

# FOREST HISTORY IN JAPAN WITH A CHANGING ENVIRONMENT

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### INTRODUCTION

Forest is regarded as a renewable resource, and has multiple functions including matter production, moderation of environmental change, recreation and aesthetics. (MEA 2005; KOIKE et al. 2011). The Japanese people have often overused forest resources, however, with consequent degradation of forested areas. Severe problems have arisen as a result of laying forests bare at least three times (MAKINO 1988, TOTMAN 1989). The first was around 800AD near Kyoto, then the capital of Japan. The second time was the Warring States era between 1477 and 1573. The third and most recent time was just after WW2. How can we use our forest resources wisely? MAKINO (1988) described the forest history of Japan around the setting-up of man-made forests by prominent foresters.

Prof. Conrad Totman, a historian of Yale University, was shocked to see barren lands in the 1950s, after WW2; he then wondered why the Japanese could recover and maintain the green cover of their land from the 1970s when much of the developed world had lost its green cover. His book "Green Archipelago" (1989) was the result. In it, TOTMAN analyzed forest recovery in relation to human activities and forest recovery up to the Meiji Restoration, when the important role of the structure of big family with many generations for sustainable use of fore-

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sts was realized. Recently, SUZUKI et al. (2011) took up the work of Prof. Tatsuo KIRA on why Japanese forests were conserved around Lake Biwa, near Kyoto. According to KIRA (2001), the lack of ecotone between farmland and mountain may be one reason why Japanese forests were conserved partly because Japanese had no meat diet from mid Tokugawa-shogunate until the Meiji Restoration. We therefore provide an overview of Japanese forest history to shed light on how to use forests (KOBAYASHI 2011) for sustainable use of forest resources.

The aim of forest history is to reveal the history of human interaction with the forest environment in order to understand the establishment process in forestry and find a way of sustainable use of our forest resources. We should learn the history of forest utilization in Japan to enable sustainable use and hand on our valuable forest resources to future generations. Accordingly, we outline below the vegetation characteristics of Japanese forests and the forest history of Japan accompanied by the trend of population.

#### **VEGETATION CHARACTERISTICS OF JAPANESE FOREST**

Japanese forests have relatively high species richness and biodiversity, because of the long N-S axis of the land from about 20°N to 45°N, with a large amount of precipitation, on average around 1800 mm per year under monsoon climate conditions. Given sufficient precipitation, forest vegetation is determined mainly by the temperature conditions (KIRA 1945, 1949) (fig. 1). The precipitation pattern in Japan differs between the Pacific Ocean coast and the Sea of Japan coast; Pacific regions experience large precipitation mainly in summer, whereas the west coast experiences heavy precipitation mainly in winter, as snow (SHIDEI, KIRA 1977).

The genus *Sasa*, dwarf bamboos that grow along the westerly side, usually inhibit natural regeneration in forests (KOIKE et al. 2001) as shown in figure 2. Snow cover deeper than 50 cm protects *Sasa* plants from cold temperatures. The great species richness in Asia is considered to be due to the absence of a barrier to the south (ADAMS, WOODWARD 1989). This enables plant species to shift southward during glacial intervals. As a result, species richness has been higher in Asia than in Europe or America (table 1).

#### **IMPORTANCE OF FOREST HISTORY**

Forest history consists of a life-cycle of forests influenced by natural and man-made disturbances (NISHIKAWA 2011), as shown in figure 3. Environmental history is also needed; in particular, we should consider not only forest ecology but also social science and philosophy. The vital role of sustainable use of forests is obvious in the sad case of Easter Island or "Rapa Nui" (PONTING 1992) and of The Republic of Lebanon symbolized its flag of Lebanon cedar (*Cedrus libani*) (KANEKO 1990). The people failed to use the forest resources and declined sharply

in population, then lost their culture or own crop filed of wheat in the latter case. Therefore, forest history is deadly important for the future as well as the past.

Our overview of Japanese forest history from the viewpoint of human activity is divided as follows: Prehistoric and Ancient, Medieval including the Warring States period, the early Modern including Tokugawa shogunate, the Modern after the Meiji Restoration, after WW2 and the present. The terminology of forest harvest styles was mainly followed by the idea of TOTMAN (1989), i.e. "predation" in ancient days and before Tokugawa shogunate without any special plantation forestry or failure in plantation while "exploitation" was employed when people partly rehabilitated forest resources.

#### PREHISTORY AND ANCIENT PREDATION

People originally lived in a forest as if they were a part of nature, and their predation and disturbances were not severe. Prehistoric people collected chestnuts, beech, buckeye and other kinds of acorn as food. They used trees from forests for housing and fishing (e.g. WATANABE et al. 2008). However, they systematically destroyed forests to make settlements when they began to cultivate rice plants in the ancient period. In southern Japan, ancient people used trees to make farm implements for paddy fields. Given the high productivity of rice, the Japanese population increased rapidly. At around 600AD, the population was estimated to be approximately 4 million (ISE 1974; MCEVEDY, JONES 1978, KITO 2000).

#### EXPLOITATION FORESTRY

From about 600 AD, a metropolis developed at Nara and Kyoto, the ancient capitals of Japan, requiring much timber, and as a result many mountains became bare. This trend was accelerated to produce ironware from iron-bearing sand. The Heijyo-kyo ("kyo" means capital) was located near Nara in the southern part of Kyoto from 710~784 AD. The inhabitants collected timber around Lake Biwa and near to Kyoto and Nara because conveyance by water was then the only efficient way to transport timber. The total population of Japan was about 4~6 million (ISE 1974; KITO 2000). But the Mongolian Invasions (of 1274 and 1281) influenced the society of Japan.

Heian-kyo, shown in figure 4, was established in 794 AD following the Nagaoka-kyo in the western part of the city of Kyoto, and was settled for about 400 years. During this period, people constructed large shrines, temples and residences involving intensive and destructive use of forests. As a result, mountains along the Hodzu River, for example, in Kyoto prefecture were laid bare. The names of many towns located at river mouths include the word "Tsu", which means a port involved in the timber trade. Moreover, the locals made new land for growing crops out of formerly forested areas. People tried to rehabilitate degraded forests in the upper stream region to protect paddy fields from erosion (MAKINO 1988; SETA 2000). They also used fire as defense against wolves, which sometimes accelerated forest decline accompanied by erosion of land surface.

In the northern part of Kyoto, Kitayama-ringyo (=forestry) commenced with special use of poles as decoration in Japanese houses, especially in alcoves. The practice produced elegant wooden poles in dense plantations, requiring vertical storage and multiple pruning and polishing naked pole during the winter season with special sand (fig. 5).

Moreover, the Japanese had been collecting pine and oak species as superior firewood, to make ironware from iron sand, and salt from sea water. They introduced a social rule of sharing forest resources among people living around the forest, it was called as "iriai" right (MAKINO 1988; SETA 2000). The trees were intensively harvested, and were often modified by such practices as pollarding, especially oak and beech stands (fig. 6). At this time, tree fellers would pray to their god before and after the harvest (fig. 7), because they believed that gods lived in forests and big trees, a belief shared with the Ainu people (KITAHARA 2011). The people believed that the gods provided them with natural resources and timbers in their forests. This idea is also found in very early Europe (HERMAND 1993). After harvesting a tree, the feller usually prayed to the stump decorated with the shoot top of the cut tree for safety during harvest and for future tree growth.

# EARLY MODERN PREDATION INCLUDING THE WARRING STATES PERIOD

With increasing crop production, predation of forest and forest land increased. Many Samurai lords intensively exploited forests and increased their own farmland, then built castles (fig. 8) in many parts of Japan, apart from Hokkaido Island. These activities led to severe degradation of forests, and the lords sought to prevent it but without success.

During the Warring States period (approximately 1460–1570), there was extensive degradation of forests, including bamboo stands, in Japan. Bamboo, which had been partly introduced from China, was useful in Japanese archery (MORIMOTO 2008) as well as making wall of houses with mud. The Samurai lords sought to prevent forest degradation with many rules, to maintain a natural environment for human use and survival. They enclosed forests for timber and allowed farmers to collect litterfall to enrich their farmlands. Among the lords, Hideyoshi TOYOTOMI, an adviser to the emperor, is considered to be the first person who regulated timber-production in Japan (TOTMAN 1989). He constructed many castles and temples, using much timber. He also supported the tea ceremony and built many special houses and rooms for the tea in order to display his power without actual battles.

Beginning around 1603, the Tokugawa shogunate sought to regulate timber production in detail, but the effort in deploying forest resources (e.g. timber, getting resin for light, litterfall as fertilizer, etc.) was well not a success (TOTMAN 1989). The Tokugawa shogunate then tried to introduce plantation forestry in

each regional feudatory for the establishment of multi-purpose timber production without further degradation of forests. As increasing the population in this period reached about 30 million (ISE 1974; KITO 2000), we developed the region specific plantation forestry during the Tokugawa shogunate. The method of plantation forestry was shown in the following.

#### PLANTATION FORESTRY

During the Tokugawa shogunate, an attempt was made to establish a silviculture system in each region for sustainable management of forest resources. As a result, many region-specific systems of forest management sprang up for specific uses of timber (OGANE et al. 1973) (table 2). This system was well accepted in many regions of Japan, except Hokkaido, and continued to be effective up to about 1930. As an example, Yotsuya and Ome forestry in and near Tokyo respectively were characterized by dense plantations needing no special tending that produced poles for flags and scaffolding poles in construction work. Yoshino-ringyo is famous for intensive tending (thinning and pruning) to produce high quality timbers, Sake cask or barrel and staves. In contrast, Obi forestry in Kyushu Island has been producing deck timber from very sparse plantations, with careful pruning in long-term harvesting. In a dense plantation without intensive tending and with short-term harvesting, Tenryu and Hita forestry produced telegraph poles and ordinary timbers for the construction of Japanese-style houses.

This effort was delayed by the outbreak of several wars, including the battle with the Qing Empire of old-Chinese, the Russia Empire, and especially World War 2 (WW2). The population in 1900 stood at around 50 million (KITO 2000). Most young people were obliged to move to large cities to work in industry, and the average age of people in rural areas increased. After 1868, many Japanese migrated to Hokkaido and developed Hokkaido Island where the Ainu race had been living in a way unchanged for many centuries. From Hokkaido, the bark of oak trees (*Quercus dentata*) was used intensively for tannin production, to soften animal skins mainly for soldiers. The armed forces had sought to cut beech forest for making wooden fighter planes. Although people used forests for more resources, forestry offices maintained the concept of forest preservation, which originated from Germany, i.e. "Der Dauerwaldgedanke" in Germany (continuous forest management or sustained yield) (NISHIO 1988; TOTMAN 1989; KOIKE et al. 2011).

From the Meiji Restoration, around 1868, Japanese people began to change their lifestyle from the traditional Japanese way to a European way of life (KOBAY-ASHI 2010), especially hair-styles and clothes, from Kimono dressing to European clothes, as seen in Japanese wedding pictures (fig. 9). The method of construction of houses also changed greatly. This trend has since been accelerated by economic globalization.

#### AFTER WW2 AND INTENSIVE PLANTATION

Japanese forests were exhausted before and during World War 2, for wood resources. After that war, tree seedlings were intensively planted to recover the degraded forests (RINSEI-SOGO ASSOCIATION 1980) (fig. 10). Ordinary Japanese people began to live in western-style houses rather than Japanese traditional houses, with a change in lifestyle and food during the occupation by GHQ (General Headquarters), mainly of the U.S.A. Before that time, the Japanese people had already been moving to a European or American lifestyle from the Meiji Restoration. Much timber was used to rebuild wooden houses that had been bombed by U.S.A. Army during the war, mainly in the cities. We needed lots of timber at one time for rebuilding houses.

After WW2, two forest management systems, those of the emperor forests and the common forests, were united to become the Japanese National Forest (Ogino 2006). To achieve an economic boom, the Japanese Forestry Agency commenced transplantation from secondary forests with broadleaved trees to highly productive man-made conifer forests (SHIDEI, KIRA 1977). The choice of tree species for each site was not always made carefully, such as Sugi-cypress (fig. 11) in Tohoku District of Honshu Island and larch in Hokkaido Island (RYU et al. 2009). They only paid attention for biomass productivity but not for the principal idea of suitable tree species for suitable site. As a result, we failed to make high productive confer forests in many parts of Japanese land.

Although Kitayama-ringyo in Kyoto has a long history, at least 650 years, it was greatly reduced because many Japanese prefer to live in western-style houses without Tatami (reed)-mat rooms and decorated alcoves with poles. People concentrated themselves into European-type homes in tower-block apartments in large cities such as Tokyo, Nagoya and Osaka (KITO 2000).

Man-made forests in Japan suffer from typhoons typically several times during summer and early autumn in southern part of Japan, although rarely in Hokkaido Island. If a typhoon does reach the forests in Hokkaido, it can cause serious damage, as in 1954 according to modern record of Japanese Meteorological office. Many secondary and plantation forests, to a total of 747,000 ha, were wrecked by the typhoon "Toya-maru" named after a sunk ship (Ist-Ishikari 1955). After the typhoon, an outbreak of wood borers (e.g. *Ips typographus japo*nicus Niijima) damaged and killed a further area of conifers four times as large (fig. 12). The typhoon damage was replaced mainly with mono-culture conifer plantations, such as fir, spruce and larch in Hokkaido. Japanese Forestry Agency employed the theory of pre-established harmony: if we plant tree seedlings after the harvest, we should keep resource as far as possible independent of forest condition. This method was employed for intensive harvesting according to the idea of the theoretical "Normal Forest" (SUZUKI 1979). Although the theory is well established, this idea brought finally the imbalance between stock and flow of forest resources in Japan. As nature protection is more popular, we shifted to reduce making large-sized plantation.

#### **CURRENT FORESTS**

The advanced systems of forest management specific to each region gradually declined from the 1970s, because of the rapid change in the Japanese lifestyle and rapid industrialization (e.g. NISHIKAWA 2011). Until the 1980s, some forests suffered from environmental pollution (SATOO 1979; KOIKE et al. 2011). Unfortunately for us Japanese forestry, freedom of trade in timber reduced forestry activities (MAKINO 1988; KUMAZAKI 1989; NISHIKAWA 2011). Following intensive production of man-made forests, the age-distribution of Japanese plantations is not the ideal flat shape, but shows a peak at around 40-50 years of age. This is a significant problem in attaining sustainable forest management. The Forestry Agency of Japan is working to set up a flat age distribution of forest trees throughout Japan.

It is now the norm to live in westernized houses without Japanese traditional rooms containing decoration and beautiful poles. A 2 x 4 system is becoming increasingly popular. As a result, laminated woods are most common in the construction of wooden houses in Japan (TSUTSUMI 2003; MITSUI TRUST HOLDINGS 2005). Only wealthy people and inhabitants of rural forested areas now live in traditional Japanese houses having an elegant timber style. In addition, land prices in rural forest areas are still reasonable. Such houses are designed to last not less than 26 years, less than one-half that in Europe and the U.S.A., because of the frequency of earthquakes and typhoon damages (TSUTSUMI 2003).

Most people in rural areas no longer tend man-made forests for timber production, because there is no economic interest at present. The self-support ratio of timbers in Japan has declined sharply, from about 90% in 1960 to 20% in 2005 (It is now around 27%). However, we should tend man-made forests because artificial forests should be tended to produce timbers. These tending practices are the condition of making plantation.

In 2004 many forests in Japan, especially in Hokkaido, were destroyed by typhoon No 18, like typhoon No 15 in 1954. Many man-made evergreen conifer stands were totally leveled, extending to an area of 37,000 ha (fig. 13). Following the damage caused by this typhoon, we seek to simulate the original vegetation of Hokkaido: i.e. mixed conifer-broadleaved forests. This is an original vegetation of Hokkaido, the ecotone between cool-temperate forests and sub-frigid forests (TATEWAKI 1958; MATSUDA et al. 2002).

Moreover, Japanese forests are once again suffering from pollution, including nitrogen deposition and ozone stresses (e.g. IZUTA 2006; WATANABE et al. 2011). Discarded man-made forests require intensive thinning, because production of leaves in the top layer is accelerated by elevated  $CO_2$  (OIKAWA 1986; KIKE et al. 1995). Otherwise, with increasing  $CO_2$ , regenerated seedlings at the forest floor will die because insufficient light would reach the forest floor. The former silviculture techniques were developed during the atmospheric condition, such as  $CO_2$  concentration and nitrogen deposition had been relatively stable for more than 400 years (e.g. IZUTA 2006, KOIKE 2011).

Under these circumstances, Japanese people now expect an increase in ecological services in forest ecosystems as mentioned above, involving moderate environmental change, erosion control, esthetics, etc. (MEA 2005). To realize this goal, intensive tending of man-made forests is necessary in Japan.

In conclusion, Japanese forests have suffered from excessive exploitation three times: in the ancient period around Heian-kyo, during the Warring States period, and during/after World War 2 (table 3). The Japanese developed manmade forests for protecting paddy fields used for rice production in and after the ancient period, with an increase of forest stock during the Tokugawa shogunate, and intensive planting of conifers for increasing timber production after WW2. During these trials, Japanese people have been planting trees based on the sprits of nature preservation. It is important to tend plantation forests in order to smooth the age distribution of trees in the present changing environment.

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#### FOREST HISTORY IN JAPAN WITH A CHANGING ENVIRONMENT

#### Summary

Japanese forests are characterized by their high biodiversity. This is because there is no southern barrier; during the glacial period, many species survive the cold by shifting their range southward. Given adequate precipitation, temperature is then the main factor in determining the type of vegetation. In ancient times, use of timber from forests for housing and fuel was not great, and forest vegetation recovered rapidly. From about 500BC the cultivation of rice-plants began in the south of Japan, using litterfall of forests as fertilizer. People established villages where they lived, and eventually a metropolis was established near Kyoto, the former capital of Japan. Large and elegant wooden buildings were erected there, but the mountains in the neighborhood of Kyoto became bare due to overuse. During the Warring States era (1460–1570), forests throughout Japan (except Hokkaido) became degraded due to overexploitation of timber for fuel, making salt, building and other uses. To restore the forests, the Tokugawa shogunate and its administrators developed various forest management systems in specific regions, which maintained the land in question as green until World War 2 (WW2). During and after WW2, the Japanese intensively created manmade forests to enable recovery from overuse and make more timber available. Around 1960, however, economic globalization accelerated. This reduced forestry activity in Japan, and Japan imported about 75% of its timber in 2010. With rapid change of atmospheric condition, we should develop further tending on forests. Wise use should be made of the ecological services of forests so as to enable further progress in setting up sustainable forest resources, informed by a study of forest history.

**Key words:** forest history, Warring States period, plantation forestry, economical globalization, changing environment

#### HISTORIA LASÓW JAPONII NA TLE ZMIAN ŚRODOWISKA

#### Streszczenie

Japońskie lasy charakteryzują się wysoką różnorodnością biologiczną, co jest możliwe z powodu braku barier przyrodniczych na południu. Podczas okresu zlodowacenia wiele gatunków przetrwało zabójczo zimny klimat przemieszczając się właśnie na południe. Odpowiednia ilość opadów atmosferycznych oraz temperatura są głównymi czynnikami wpływającymi na rodzaj szaty roślinnej. W starożytności wykorzystanie drewna w celach budowlanych i opałowych nie było zbyt duże, dlatego też lasy szybko się regenerowały. Od około 500 roku p.n.e. rozpoczęto w południowej Japonii uprawy ryżu, używając ściółki leśnej jako nawozu organicznego. Ludzie zakładali wioski i w końcu powstała duża metropolia w okolicach Kyoto, pierwsza stolica Japonii. Wybudowanie dużych, eleganckich, drewnianych budynków spowodowało, że góry w sasiedztwie Kyoto stały się nagie, pozbawione roślinności drzewiastej. W okresie Walczących Państw (1460–1570), lasy Japonii (oprócz Hokkaido) zostały zdegradowane z powodu eksploatacji drewna na cele opałowe, budowlane i inne. Przywracanie lasów, odbywało się za shogunatu Tokugawy i jego administratorów, którzy rozwinęli różne systemy zarządzania lasami w zależności od regionu, co pozwoliło utrzymać zielony teren aż do II wojny światowej. Podczas i po II wojnie światowej podejmowano szereg wysiłków by lasy były bardziej dostępne dla celów gospodarczych. Nie mniej jednak większość zapotrzebowania na drewno jest zapewniana przez import. W 2010 roku Japonia importuje około 75% drewna. Wraz z szybką zmianą warunków klimatycznych, powinno się dostrzegać także inne walory

terenów leśnych. Mądre i oparte na ekologicznych podstawach wykorzystywanie zasobów leśnych powinno kierować się zasadami zrównoważonego rozwoju.

**Słowa kluczowe:** historia lasu, okres Walczących Państw, plantacja leśna, ekonomiczna globalizacja, zmiany środowiska

Table 1. Species richness of tree species in Europe, U.S.A. and Far East (after Fujimori 2003)

Tabela 1. Bogactwo gatunkowe drzew w Europie, USA oraz na Dalekim Wschodzie (za Fujimori 2003)

H	Broad-leaves trees	Conifer trees		
Region	species	variety	species	variety
Europe	30	60	7	18
U.S.A. east	110	220	13	30
U.S.A. west	34	70	22	50
Far East	150	400	26	100

Table 2 Traditional forestry systems in Japan (Adopted from Fujimori 2003) Tabela 2. Tradycyjny system leśny w Japonii (wg Fujimori 2003)

Density	Times of thinning	Rotation	Region	Final products
High	Almost no tending	Short	Old-Yotsuya	Flag pole
	Few	Short	Nishikawa, Ohme, Owase	Pole for flatwork
	Many times from early stage	Long	Yoshino	High quality timber
		_		Barrel
Inter-Mediate	Few	Long	Chizu	High quality timber
				Barrel
	Often (tending)	Long	National	Large diameter
			Forests	Ordinal timber
Low	Growth regulation of individuals	Long	Obi	Deck wood, Beam
	Very rare or few	Short	Tonmu Lita	Utility pole,
			Oguni Kidu	Ordinary timber
			Oguin, Kluu	Woody species

## Table 3. Brief history of forestry in Japan (modified from C. Totman) Tabela 3. Zarys historii leśnictwa w Japonii

Year		Epochs in Forestry	Historical preiod	Period: & capital	Estimated Population (year)	Historical Entries
						Agriculture 2500B.C500A.D. Smelting A.D. 200- Social Consolidation A.D. 300-
A.D. 600						
	700	Acient predation 600-850	Ancient	Nara: Heijyo-kyo 710-794	5 million (700)	Todaiji−temple (about 740)
	800		1			
	900			Heian: Heian-kyo 794-1185		Heian-kyo built (740)Heian-kyo decay (959-)
	1000				6.5 million (1000)	
	1100	Exploitaion Foresty	↓ ↓			Todaiji-temple re-built (1180-)
	1200		↓ ▼	Kamakura: 1185- 1337		Bum in Kamakura (1219)
	1300		Medieval			
	1400 1500		Ļ	Muromachi: Kyoto 1337-1600		Share forest resources (Iriai- proliferate) (about 1400) Hideyoshi Toyotomi built
	1600	Early modern predation	▼ Early modern	Tokugawa (Edo) 1603-1868	12 million (1600)	(1590) Meireki-fiire in Edo (1657) Tougawa Bakufu governed Hida mountain (1962)
	1700				31 million (1720)	Profit sharing forestry expanded (1720)
	1800	Plantation forestry	Ļ	Modern: Tokyo 1868-	33 million (1870)	Lental forest from Bakufu (Nenki- yama) (1760) Immigration to Hokkaido National forests establised (1880)
	1900		¥		83 million (1950)	Import of tropical timbers
	2000		modern		127 million (2005)	Export timber to China



Fig. 1. Horizontal and vertical vegetation of Japan Ryc. 1. Zbiorowiska leśne w Japonii



Fig. 2. Forest floor is covered by deep and dense *Sasa* community in forest along with Japan Sea side with heavy snow fall

Ryc. 2. Dno lasów wzdłuż wybrzeży Morza Japońskiego jest pokryte gęstymi zbiorowiskami roślinnymi z dominującymi gatunkami z rodzaju Sasa



Fig. 3. Schematic representation of relation between environmental history and Forest history (after Totman 1989)

Ryc. 3. Schematyczne przedstawienie zależności pomiędzy historią zmian środowiska a historią lasów (Totman 1989)





Fig. 4. Location of old metropolis around Kyoto and Nara (offered by H. Uchida, c/o, Geoscience Co. Ltd. Kyoto) Ryc. 4. Lokalizacja dawnej metropolii w okolicach Kyoto i Nara (wg H. Uchida, c/o, Geoscience Co. Ltd. Kyoto)



Fig. 5. Pollard shape of Siebold beech in Tohoku District of Honshu Island of Japan (offered by T. Nakashizuka)

Ryc. 5. Ogłowiony buk w rejonie Tohoku na Wyspie Honshu w Japonii (wg T. Nakashizuka)



Fig. 6. Production of decoration of pole after polishing with "Shirakawa" (fine) sand in Kitayama-Ringyo, Kyoto

Ryc. 6. Realizacja dekoracji po wypolerowaniu drewna drobnym piaskiem w Kitayama-Ringyo, Kyoto



Fig. 7. Before harvest of big spruce tree, we pray the God of trees with serving special Sake-wine and thanks (offered by H. Furihata)

Ryc. 7. Przed wycięciem dużego świerka, modlimy się do Boga ofiarując wino i podziękowania (źródło: H. Furihata)



Fig. 8. Big woody castle, Himeji-jyo, cultural heritage of UNESCO Ryc. 8. Okazały drewniany zamek Himeji-jyo, kulturowe dziedzictwo UNESCO



Fig. 9. Mixture of Japanese traditional and western clothes on the wedding ceremony at the Meiji Shrine in Tokyo

Ryc. 9. Mieszanina kulturowa widoczna podczas ceremonii ślubnej w Meiji Shrine w Tokyo, gdzie ludzie są ubrani zarówno w tradycyjne stroje japońskie jak i zachodnie ubrania



Fig. 10. Forest rehabilitation practices in Rokko Mountain range of Kobe near Kyoto at round 1900 to 1930, A – beginning of plantation, A – on the way of rehabilitation practices (offered by Kobe City Bureau)

Ryc. 10. Odnowienie lasu w łańcuchu górskim Rokko, Kobe nieopodal Kioto, 1900–1930, A – początki uprawy, B – w trakcie odnawiania (wg Biura Miasta Kobe)



Fig. 11. Failure of Sugi-cypress plantation at high mountain sites (photo by N. Toyota) Ryc. 11. Nieurodzajna uprawa cyprysów w wysokich górach (fot. N. Toyata)



Fig. 12. Damaged conifer plantation and secondary forest in Sounkyo, central Hokkaido by "Toya-maru" typhoon in 1954 (offered by Hokkaido Regional Development Bureau) Ryc. 12. Zniszczona przez tajfun "Toya-maru" w 1954 roku uprawa oraz drzewostan w Sounkyo, środkowe Hokkaido (wg Hokkaido Regional Development Bureau)



Fig. 13. Typhoon damage around Lake Shikotsu in Hokkaido in 2004. Most coniferous plantations were fallen (offered by Hokkaido Forest Management Office) Ryc.13. Szkody po tajfunie w okolicach Jeziora Shikotsu, Hokkaido w 2004 roku. Większość upraw gatunków iglastych została zniszczona (wg Hokkaido Forest Management Office)