office.

2. (A): Direct governed. (B): Contracted works. (C): Total.

3. The figures in brackets show the rate of contracted works.

period however, the area dropped to 2.3 thousand hectares in 1972 and by 1981 the forestation area was only 16 thousand hectares (Table-5). 3) There was no change in the main species of planting tree, consistently the Sakhalin fir, and especially in the period from 1966 to 1971 when the annual planting area was over 20 thousand hectares. While this trend predominated, in the period after the typhoon windfalls from 1957 to 1965 Japanese larch showed a great increase, but from 1962 outbreaks of fungus shoot blight began to appear. Up until 1969 forestation with white pine and Scots pine was tried and from 1970 the planting of Yezo spruce increased as a measure to avoid the forest damage to which the Sakhalin fir is susceptible (Table-5). 4) The percentage of forestation operations carried out by sub-contractors after 1975 includes 69 to 75 percent of the planting, 66 to 74 percent of the land preparation, 79 to 81 percent of the brush cutting and weeding, showing the high reliance of forestation operations on sub-contracting (Table-6).

3. Mechanization of forest production

With the disposal of windfallen logs after 1954 operations turned to a great extent from winter to summer type and as a result of the consolidation of the logging road network and efforts to mechanize in response to rapid progress in the mechanization of forestry operations. As seen in the statistics, logging railroads, which had reached a peak of 963 kilometers in 1954, began to diminish while

vehicle logging roads expanded dramatically from 2.1 thousand kilometers in 1956 to 13.2 thousand kilometers in 1981. In machinery, chain-saws which were particularly effective in dealing with the windfallen logs continued to increase thereafter. After that the skidder in 1968, and the brush cutter in 1962 were introduced on a large scale. The brush cutter was used extensively from 1962 to 1974 and the skidder was particularly widely used during the 1960's. After that, as logging methods changed generally to stem- or tree-length skidding, and as the machines whose use had been extended throughout the year wore out, they were replaced by tractors. The number of tractors was at its peak in 1976 when there were 604, but even now the tractor continues to be the main machine used for skidding (Table-7).

Table-7 Number of machines used in national forests in Hokkaido

Year	Chain-saw	Brush cutter	Skidder	Tractor
1958	715	187	157	190
59	822	191	166	205
1960	931	630	347	224
61	983	1,660	445	264
62	1,010	2,812	467	315
63	1,011	3,940	478	422
64	1,041	3,979	476	319
1965	1,033	4,198	461	544
66	953	3,603	405	505
67	957	3,119	368	405
68	949	2,982	341	391
69	1,015	2,988	314	455
1970	1,383	2,592	282	464
71	1,500	2,400	237	436
72	1,503	2,335	196	564
73	1,618	2,250	187	561
74	1,562	2,130	161	519
1975	1,622	1,887	145	573
76	1,703	1,515	128	604
77	1,549	1,148	108	506
78	1,374	1,090	93	506
79	1,362	1,044	79	513
1980	1,339	1,046	67	516
81	1,352	1,106	60	510

Footnote: The figures are arranged by Hokkaido Regional Forest Office.

The following Figure shows the mechanization of logging under direct government management in Sapporo Regional Forest Office.

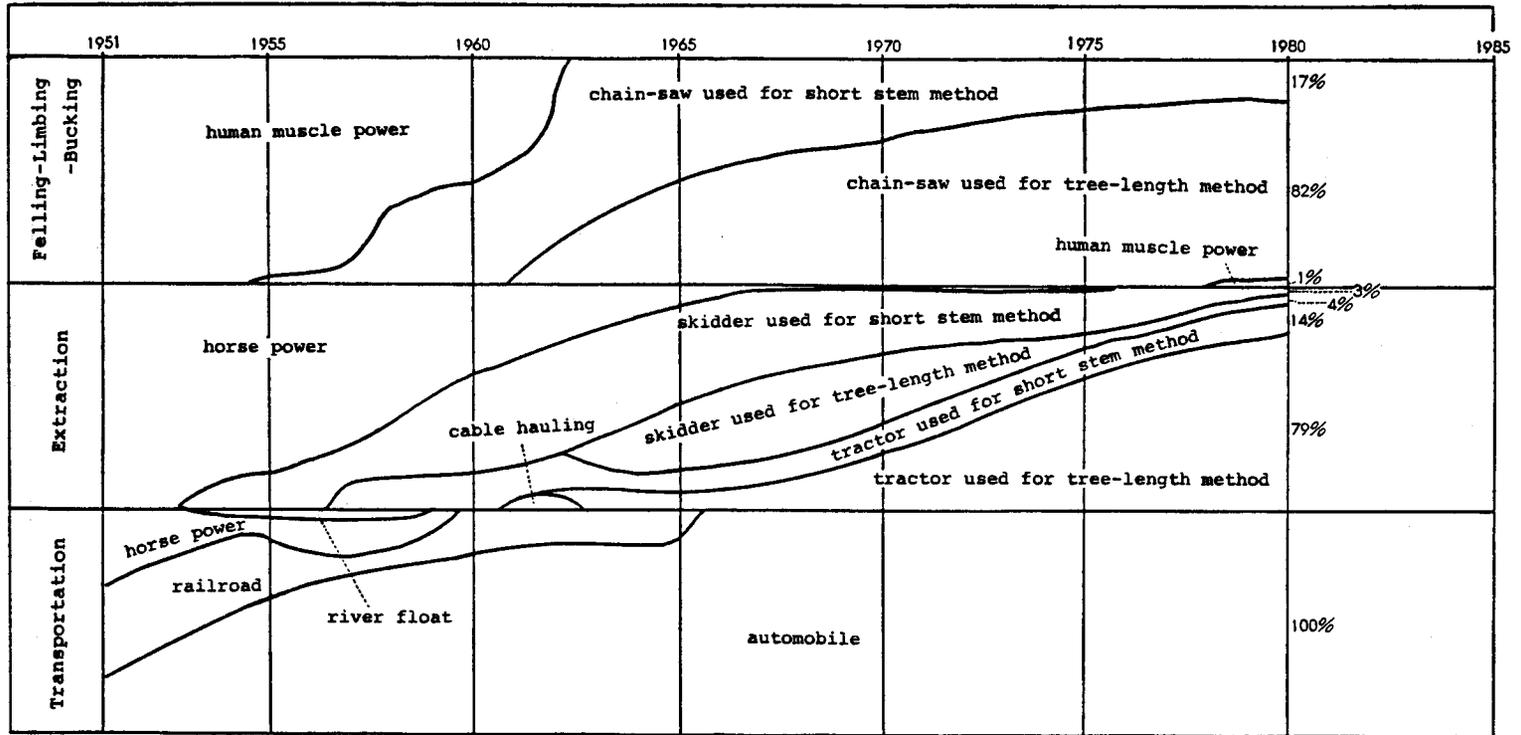


Figure Mechanization of logging under direct government management in Sapporo Regional Forest Office.

Footnote: 1. Prepared by Hokkaido Regional Forest Office. Sapporo Regional Forest Office is reorganized to H.R.F.O. in 1979.
 2. The percentage shows the rate of timber volume treated with various kind of tool and machine.

4. Characteristics of labor structure

1) The number of workers employed in Hokkaido national forests diminished from a peak of 37,290 in 1959 to 7,173 in 1981, only one fifth of the peak, through saving personnel expenses and development of mechanization in the process of production rationalization. Looking at the trend in aggregate number of workers by category of type of employment, the author finds that mainly temporary day laborers were used for operations up to 1962, after which, with the mechanization and rationalization of management that began in the 1960's, mainly periodic employees were used and, after 1970, the annually employed workers were used to

Table-8 Number of laborers classified by employment form of national forests in Hokkaido

Year	Total	Permanent employee	Annual employee	Periodic employee	Temporary day laborer
1954	21,624		1,209	2,512	17,903
1955	30,173		1,782	2,799	25,592
56	29,529		699	3,240	25,590
57	26,929		695	5,527	20,707
58	7,803		799	576	6,428
59	37,290		1,146	9,082	27,062
1960	37,214		1,203	9,191	26,820
61	32,062		1,195	9,015	21,852
62	28,534		1,350	9,795	17,389
63	26,649		1,458	11,637	13,554
64	24,218		1,560	11,779	10,879
1965	21,569		1,561	10,570	9,438
66	18,832		1,527	9,298	8,007
67	17,417		1,400	8,582	7,435
68	15,339		1,467	8,370	5,502
69	14,159		3,853	6,178	4,128
1970	11,484		5,048	4,413	2,023
71	11,097		5,033	4,045	2,019
72	9,777		5,132	3,716	929
73	9,462		5,078	3,486	898
74	9,317		5,110	3,246	961
1975	9,628		5,190	3,050	1,388
76	9,367		5,319	2,867	1,181
77	9,036		5,359	2,657	1,020
78	8,446	4,902	478	2,402	664
79	7,740	4,906	394	2,061	379
1980	7,611	4,863	345	1,809	594
81	7,173	4,813	305	1,662	393

Footnote: The figures are arranged by Hokkaido Regional Forest Office.

carry out operations. The number of workers continued to contract and as it became difficult to employ workers, the system of permanent employment of workers was put into effect and from 1978 on, this type of worker became the main group in carrying out operations (Table-8 and Table-9). 2) In the process of rationalizing management in the 1960's, there was the introduction of sub-contracting into the operations under direct government management in national forests so that the labor force became stratified into a direct-employment category and an indirect sub-contracted one. And here, while the directly employed category was undergoing a modernization revolution within the labor process of permanent

Table-9 Aggregate number of labor-day classified by employment form of national forests in Hokkaido

Year	Total	Permanent employee	Annual employee	Periodic employee	Temporary day laborer
1954	5,315,902	—	372,391	477,621	4,465,890
1955	5,506,743	—	492,251	513,915	4,500,577
56	5,939,184	—	453,033	632,665	4,853,486
57	5,865,631	—	562,267	998,481	4,304,883
58	6,229,101	—	743,488	1,251,367	4,234,246
59	5,867,185	—	916,398	1,471,438	3,479,349
1960	5,590,593	—	1,029,013	1,540,973	3,020,607
61	4,245,046	—	351,705	1,551,515	2,341,826
62	4,114,059	—	361,191	1,777,507	1,975,361
63	3,811,734	—	408,335	2,051,328	1,352,071
64	3,432,021	—	440,016	2,024,634	967,371
1965	2,913,573	—	435,287	1,770,223	708,065
66	2,525,861	—	422,240	1,518,597	585,027
67	2,349,471	—	386,160	1,468,545	494,768
68	2,396,998	—	384,268	1,635,767	376,965
69	2,382,099	—	1,064,726	1,134,493	182,881
1970	2,249,281	—	1,313,891	803,949	131,441
71	2,082,111	—	1,268,768	717,791	95,552
72	1,916,599	—	1,247,594	631,810	37,194
73	1,838,360	—	1,208,456	592,560	37,344
74	1,724,997	—	1,171,529	512,885	40,584
1975	1,720,012	—	1,183,571	475,195	61,251
76	1,702,061	—	1,190,442	452,017	59,602
77	1,640,658	253,550	923,849	419,259	44,002
78	1,581,846	1,062,568	102,997	383,553	32,727
79	1,499,042	1,057,924	89,364	331,296	20,458
1980	1,425,182	1,037,041	78,256	290,281	19,604
81	1,343,197	999,177	66,876	259,929	17,215

Footnote: The figures are arranged by Hokkaido Regional Forest Office.

employment and mechanization, the sub-contracted sector continued on in the same old fashioned manner.

5. Financial conditions

The author sees that they were profitable only during the first period from 1949 to 1954 and during the period from the disposal of windfallen trees to the time of

Table-10 Finance of national forests in Hokkaido

(Unit: Thousand Yen)

Year	Income				Expenditure	Difference
	Total	Timber sale	Forestland disposal	Miscellaneous		
1948	2,005,740	1,952,724	—	53,016	2,298,993	-293,253
49	2,774,443	2,583,042	69,697	121,704	2,640,813	+133,630
1950	4,846,703	4,463,688	230,608	152,407	3,694,771	+1,151,932
51	9,400,751	8,807,086	387,951	205,534	4,656,668	+4,743,903
52	8,925,498	8,177,780	488,443	259,275	6,407,538	+2,517,960
53	10,015,675	8,767,805	990,807	257,063	7,381,404	+2,634,271
54	9,384,238	8,439,211	592,145	352,882	8,853,802	+530,436
1955	10,173,725	9,288,824	394,565	490,336	11,556,099	-1,382,374
56	10,524,548	9,654,651	361,030	508,867	11,656,788	-1,132,240
57	13,907,229	12,959,636	359,196	588,397	12,237,267	+1,669,962
58	13,753,096	12,696,362	430,790	625,944	12,942,724	+810,372
59	14,493,192	13,453,871	450,285	589,036	14,386,220	+106,972
1960	15,952,785	14,889,881	430,984	631,920	15,636,686	+316,099
61	18,050,534	16,915,672	397,217	737,645	18,077,561	-27,027
62	16,914,255	15,873,099	251,806	789,350	22,831,937	-5,917,682
63	18,030,441	16,976,145	221,914	832,382	24,642,801	-6,612,360
64	16,835,770	15,677,699	276,206	881,865	25,747,815	-8,912,045
1965	22,596,474	21,104,181	464,777	1,027,516	26,729,835	-4,133,361
66	21,663,613	20,309,773	327,066	1,026,774	27,104,222	-5,440,609
67	24,501,303	23,075,759	350,520	1,075,024	28,832,156	-4,330,853
68	27,983,494	26,496,759	320,011	1,166,724	31,940,351	-3,956,857
69	28,418,965	26,648,473	479,571	1,290,921	36,484,838	-8,065,873
1970	29,825,504	28,131,512	475,403	1,218,589	40,084,074	-10,258,570
71	28,305,523	26,894,475	276,443	1,134,605	42,612,717	-14,307,194
72	29,488,657	27,461,189	833,233	1,194,235	40,965,020	-11,476,363
73	38,192,784	36,069,484	693,743	1,429,557	48,420,650	-10,227,866
74	50,151,337	47,454,284	184,133	2,512,920	63,508,603	-13,357,266
1975	45,327,995	42,946,278	349,231	2,032,486	75,061,842	-29,733,847
76	52,363,179	49,247,141	461,112	2,654,926	79,760,622	-27,397,443
77	55,532,037	51,562,045	497,628	3,472,364	87,469,334	-31,937,297
78	52,650,402	4,8021,282	1,321,543	3,307,577	87,987,948	-35,337,546
79	50,148,146	47,517,989	705,686	1,924,471	90,729,563	-40,581,417
1980	48,113,626	44,759,944	737,039	2,616,643	94,578,599	-46,464,973
81	58,675,230	55,003,618	560,321	3,111,291	97,399,579	-38,724,349

Footnote: The figures are arranged by Hokkaido Regional Forest Office.

the Increased Production Capacity Plan, 1957 to 1960. In recent years, because of the rigidity of the "National Forest Operations Special Account" there has been an infusion of operating funds from the Capital Funding Department of the Ministry of Finance since 1976 for reforestation expenses. Further, based on the "Special Measures Law for National Forest Operations" of 1978, there has been heavy funding from the general account into reforestation operations in contrast to that for protection forests (Table-10).

IV. Developments in the Timber Market⁵

According to Table-11, the demand for timber in Hokkaido which was 5.8 million cubic meters in 1955 approximately doubled in the next ten years, being about 12 million cubic meters in 1965. While this demand was mainly for wood for plywood, pulp and lumber, it was pulp that formed the real basis of this demand. While there are only ten pulp factories, the demand of these factories, including

Table-11-1 Timber balance in Hokkaido

Items Year	Demand		Supply						Self-sustenance ratio (B/A)	Ratio depending on foreign timber (C/A)
	Volume (A) (1,000m ³)	Index number	Total		Timber produced in Hokkaido		Foreign timber			
			Volume (1,000m ³)	Index number	Volume (B) (1,000m ³)	Index number	Volume (C) (1,000m ³)	Index number		
1955	5,847	49	5,993	50	5,979	53	14	2	102.3	0.2
1960	8,959	75	8,283	70	8,645	77	154	25	96.5	1.7
1965	11,982	100	11,872	100	11,247	100	622	100	93.9	5.2
1970	14,759	123	14,721	124	12,379	110	2,340	376	83.9	15.9
1975	14,179	118	14,419	121	9,934	88	4,485	721	70.1	31.6
1980	14,631	122	15,380	130	9,589	85	5,791	931	65.5	39.6
1981	13,142	110	12,850	108	8,782	78	4,068	654	66.8	31.0

- Footnote: 1. Calculated by statistical yearbook of Hokkaido forestry.
2. Index number is indicated by the value of 100 in 1965.
3. The figures of volume include wood chips.

Table-11-2 Timber demand in Hokkaido by use (%)

Items Year	Lumber	Pulp and paper	Veneer and plywood	Other uses	Shipment	Total
1955	44.8	24.7	3.8	14.0	12.7	100.0
1960	43.0	31.2	5.0	14.5	6.3	100.0
1965	37.8	41.5	6.6	11.7	2.4	100.0
1970	33.8	49.1	7.6	7.5	2.0	100.0
1975	34.4	50.7	7.5	6.8	0.6	100.0
1980	31.5	55.3	6.4	6.3	0.5	100.0
1981	31.8	54.9	6.5	6.2	0.6	100.0

- Footnote: Calculated by statistical yearbook of Hokkaido forestry.

chips, grew by a factor of three and one half over ten years until it was 42 percent of the total demand. Meanwhile, the demand for lumber-use timber was, during this period was 38 percent of the total.

Pulp manufacturers accumulated a great amount of capital during the Korean Conflict after 1950 and built new factories and installed new machinery in the period from 1957 to 1960. This was due to turning to the broad leaf tree as a cheap material and with the development of techniques for utilization, the broad leaf trees of Hokkaido were reassessed and large-scale factories from Honshu began to be built in Hokkaido. This investment in plants and equipment for pulp manufacturing appeared in the form of greatly increased demand for timber in 1960 and after. It was in response to this that the "Increased Production Capacity Plan" was put into effect in national forests in 1957. With the execution of this plan the ten-million-cubic-meter annual timber harvest up to 1958 that resulted from the typhoon windfalls of 1954, were able to be maintained after 1958 when the disposal of the windfalls was finished. Between 1958 and 1966 the cutting volume in national forests was around eight million cubic meters and, while as a percentage of the total coniferous tree cutting was greater, the increase in cutting of broad leaf trees was the reason this volume was sustained. As a result, not only was there a reduction in the broad leaf as well as the coniferous-tree resources, but also there were fewer of the more expensive high quality timber such as oak, linden, castor arabia and ash, and the remaining trees were those of smaller diameter. Then, in 1966, the supply from national forests began to show a distinct petrification and cutting volume fell off considerably.

On the other hand, this change in the management of national forests made it easy for the pulp capital to bring the lumber mills under its control. This was because the timber that the lumber mills bought from the national forests being from clear cutting of natural forests, naturally included some material not suitable to lumber milling and further, since there was a general insufficiency of Hokkaido timber it was impossible for the lumber manufacturer to meet the capacity of the mill relying only on timber bought from national forests. So, it became necessary to fill out the deficiency by buying or trading timber with other timber merchants. When the other partner in these transactions was, however, the pulp and plywood manufacturer with superior capital reserves, then the relationship was unequal. Pulp capital with distinctly superior capital reserves gained predominance and the configuration of control of the lumber manufacturing by pulp capital took shape from 1958 to 1965. Lumber mills slowly increased from the time of the beginning of the windfall disposal in 1955 until 1961 when they reached a peak of 1408, afterwards they began to decline for the reason why this control of the timber market by pulp capital can be considered one factor. The remaining lumber mills, 798 as of 1981, tended to become larger in scale.

As outlined above, Hokkaido's timber market, with a background of abundant natural resources, had formed an "area of supply and demand self sufficiency." But this began to collapse in 1960, eventually allowing the importation of foreign timber

and there came to be a reliance on cutting from privately and municipally owned forests. The cutting volume of 1.8 million cubic meters in 1960, grew by a factor of 1.8 in 1961, and afterwards continued in the area of from 2.5 to 3.1 million cubic meters until 1974. Total reserves in privately-owned forests being small, however, they were unable to overcome the deficiency in cuttings from national forests and the gap between supply and demand continued to increase, and this was filled by importing timber from foreign countries. In passing it may be noted that the dependence on foreign timber, as shown in Table-11, was 5 percent in 1965 and 32 percent in 1975.

This tendency increased after 1973 when the economy moved from high growth to a low growth rate and in 1980 dependence on foreign timber reached 40 percent. Foreign timber is important mainly in the form of wood chips which made up 60 percent of the imported total in 1980. Still, in spite of this importation of foreign chips, pulp manufacturers make Hokkaido produced trees the basic source of supply, taking this stance in response to the unstable supply of foreign timber. In that sense, both of these structures of long supply are maintained. The timber demand for 1980, it may be noted, was 14.6 million cubic meters of which 55 percent was for pulp, 32 percent lumber, 6 percent plywood and veneer, 6 percent for other uses and 1 percent for export.

V. Conclusion: Toward a Rational Forestry Practice

If the author looks for problems in the "New Forest Practice" policy of national forests followed since 1973, two points stand out; one is how to make in fit with public service function of the forests, the other is the problems in connection with the selective method.

Examining the first problem, the author notes that the public service function of forests includes not only the conservatory functions of conservation, storage and supply of water and soil conservation, but also of late the functions of purifying the atmosphere and recreation. On the other hand, the economic function of forests means that function of forests through which the forest becomes a source of supply of resources necessary for human livelihood. While it may be true that forests perform a public service function to some extent, there is a definite limit to this function, and at the same time, the workings of the mechanism of purification of atmosphere and water are not yet clear. Certainly the author must wait for future research on the inter-relationships of all the various functions. Therefore, the tendency to seek the total conservation forests without eliminating the sources of pollution is dangerous and there is a problem with way of thinking which would make it the duty of those benefitting to pay for the functions of the forest when they are so difficult to compute. Both of these ideas would result in exaggerating the public service functions of the forest and lead to the rejection of forestry production.

In any case, while the public service function of the forest is carried out simply by forest's existence, the economic function is always accompanied by the

act of destroying nature, i. e. tree cutting. Therefore, the two functions are always contradictory looked at as existing in the same time and place. However, there may be a direction of operations suggested if the elements of time and place are shifted for the two. The author would like to touch upon this point later. The outcome should be the strengthening of the public service function while at the same time continually increasing the forestry production capacity, and for that reason the most fundamental problem is the increase in forestry reserves.

The second problem concerns the question "whether simply because selective cutting increases does it mean that, from the point of view of productivity of labor that there will be a decrease in the volume of forestation." In the "New Forest Practice" policy the aim seems to be a natural renewal. Natural renewal, however, has always been a technique requiring intensive labor, in some aspects it requires more labor than man-made forests and further, the technique demands an experienced labor force. For example, the selective method at the experimental forests in the Yamabe district of Hokkaido belonging to Tokyo University and the Prefectural Forests in the Ikeda district have achieved success only in as much as they have been blessed both with good climate conditions and with a labor force which is numerically and qualitatively superior. Also, in the areas here where there is weak natural renewal, there has been an active supplementary planting making the renewal much easier. Consequently, the selection method should not be thought of as a method of saving labor.

Taking the above problems into considerations, finally the author will touch upon "forestry practices as involving conservation of nature." The purpose of forestry practice has heretofore been, while cutting timber, to create a forest of high production capacity. Therefore, the cutting should never overreach the limits of natural recovery, and also, there is a need to remember the point that by adjusting the time and place it is possible to cut without destroying the forest. As long as these practices are carried out forest management and conservation of nature will be unified. In forestry up to the present such practices as "shelterwood felling," "femel-cutting" and selective cutting exist for just this kind of reason. In selective cutting there is "every tree measurement" and "group system patch cutting," the "group system cutting" being an enlargement of the "every tree measurement" system, and the "shelterwood group" system can be considered an enlargement of the "shelterwood-felling" system. The one thing common to all of these systems is that they completely eliminate all clear cutting man-made forests and depend on natural renewal, that is they attempt the renewal of the forest through the natural sprouting of the seeds that fall to the ground and are spread naturally from the seed trees which stand on the forest land and produce seeds, a practice in which the fertility of the land is promoted while the production capacity is gradually increased.

This manner of creating forests is certainly in tune with the laws of nature and in this way a plant society appropriate to the environment can be reinstated. The idea is to maintain and increase that society while carrying a forestry manage-

ment which would cut a volume which counterbalances the growth volume. In this sense, forestry which perforce must destroy nature can, in this fashion both support natural conservation and at the same time make possible a sustained yield management.

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要 約

1. 本稿は北海道における国有林経営の、戦後の展開過程について、以下の諸点から明らかにした。まず経営方式の変化を木材市場の展開と関連づけて述べたあと、経営合理化の過程を伐出・造林の両事業を中心として、各種機械の導入と労働力構成の変化との関連で考察した。そして最後に「新しい森林施業」の問題点にふれつつ今後の施業のあり方についてふれた。

なお北海道の国有林は「近代的な大林業経営」として位置づけられるゆえに、その分析は重要な意味をもつ。

2. 戦後の北海道国有林経営の展開は3期にわけられよう。すなわち、第1期は戦後から風倒木処理完了時まで、第2期は生産力増強計画から木材増産計画に連なる時期、第3期は「新しい森林施業」以降の時期である。

これら3期の経営の特徴は、第1期は、1948年の「国有林経営規程」のもとで法正蓄積を排除し、収穫規制はカメラルタキセ法の変形が採用され、さらに輪伐期よりも伐期齢が重視されている。そして1954年以降の風倒木処理が第2期への移行を容易にした。第2期は、1958年の経営規程の改正で厳正保続が否定され、見込み生長量を基礎に伐採に弾力性もたされ「企業的経営」に移っている。これを現実ならしめたのが1958年からとられる「国有林生産力増強計画」である。第3期は、国有林における伐採の硬直化にともない1973年以降「新しい森林施業」が発足し、択伐作業が大幅にとりあげられることとなる。

3. 伐採事業については、(1) 伐採量は風倒木発生後急激に増加して1956年には8.4百万 m^3 となり、これが第2期にうけつがれて1966年までの11年間は8百万 m^3 内外で推移するが、第3期の1974年には5百万 m^3 台に低下する。(2) 伐採量が8百万 m^3 を維持する時期は広葉樹の伐採により生産量が増大した。(3) 立木処分と直営生産の比率では、いずれの年も立

木処分の比率が高く、風倒木処理期間の50%台を除いて、61~71%である。(4) 直営生産による素材生産量は、第2期には皆伐作業の採用と機械化の進展により生産性が高まり生産量を増加させるが、1971年をピークに減少に転じ、第3期には択伐作業の増加、振動障害認定者の増加により生産性が低下し、生産量を著しく減少する。(5) 直営による生産方法は、風倒木処理を契機に冬山生産から夏山生産へ、また人力・馬力による生産から機械化生産へと変り、さらに民間の素材生産業者による請負生産が大幅に導入されている。

4. 造林事業については、(1) 毎年の造林面積は戦後順調に伸び、風倒木発生後の1957年には2万haをこえ、さらに第2期の1961年には3万haに達し、1971年までの11年間は3万ha台を保つが、第2期末の1972年には2.3万haに減少している。(2) 造林樹種の中心をなすのが一貫してトドマツであることに変わりはないが、このような動向のなかであっても、風倒木発生後の1957~1965年にはカラマツ造林が大幅に伸び、カラマツ先枯病の発生が目立つ1962年頃から1969年頃までは、ストロブマツとヨーロッパアカマツの造林が試みられ、1970年からはトドマツの霜害をさけるためにアカエゾマツ造林が伸びている。(3) 1975年以降の造林事業にしろる請負の割合は、植栽では69~75%、地拵では66~74%、下刈では79~81%と、その多くを請負業者に依存している。

5. 林業生産の機械化は、1954年の風倒木処理以降夏山生産にきりかえられた結果、林道網の拡充とあいまって急速に進展した。一方、労働力事情についてみると、労働者の実人数は機械化が進むなかで、1959年の3.7万人をピークとして毎年減少し、1981年にはピーク時の1/5にも満たない7千人強の雇用にすぎない。なお雇用区分作業員の延人数の推移をみると、1962年までは日雇作業員が作業遂行上の中心的集団をなすが、1960年代に始まる機械化—経営合理化の過程のなかで、1963年からは定期作業員が、1970年からは常用作業員が作業遂行上の中心的集団となり、さらに雇用量が圧縮され、しかも新規労働者の雇用が困難となるに及んで基幹作業員制度を発足させ、1978年以降はこの集団が作業遂行上の中心的存在となる。

6. 財政の推移をみると、収支が黒字の時期は第1期の1949~1954年と、風倒木処理から生産力増強計画時にかけての1957~1960年のみである。そして特別会計の硬直のもとで、1976年から造林費の一部に大蔵省資金部運用資金が導入され、さらに1978年に成立した「国有林野事業特別措置法」にもとづき、保安林を対象とした造林事業に対して一般会計からの繰り入れが行われている。

7. 北海道の木材市場は、かつては国有林の豊富な天然林資源を背景に「自給自足の市場圏」を形成していたが、1960年以降次第に崩壊し外材輸入を許すことになる。そして一方では民有林に対し伐採を期待するようになる。しかし民有林における伐採の絶対量が少いなかであってこれによって国有林からの伐採を補うまでには至らず、需要と供給の開差はますます増大し、その不足分を外材で補うことになる。

第2期以降の需要の増大は、合板材・パルプ材・製材などの需要、とりわけパルプ材の需

要に支えられた。すなわち1957年から1960年にかけてのパルプ資本の広葉樹利用を指向した工場増設・設備更新と無縁でない。この需要拡大に応えたのが国有林の生産力増強計画である。その結果、針葉樹資源はもちろんのこと広葉樹資源も量的に減少したのみならず、優良な樹種や大径木が失われた。そして1966年には国有林からの供給は硬直化し、伐採を大幅に低下させた。

外材輸入の増加は経済成長が低成長に移行した1973年以降も続き、1980年には外材依存率40%にもなっているが、その中心はチップで、全輸入量の60%はこれによってしめられている。

8. 国有林の「新しい森林施業」のなかから問題点を探ると2つある。第1は森林の公益的機能と経済的機能をどう調節するかであり、第2は択伐施業のあり方に関するものである。

第1の問題にまずふれよう。公益的機能は森林がその存在のなかで発揮される機能であるのに対し、経済的機能は必ず伐採という自然破壊行為を伴うため、両者は同一の場所と時間を限ってみると相対立する局面を含んでいる。したがって時間と場所をずらす施業のなかに両機能が統一される方向を見出そうとした。

第2の問題は「択伐施業林が増加するからといって労働生産性からみた造林量が減る」かどうかという疑問である。天然更新は本来きわめて労働集約的な技術であり、ある面では人工造林以上に多量の、しかも熟練した労働力を必要とする。さらに天然更新力が弱い林地には積極的に人工補植を行い更新を容易にしていることを考えると、労働節約的発想のなかで択伐施業をとらえるべきでない。

9. 以上の問題点をふまえつつ、最後に「自然保護を加味した森林施業」についてふれた。森林施業の本来的な使命は伐採を加えつつ、より生産力の高い森林をつくりだすことである。したがって伐採は決して自然回復力の限界をこえて行われるべきではないし、また伐採は場所と時間とをずらすことによって破壊されない森林になりうる点に留意すべきである。本来的な択伐・漸伐がそれで、かかる施業が行われている限りは林業経営と自然保護とは統一され、保続的経営が可能になると思われる。