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***Kemiri (Aleurites moluccana) and Forest Resource Management in Eastern Indonesia: An Eco-historical Perspective*<sup>1)</sup>**

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**Abstract**

*Kemiri, Aleurites moluccana*, is an important useful plant in the Indonesian archipelago. It has been grown for both subsistence and commercial purposes, particularly in regions with a tropical monsoon climate, and has been important in sustaining the everyday life of people in Eastern Indonesia. It has been utilized for various purposes: the lipid-rich seeds provide material for illumination, cooking and pharmaceuticals, and its trunks provide timber. Most of the production is currently exported to Surabaya for local consumption, and part of it is exported abroad.

In addition to such economic uses, it is worth paying attention to *kemiri*'s role in the rehabilitation of forest areas in Eastern Indonesia. There were two epoch-making periods in relation to *kemiri* plantations, one in the colonial and the other in the New Order period. In South Sulawesi in the 1920s and 1930s, the Dutch forestry agency recommended *kemiri* planting to rehabilitate abandoned fields of shifting cultivation. This was the region's first encounter with government forest policy. Under the New Order regime, in accordance with policies favoring rapid economic development, "encroachment" on forest areas raised complicated issues. As local people, both natives and migrants, began to open forest areas for agricultural purposes, the government of South Sulawesi was forced to adjust the designated boundaries of forest areas and also to launch a new policy for stabilizing the encroachment. Under Pola Sul-Sel (the South Sulawesi system), agricultural activities were legally recognized, even in the forest area, if combined with the plantation of useful trees such as *kemiri*.

As these cases show, *kemiri* can be considered to have left an important "footprint" from which we can learn about the process of political ecology in forest areas adjacent to agricultural lands in Eastern Indonesia.

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1) This paper is a revision of an oral presentation in Indonesian given at the International Symposium and Workshop, "The Beginning of the 21st Century: Endorsing Regional Autonomy, Understanding Local Cultures, Strengthening National Integration," held by the editorial committee of the *Journal of Antropologi Indonesia* at Hasanuddin University, South Sulawesi, on 1st to 5th August, 2000, and of an oral presentation in Japanese given at the 88th Meeting of the Japan Tropical Agriculture Society held at the Faculty of Agriculture, Gifu University, in October, 2000. It summarizes the results of research conducted in Indonesia, Vietnam, China, and Laos as part of the project on "Migration and Transformation of Resource Management under the Confrontation of Different Ecosystems" (Team Leader: Hisao Furukawa) with financial support by a Grant-in-Aid for Scientific Research (A) from MEXT, 1998-2000.

## 1. Introduction

Oil (or lipid)-containing plants are one of the most important resource plants in the tropics. Their oils, mainly contained in the seeds and fruits, have been used in a wide range of applications, including as food, fuel, illumination, pharmaceuticals, and industrial materials. Oil-containing plant species are quite frequently found among the plant families Palmae, Sapotaceae, Euphorbiaceae, and Leguminosae, among which about 70 % are estimated to have their origins in the tropics.<sup>2)</sup> Not surprisingly, people in these regions have established close relationships with the oil-containing plants, both cultivating them and using wild or semi-cultivated plants to produce oils. Whether for subsistence or for earning cash, they have harvested these plants as a part of their everyday lives.

As the demand for oils increased with the development of the colonial economy, the cultivation of oil-producing crops or plants expanded at various levels, from that of small-scale subsistence farming to large-scale commercial plantations. This expansion has continued in the post-colonial age and persists in Southeast Asian countries today as shown by the rapid expansion of areas cultivated with coconut palm, oil palm, and cacao [Tanaka 1990]. In subsistence farming, diverse oil-producing plant species are cultivated or harvested on a small scale and used for various purposes by local people, while large-scale commercial cultivation in plantations generally concentrates on uniform, extensive cultivation of a single useful species. In both cases, the cultivation of oil-producing plants has been accelerated and expanded because of a global increase in demand for oils. This rapid expansion of cultivation should greatly affect the use of lands and resources and their management systems and should be particularly observable at the boundaries between forest areas and farmlands.<sup>3)</sup> In Indonesia, the expansion of clove, cacao, and oil palm cultivation has recently highlighted several issues concerning land and resource management [Tanaka 1997; 2000; Ruf 2001].

This paper deals with *kemiri* (*Aleurites moluccana*) as a representative example of such oil-producing plant involved in these issues. To meet the increasing demand for

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2) Personal communication from Dr. M. Hotta, Professor Emeritus of the Faculty of Science, Kagoshima University.

3) The term “forest areas” is here used to describe the areas managed and designated as *kawasan hutan* (forest areas) by the Indonesian Department of Forestry. The forestry law classifies the *kawasan hutan* into several categories, including protected forests, production forests, and utility-convertible forests. The invasion of farmers is mostly found in forests in the last two categories.

various agricultural products, or simply to make a living, farmers have expanded their farmlands into the forest areas to earn cash. Meanwhile, local governments must restrain such “invasion” of farmland into the forest areas. These conflicts between farmers and government over land resource management are taking place frequently in many tropical countries. And *kemiri*, an oil-producing arborescent plant generally cultivated on slopes such as piedmonts and hillsides, has been greatly involved in the process. By focusing on this particular plant’s role in upland agriculture and forest management in Eastern Indonesia, this paper aims to illustrate land and resource management in mountain regions from an eco-historical perspective. Furthermore, the paper refers to *Aleurites fordii*, another oil-producing member of genus *Aleurites*, which is cultivated in the mountain regions of continental Southeast Asia and in Yunnan Province in southwestern China, with the intention of presenting preliminary information useful for the future comparison of the ecological history of insular and continental Southeast Asia.

## 2. *Kemiri* and Its Uses

### 2.1 *Kemiri* Cultivation

*Kemiri*,<sup>4)</sup> also known as the candlenut tree in English, is an evergreen arborescent plant (Photo 1) belonging to genus *Aleurites* of the Euphorbiaceae family. It has a wide distribution, ranging from insular Southeast Asia to the Pacific. Its lipid-rich fruit has historically been used for various purposes in Indonesia and is still an important seasoning in Indonesian cooking today.

Although *kemiri* is widely distributed throughout Indonesia, it is extensively cultivated in areas associated with the tropical monsoon climate which have rather drier conditions in the dry season. The main *kemiri* cultivation areas in Indonesia are the provinces of Daerah Istimewah Aceh, Sumatera Utara (North Sumatra), Sulawesi Selatan (South Sulawesi), and Nusa Tenggara Timur (East Nusa Tenggara). As shown in Table1, *kemiri* is cultivated in approximately 170,000 ha in Indonesia, yielding around 60,000 tons of fruit. The largest *kemiri*-growing province is Sulawesi Selatan, which accounts for about 40 % of both cultivation area and production.

*Kemiri* plants usually bear their first fruits within three to four years and mostly by the

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4) *Kemiri* is a Malayan name for *Aleurites moluccana*. Many vernacular names are listed in *De Nuttige Planten van Nederlandsch Indië* (Useful Plants of the Netherlands East Indies) [Heyne 1927], but this name is widely and commonly recognized in Indonesia and Malaysia.



**Photo 1 Tree Form and Fruit of *Kemiri***

Generally, one fruit includes two seeds. Each seed covered with a hard shell contains a fat-abundant endosperm (albumen).

**Table 1 Cultivated Area and Production of *Kemiri* in Indonesia**

Year	Cultivated area				Production			
	1984	1988	1992	1996	1984	1988	1992	1996
Indonesia	74.7	70.6	131.7	172.3	29.2	27.7	38.2	61.5
Daerah Istimewah Aceh	7.6	9.1	—	—	19.5	23.8	—	—
Sumatera Utara	4.2	6.7	—	—	9.6	14.8	—	—
Sulawesi Selatan	44.4	44.0	—	—	41.0	42.5	—	—
Nusa Tenggara Timur	24.6	29.4	—	—	17.0	12.0	—	—

Unit: Cultivated area and production totals (Indonesia) are 1,000 ha and 1,000 ton, respectively. Values for each state are a percentage of the total.

Source: *Statistik Indonesia*

fifth year after the seedlings are planted. On average, the production of shell-removed fruit is 10 kg/tree in the first year of fruiting, 25 kg/tree by the sixth year, and 35-50 kg/tree in the tenth to twentieth years. After the age of thirty-five to fifty, the trees gradually lose their fruit-producing ability until they finally become completely fruitless [Paimin 1997]. As can be calculated from Table 1, the average yield in Indonesia is 0.35 ton/ha, which is quite low, but it may reach 2-3 ton/ha under intensive cultivation. In fact, the production greatly varies among areas, being high in Daerah Istimewah Aceh and Sumatera Utara with average yields of approximately 1 ton/ha, but low in Sulawesi Selatan and Nusa Tenggara Timur with average yields of approximately 0.3 and 0.15 ton/ha, respectively.

In pre-colonial times, *kemiri* cultivation was combined with shifting cultivation by sowing *kemiri* seeds in swiddens, leaving the volunteer seedlings found growing during

shifting cultivation, and transplanting natural seedlings grown in other lands to swiddens. Abandoned swiddens were weeded once a year, the only management practice necessary in the early stage of *kemiri* cultivation. Such association of *kemiri* with shifting cultivation is still found in many places in South Sulawesi and Nusa Tenggara Timur. For example, in Detu Soko in Kabupaten (District) Ende, Flores Island, people cultivate *kemiri* when they develop fields (*uma maja*) by shifting cultivation. They plant *kemiri* seedlings as they sow upland rice and maize in the first year of *uma maja*; after cultivating maize in the second year and cassava in the third, they abandon the swidden but leave the *kemiri* plants. The field becomes a *kemiri* garden called *uma feo* (field of *kemiri*) which will be managed by weeding every year. In cases where *kemiri* is sowed in swiddens, first people clear the land and bury the seeds without removing the shells at a depth of about 4 cm. Next they burn the field and sow upland rice and maize. *Kemiri* is sowed before the burning to induce its germination with the heat, a technique also applied to artificial seedling production.

Although people usually lose their usufruct of the swiddens when they abandon them and move to other sites, their ownership of the *kemiri* trees growing at the abandoned sites is recognized among the villagers, the same as the fruit trees or other useful trees which are more frequently left in abandoned swiddens. In the past, similar systems of *kemiri* cultivation were applied in many areas other than Flores Island, indicating a strong association existed between *kemiri* cultivation and shifting cultivation.

Wherever I visited, people told me that *kemiri* cultivation was very easy. Once they created a *kemiri* garden, all they needed to do was weed it once a year and wait until harvest time. Conventionally, *kemiri* trees were planted at intervals of  $10 \times 10$  m or wider, as they were basically for private use rather than for developing *kemiri* forests. The wide distances were more convenient for inter-planting other species of trees among the *kemiri* trees or for cultivating various annual crops in the vacant space. Today, technical instructions are given for *kemiri* cultivation, which will be discussed later, encouraging dense planting with an ideal distance of  $6 \times 6$  m or  $8 \times 8$  m for fruit harvesting or  $4 \times 4$  m for industrial forestation [BPKU 1994].

## 2.2 Uses of *Kemiri*

Since the old days, *kemiri* has been greatly involved in people's lives [Heyne 1927; Burkill 1966]. Its lipid-containing kernel has been used for illumination, pharmaceuticals, and seasonings, while its seed covered with a hard shell has been used for children's toys

or ritual offerings. *Kemiri* wood has been used for fuel or woodworking. Today, the fruit is widely used in cooking within Indonesia and Malaysia, and some is exported to other countries where the drying oil has medicinal or industrial use as an alternative to tung oil. About 95 % of total *kemiri* production in Indonesia today is domestically consumed, with the remainder exported, mainly to Singapore and Malaysia [BPKU 1994; Paimin 1997].

Investigations in Sulawesi Selatan and Flores Island and Sumbawa Island in Nusa Tenggara Timur reveal that *kemiri* has been used in many aspects of people's lives. Besides cooking, *kemiri* was most commonly used for illumination, leading to its English name, candlenut tree. The *kemiri* endosperm has an oil content of about 60 % and burns easily if simply lit with fire. To make a candle, several *kemiri* fruits are squashed into a paste which is subsequently mixed with kapok or cotton fibers and pasted on a spit made of bamboo or a branch. A candle can also be made with the dry corn cob. Rubbing *kemiri* fruits against the corn cob makes a candle that lasts for at least one night. Use of the *kemiri* candles, called *sulo kanjoli* in Buginese, *rrasa kanjoli* in Makassarese, and *ilo* in Sumbawa, ceased with the spread of kerosene lamps, but in Camba, Kabupaten Maros, a famous *kemiri*-producing area in Sulawesi Selatan, they are still used on ritual occasions such as rice harvest festivals.

*Kemiri* was also used as a medicine, especially for treating injuries, toothaches, fever, swelling, etc. Generally, *kemiri* was used as an ointment prepared by thoroughly kneading the smashed fruits which were then broiled over fire and mixed with finely mashed garlic or ginger. The ointment or medicated oil could also be prepared by broiling the *kemiri* fruit alone. The oil made through a similar process was also used for washing or dressing hair.<sup>5)</sup>

In Sulawesi Selatan, *kemiri* is used as an additive in the production of palm-sugar that is prepared by boiling down the sap of sugar palm (*Arenga pinata*). The *kemiri* is believed to promote solidification of the palm sugar and to improve its flavor and taste. Moreover, in Flores Island, *kemiri* oil is used for strengthening cotton thread. According to people there, thread can be strengthened by soaking it for about two days in the oil obtained by

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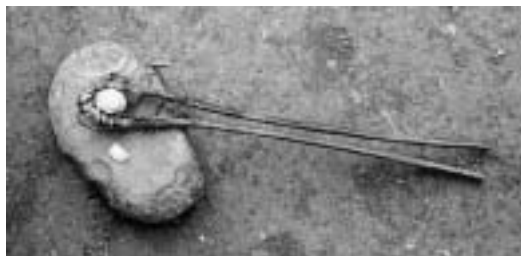
5) According to people in Detu Soko, Flores Island, there are two ways of extracting oil from *kemiri*. In the first method, they burn the fruit without removing its shell and allow the heat to crack open the shell. After the shell and the endosperm both turn black, they take out the endosperm and scrub it against the base of a *pinang* leaf petiole, in the same manner as a grater, to obtain the oil. In the other method, they take the endosperm out of the shell, grind it, wrap it in a banana leaf, and burn it, before finally squeezing out the oil.

grinding a mixture of *kemiri* and *kenari* (*Canarium vulgare*) fruits, then drying it in the sun.

The shells of *kemiri* fruits are also utilized. After the harvest, the fruits are first dried and the shells cracked to remove the kernels. It is extremely laborious to crack the shells manually one by one. *Kemiri* producers commonly use a small ladle-like tool made of rattan or wood for this process. They place the *kemiri* fruits on the tool and strike them against a large stone to crack the shells (Photo 2). After the fruits are extracted, the remaining shells can be used directly as fuel or as material for making charcoals. Moreover, the ashes can be used as detergent for washing or can be used as fertilizer. Unshelled fruits are used in games which are popular among children in any *kemiri*-producing area. In one such game, *kemiri* fruits are placed within a circle drawn on the ground and players compete for the number of fruits they can flick out of the circle by throwing fruits from outside. In another game, the fruits are placed in a row and players throw stones against them from a certain distance (Photo 3).

Due to their poor quality, *kemiri* wood is rarely used for construction but is widely used for fuel. Their bark is known to contain tannins, so it is brewed into folk medicines effective for diseases such as dysentery.

Although in the past *kemiri* was commonly used in all the applications outlined above, today most domestic *kemiri* is consumed as a seasoning in Indonesian cooking. The product sold through the market under the name *kemiri* is the endosperm separated by drying the fruits and removing the shells. Products from Sulawesi Selatan or Nusa Tenggara Timur are first gathered in Surabaya before their distribution to different areas of Java Island. But the extinction of many of *kemiri*'s applications does not mean that its significance has diminished. Its consumption as a seasoning in Indonesian food is increasing markedly, which has led to shortages in the Jakarta market [Paimin 1997].



**Photo 2 Tools for Cracking *Kemiri* Seeds**





**Photo 3 Villagers Demonstrating the *Kemiri* Game**

The villagers kindly demonstrated the game as soon as the use of *kemiri* in games was mentioned during a break between interviews. The players are usually children, but here the adults are playing it for demonstration.

This increase in demand has led to a definite expansion of *kemiri* cultivation, which can be seen in the doubling of its cultivation area and production over the past decade (Table 1). And as an important cash-earning plant, it still plays a certain social role at the local community level.

In most cases, *kemiri* harvesting is managed by individual families. At harvest time, the owner of the trees or landowner who has planted the *kemiri* plants uses family labor and/or employed domestic workers to gather the *kemiri* fruits which have dropped to the ground. *Kemiri* trees often spread their crowns across the boundaries between adjacent lands owned by different owners; in such cases, the owners can only claim ownership of the fruit lying on their property. *Kemiri* fruits may roll out or be washed away by rain, and in many regions, fruit that has gone out of private areas can be harvested by anyone. Moreover, in many communities, all the *kemiri* gardens are opened to the public as commons after the harvesting season is over, allowing any member of the community to enter and gather the leftovers.<sup>6)</sup>

Perhaps these customs of *kemiri* harvesting were originally associated with shifting cultivation, but even after shifting cultivation was no longer practiced, such customs

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6) For example, in Camba, Kabupaten Maros, Sulawesi Selatan, the peak season (*kampiri*) of the *kemiri* harvest is from November to December; after the *kampiri* comes a season called *kallice*, in which anyone can harvest *kemiri*. In Desa Bontokaraeng, Kabupaten Jeneponto, Sulawesi Selatan, *kemiri* is harvested by landowners from September to January or February, but when the *jambao* season comes in March, the fruits can be gathered by anyone, regardless of the ownership of the land.

have remained. In *kemiri*-producing areas today, *kemiri* plays an important role in uniting village society. When interviewing people in such areas, I often heard success stories about large profits, becoming hajji, or providing education to their children. Those people claim to owe their success to *kemiri*. Other people, especially elders or village officials, mentioned the importance of *kemiri* cultivation as a public property or a safety net for the village. They claim that *kemiri* brings at least some income to the aged and the handicapped through the post-harvest opening of *kemiri* gardens to the public. In many parts of Eastern Indonesia, there are mountainous areas that were used for shifting cultivation in the past and that are completely covered with *kemiri* today. In most of these areas, people still use *kemiri* for the various applications mentioned above, which demonstrates the continuing significance of *kemiri* within these communities.

### 3. The Expansion of *Kemiri* Cultivation

#### 3.1 Government Promotion of *Kemiri* Cultivation in the Colonial and New Order Eras

Most people today do not know the exact period in which the number of *kemiri* plants began to increase in the *kemiri*-producing areas. People's answers are vague, such as "a long time ago" or "way back at the time of their ancestors." Some people can be more specific, stating that *kemiri* plants were much fewer in the prewar period but started to increase around the 1960s. Perhaps all of these answers are correct, but it is rather doubtful that the *kemiri* forests observed today have existed for ages. It is more likely that *kemiri* plants used to be grown sparsely around the abandoned swiddens and villages but their numbers rapidly increased after a certain point. In fact, the history of expansion of *kemiri* cultivation in Eastern Indonesia contains two epochs; one is the promotion of *kemiri* cultivation by the Dutch colonial government and the other is its promotion in the New Order regime, which began in the late 1960s.

In the case of Sulawesi Selatan, the Forestry Department of the colonial government promoted *kemiri* cultivation in 1920s and 1930s to restore the forests degraded by shifting cultivation. This was the first experience with a forestation administration for the people in this area, but no one remembers it today. A study conducted in Kelurahan Mario Pulana, Camba, Kabupaten Maros, contains an interview mentioning that *kemiri* had been grown in the village for a long time, but that its cultivation for cash-earning purposes probably started around 1900 [Zainal 1996/97]. Therefore, it can be assumed that people recognized *kemiri* as a commercial crop no earlier than the beginning of the twentieth

century.

The modern colonial period brought forestry administrations gradually into Sulawesi Selatan, where forest officers began to emphasize the need to forest the mountains ruined by shifting cultivation. Table 2 shows a list of travel reports containing references to Sulawesi Selatan by visiting forest officers. For instance, Plasschaert visited Sulawesi Selatan in 1923 and stated in his report that “on the lower slopes (up to 500 m altitude) of the G. Lompobattang there are many *kemiri* (*Aleurites moluccana*) plantations which keep the slopes of the ravines in good hydrological condition. These *kemiri* plantations, which cover 1,000 ha, will be extended by planting on former ladang fields [Plasschaert 1923].” In Mol’s travel report of 1930, he stated that “almost everywhere the forest has been devastated by wood exploitation and ladang cultivation,” and that “the plantation of *kemiri* (*Aleurites* sp.) which frequently is done by the people, may be a solution in reforestation

**Table 2 Reports on *Kemiri* by Dutch Colonial Government Forest Officers**

Year	Reporter	Contents of reports	References
Sept.-Oct. 1923	Plasschaert, E. K.	<i>Kemiri</i> cultivation by residents	Unpublished Report: Trip to Makassar, Manado, and Muna.
Apr.-May 1924	Koppel, C. van de	Promotion of <i>kemiri</i> planting in former swidden sites	Unpublished Report: Trip to Polewali, Mamasa, and Majene.
Dec. 1924	Koppel, C. van de	<i>Kemiri</i> cultivation by residents	Unpublished Report: Sulawesi Forest Division. Report on December 1923.
1928	Rhijn, Van	<i>Kemiri</i> planting in former swidden sites by Forestry Department	Unpublished Report: Report on the measures to be taken in the catchment area of the Palaka and Patiro rivers (South Sulawesi).
Sept. 1930	Mol, C. J.	<i>Kemiri</i> cultivation by residents	Unpublished Report: Travel Report in the Palanro water catchment area, Sulawesi.
1931	Gonggrijp, L.	Cultivation technique development: Trees suitable for mixed planting with <i>kemiri</i>	Unpublished Report: State of the main activities in Sulawesi and Dependencies.
1932	Gonggrijp, L.	Cultivation technique development: <i>Kemiri</i> germination test	Unpublished Report: Report by the senior forester of Sulawesi and Dependencies, November 1932.
1937	Handelsmuseum	Exploitation of <i>kemiri</i> : utility as drying oil	Information and Research from the Handelsmuseum Division in 1936.
Sept. 1948	Haan, J. H. de	<i>Kemiri</i> planting in former swidden sites by Forestry Department	Unpublished Report: Travel Report no.13 to Ujungpandang and Bone.
Mar.-Aug. 1949	Haan, J. H. de	<i>Kemiri</i> planting in former swidden sites by Forestry Department	Unpublished Report: Travel Report no.18 to Ujungpandang and Bone.
1950	Griffioen, K.	Exploitation of <i>kemiri</i> : utility as matchstick	<i>Rapp. B.P.S.</i> 30: 11; <i>Rimba Indonesia</i> 1: 69-85.

Source: Based on CAPD [1982].

[Mol 1930].”

As it can be seen from these reports, by the 1920s, forest officers of the Dutch colonial government already recognized the effectiveness of *kemiri* cultivation in the reforestation of former swidden sites. In fact, old records of actual forestation with *kemiri* can occasionally be found. For example, in 1928, Rhijn reported that *kemiri* had been planted in former swidden sites found within the forest reserve in the Palaka and Patiro river basins in Sulawesi Selatan. “In 1924 about 620 ha former ladang fields near Ponre were reafforested with *kemiri* (*Aleurites moluccana*) by the population under the supervision of the Forest Service. However, only 25 % of the reafforestation succeeded, probably because the *kemiri* seeds were planted too far apart (5 × 5 m) [Rhijn, 1928].” This report indicates that the colonial government had worked out a positive policy of *kemiri* planting for recovering former swidden sites. Later, in 1948, Haan reported that the Forestry Department decided to plant *kemiri* to promote reforestation of abandoned swiddens in areas where shifting cultivation was approved [Haan 1948]. These reports show that *kemiri* planting in former swidden sites was actively promoted by the prewar colonial government; such instruction by forestry offices may have served as a trigger for the expansion of *kemiri* cultivation in prewar Eastern Indonesia.

In the postwar period, during “the age of development” under the New Order regime established in 1966, the government actively promoted the development of forest resources through the Fundamental Law for Forestry (Undang-undang Pokok Kehutanan). In other words, forest resources came to be systemically extracted through government-supported tree felling. Meanwhile, reforestation was promoted within and outside the former forest areas using quick-growing tree species. Most of the trees used for such purposes were leguminous trees such as *ipil-ipil* (*Leucaena leucocephala*); other useful trees, such as kapok, cacao, and *kemiri*, were also employed. In *kemiri*-producing areas, *kemiri* was recommended as the planting species for such reforestation projects.

According to interviews by the authors in the region of Ende in Flores Island, such reforestation had been promoted even before the New Order. The former chief of Desa Roa village referred to a reforestation project called “5 K” conducted in this area employing five different useful species including coconut palm (*kelapa*), cacao (*kakao*), *kemiri*, kapok, and coffee (*kopi*). This suggests that *kemiri* planting was also active in this period. Since the mid-1970s, a program under the direct control of the president of the Republic of Indonesia (IMPRES) has promoted reforestation employing useful species with the dual

aims of afforestation and economic production. In cooperation with the Provincial Forestry Department (Dinas Kehutanan) and the Plantation Department (Dinas Perkebunan), the village received a subsidy for planting coffee, *kemiri*, and cashew in 100 ha areas in the years 1972-73, 1975-76, and 1978-79, respectively. The village has organized a farmer association to take over the project, but along with the progress of the projects, even people outside the association have started to plant these useful trees.

Beyond such reforestation projects, however, local people were locked out of the forest areas by Undang-undang Pokok Kehutanan. They were obliged to abandon practicing conventional shifting cultivation and prohibited from expanding their farmlands into the forest areas, and as a consequence, illegal “invasions” of farmland into forest have gradually become common. It was not only local people, but also migrants from distant places, who could no longer make a living through conventional subsistence agriculture; their expansion of farmland into forest areas coincided with advances in the economy. Since the government could no longer ignore such “invasions” of residents into the forests, it worked out a policy for conserving the forest areas as forests of useful trees, to be used virtually as farmlands, by planting *kemiri* and other useful tree species in the illegal fields. This may have been a desperate measure taken by the Forestry Department, which could not officially approve of the “invader” farmlands as farmlands, but on the other hand, it could be evaluated as a positive, extremely down-to-earth policy for coping with the established fact of “invasion.” For example, in the latter half of 1980s, the provincial government of Sulawesi Selatan cooperated with Dinas Kehutanan in the introduction of the “Pola Sul-Sel,” a management system for farmland which had invaded into forest areas. Under this system, agricultural activities in the forest areas were legally approved if they planted useful trees such as *kemiri*. Later, this system was employed by other provinces and became a model for social forestry programs for reforestation and planting of the forest areas and surrounding denuded areas. *Kemiri* is the most important tree species in such programs, and the introduction of such policies must have contributed immensely to the expansion of *kemiri* cultivation in recent years.

Table 3 shows the area in which reforestation and planting were conducted by Kanwil Sul-Sel, the Provincial Office of the Central Department of Forestry, based on the Pola Sul-Sel. Although the total number of hectares is not large, the development is significant because it has resulted in the formation of groups at the district level and in individual villages and has stimulated their social participation in the reforestation of forest areas

**Table 3 Areas (ha) in Which Reforestation and Planting were Conducted under the Social Forestry Program (Pola Sul-Sel)**

District	91/92	92/93	93/94	94/95	95/96	96/97
Polmas	518	737	0	42	150	0
Barru	510	400	450	111	70	170
Pangkep	200	400	700	280	450	0
Sidrap	630	200	200	100	70	200
Bone	633	584	250	65	100	160
Maros	205	400	150	100	50	100
Gowa	1,066	1,200	200	200	250	0
Total	4,912	5,694	2,980	1,646	2,150	1,405

Source: Kanwil Kehutanan Sulawesi Selatan.

Note: Not all the districts are listed.

**Table 4 Recent *Kemiri* Production in Kabupaten Maros**

Year	1991	1992	1994	1996
Cultivated area (ha)	9,066	9,072	9,303	9,637
Production (ton)	4,980	4,734	5,409	5,602

Source: Dinas Perkebunan Maros

that have been used as virtual farmlands. Table 4 shows changes in *kemiri* production in Kabupaten Maros, Sulawesi Selatan, as an example of *kemiri* production at the district level. The data show a slow but steady increase in the cultivation area and production of *kemiri*. Such evidence shows that government-driven forestation projects have also stimulated *kemiri* forestation in areas outside project target areas and that government initiative has partially contributed to the expansion of *kemiri* cultivation.

### 3.2 Increasing Demand for *Kemiri* and the Expansion of *Kemiri* Cultivation

The previous section discussed the involvement of government-driven planting policy in the expansion of *kemiri* cultivation in the prewar and postwar years. However, the expansion of *kemiri* cultivation cannot be completely explained as being the result of the government promotion. Without economic incentives, such as rising prices accompanied by increasing demand, *kemiri* cultivation would not have expanded on such a large scale from the level of subsistence production to commercial production.

Before the war, the forest officers of the Dutch colonial government already paid a great deal of attention to the economic potential of *kemiri*. As shown in Table 2, they noticed the potential of *kemiri* oil as a drying oil, attempted to develop its industrial application, and proposed the use of *kemiri* wood for matchsticks. Furthermore, they performed

some experiments on seed germination, planting techniques, and intercropping with other woody plants to establish an efficient cultivation method for *kemiri*. They seemed to have pursued the possibility of large-scale cultivation for industrial applications.

However, a plantation-type production system of *kemiri* for industrial applications has never been established, while *kemiri* production on the small-scale farmer level has persisted through the pre- and postwar periods. The possible reason for this is that *kemiri* was no match for *Aleurites cordata* or *Aleurites fordii* in the drying oil market. In later years, petrochemical products replaced plant-derived oils, eliminating the need for plantation-type production of *kemiri*. Moreover, small-scale production could sufficiently meet the increased local demand for *kemiri* which has continued from the prewar period until today.

The largest factor contributing to the increase in demand for *kemiri* was the population increase on Java Island. The *kemiri* fruits are essential in Indonesian daily cooking, so the increase in population led directly to an increase in demand. Other factors are a rise in interest in cooking among urban residents, leading to the popularization of Indonesian recipes,<sup>7)</sup> and an increase in the number of restaurants in urban areas. Although the fluctuations of *kemiri* market prices have not been investigated thoroughly, these developments are assumed to have triggered *kemiri* planting in Eastern Indonesia.

Meanwhile, some grower-related factors were also responsible for the expansion of *kemiri* cultivation. One was the improvement of roads for transporting *kemiri* from farm to the markets. Flores Island, for example, has a long history of *kemiri* cultivation in the mountain areas, but in the old days, even if residents heard that *kemiri* could be sold at a good price at the island's port, it was very hard to delivery the product. According to the former chief of Desa Roa, in the 1950s villagers heard that *kemiri* sold well in Maumere, but road conditions were so poor that no one dare to go there. Only in the 1960s, after the government-aided planting program started and road conditions had improved, did villagers start selling their *kemiri* outside the village.

Furthermore, the nature of *kemiri* production made it a suitable crop for small-scale farmers. This was also an important factor in the expansion of its cultivation in response to increasing external demand. As mentioned above, *kemiri* cultivation does not require

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7) *Kemiri* appears in many recipes in cookbooks published in the pre- and postwar periods [Cornelia c.1870; Departemen Pertanian 1967]. Perhaps the recent popularity of these books among the urban middle class has secured *kemiri* an essential position among Indonesian food materials.

much labor, so it can be well managed with domestic labor alone. *Kemiri* can also be cultivated over a long period, so it does not require a large amount of labor at any one time. Only the shell-removing step is quite laborious, but can be overcome if no effort is spared. Moreover, once harvested, *kemiri* fruits can be stored for a long period with their shells on, enabling the growers to wait for the price to rise instead of worrying about the current market price. Table 5 shows the amount of *kemiri* purchased from farmers by the cooperative (KUD) in Detu Soko, Flores Island. Stocks were higher in March and April compared to the harvesting months of October to January, probably because farmers waited for the price to rise. Such characteristics of *kemiri* seem to have contributed to the continuous expansion of cultivation supported by small-scale farmer production based on domestic labor.

Stimulated by the policy promoting the use of *kemiri* in reforestation of degraded forest areas and afforestation of surrounding areas, as well as by the increase in external demand, *kemiri* cultivation has developed in many areas in Eastern Indonesia. The *kemiri* forests found today are supported by a delicate balance between local people's ambitions for economic opportunity and the government's mission to conserve forest areas.

**Table 5 Monthly Amount of *Kemiri* Purchased by KUD in Detu Soko, Flores Island**

	1995		1996	
	kg	%	kg	%
Jan.	829	5.3	2,878	15.8
Feb.	583	3.7	1,755	9.6
Mar.	3,437	22.0	3,568	19.6
Apr.	1,138	7.3	3,068	16.8
May	390	2.5	1,084	5.9
June	733	4.7	768	4.2
July	—	—	292	1.6
Aug.	446	2.9	90	0.5
Sept.	—	—	265	1.5
Oct.	543	3.5	968	5.3
Nov.	3,329	21.4	1,841	10.1
Dec.	4,161	26.7	1,667	9.1
Total	15,588	100	18,243	100

Source: KUD Lepembuse, Detu Soko



#### 4. Reconstructing Local “History” or a “Curriculum Vitae” of the Area Investigated through *Kemiri*: Possibilities for Future Comparative Studies of Oil Plants in Southeast Asia

As mentioned above, although *kemiri* is not as popular as other oil plants such as coconut palm or oil palm, the plant deserves an important place in the discussion of the transition of agricultural land use in the tropics and land property issues.

Table 6 shows the change in the cultivated area of cacao over recent years in Sulawesi Selatan, representing a rapid expansion of cacao cultivation. For comparison, the cultivated area for *kemiri* is also included. The data indicate that cacao cultivation in Sulawesi Selatan has expanded since the 1980s; this rapid expansion of the cultivated area, which may be called the cacao boom [Ruf 2001], was triggered by the rising price of cacao reflecting increased demand outside the country. Perhaps a similar boom existed for *kemiri* during the prewar Dutch colonial period and the postwar age of development.

Today, cacao trees are often found on the forest floor of *kemiri* plantations, but surely those cacao trees were not there ten or twenty years ago. Perhaps the same applied to *kemiri* in the past. There must be many places where *kemiri* cultivation is popular today but *kemiri* forests did not exist, say, in the 1960s, let alone at the beginning of the twentieth century. Figure 1 shows a “history” of land use in such an area, which may be considered a “footprint” [Balée 1994] or a “curriculum vitae” of the area, with the focus on *kemiri* and cacao. As depicted in this figure, re-viewing the landscape by stripping off the currently existing *kemiri* forests, in the same manner as stripping off the geological strata, may lead to an understanding of the history of the area.

In addition to fieldwork focused on *kemiri* plants in Eastern Indonesia, I was able to conduct similar research in continental Southeast Asia and southwestern China. On this occasion, I was lucky to have a chance to observe the cultivation of the tung-oil tree (*Aleurites fordii*) in the Nu Jiang River basin in Yunnan Province. I could observe that *Aleurites*

**Table 6 Changes in Cultivated Areas (ha) of *Kemiri* and Cacao in Sulawesi Selatan**

Year	1975	1980	1985	1990	1994
<i>Kemiri</i>	27,343	29,121	32,011	35,413	41,022
Cacao	111	850	13,906	79,974	114,289

Source: *Sulawesi Selatan dalam Angka*

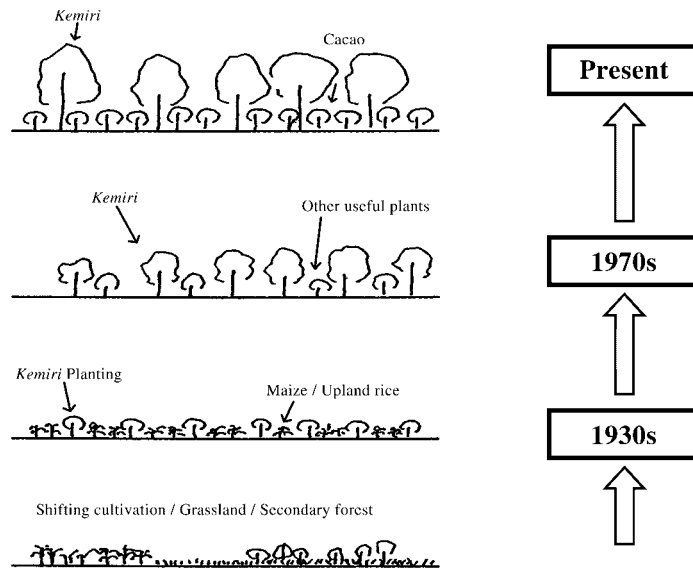


Fig. 1 History of Land Use Focusing on *Kemiri* and Cacao

*fordii* was widely cultivated along the Nu Jiang River in Fugong Township in Nu Jiang District and confirmed that the district was one of the most famous tung-oil producing areas in Yunnan Province [Nu Jiang District Department of Forestry *et al.* 1998]. A Lisu farmer who responded to our interview request told us that they started cultivating this plant in riverside fields about ten years ago. According to the farmer, the initial growers were stimulated by government promotion, but many people have since begun its cultivation on a voluntary basis. Perhaps the market price for tung-oil is rising; like Indonesian farmers, the face of the Lisu farmer was full of expectation for oil-crop cultivation as a promising cash-earning source. He told us that he actually lives on the mountainside but moves to the riverside every year with his family to harvest the crop. The farmer told us that he had been doing this for about ten years already. Unfortunately, there was not enough time to ask other questions, such as how they acquired the land for planting *Aleurites fordii* and when these *Aleurites fordii* forests started to expand along the river. Nevertheless, it was apparent that a particular oil crop, *Aleurites fordii* in this case, played an important role in the rapid change of the landscape within this area. The interview was extremely meaningful since it confirmed the involvement of oil crops in building a history of land use in an area.

Besides *kemiri* and *Aleurites fordii*, there are other oil-producing members of the genus

*Aleurites*, such as *A. montana* and *A. cordata*, which are cultivated in areas extending from China to continental Southeast Asia. They may have little popularity compared to other oil crops such as coconut palm and oil palm, but as in the case of *kemiri*, such minor oil plants may provide a useful account of the large innovations involved in local history. Therefore, studies focusing on oil plants have their own advantages for the understanding and comparison of regions and areas.

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