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Forest Resources Exploitation and its Impact in the Extreme Salient of Java, 1870-1970

ABSTRACT: This article deals with the human's role in altering the environmental realities and the adaptation to the changing environment in the context of forest resources exploitation. The study is focused on a region of Java, called the Residency of Besuki, during the period of 1870-1970. The extraction of forest resources in the region had long taken place, but from circa 1870, it grew on an increasingly large scale. The growth was induced by the rising market demands for forest products and was facilitated by the gradually improved extraction technologies. Diverse products were taken from the region's forests to provide construction materials, firewoods, foodstuffs, and other requirements. The commercial extractions immediately led to a resource depletion and the small territorial size of the region made the possibilities of adopting a frontier's exploit-and move-on attitude more limited. Under this constraint, adaptations were developed to adjust with the decline in forest resource supplies and to meet the challenges in securing the resources in demand by developing human-made production forests. This indicated that there was already interest in sustainable forest exploitation. The impact of the forest exploitation, however, was larger than being merely a matter of resource supplies. It also radically altered the region's environmental realities by replacing heterogenous natural forests with more homogenous human-made production forests. This change inevitably also led to the loss of the region's biodiversity richness.

KEY WORDS: Environmental change, forest exploitation, human impact, colonial and early independence periods, Besuki residency, and Java island.

INTRODUCTION

Java is widely known as the least forested island of Indonesia. The shrinkage in forest cover of Java has been associated mainly with the population pressure and agricultural expansion (Donner, 1987:70-75). From the nineteenth century, Java began to build its major feature as one of the world's most densely populated islands. It was a time when the population of Java experienced "an

explosion" (Geertz, 1963:53-70). The growing population led to the increase in demand for food, wood, and settlement. It can be understood that with regard to the forest in Java, the nineteenth century has been depicted as "the age of destruction" (Boomgaard, 1988:76).

In the same period, Java also began to experience an expansion in agricultural production. The transformation of Java into a

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leading centre of the commercial agriculture was one of the greatest achievements of the Dutch colonialism in Indonesia and the sector served as major foundation of the Dutch colonial economy (O'Malley, 1988:197); and continued to play its important role during the early independence period. It comes as no surprise that the population growth and agricultural development were regarded major forces behind the changing environmental realities.

The two factors, however, were not only causes of the loss of forests. The present article argues that the extraction of forest resources exerted significant influence on the forest environment. Its significance, as an environment-changing force, had often been overlooked or only implicitly recognised in the existing studies focusing mostly on the political and socio-economic aspects of forest exploitation (Peluso, 1992; Wartyo, 2001; and Purnawati, 2004).

There are a few exceptions, including works by Han Knapen (2001) and David Henley (2005). Han Knapen showed that in Southeast Borneo, increased extraction of timber, especially ironwood, led to its depletion in accessible areas, and hunting activities played a decisive role in bringing several animal species to extinction (Knapen, 2001:320-322 and 340-347). On North and Central Sulawesi, David Henley argued that supplies of ebony and sandalwood in the natural forest were depleted from commercial logging (Henley, 2005:551-552). All of these studies, however, deal with the outer islands of Indonesia, none focuses on Java.

This article employs historical method. By using a variety of historical materials, including colonial archives, official publications, contemporary newspapers, and secondary sources, this article elaborates the expansion in and closure of forest exploitation frontiers. The theoretical framework, which informs the argument and directs the focus of discussion here, is drawn upon frontier theories as employed especially by Timothy Flannery (1997) and John G. Butcher (2004). Both of them acknowledge the importance of market and technological factors in frontier development. Market demand

induces the extraction of untapped resources. Technology facilitates resource exploitation. More developed technologies can lead to an expansion of the frontier of resource use. But at the same time, by increasing human's ability to run resource extraction and to modify the environment, technology translates the side effects of humans on the environment (Flannery, 1997; and Butcher, 2004).

The discussion will also be sharpened with environmental adaptation analysis. By so doing, an understanding of the ways, in which people responded and adapted to the changing environment and its related problems, can be obtained as well. As shall be shown, both the teak and jungle wood forests were exploited, induced by the rising market demands and the gradually improved extraction technologies. The extractions not only radically impacted on the resource supplies, but also left their strong mark in the region's forest environment.

THE EXPLOITATION OF TEAK

Teak had long been the most valuable timber, its remarkable strength, flexibility, and durability under changing weather conditions being highly valued. For ship-building, for example, teak was considered excellent with its high salt water resistant quality. For construction and fuel wood, teak was also considered very valuable (Cordes, 1992:19-23). The quest for teak had been an integral part of the Dutch colonial expansion. Timber was required by the Dutch for multiple purposes, such as ship-building, construction, and fuel (Boomgaard, 1988:62-67). Across the Indonesian archipelago, it was only on the island of Java, especially Central and East Java, that the teak forest grew at its best (Poerwokoesoemo, 1956:46).

Teak forest was also found in Besuki, East Java. Around 1800, Resident W.H. van Ysseldyk mentioned the teak forest of Sumberwaru (in Brascamp, 1921:821-823). Jcz. J. Hageman reported hundreds of hectares of teak forest in Puger or Jember (Hageman, 1862:33,46); while F. Epp mentioned its occurrence in Banyuwangi (Epp, 1849:246). In 1871, there were around 1,500 hectares of teak forest in the Besuki residency, excluding Banyuwangi which remained unknown due primarily to

economizing measures and lack of personnel (Hardjodarsono & Pramoedibyo, 1986:96). J.W.H. Cordes, in 1881, estimated a further 1,500 hectares of teak forest in Banyuwangi (Cordes, 1992:222). The region's forest was managed as one forest district together with Probolinggo. In 1897, the Besuki forest district was formed as one of the 33 forest districts of Java (Poerwokoesoemo, 1956:37).

Based on the 1865 Forest Ordinance, the teak forest in Besuki as elsewhere in Java was exploited under the regulated felling block system. The exploitation was run by private contractors with paid workers who replaced the earlier state logging carried out with forced workers or *blandongstelsel* (Zwart, 1937:576). The exploitation right was granted by the colonial authority and designated through public bid (Hardjodarsono & Pramoedibjo *et al.*, 1986:126). Once granted the rights, the holders had an obligation to make payment for the contract value of the logging block and retribution determined on a volume basis. Under the 1897 Forest Ordinance, other logging operations were introduced, broadly grouped under unregulated logging (that included logging on license and logging on instruction), together with self-managed logging by the Forestry Service (DvhB, 1901:135).

The early teak exploitation areas in Besuki, East Java, were in the region's northern districts, such as Bungatan, Binor, Besuki, Panarukan, and Sumberwaru. In 1881, J.W.H. Cordes noted that across these districts, there were only small remnants of the natural teak forest, while the neglected teak forest growing on the hills hardly contained valuable construction timber. Although it contained bigger and better quality timber, the teak forest of Puger remained unexploited due to the problem of transportation (Cordes, 1992:221-222). It was reported in 1876 that due to the shortage of teak, bridge construction in Besuki needed to import teak from other places and partly replaced it with coconut stems.¹ With the improvement of transport facilities, the teak forest of Puger

was only exploited from around 1896, run by the Kepel-Serut firm. Another teak exploitation venture in the region was the Bungatan firm (Van der Haas, 1903:877).

Around the same time, the teak forest of Banyuwangi remained unexploited. Major obstacles for its exploitation were poor transport and small population size. The mountainous and forested landscape caused the area to remain relatively isolated. It was only after the completion of the railway from Jember to Banyuwangi in the early 1900s and the subsequent secondary lines in the 1910s that the exploitation of teak became feasible. Parallel with the transport development, there emerged optimism about the possibilities of expanding teak exploitation and of converting the jungles and grass-covered lands of the Rogojampi district into teak plantations (DvhB, 1901:133-137). From around the 1910s, the teak in Banyuwangi began to be cut down.² In the 1930s, the logging of teak was reported to have run at a greater pace, with an average annual felling of 9,000 m³.³

The felling of teak in the Besuki region seems to have been similar to that adopted by the Dutch colonial authorities in Java in general. Teak was exploited with a clear felled-block system. The clear felling method had been commonly employed in teak exploitation after 1865, replacing the earlier selective felling (Boomgaard, 1996:19). The felling normally took place during the dry season due to transport considerations. Moreover, the felling was a lot easier when the teak was dry. When it had a high water content, teak was harder to cut down and an ax would easily lose its sharpness. At least six months before being felled, the teak was ring-barked to release its liquid contents. This practice was done at the beginning of the rainy season, which was the right time to accelerate the dryness of the teak. The ringbarking of the teak was also useful to obtain more stable and durable timber (Cordes, 1992:57-58).

The loggers employed in the Besuki region

²News on "Lelang Kajoe Djati" in newspaper of *Pewartu Soerabaia*. Surabaya: 22 December 1914.

³See "MvO [Memorie van Overgave] van den Resident van Besoeki, Ch. A. van Romondt over de periode 30 January 1935 – 26 February 1938" in ANRI [Arsip Nasional Republik Indonesia] in Jakarta, p.181.

¹See, for example, "AR [Arsip Residensi] Besuki, 9.7: Algemeen Verslag van Residentie Besoeki, 1876" in ANRI [Arsip Nasional Republik Indonesia] in Jakarta.

Table 1:
The Planting of Teak in the Residency of Besuki, 1891-1929 (Hectares)

Year	Bondowoso	Jember	Banyuwangi	Total
Until 1891	578	118	0	696
1891 - 1900	130	77	0	207
1901 - 1910	147	215	109	471
1911 - 1920	1,276	195	125	1,596
1921 - 1929	429	160	74	664
Total	2,560	765	308	3,634

Source: DvhB [Dienst van het Boschwezen], 1930, pp.185-191.

were in part locally recruited, particularly in its more densely populated parts. But in Banyuwangi, they mostly came from outside, especially from Kediri and Madura. The small population size and relatively large average land ownership were reported to have discouraged the local people from searching for additional employment outside their own farms (*ibidem* with footnote 3, pp.180-181). In the felling sites, loggers lived in temporary cottages, which were usually fenced to protect them at night from attacks by tigers and other wild animals (Epp, 1849:247).

The teak product was broadly divided into two categories: construction wood and fuel wood (DvhB, 1939, Appendix 23). The demands for teak came from different parties. The major users of teak and other timber products were the tobacco and sugar industries in the region. The other party was the railway service, demanding large quantities of teak for sleepers (Hardjodarsono & Pramoedibyo, 1986:133). Resident Ch. A. van Romondt stated that the annual teak deliveries were about 2,000 m³ to the Surabaya-Gubeng state railway workshop, and 2,000 m³ of sleepers to the S.S. Magazijn in Madiun (*ibidem* with footnote 3, p.181). The demands for teak occasionally came from other government agencies. In 1900, for example, the Forestry Service in Besuki supplied 113 m³ of teak to the Department of Public Works (DvhB, 1901:136).

The depletion of the natural teak forest stemming from the continuing exploitation already raised concerns before 1870 (Cordes, 1992:221 and 262). Attempts were made by the Dutch to overcome the dwindling teak supplies. Recorded as early as 1839, the plantings of teak in Besuki together with

Probolinggo, area ranged from 76,000 to 931,000 trees in the early 1860s (Boomgaard, 1996:155-157). From around 1870, a contractor obtaining the right of felling was obliged to clear tree stumps left on the sites before returning the felling block to the head of the forest district, who had the responsibility of organizing its replanting. In Puger, the replanting was done through natural regeneration (*natuurlijke verjonging*), which was considered less costly (Van der Haas, 1903:878).

This method meant "to create teak forests by saving and stimulating the maximum amount of young growth before and after the clear felling of a parcel of land" (Boomgaard, 1996:20). There were also new teak plantings, for example in the districts of Wringin, Jember, and Sukowono (Cordes, 1992:222). In the newly established teak areas, artificial regeneration, or *kunstmatige verjonging*, was applied (Becking, 1928:17). Between 1870 and 1929, the plantings of teak in Besuki reached around 3,600 hectares. Table 1 shows varying sizes of teak planted across the region.

The plantings of teak faced some problems. One of them was *Imperata* grass. In Java, this sort of grass often caused deaths and stunted the growth of young teak plants, because of root competition for soil nutrients. Such a problem also prevailed in Besuki, and can be seen in the case of Banyuwangi, where teak planting was extended to an *Imperata* grass area. The adoption of the *tumpangsari* system, allowing the planting of food crops among teak rows, introduced by Buurman in 1883, and the use of leguminous interplants advocated by Jaski in 1907, were reasonably effective in containing the *Imperata* problem elsewhere in Java (Simon, 1993:39-40). But in Banyuwangi,

Imperata control remained difficult, even when mechanisation was set in place in the 1950s. Part of the tilled fields was soon back under *Imperata*, because of the lack of workers to plant the seedlings (Soetopo, 1954:488).

Partly because of the *Imperata*, teak in Besuki was also prone to fire. During the droughts, this grass provided flammable material and compounded the fire danger (Simon, 1973:11). Although teak was a fire resistant plant, this was only after it reached a certain age. The damage inflicted by fires on young teak plants appears to have been serious, but even without fires abnormal droughts also inflicted notable damage (Van Asbeck, 1920:247).

Evidence for Java suggests that fires struck teak forest in Java almost every year between 1911 and 1941, with large fires during 1911-1914, 1918-1919, and 1929 (Boomgaard, 1996:161). The absence of data makes it hard to suggest the loss from fires in Besuki, but a number of reports suggested frequent forest fires in the region (DvhB, 1928:109; and Djatipit, 1951:57). Severe damage was reported to occur in 1902 (Boomgaard, 1996:31). Other reports revealed fire damaged 3,000 hectares of forest in Baluran in 1930; and 2,200 hectares in Baluran, Kendeng, and Ijen highland in 1935 (Boelen, 1936; and DvhB, 1937:45).

Another problem was attacks by pests and diseases. As elsewhere in Java, the teak plant in Besuki often suffered from stem borers, *Xyleborus destruens*, which downgraded its timber (Suhartati & Intari, 1974:15). The attacks, identified first in 1920 by Kalshoven's observations on teak forests of Pekalongan and Malang, were reported to have occurred in Bondowoso before the Second World War in 1939, North Banyuwangi in 1943, and Jember in 1945 (Van Alphen de Veer, 1956:3-4). By 1970, the teak stands in North Banyuwangi suffered seriously from the attacks of *Xyleborus destruens*, reaching 70 per cent of trees (Chusairi, 1971:14). Several observations linked the severity of the attacks to that area's high rainfall, which made it too wet for teak (Van Alphen de Veer, 1956:401-402; and Natawiria, 1969:9-10).

Mixed planting and plant species replacement were the major responses to the problems. E.W. Clason reported the mixed planting of teak with red-flower bearing *Blutea monosperma* in Baluran (Clason, 1934:128). In a few places, where a mixed planting was unsatisfactory, teak was replaced with other species (Van Alphen de Veer, 1956:402; and Natawiria, 1969:9-10). In Jember, the *Livistona rotundifolia* (*sadeng* palm) replaced the poorly growing teak plants (Fluyt, 1938:292). The teak forest of Gombeng was replanted with *A. damara*, while in South Banyuwangi beetle attacks led to the replacement of teak with mahogany (Chusairi, 1971:13-14; and Natawiria, 1974:24).

Native to South America, *mahogany* was regarded as delivering good results on poor soils where teak could hardly grow (Huitema & van Heeteren, 1943:23). Other methods were employed too, including the manual capture of beetles in the beginning of the rainy seasons, when they emerged from the soil and the application of chemicals (Natawiria, 1974:24-26).

Despite the difficulties, expanding teak cultivation was considered a vital measure to deal with the problem of teak shortages during post-colonial times. In 1950, there was a plan for converting jungle wood forest into teak in West Kalibaru (Ottow, 1982:268). In 1954, around 19,000 hectares of the Banyuwangi nature reserve was taken out for a conversion into teak in order to increase its supplies in Java (Hoogerwerf, 1974:19).

Mechanized soil preparation helped to execute the plan. Assuming no new area was brought under teak in the 1940s, in twenty years, the area of teak in Besuki, East Java had almost doubled, from 16,600 hectares in 1938 to 31,500 in 1968. The major expansion occurred in Banyuwangi, where there was an increase by almost 300 per cent, from 5,900 hectares in 1938 to more than 17,000 hectares in 1968 (DvhB, 1939, Appendix 1; and Perhutani, 1968:68). This process radically altered the original form of vegetation and reduced the area broadly categorised as jungle wood forest. But, within the jungle woods itself, there were also other environment-changing human activities at work.

THE EXPLOITATION OF THE JUNGLE WOOD FOREST

Unlike teak exploitation, the Dutch interest in jungle wood forest grew relatively slowly. The jungle woods forest as a separate category, distinguished from teak forest, was legally stipulated in the 1874 Forest Ordinance. The position of jungle forest was improved in the subsequent Forest Ordinances of 1897, 1913, and 1927; and its follow-up regulations, containing further stipulations and details on the aspects of management and exploitation. Apart from the continuing pressure on teak supplies, the exploration of the jungle wood forests in the outer islands of Indonesia contributed to the growing interest in non-teak tree species (Kramer, 1925:95-96). Although until around 1900 its size remained unknown, the jungle woods made up a major proportion of the forest of Besuki in East Java (Broersma, 1912:160).

The local people of Besuki had long extracted products from jungle wood forests. With a special reference to Banyuwangi, R.J.L. Kussendrager noted some highly valued tree species, including *tengulung*, *laban*, *sonokeling*, *sonokembang*, and *pronosodo* (Kussendrager, 1841:519). Referring to Puger, it was mentioned non-timber products like bamboo, rattan, hardy grass (*alang-alang*), and several others (Hageman, 1862:34). The forest also provided important source of foodstuffs. If recent evidence is any guide, they included tubers, herbs, sprouts, kernels, and fruits. Two explicit cases from Jember were bamboo and rattan shoots (Soepardi, 1952:86-90). Also significant were meat products obtained from hunting.

In addition, the forest provided grazing fields for livestock. F. Epp reported that the Osingers of Banyuwangi released their livestock to graze freely in a nearby forest and collected them when needed (Epp, 1849:247). In 1905, G.D. Birnie recalled the practice of herding buffalo on forest lands in Jember around 1870.⁴ Similarly, during the dry season,

⁴See, for example, OMW [Onderzoek naar de Mindere Welvaart]. (1906). *Onderzoek naar de Mindere Welvaart der Inlandsche Bevolking op Java en Madoera*, Vol.3(14): *Samentrekking van de Afdeelingenverslagen over de Uitkomsten der Onderzoekingen naar de Veeteelt in de Residentie Běsoeki*. Bijlage 3: "Beantwoording van het Lid van de Afdeelingscommissie van Bondowoso G.D. Birnie Sr". Batavia: G. Kolff, Appendix 3.

a time when grasses were usually scarce, in some areas of Jember and Bondowoso people herded their livestock on forest lands (*ibidem* with footnote 4, Vol.3/16, 1906:3-4).

The longstanding practice by the local people of collecting forest products continued during the period under consideration. Reports of Besuki in the 1880s, cursorily mentioned bamboo, rattan, *agel* (*Coryphatan*), and food products such as *gadung* (*D. hispida*), palm sugar (*aren*), *siwalan* (*B. flabellifer*), and wild honey.⁵ A 1907 report stated that *alang-alang* was among trade articles used for roofs and was collected in significant quantities from the forest of Puger. Rattan exports from the forest-adjointing districts of Puger, Mayang, and Tanggul were also mentioned.

Other products were firewood and charcoal for lime-kilns and smithies, as reported by Forester Spaan in the early twentieth century.⁶ The favourite wood was *S. trijuga* or *kesambi*, with its heavy, hard, and firm wood offering a much better charcoal quality, even compared with teak (Cordes, 1992:82). Resident A.H. Neys reported in 1929 that the forest of Prajekan slowly, but steadily, diminished as a consequence of charcoal production (in Kartodirdjo *et al.*, 1978:cxxxv). In 1938, Resident Van Romondt suspected the links between the stealing of forest wood by the locals and Chinese charcoal buyers.⁷

But the Indonesians of Besuki were not only parties who had interests in the jungle wood forest. From around the 1870s, state and private enterprises expressed an increasingly growing interest due to the rising demand for woods from the development of export agriculture. The ways in which the jungle

⁵See "AR [Arsip Residensi] Besuki, 9.17: Algemeen Verslag van Residentie Besoeki over het Jaar 1886"; "9.18: Algemeen Verslag van Residentie Besoeki over het Jaar 1887"; and "9.19: Algemeen Verslag van Residentie Besoeki over het Jaar 1888" in ANRI [Arsip Nasional Republik Indonesia] in Jakarta.

⁶OMW [Onderzoek naar de Mindere Welvaart]. (1907). *Onderzoek naar de Mindere Welvaart der Inlandsche Bevolking op Java en Madoera*, Vol.6(14): *Samentrekking van de Afdeelingenverslagen over de Uitkomsten der Onderzoekingen naar Handel en Nijverheid in de Residentie Besoeki*. Weltevreden: F.B. Smits, p.6 and 60.

⁷See, for example, "MvO [Memorie van Overgave] van den Resident van Besoeki, Ch. A. van Romondt over de periode 30 January 1935 – 26 February 1938" in ANRI [Arsip Nasional Republik Indonesia] in Jakarta, p.166.

Table 2:
Firewood Sales by the Forestry Service to the Tobacco Industry
in Jember and Bondowoso, 1933-1937

Year	Firewoods	
	Quantity (m ²)	Value (guilders)
1933	36,874	48,366
1934	34,509	45,041
1935	37,081	55,048
1936	50,623	50,983
1937	62,732	62,202
1938	42,296	n.a.

Sources: For 1933-1937, see P.C.M. Fluyt (1938:287); and for 1938, see DvhB [Dienst van het Boschwezen] (1939, Bijlage 23).

wood forest was exploited appear to have been similar to those of teak forest, involving both private contractors and self-managed exploitation by the Forestry Service. Private exploitation was given, for example, to the Bosch- en Exploitatiebedrijf Jansen en Liem (*ibidem* with footnote 7, pp.53-54).

The colonial authorities also made an attempt at improving the management of the jungle wood forest. By 1909, for example, a regulation determining the non-teak forest boundaries in the Panarukan regency was promulgated (Staatblad, 1909). In the 1920s, the Forestry Service redrew the borders of the jungle wood forest of Bondowoso (Kartodirdjo *et al.*, 1978:cxxxiv). The mapping of borders had two strategic functions: (1) establishing clearer state control; and (2) restricting the traditional rights of the inhabitants to access forest resources.

The exploitation of jungle wood forest delivered both construction timber and fuel woods. Unlike teak forest, the jungle woods forest produced a variety of timber with extremely different qualities. A few of them did provide good building materials, but some woods were only useful for firewood. This fact seems to be one major reason why Resident B. Schagen van Soelen in 1918 urged the Forestry Service to convert the region's jungle woods into a more profitable silviculture-based planted forest.⁸

In 1917, the volume of construction timber obtained from the exploitation of the jungle woods was 2,900 m³. It grew to 7,700 m³

in 1918 and dropped down to 2,600 m³ in 1919 (Van Asbeck, 1919:249 and 1920:248). No further information is available on why there was a steep decrease in 1919. The decrease was not due to depletion because the movement to new jungle forest areas, probably the last one, took place in the 1960s (Sastropranoto, 1972:23-29). The reason was probably a change in the number of logging workers or simply because small stands were left in the currently exploited blocks, while new plots were still being prepared.

One of the construction timbers from the jungle wood forest was *sadeng* palm or *L. rotundifolia*. In the 1860s, millions of *sadeng* trees grew in the forest of Jember and there was sporadic occurrence of *sadeng* in Rogojampi, Banyuwangi (Hageman, 1862:47). This palm had something in common with bamboo, but it offered a more durable use and was stronger (Hageman, 1863). Rumphius described *sadeng* as one of the best palm woods and it had been popularly used as pillars and beams in tobacco drying sheds (in Broersma, 1912:15). Extensive logging of *sadeng* occurred from the 1880s (Boomgaard, 1996:20). The high demand and the long maturing period of about 50 years immediately caused the *sadeng* in the region's forest to be in short supply. At the turn of the twentieth century, the plantings of *sadeng* were undertaken both on forest and *erfpacht* plots. In Jember alone until 1912, the plantings reached 80,000 trees (Broersma, 1912:15).

Large quantities of the jungle wood products were used as firewood. With the need for firewood for drying tobacco in

⁸See "MvO [Memorie van Overgave] van den aftredenden Resident van Besoeki, B. Schagen van Soelen, 1918" in ANRI [Arsip Nasional Republik Indonesia] in Jakarta, p.12.

smokehouses, the expanding tobacco industry created strong demand. In the 1933-1936 period, between 22 and 32 per cent of the total firewood required by the tobacco estates was provided by the Forestry Service and their absolute quantities and values are presented in table 2.

The rest of the firewood was from diverse origins, such as rubber estates, fruit trees, dry fields and gardens, but some were suspected to have been stolen from the state forests (Fluyt, 1938:293-295). Another major user was the sugar industry. The demand appears to have grown with the increasing scale of operations and rising number of sugar factories in Besuki, from four in the 1870s to ten before the 1930s depression (Tennekes, 1963:377).

The scarcity of data makes it hard to look more systematically at how the extractions affected the supply and what kind of responses was made to adjust to the changing realities. The case of bamboo, on which more historical data are available, will illuminate these issues.

THE CASE OF BAMBOO

Bamboo had long been known as a useful plant in the Besuki residency, East Java. From the 1870s, however, it gained an increasingly important position in the region. This development was induced by the tobacco estates. P.C.M. Fluyt noted that bamboo had been widely used for smokehouse constructions. In 1938, there were about 1,500 smokehouses, with a total length of about 100 km. Each smokehouse had large quantities of bamboo gallows, upon which tobacco was hung during drying (Fluyt, 1938:291-292).

Meanwhile, among the local people of Besuki, bamboo was used in various constructions, for example houses, stables, fences, bridges, and rafts. The same material was used for many other things: benches, cages, baskets, kitchen utensils, ropes, and a great variety of plaited works (Epp, 1849:58). So valuable was the bamboo that K. Heyne estimated nine of ten house parts and house utensils were made from bamboo (Heyne, 1987, 1:326).

Before the promulgation of the 1897 Forest Ordinance, bamboo was considered

a byproduct. With this category, the local inhabitants had free access to collect bamboo from the forest (Reilingh, 1921:609); despite the fact that from 1865, the forest was placed under state control and the rights of the people were substantially curtailed (Peluso, 1992:52). Parts of the bamboo were used to serve their own needs, but large quantities went to the estate companies. They could obtain delivery contracts of determined quantities of bamboo from contractors who channeled their bamboo to them.

In Jember region, where the tobacco estates were largely found, there were thirty bamboo depots (Broersma, 1912:15). Some of the delivered bamboo came from gardens, but the largest proportion was often obtained from the forest. The free felling practices caused extensive damage to the bamboo forest, due to the widely-scattered felling sites and reckless cutting techniques adopted at the expense of young stands for short term gains of good quality bamboo (Reilingh, 1921:609).

As the result of consultation between the Resident of Besuki and W.J. Spaan, former forester of the Besuki-Probolinggo forest district, the free felling system was replaced by felling on license. Starting from Bondowoso in 1901, the system was set in place in Jember and Banyuwangi in 1902. Felling was undertaken by estate companies and indigenous license holders. From 1907, the felling of bamboo for tobacco estates was replaced with self-managed felling by the Forestry Service. Despite the complaints raised by tobacco growers, A. Reilingh claimed it was a system that worked better in creating a balance between bamboo protection and fiscal interests. The system was improved with the adoption of block felling, which was regarded as bringing notable progress in bamboo stand protection and supervision against malpractices (Reilingh, 1921:609-612).

Demand from the tobacco industry constituted the largest proportion of the bamboo market. A. Reilingh again estimated that about 90 per cent of the bamboo production went to tobacco estates. The annual demand normally ranged from 6 to 7 million bamboo canes. Between 2 and 5 million were supplied by the Forestry

Table 3:
Bamboo Sales by the Forestry Service to the Tobacco Industry
in Jember and Bondowoso, 1925-1927 and 1933-1937

Year	Bamboo	
	Number of canes	Value (guilders)
1925	2,350,000	n.a.
1926	1,900,000	n.a.
1927	4,790,000	n.a.
1933	4,321,000	31,774
1934	1,702,000	12,993
1935	784,000	6,862
1936	2,067,000	14,615
1937	5,043,000	33,951

Sources: For 1925-1927, see DvhB [Dienst van het Boschwezen] (1928:111); and for 1933-1937, see P.C.M Fluyt (1938:287).

Service, while the rest originated from the local inhabitants (Reilingh, 1921:606). The most highly valued bamboo was said to originate especially from the slopes of the Hyang mountain complex (Kartodirdjo *et al.*, 1978:cxxxiv).

Table 3 shows the quantities and values of bamboo sold by the Forestry Service to the tobacco estates during the depression years. It is reasonable to suggest that the exploitation of bamboo was one major part of the forest resource exploitation.

In the 1900s, there had been growing concerns about the depletion of bamboo. Supply was unable to keep up with demand. The pressure on bamboo supplies was exacerbated by the fact that about one-third of the bamboo stands could not be exploited because of being situated in remote locations, and that some of them were of inferior qualities and sorts. Although containing highly valued bamboo, in many areas the number of stands were limited and consisted of different varieties, and even often in a mix with wild trees (Reilingh, 1921:602). There were trials of substituting bamboo with woods from Kalimantan and with galvanized wire, but the two options were regarded as costly. It was believed that the most feasible solution was bamboo planting. Such a measure was immediately needed, because sustaining the bamboo supply was a “matter of life and death” for the tobacco industry in Besuki (Reilingh, 1921:617-619).

The first planting was in 1903, but more

were undertaken from 1910. They included several complexes such as Sumberkeneng in 1903 and 1910; Penanggungan in 1912, 1925, and 1927; Kupang in 1927; Curahcabe in 1911-1912; Nogosaren in 1911-1912 and 1916; Kabuaran in 1921-1922; Pakis in 1921; Badean in 1921 and 1925-1927; Pakuniran in 1925-1927; Sumberklopo in 1926-1927; Mumbul in 1926-1927; and Curahmanis in 1927 (Booberg, 1928; and Verhoef, 1957:18).

In 1929, Resident Neys reported the conversion of around 100 hectares of the Hyang jungle woods into a bamboo area (in Kartodirdjo *et al.*, 1978:cxxxiv). Another planting in Jember was reported in 1932 (Soerachmat, 1938:197). Most areas were planted with the highly valued bamboo, *Gigantochloa apus* or *tali* and a few areas were devoted to *Dendrocalamus asper* or *petung* and *Schizostachyum blumei* or *mluwo* (Reilingh, 1921:623; and Soerachmat, 1938:195). In Jember alone, there were 300 hectares of bamboo complex under *Gigantochloa apus* or *tali*, a variety that was also common in the gardens of the local inhabitants (Hildebrand, 1954:31-32).

The need for bamboo cultivation grew bigger in the late 1950s with the ongoing plan of establishing a Banyuwangi-based paper industry, PN (*Perusahaan Negara* or Sate Enterprise) Basuki Rachmat, which used bamboo as its raw material (Banoewidjojo, 1959:24). Bamboo produced a long fiber plant, which could be processed for a variety of quality papers (Sindoesoewarno, 1963:5).

The construction of the factory started in 1963 and was completed in 1968 with a total capital of USA \$ (Dollar United States of America) 8.5 million from the Japanese government (Rs, 1969:60).

Besides forest bamboo, the raw materials would largely be supplied from the planted bamboo, whose development was studied in the late 1950s.⁹ This research was soon followed up by bringing parts of the Banyuwangi forest into bamboo cultivation (Soenarwanto, 1971:47). But problems of supply immediately emerged as the production levels were below expectations. The forest bamboo could only meet 60-75 per cent of the estimated annual output, whereas the planted bamboo could only deliver 30 per cent of the initial estimation. The supply which had been estimated to last for up to 10 years, in fact, would only meet the requirement for 3.5 years.¹⁰

Realizing the problem, a decision was made to gradually shift the raw materials of the paper industry in Banyuwangi from bamboo to pine or *Pinus merkusii*. This shift was part of a new trend in the paper industry in Indonesia.¹¹ The pine offered several advantages. With a smaller requirement of annual clearing, it provided more sustainable supplies than bamboo, which required a daily clearing of 3 hectares to support the factory operation (Baal, 1971:27). Moreover, a lot of areas were available for pine because of its ability to grow even on degraded soils, either lowlands or uplands, and to compete with *Imperata* grass (Hellings, 1954:63). Pine not only produced high quality fibers for paper and pulp, but also delivered resins (Warsopranoto, 1965:258).

Consequently, some areas planned and used for bamboo were brought under pine. The conversion occurred in East and West Banyuwangi and West Raung (Jember), whereas in Sumbering (Bondowoso) the pine took over part of the areas previously under *A. decurrens* (Poedjorahardjo, 1971:18-19). The reasons behind the replacement of *A.*

decurrens were its short rotation, clear felling, and fast soil exhaustion (Hellings, 1954:63). Despite the conversion, the plantings of bamboo remained important as the need for bamboo from other parties never ceased.

TECHNOLOGICAL CHANGE IN FOREST EXPLOITATION

The type of technology was a key factor affecting the extent to which forest resources could be utilized and the scale of impact the exploitation might bring to the forest environment. Forest exploitation technology might be subdivided into three clusters: logging implements, transport facilities, and soil preparation. The development of each of the three technological clusters in Besuki appears to have started and gradually progressed at different times. But, all of them facilitated the pushing back of the natural forest frontier and the expansion of the human-made forest in the region.

The use of manual implements seems to have long been common in the exploitation of forest. The felling of forest trees involved the use of axes (Hardjodarsono & Pramoediby, 1986:132). The use of saws was comparatively new. F. Epp reported that in mid-nineteenth century, Banyuwangi saws remained unknown (Epp, 1849:247). The axes were either locally made or imported from outside Besuki and their improvement progressed slowly. Only in the 1950s were there initiatives to introduce better axes by taking inspiration from other countries, especially Germany (Sanjoto, 1958:477-479 and 486-488).

The use of steam-powered logging machines was long delayed (Hardjodarsono & Pramoediby, 1986:132-133). But in the late 1930s, the steam-powered machine began to be adopted in the region and was first found in Jember.¹² In the early 1950s, a sawmill was established in Benculuk, Banyuwangi; and two portable sawmills were added around 1970, one in Jember and the other one in West Banyuwangi (Soetopo, 1955:415; and Soengeng & Soekotjo, 1980:84).

⁹See, for example, *Laporan Lembaga PPKB [Pusat Penyelidikan Kehutanan Bogor] Tahun 1957; and 1959*. Bogor: Pusat Penyelidikan Kehutanan, pp.18-19 and 14.

¹⁰Article on "Bambu Banjuwangi" in magazine of *Gema Perhutani*, 3(29), 1971, pp.13-19.

¹¹Article on "Kaju Tusam" in magazine of *Pertanian*, Special Edition, 1961, pp.323-324.

¹²See "MvO [Memorie van Overgave] van den Resident van Besoeki, Ch. A. van Romondt over de periode 30 January 1935 – 26 February 1938" in ANRI [Arsip Nasional Republik Indonesia] in Jakarta, pp.175-176.

Logs were dragged from felling sites to temporary collection places near roads. From these points, logs were carried away with animal-drawn bullock carts. This mode of transport was predominant in Java until the early 1900s (Hardjodarsono & Pramoedibyo, 1986:148). A notable improvement was made with the adoption of pneumatic tires to replace iron wheels. Unlike the iron-wheeled carts, the pneumatic tire-wheeled carts did less damage to the roads. Another advantage was that the lower tray resulting from its smaller wheel diameter, which made loading and unloading easier.

Moreover, the lighter requirement of pulling power increased substantially the carrying capacity (Hofman, 1953:239). To support its operation, the Forestry Service built several cart road networks, for example a 12 km cart road in Bondowoso, stretching from Pekalongan via Gunasari to the forest of Raung-Suket mountains and a 60 km cart road in Jember. For the same purpose, in Bondowoso, the Forestry Service was reported to have hardened an 8 km road from Pakisan to Sumberbalen (*ibidem* with footnote 12, pp.171-172).

The use of animal-drawn carts in forest exploitation continued during the post-colonial times (Djojopranoto, 1958:202). But another development also occurred in Java from the early 1900s, marked by the adoption of railway transport for conveying forest products (Soeharto, 1957:84). Although starting somewhat later than the other parts of Java, such a development also took place in the region (Broersma, 1912:17; and Nawiyanto, 2001:181-182).

There were 12 km of rail lines in Jember and 20 km of rail lines in Banyuwangi built by the Forestry Service to facilitate the exploitation of forest (*ibidem* with footnote 12, pp.175-180). One major line in Banyuwangi connected Benculuk with Grajagan. The line went through plains and remote areas to Kutorejo and from this point it curved to Pangpang Bay (Jacobs, 1958:77). A loco traction with a formation of 15 lorries served this track before and after the Second World War (Kools, 1976:268). The reason for the

mechanisation of forest wood transportation in Banyuwangi was primarily the lack of workers (Soetopo, 1955:418).

In the 1950s, there was an attempt to improve the transport facility for forest exploitation. The lack of capital, however, forced the search for a less costly alternative. Rather than a rail line, the choice was directed to a road network which was seen as cheaper to construct. Another major reason was the growing popularity of trucks and trailers as a means of transport; these were considered more suitable to the region for topographical reasons (Soeharto, 1957:91-92). The result was the construction of the Kalipuro-north Banyuwangi road. A 36 km road track stretching from Kalibarumanis to Kalisetail was built in order to facilitate the transport of bamboo supplies from the felling plots to the Basuki Rachmat paper factory. In addition, there was improvement to the road connecting Rogojampi with Licin (Soenarwanto, 1971:50).

Unlike the mechanisation of the transport of wood, that of forest soil preparation occurred during post-colonial times. The practice was undertaken in South Banyuwangi, where the teak cultivation was extended to *Imperata* areas and there was a lack of workers to prepare the soil (Tjau, 1953:346). The first mechanically prepared plots were the Plaosan and Tegalsari complexes (Soetopo, 1954:485-486). Two different views on mechanisation emerged. On one side, the adoption of mechanical land preparation was regarded as positive, because it offered the fastest and cheapest way of establishing teak forest in such a difficult area (Tjau, 1953:348). On the other side, there was a view that although helping with the preparation of soils, the small number of workers for planting in relation to the extensive mechanically prepared soils caused parts of the plots to revert to *Imperata* grass cover again before being planted (Soetopo, 1954:488). Despite the conflicting views, mechanisation undoubtedly facilitated the expansion of the human-made production forest and increased the scale of impact the human activities had on the forest environment.

HUMAN IMPACT ON THE FOREST

Together with agriculture and settlement expansion, the extraction of forest resources exerted significant influence on the forest. As has been shown, one major effect was the alteration of original vegetation into human-made production forest, including teak and bamboo. In addition, by the late 1940s, there were another 2,700 hectares of human-made industrial forest (Soepardi, 1950:52-53). By 1968, the human-made forest reached 57,700 hectares, consisting of 26,200 hectares of industrial tree species, mainly bamboo, pine, and mahogany; and also 31,500 hectares of teak (Perhutani, 1968:68). They accounted for 15 per cent of the region's forest cover, larger than the figure of below 2 per cent in 1930 (Zwart, 1939). There were other impacts which were often unexpected and problematic to the humans and their interests. Deforestation, biodiversity loss, and species extinction were important ones.

On the Deforestation. Besuki experienced deforestation somewhat later than most parts of Java. This by no means suggests that there was no forest clearing in the Besuki region before. Forest clearing certainly was not new (Arifin, 1995:105-112); but for centuries, it was not seen as a problem due to there being little clearing with the small population size, less developed technologies, and less intensified forest extractions. Among the Dutch officials, increasing population and converting more forest in the region's hinterlands into agricultural lands was still seen as desirable for the region's development until the early 1900s.¹³ Rather than being seen as a problem, the conversion of forest was regarded by the estate planters and most colonial officials as aesthetically and economically beneficial as it transformed the region's less valued wilderness into "the garden of Java" and "the earthly paradise" (Molsbergen, 1939:380).

¹³See, for example, article on "De Oeconomische Toestand van de Gewesten die Door den Geprojecteerden Spoorweg Probolinggo-Pasirian Worden Doorsneden" in *De Indische Gids*, 15(1), 1893, pp.1073-1093; and OMW [Onderzoek naar de Mindere Welvaart]. (1907). *Onderzoek naar de Mindere Welvaart der Inlandsche Bevolking op Java en Madoera*, Vol.6(14): *Samentrekking van de Afdeelingsverslagen over de Uitkomsten der Onderzoekingen naar Handel en Nijverheid in de Residentie Besoeki*. Weltevreden: F.B. Smits, p.28.

The expanding forest removal in the Besuki region caused deforestation. The Declining Prosperity Investigation Commission in 1908 reported the occurrence of deforested areas in Besuki and blamed them for the declining springs and river discharges. In some villages of the Wonosari and Wringin districts, no water was found though deep wells were dug. Many springs dried up, forcing villagers to search for water from distant places. In the Panarukan, Sumberwaru, and Prajekan districts, the condition was said to be the same.¹⁴

The decreasing river discharges were reported observable in the Kumbolo, Tikus, and Deluwang rivers in Panarukan, and in the Baru and Setail rivers in Banyuwangi (*ibidem* with footnote 14, pp.12-14). The extensive forest clearance was said to have caused a decrease in rainfall in Kalibaru, Banyuwangi (Cramer n.y.:2). As Ch.G. Cramer and Th. Altona found in the Brantas river, the deforestation of the Hyang forest was blamed for the more frequent and violent floods in the Sampean river (Cramer, n.y.:4; and Altona, 1914:251-255).

The deforestation also provoked the increasing erosion. Forest was regarded as serving to prevent soil erosion (Bos, 1938:189-190). The loss of forest cover caused an increasingly high silt content in the Bondoyudo and Bedadung rivers, and large quantities of fertile soils were brought down to the sea (Groneman, 1902:61). The removal of the Ijen upland forest was blamed for the huge mud flood in the Banyuputih river in 1915 (Red, 1915:183). In the Tanggul river, the fast siltation posed health problems in the nearby villages during the dry season, because the silt disturbed river flows and created mosquito breeding grounds (RC, 1931:12).

In 1918, the erosion brought by the Banyuputih river was reported as high as that of the Brantas river (Ponto, 1954:332). In the Wringin upland (Bondowoso), the disappearing forest was said to be a cause of the loss of fertile soils and the creation of

¹⁴OMW [Onderzoek naar de Mindere Welvaart]. (1908). *Onderzoek naar de Mindere Welvaart der Inlandsche Bevolking op Java en Madoera*, Vol.7(14): *Samentrekking van de Afdeelingsverslagen over de Uitkomsten der Onderzoekingen naar de Irrigatie in de Residentie Besoeki*. Batavia: Albrecht, pp.78-80.

barren lands (*ibidem* with footnote 14, pp.39 and 59). Ch. Coster stated in 1936 that forest clearance by Indonesians created “dying land” (*stervend land*) and “catastrophes”. Part of the planting area of the Buduan sugar industry was devastated and on Mlandingan plain, erosion materials consisting of silt, sand, gravels, and stones “covered up agricultural fields, destroyed harvests, and reduced soil fertility” (Coster, 1936:1961-1962).

The forestry report revealed that in Bondowoso alone there was about 2,000 hectares of deforested area in 1929 (DvhB, 1931:116). Shifting cultivation practice was said to be a major cause of the deforestation. Concern linking the two phenomena gained momentum around the 1920s. A.J. Koens was one of the figures who drew the attention of the colonial administration to the origins and consequences of shifting cultivation, which at that stage was said to constitute the major cause of deforestation in the outer islands of Indonesia (Koens, 1925/1926:334-340).

While regarding it as an economically efficient system, another study by B.J. Hageis acknowledged that under certain circumstances, especially if applied in a short-term rotation, shifting cultivation could provoke the creation of *alang-alang* (hardy grass) vegetation and increase the danger of fire (Hageis, 1930/1931:77). In Besuki, the stigmatization of shifting cultivation as causing deforestation was explicitly expressed in the resident’s 1934 report, pointing specifically at the northern slopes of the Kendeng hills.¹⁵ Other causes of deforestation included forest fires and timber stealing. The deforestation caused by timber stealing was reported to have occurred for example in the Brebes and Beser hills, and also on the west slopes of the Raung mountain (DvhB, 1928:95).

Attempts were made by the colonial authorities to tackle the problem of deforestation. One of the major measures in this field was afforestation. Although prior to 1870 there had been initiatives for afforestation, the primary objective was basically to secure timber supplies, rather than

for environmental purposes. The adoption of afforestation measures for environmental reasons grew in importance in Java from the 1880s (Boomgaard, 1996:20-21).

In Besuki, such a measure started in the early 1900s in the Mlandingan and Kendeng hills in Panarukan, East Java.¹⁶ But it was only from the 1920s that afforestation was undertaken more systematically. With financial support from the Buduan sugar industry and the Raad van Besoeki (the Besuki Council) in 1926-1927, the deforested slope of the Ranu hills in Panarukan was reforested. On the Kendeng hills, at around the same time, the Dampit estate was reported to have reforested part of its estate lands (Kartodirdjo *et al.*, 1978:cxxxiv). Ch. Coster reported that the afforestation measure gradually improved the conditions of the site (Coster, 1936:962).

The colonial authorities also took preventive measures, primarily taking the form of forest conservation. In fact, a preference was apparently given to such measures rather than afforestation, which was considered a more costly and time-consuming effort (Djatipit, 1951:61). The Prosperity Investigation Commission already suggested the need for preserving forest in Jember for climatic and irrigation considerations.¹⁷ From 1913, for example, a ban on forest clearing in the Hyang mountain complex was imposed. The need to protect the forest and for immediate and firm actions to fight against clandestine clearings were continuously reiterated (Wijnmaalen, 2001:206).

One of the preventive measures was forest fire control. Colonial officials, including those in Besuki, actively looked for techniques to effectively deal with the problem.¹⁸ On the Hyang highland, the technical measures

¹⁶OMW [Onderzoek naar de Mindere Welvaart]. (1908). *Onderzoek naar de Mindere Welvaart der Inlandsche Bevolking op Java en Madoera*, Vol.7(14): *Samentrekking van de Afdelingsverslagen over de Uitkomsten der Onderzoekingen naar de Irrigatie in de Residentie Besoeki*. Batavia: Albrecht, pp.59-60

¹⁷OMW [Onderzoek naar de Mindere Welvaart]. (1907). *Onderzoek naar de Mindere Welvaart der Inlandsche Bevolking op Java en Madoera*, Vol.6(14): *Samentrekking van de Afdelingsverslagen over de Uitkomsten der Onderzoekingen naar Handel en Nijverheid in de Residentie Besoeki*. Weltevreden: F.B. Smits, p.61.

¹⁸See “MvO [Memorie van Overgave] van het Gewest Besoeki, Resident H.A. Voet, April 1926” in ANRI [Arsip Nasional Republik Indonesia] in Jakarta, pp.79-80.

¹⁵See “MvO [Memorie van Overgave] van den Resident van Besoeki, 1931-1934” in ANRI [Arsip Nasional Republik Indonesia] in Jakarta, p.9.

included the construction of fire belts in the form of a 50 metre-wide coffee garden and living hedge with fire resistant plant species and the construction of pathways to speed up fire fighter mobilization (Von Faber, n.y.:37).

In addition, special guards were placed in supervisory posts in charge of reporting any forest fire to the head of the sub-district, who then was responsible for forwarding the message to the related forest officials. Together, they would mobilize the designated villagers to extinguish the fires.¹⁹ Other measures were tighter control on setting of fires to vegetation and on the practice of livestock grazing, and campaigns to reduce the growth of *alang-alang* (Boomgaard, 1996:31-32).

Despite the measures, the problem of deforestation persisted. From the 1940s, the problem even worsened because more clearing occurred. Two years after the proclamation of Indonesian independence in 1945, there were new deforested areas in the region: 2,200 hectares in Bondowoso, 900 hectares in Banyuwangi, and 600 hectares in Jember (Rappard, 1949). In total, it constituted more than one-third of the total newly deforested areas in East Java, i.e. 9,700 hectares (Soepardi, 1954:38). Moreover, it was reported that the local people also cleared part of the mountain estates of Jember (Drooglever & Schouten, 1982:420).

The severity of the deforestation was due partly to the emerging popular misconceptions of independence as freedom from any rule, including freedom to clear forests for agricultural fields and firewoods (Soepardi, 1954:38). The deforestation continued in the 1950s.²⁰ In 1960, the deforested areas in the region covered 20,200 hectares, mostly found in Bondowoso and South Banyuwangi. Deforestation grew to 30,000 hectares in 1969 (Perhutani, 1969:10).

The problems linked to deforestation from the 1940s continued unabated. A huge flood striking south Jember in 1942 was reported due primarily to the deforestation of the

southeastern slopes of the Bromo mountain complex (Soepardi, 1954:22). Beside heavy rainfalls, deforestation was reported to have been a primary cause for the severe floods striking Jember from mid-December 1954 to early January 1955, which were described as the worst floods that ever occurred.²¹ Similarly, the deforestation was reported responsible for the huge floods inundating Panarukan in 1952.²²

Many newspaper reports on Java in the 1950s indicated more frequent and violent floods resulting from deforestation (Hoogerwerf, 1953:288). During the dry season, deforestation brought a different problem. Writing on Panarukan, Ashadi Djojopranoto stated in 1958 that the deforested upland of Asembagus caused a decrease in irrigation supplies (Djojopranoto, 1958:198). The deforestation was also regarded as one of the three major reasons for the seriously deteriorating capacity of the Sampean irrigation network (HECI, 1973:5; and Suparmoko, 1980:62).

The Indonesian government certainly did not turn a blind eye to the seriousness of the deforestation. In 1952, the Forestry Service was reported to have planted the deforested areas of Tanahbulan and Pakuniran in Bondowoso (*ibidem* with footnote 22). Around the same time, a similar measure was taken in the deforested areas of Lembean and Puger in Jember.²³ In cooperation with the Information Service, the Forestry Service in the region discouraged the villagers from setting fires to *Imperata* grass.²⁴ Another measure took the form of a one-kilometre tree forest belt to shield the protected forest against any encroachment from the nearby villagers.

²¹See, for example, news on "20 Orang Mati Karena Bandjir Besar di Djember" in newspaper of *Trompet Masyarakat*, 27 December 1954; news on "Kerugian Bandjir di Djember Selatan" in newspaper of *Trompet Masyarakat*, 11 January 1955; and news on "Kerugian Akibat Bandjir Melebihi dari Dugaan Semula" in newspaper of *Trompet Masyarakat*, 3 February 1955.

²²See also news on "34.5 Ha Direboisasi dg Angsana" in newspaper of *Trompet Masyarakat*, 24 January 1952; and news on "Bandjir Besar Didaerah Panarukan" in newspaper of *Trompet Masyarakat*, 24 January 1952.

²³News on "34 Ha Tanah Dihutankan Kembali" in newspaper of *Trompet Masyarakat*, 2 October 1953; and news on "49.05 Ha Dihutankan Kembali" in newspaper of *Trompet Masyarakat*, 2 October 1953.

²⁴See also news on "Tahun 1953 Banjak Hutan Terbakar" in newspaper of *Trompet Masyarakat*, 9 December 1953.

¹⁹See also "MvO [Memorie van Overgave] van den Resident van Besoeki, 1931-1934" in ANRI [Arsip Nasional Republik Indonesia] in Jakarta, p.10.

²⁰News on "18 Orang Penebang Liar Ditangkap" in newspaper of *Trompet Masyarakat*, 4 October 1951.

The fight against deforestation, however, seems to have been an endless battle. While the afforestation measures were taken in particular places, at the same time the opposite process continued to occur in others. There were views that the measures were only partial and too small to have a significant effect on such a huge and complicated problem (Prakoso, 1954:116-118). In the early 1960s, the approach to dealing with deforestation was improved, but a lack of funds posed a serious obstacle for its implementation.

Only from the late 1960s were there more regular funds to carry out afforestation. Under the first Five Year Development Plan starting from 1969, in the Jember regency alone about 4,100 hectares of deforested lands were rehabilitated (Hadi, 1973; and Pasandaran *et al.*, 1973). Such a measure was likely to have been undertaken also in the other regencies of Besuki. In East Java, the afforestation target of 21,000 hectares in 1970/1971 was reported to have been fully reached (Sekretariat DPR RI, 1972:4).

Apart from the deforestation problem, the forest resource exploitation had caused declining biodiversity. In several areas, the richness of the heterogeneous natural forest had disappeared, being replaced with a more homogenous industrial forest. In the early twentieth century, forester Spaan was alarmed by the scarcity of *soga* or *Peltoporum pterocarpum*, which used to be abundant.²⁵ This plant produced tannin which was used in the process of making leather and in dyeing *batik* cloths (Heyne, 1987:937).

The biological richness of the Hyang highland with its diverse meadows was reported in 1971 to have gone and remained only "a shadow of its former glory" (Whitten, Soeriaatmadja & Afiff, 1996:809). In addition, *Acacia nilotica* species, introduced in 1963 as a part of the creation of fire resistant belts, was reported to have expanded beyond control, pushing aside other plants, and reducing the grass vegetation of Baluran (Appelman, 1937;

²⁵See, for example, OMW [Onderzoek naar de Mindere Welvaart]. (1907). *Onderzoek naar de Mindere Welvaart der Inlandsche Bevolking op Java en Madoera*, Vol.6(14): *Samentrekking van de Afdeelingsverslagen over de Uitkomsten der Onderzoekingen naar Handel en Nijverheid in de Residentie Besoeki*. Weltevreden: F.B. Smits, p.61.

Alikodra, 1987:32-33; and Hasanbahri & Purwanto, 1996:11).

CONCLUSION

Forest resource exploitation in Besuki, East Java intensified from around 1870. The major driving force behind the intensification was the rising demand for forest products created by the establishment of export agriculture, the increasingly large population size, and partly the broader market. Diverse products both plants and animals were taken from the region's forests to provide construction materials, firewoods, foodstuffs, and other requirements. All the examined cases, from teak, sadeng palm to bamboo, suggest that their commercial exploitation immediately led to resource depletion in the natural forest environment.

The small territorial size of Besuki made the possibilities of adopting a frontier's exploit-and move-on attitude more limited. The case of Besuki indicates that there was an interest in sustainable forest exploitation. This feature was clearly manifested in the increasingly large size of the planted forest with highly valued tree species. But, the resulting outcomes seem to have varied from one species to another due to the different regenerative ability of each species. The exploitation of bamboo, for example, gave more sustainable output than those of *sadeng* palm and teak. Bamboo could give yields after three years, whereas teak and *sadeng* palm would need more than 50 years before they were ready for harvesting.

The forest exploitation also had complicated effects on the environment, larger than being merely a matter of resource supplies. It also radically altered the region's environmental realities by replacing the original, heterogeneous forests with more homogenous ones. In this process, the gradually improved technologies played an instrumental role, both in intensifying the forest extraction and in facilitating the expansion of the human-made forest, by removing a complex of natural obstacles for exploitation. As a result, the jungle wood forest area continued to decline in size and deforested lands emerged in some places.

The region's biodiversity appears to have also experienced a deterioration, even though the evidence for this is inconclusive. It is likely that such an impact, especially with the conversion into homogenous planted forest, could have happened to a number of less valued species, but had gone unnoticed in historical records. Another impact took the form of deforested areas, which tended to expand until the late 1960s and ignited a series of disasters, amid attempts by the government agencies to contain the problem and its multiple causes.²⁶

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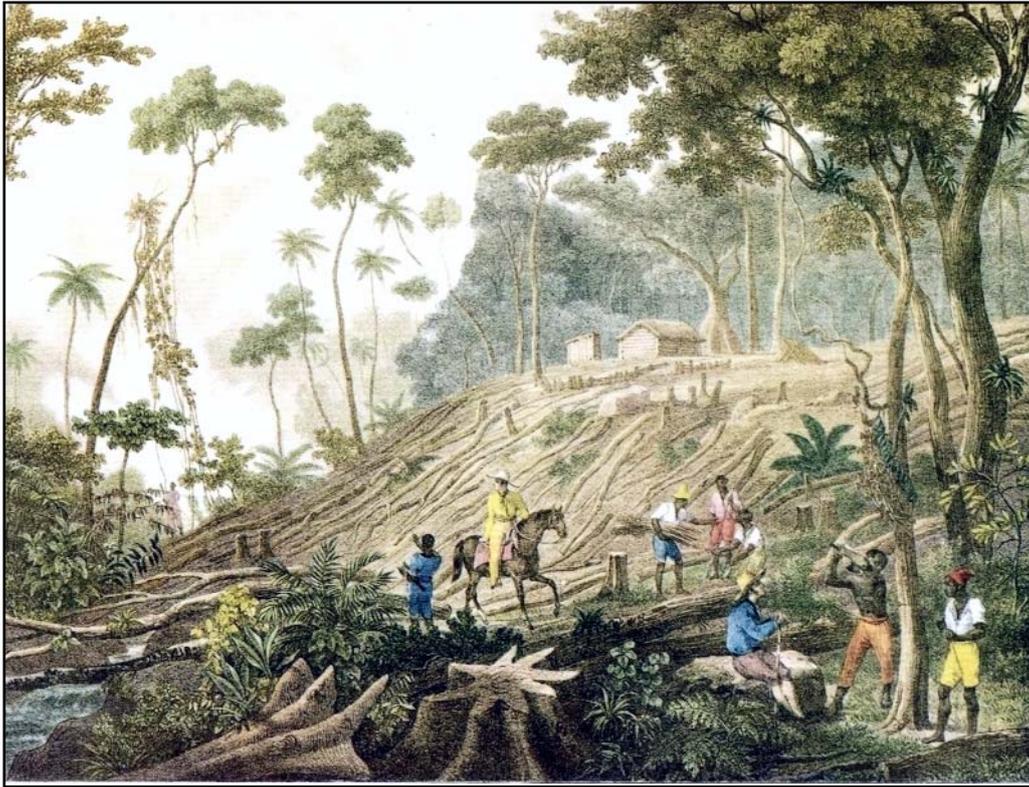
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²⁶**Statement:** I hereby declare that this article is entirely my own work, not a product of plagiarism, not to be submitted, reviewed, and published by other scholarly journals.

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The Forest Exploitation in Java
(Source: www.google.com, 2/3/2014)

The forest exploitation also had complicated effects on the environment, larger than being merely a matter of resource supplies. It also radically altered the region's environmental realities by replacing the original, heterogenous forests with more homogenous ones. In this process, the gradually improved technologies played an instrumental role, both in intensifying the forest extraction and in facilitating the expansion of the human-made forest, by removing a complex of natural obstacles for exploitation. As a result, the jungle wood forest area continued to decline in size and deforested lands emerged in some places.