According to them the oil palm boom is responsible for the destruction of millions of hectares of rainforests, for the decrease of biodiversity, the pollution of rivers, the rise of forest fires and the displacement of local communities.

The home of the oil palm (Elaeis guineensis) is the tropical rainforest along the West African coast. For generations the local population has been planting the tree to gain vegetable oil for their daily diet. In the 19th century the oil palm estates were founded under European colonial rule in several countries in West and Central Africa.

In Southeast Asia the first oil palms were planted by the Dutch in a botanical garden in Bogor. From here they spread to other places in Southeast Asia, however, only as ornamental trees along roads or in parks. It took more than a century before the enormous economic potential was recognized. Around 1920 Malaysia started with the foundation of a large scale palm oil industry and secondary enterprise besides the then dominating rubber-production. After World War II Indonesia followed the Malaysian example in search for an alternative export commodity in the place of the vanishing oil and gas reserves. It was the start of the real palm oil boom. Today the two countries dominate the international palm oil market with about 85% of the world production. In Indonesia alone, every year an area of about 400,000 hectares has been cleared since 1995 for new oil palm estates [Statistik Perkebunan Indonesia, 2006], covering a total area of more than 6 million hectares (2005) - double the size of Belgium.

Among the world’s leading vegetable oils and fats palm oil ranks second (28%) behind soya oil (29%), followed by rape oil (14%) and sunflower oil [Malaysian Palm Oil Board, 2001]. Western Europe has always been the main importer, but developing countries like India, Pakistan and China are now also increasing volumes of palm oil due to its relatively cheap price. In Germany palm oil ranks second behind rape oil [WWF, 2002].

RESULT AND DISCUSSION

The oil palm is the only crop providing two different oils: 88% crude oil (CPO) from the fleshy mesocarp and 12% palm kernel oil (PKO) from the (endosperm) of the same fruit (see Fig. 1). While crude palm oil is also mainly used for foodstuffs, palm kernel oil contains a lot more saturated fats and is therefore preferably used for non-food items like soap and candles. Due to its high boiling point palm oil is especially well suited for frying - e.g. of pizza and ice cream etc. Palm oil plays an important role in the worldwide expanding food industry. Due to its cheap price it is the preferred vegetable oil (“the peoples’ oil”) in many developing countries. In North America, on the other hand, palm oil became reputed as a risk for health because of its pretended high...
of cholesterol. It is believed that this ill-reputation was launched by the US soya-lobby to keep palm oil away from the American market. Although later research proved the opposite, the negative image still persists.

![Image of the oil palm](image-url)

Figure 1. The fruits of the oil palm contain two different oils: the yellow fleshy mesocarp produces "crude-palm-oil" which is preferred as vegetable oil for food items. The white endosperm contains the "palm-kernel-oil" which is mainly used by the oleo-chemical industry. (Source: Ulrich Scholz)

Apart from food items, an increasing share of palm oil is used in the growing oleo-chemical industry for a big variety of cosmetics, pharmaceutics, detergents etc. It also has been successfully tested as "bio-diesel" but due to its higher price, it can so far not compete with normal diesel (different from the highly subsidized rape oil in Europe).

Production methods: Estates versus smallholders

The extraction of the oil from the oil palm fruit is a complicated process which requires a sophisticated management. After the harvest the perishable fruits have to be processed within 24 hours. The processing can only be performed by big factories which need a regular supply from at least 6,000 hectares. Such conditions can of course, be best fulfilled by large estates. For a long time it was therefore believed that smallholders would have no chance to compete in the palm oil business. This opinion changed with the introduction of the so-called "nucleus estates". In such estates only a certain part of the plantation is managed by estate laborers; the other part is distributed to smallholders. Each smallholder is made responsible for the management of a 2-4 ha block. All inputs like seedlings and fertilizer are supplied by the factory which guarantees a fixed price for the yield. In this way it is tried to combine the advantages of an estate with those of smallholders. This integrated plantation system was introduced into Malaysia 1972, with the foundation of the "Federal Land Development Agency" (FELDA). Within 15 years FELDA opened about 760,000 hectares for new plantations, beginning mainly for rubber, later almost exclusively for oil palms. More 200,000 settler families, usually previous poor rice farmers, found a new The political idea behind this settlement strategy was to support the relatively Malay majority against the rich Chinese minority in Malaysia [Uhlig, 1988].

After 1980 Indonesia also took over the concept of the nucleus estate incorporating it into the national "transmigrasi" program, i.e. the resettlement of poor families from the overcrowded island of Java to the scarcely settled islands like Sumatra and Kalimantan [Scholz, 1992]. Like in Malaysia each family was appointed to manage 2 or 3 hectares within a plantation. One of the Indonesian nucleus estates was the Ophir Estate in West-Sumatra which started in 1981 in cooperation with the German Kreditanstalt für Wiederaufbau (KfW) and the Gesellschaft für Technische Zusammenarbeit (GTZ). Encouraged by the success of the nucleus estates, even "autonomous" smallholders began to cultivate oil palms into their farming systems. Today, already of the Malaysian and 33% of the Indonesian oil palm plantations are managed by smallholders [Statistik Perkebunan Indonesia, 2005].

Economic aspects

As already mentioned, palm oil is cheaper than its main competitors on the world market, namely soybean, rape and sunflower oil, although the products these are highly subsidized especially in the USA and the EU. The cheap price of palm oil results from the cheap labor-costs of the Indonesian laborers, both Indonesia itself, but also in Malaysia where most of the plantation workers are from Indonesia, especially from Java. Whereas the cultivation of soya, rape and sunflowers is mainly achieved by machines, most of the works in an oil estate, especially the harvest of the fruit bunches, can only be done manually. It takes only 0.7 man days to produce 10 tons of soya oil but about 20 man days for the case of palm oil, i.e. around 30 times more. This shows the definite depend of the palm oil industry on the labor-price, which is especially cheap in Indonesia where an estate laborer earns about 40 €/month. Already a modest increase in Indonesian wages could bring the whole palm oil industry into serious trouble.

Probably the strongest argument in favor of the oil palm is its superior productivity per unit of area. Only very few other crops convert solar energy efficiently into food energy like the oil palm. On average, oil palms produce about 4 tons of oil per hectare (well managed estates achieve 5 tons and more) - soya 0.4 t/ha and rape only 0.7 t/ha. This fact provides the oil palm a very strategic position in view of the growing world population and diminishing land reserves. Another advantage is the missing of seasons. Being a typical representative of tropical rainforest, the oil palm is flowering and fruiting throughout the
without seasonal variations. The steady supply of ripe fruits guarantees the factory a year round use of its machinery and a constant employment of the workers without seasonal interruptions. The recruitment of seasonal labor, being a key problem for many other plantations in other parts of the world, is not necessary. The 1000 Rupiah coin with an oil palm on its back demonstrates the important role of palm oil for the Indonesian economy (see Fig. 2).

Figure 2. The 1000 Rupiah coin with an oil palm on its back demonstrates the important role of palm oil for the Indonesian economy. (Source: Ulrich Scholz)

Environmental aspects

Basically the oil palm is an environmentally friendly plant. This is also true for its products. As a perennial tree-crop the oil palm is well adapted to the ecological conditions of the humid tropics. It even grows on relatively poor soils, which are hardly suited for other agricultural activities. The canopy shades the ground and secures a balanced micro-climate. Today, in all new plantations fast growing leguminous herbs are planted between the oil palm-seedlings. These cover the ground, prevent soil erosion, enrich the soils with nitrogen and stabilize the soil fauna (see Fig. 3).

There remain, however, several critical aspects, too. Probably the most serious one is the disputed role in the destruction of tropical rainforests. In Indonesia alone every year about 400,000 hectares are opened for new oil palm plantations - mostly in rainforests. This is about 0.5% of the present rain forests area of the country. The change from one of the richest ecosystems on earth to a monoculture results, of course, in a serious loss of biodiversity.

Another critical point is the technique of "slash and burn" to clear rainforest for a new plantation (actually the same technique is applied by the farmers for their traditional shifting cultivation). Normally the fire does not the adjacent rainforest because this is too wet. However, in exceptional dry fire may spread into the rainforest. This happened in the "El Niño-1997/98 when millions of hectares of rainforest were burnt in Sumatra Kalimantan. The haze stopped the air-traffic within parts of Malaysia, Indonesia and of Singapore for several weeks. Satellite-images proved that the fires were mainly caused by slash-and-burn clearing for new oil palm estates. Since slash-and-burn is officially forbidden in Malaysia and Indonesia, many companies still apply this habitual technique.

A further environmental problem has been the pollution of rivers by water from the palm oil factories. In the meantime most factories use clarificar ponds which have by and large solved the problem.

In general, agricultural mono-cultures are easily prone to diseases, insect pests, requiring the application of pesticides. Astonishingly, this is the case with oil palms. Although in some parts of West-Malaysia oil palms have been planted continuously for several generations, there have never been attacks of pests. Thus the use of pesticides can be kept to a minimum being no serious to the environment.
On the other hand the oil palm needs considerable amounts of fertilizer. Most of it consists of organic material delivered by the oil palm itself, i.e. the leaves, the emptied fruit bunches, and finally the trunk. All these materials are cut into pieces and spread between the trees as mulch.

With regard to energy consumption the palm oil factories are fully self-supporting. During the milling process big quantities of fibers and shells are left which serve as fuel for the boilers and produce electricity. The remaining ashes are used as fertilizer. What applies to the rainforest is also true for an oil palm estate: it is fed by its own organic materials.

Social aspects

Very often the plantation companies are reproached with their neglect of the interests of the local population, e.g. in Sumatra and in Kalimantan. This applies in particular to the question of land-ownership, which is frequently the reason for conflicts. The indigenous people do not dispose of individual land-ownership, but only of individual utilization rights. The land itself belongs to the clan who was the first to clear the forest. Even if a piece of land is no longer utilized and turned into secondary forests or grass savannas ("alang-alang"), it still remains clan-land [Scholz, 1988, 2003].

As a matter of fact, many estate-companies do not consider these traditional rules. Often the conflict starts when the plantation is already fully productive. Especially during the “Asian Crisis” after 1997 the situation escalated. For example, in South-Sumatra enraged villagers entered the offices and occupied the machinery of a plantation because the company had planted the oil palms on clan-land without sufficient compensation. Similar cases happened in several other plantations too [Casson, 1999: 73].

In spite such understandable reactions of the local people, one should, on the other hand, not forget the socio-economic benefits of oil palm-plantations. This applies first of all for the provision of employment. As mentioned earlier, the palm oil production is very labor-intensive. If 1 man-power is needed for 3 hectares, a normal 6,000 ha-estate offers about 2,000 working places. Additional work-force is needed in the factory, the office, etc. Altogether the Indonesian and Malaysian palm oil-industry employs at least 6,000,000 people. If one includes the families of these workers it can be assumed that more than 20,000,000 people depend on the palm oil-industry [Fairhurst and Muiett, 2000].

On average, a plantation worker in Indonesia earns about 40 € per month. This might be extremely low according to European standards, but it represents the average income of the country. In addition several fringe benefits are provided, such as free accommodation including drinking water and electricity, free school education for the children and free health services for the family.

The economic situation of the contract-farmers in the nucleus estates is even better. An evaluation of the mentioned Ophir Estate in West-Sumatra showed that the contract-farmers earned about three to four times more than the local farm the surrounding areas. Some of them even employed laborers on their 2-he plot while they themselves started a new business in Padang or in other town the province.

The specific situation in Malaysia

For many years, Malaysia has been the biggest producer of palm oil world (but will loose this position to Indonesia from 2006 onwards). Palm oil is most important agricultural commodity of the country. Around 60% of agriculturally used area is occupied by oil palms and about half of the agricultural labor force is employed in the palm oil industry [Barison et al., 2 Figure 4 illustrate the palmoil factory in Malaysia. The country also disposes world’s leading institutions for palm oil-research.

Figure 4. A palmoil factory in West-Malaysia. In order to achieve an optimal quality the fruits of the oilpalm must be processed within one day after the harvest. (Source: Ulrich Scholz)
There exist, however, some problems. This applies first of all to the labor-force. Compared to other Southeast Asian countries the salaries are quite high in Malaysia, e.g. 2-3 times higher than in Indonesia. Therefore most workers in the Malaysian estates come from Indonesia or from the Philippines in the special case of Sabah (East Malaysia). Even the relatively well-off contract farmers in the FELDA-nucleus estates complain about labor-shortage because their children are no longer interested to live and work in the somewhat boring plantation villages, but rather prefer a job in the booming Malaysian industry or service centers.

Another problem is the increasing price for land. Especially in West Malaysia the palm oil companies find it more and more difficult to acquire land for new plantations. On the contrary - more and more plantation land is transformed into industrial areas, living quarters, golf-courses or new towns. The new international airport of Kuala Lumpur or the F1-course of Sepang are examples of this trend. In East Malaysia, especially in Sarawak, still exist abundant land reserves, but not enough labor-force. A solution could be the recruitment of even more laborers from Indonesia than already exist. This is, however, not in line with the Malaysian immigration policy which tries to restrict the number of Indonesian immigrants being afraid of social tensions. Another solution is to shift the palm oil industry across the border into Indonesia which is indeed done at present. An increasing number of oil palm plantations on Indonesian territory are managed by Malaysian entrepreneurs [Scholz, 2004].

In the future the palm oil industry will probably put less weight on the expansion of the production by new plantations but more on an intensification of the existing plantations and an improvement of the processing. In addition the oleochemical industry will be pushed. Already today Malaysia produces more than 20% of the oleo-chemical items of the world - often in cooperation with western companies like Procter & Gamble or Henkel. Another future option might be the use of the big quantities of biomass of an oil palm-estate by the wood-processing industry [Barison et al., 2000].

**The specific situation in Indonesia**

No other country in the world offers better conditions for the cultivation of oil palms than Indonesia. The country disposes of huge land reserves, abundant cheap labor-force and a favorable legislation and policy. Almost the whole palm oil business is controlled by roughly ten big companies - often in cooperation with Malaysian companies. The Indonesian government offers concessions of up to 20,000 ha in a province or up to 100,000 ha in the whole country [Casson, 2000]. The first step is to exploit the timber of the concession area before the palm trees are planted, i.e. timber and palm oil-companies work together.

Due to the big population of more than 200 Mio persons Indonesia exhibits (different from Malaysia!) a considerable domestic market for palm oil. Depending on the export-quota around 50-60% of the production is consumed in the country itself. More and more households switch from the traditional coconut-oil to cheaper and better usable palm oil - especially in urban areas. Palm oil constitutes about 30% of all export earnings of agricultural commodities and thus an important source of foreign exchange. The great importance for the Indonesian labor market has already been mentioned - especially if one considers that a lot of the Malaysian plantations most workers come from Indonesia.

No wonder that the palm oil-sector booms. Since 1980 the plantation area grew by 20 times from 300,000 ha to about 6 Mio ha in 1995 [Statistik Perkebunan Indonesia, 2006]. Since 1995 every year about 400,000 ha have been cleared for new plantations. In the beginning most oil palm-plantations (like rubber and cocoa plantations) were located in the former “estate-belt” around the city of Medan (North Sumatra). From there they spread all over Sumatra, where almost 75% of all oil palm plantations of Indonesia exist. In the future the biggest expansion will take place in Kalimantan. According to WWF [2006] exist plans to open the huge plantation of the world with a size of 1.8 Mio hectares along the border to Malaysia. In 2006 Indonesia surpassed Malaysia as the biggest palm oil producer of the world. There is no doubt that the country will extend this position in the coming years.

**Prospect**

The worldwide demand for vegetable oils will definitely keep on rising in the coming years - not only because of the growing world population but also because of the increasing demand for oils and fat per capita. This has indeed been growing from 5.5 kg per capita in 1960 to 18 kg in 2000 - a typical sign of the raising living standard in the world. Another factor is the expected growth in the oleo-chemical industries versus the petrochemical industries.

It is also expected that among the vegetable oils especially palm oil is the profit from the increased demand for oils and fats. Experts estimate that the production of palm oil will double within the next 20-30 years. This means another 5-6 Mio hectare of land would have to be cleared, most of it certain in Kalimantan. Skeptics are afraid of further encroachment into rainforests, thus forest fires and escalating conflicts between the plantation companies and the local people.

But what could be an alternative? Palm oil is a cheap and healthy component for about half of the world population. It offers employment millions of families and raised incomes for hundreds of thousands of smallholders. Last but not least it is an option for the solution of the world’s energy problem. But other vegetable oils like soya, rape or sunflowers should cover the growing demand, at least double the size of land would be needed as with palm oil. Thus additional human labor would be replaced by energy consuming machines resulting in a loss of millions of working places. Altogether the ecological and economic risks would certainly be bigger with soya, rape, and sunflowers than...
oil palms. Thus an increase of the palm oil production is not only inevitable but also meaningful.

CONCLUSION

Nevertheless, one has to agree with the critics when they complain about the methods of land clearing and the way the local population is treated when a new plantation is opened. Indeed, their complaints are the more justified since there exist relative simple ways to overcome these difficulties. The following measures and strategies should be applied in the first line:

- Refrain from “slash and burn” techniques to prevent forest fires. “Slash without burn” can be applied as well.
- To open new estates on grass lands and not in forest areas. Technically this is no longer difficult. The only problem remains with the land rights of the local clan societies. This means:
  - participation of the local people in planning and implementing new plantations;
  - application of the “nucleus estate” concept for all new estates;
  - strengthening the cooperative component within the nucleus estates;
  - support of independent “autonomous” smallholders through extension, fair credits and improved marketing conditions.

There exist already several examples, where the mentioned measures have been successfully applied, e.g. the Ophir Estate in West-Sumatra. Also western food companies like Nestlé, Migros and Unilever show increased consciousness with regard to ecologically sustainable and socially tolerable ways of palm oil production. They realize that they can only compete on the international market without the negative image of being involved in the destruction of rain forests or violating the human rights of indigenous societies.

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