The abstracts are set up in the following way:

(1) Abstract number.

(2) Principal key-word: traditional land-use systems, cropping systems, agroecology, agroforestry, farming systems research and development etc.

(3) Key-words: if relevant, the geographical demarcation (continent, country) or the agroecological zone is given; the key words "review", "field trial", "field study" or "farm survey" indicate the nature of the paper; common names of field crops, soil fertility, pests, diseases, socioeconomic aspects etc. are used.

(4) Author's name.

(5) Title in the original language.

(6) Abstract: Because the abstracts are more comprehensive than is normally the case, it may often not be necessary for the reader to refer to the original. In a few cases, the summary by the author was used directly, sometimes because the original work could not be obtained.

The subject index, based on the key-words, and the geographical indices are intended to help the reader quickly find abstracts on specific aspects or areas of sustainable agriculture. The index of authors is intended to help the reader find all publications by a particular author.

I. TRADITIONAL LAND-USE SYSTEMS

1 88 - 1/1

Traditional land-use systems
Asia, Sri Lanka, dry zone, shifting cultivation, soil fertility, fallow periods, cropping system
ZIMMERMANN, T.
Shifting cultivation in the dry zone of Sri Lanka.
In: Handbook for Highland Farming in the Dry Zone, Sarvodaya Rural Technical Services, Sri Lanka, 1, IV-VI, 1981

Chena or shifting cultivation is a widespread farming system in the area of tropical rain- or monsoon forests. Its main feature is the lack of settled farms. Under ideal conditions the plot under cultivation is rotated in a cycle of 10-20 years within a jungle area. In the dry zone of Sri Lanka jungle clearing, burning and fencing of the plot is done between July and September.
Cultivation is started with the first rains. Seeds are broadcast on the cleared land and very limited cultivation work is done with mammoties to bury the seed. After sowing little attention is paid to the crop. Most important is permanent watching to protect crops from wild animals (wild boars, birds, elephants). By burning the jungle material, a part of the nutrients enclosed in the living plant matter, especially potash, can be gained for the following crop. Without fertilizer application, cultivation can be continued for 2-3 years. Then the fertility of the soil is exhausted. After this cultivation period the land should be left fallow under jungle for at least 10 years. During this period under natural vegetation the soil fertility is restored and the cultivation process can start again. Chena cultivation is practised in villages of the dry zone of reddish brown earth, often in combination with paddy cultivation under a small tank system.

Chena cultivation is a rewarding cropping system in low populated areas in terms of minimizing farmer's risks and optimizing his labor input in combination with paddy cultivation.
The fallow is a cheap method of restoring soil fertility.
The jungle clearing work during the dry season does not compete with other cultivation work.
The fallow period under jungle eliminates weeds, pests and diseases. The farmer faces less weeding problems than under permanent cultivation.
Capital inputs can be reduced to a minimum and only seed material is required.
On the other hand Chena cultivation has caused extensive destruction of forest in the whole dry zone of Sri Lanka. Primary forest is cut and burned and the wastage of valuable timber is tremendous.
Soil destruction takes places very quickly and only on flat land can erosion be controlled to some extent.
Yields are always low since there is complete dependence on rainfall. No Chena farmer is going to practise lift irrigation since

it would be wasteful to dig a well on a plot which would have to be abandoned in a few years.
Under population pressure there is a dangerous tendency toward shorter fallow periods. Thus, soil fertility can no longer be restored to the required extent and the system destroys itself.
Chena cultivation is restricted to reddish brown earth areas and is a cropping system especially adapted to this soil type. The reddish brown earth is a soil of high chemical fertility and is able to store nutrients from the fallow period over more than one cultivation season. On the other hand the nonfriability of the reddish brown earth is regarded as the most important factor which had operated against the evolution of a settled system of arable farming.
The traditional Chena crops are Kurakkan maize, chilli, cowpea and manioc in the Maha season and gingelly (sesame) in the Yala season. Of lesser importance are sorghum, meneri rainfed paddy, green gram, sweet potato, brinjal, pumpkin, tomato and mustard.

2 88 - 1/2

Traditional land-use systems
South America, Andes, land-use patterns, ecology, traditional systems, deforestation, soil erosion, potential use, research needs
MILLIONES, O.J.
Pattern of land-use and associated environmental problems of the Central Andes.
Mountain Research and Development, 2, 1982, pp. 49-61

During the last several thousand years the Andean region has been exposed to strong and persistent processes of erosion which have led to a deterioration of its natural renewable resources. The population of the Inca Empire deeply appreciated the value of the soil as a resource; hence, they had developed a high-level agricultural technology which included the construction of complex engineering works. Thousands of hectares were protected by terracing to preserve the soil and were irrigated by water stored in "chochas" (artificial lakes). In this way intensive cultivation of a variety of plants was possible.
The arrival of the Spaniards had a catastrophic impact upon both the environment and the native population of the Andes. The newcomers' activities and policies were, from the ecological viewpoint of the use and preservation of the natural resources, highly detrimental. The strong discipline imposed by the Incas for the maintenance of the renewable natural resources disintegrated.
The introduction of cattle, sheep, goats, horses, donkeys and mules by the Spaniards also had a strong effect on the complex of natural resources and led to the development of new types of economic activity. With the exception of sheep, these domesticates did not adapt well to the pastures and climatic conditions of the puna. This led to the establishment of extensive pastures at lower altitudes, generally between 2,000 and 4,000 m above sea level.
During Inca times, these lands had been kept as forests or partial

woodlands for the protection of the agriculture fields, while the domesticated cameloids grazed on the punas at altitudes above 4,000 m. In contrast to the cameloids, sheep and other hoofed animals had detrimental effects upon the soil and plants, especially when overgrazing occurred. Because cameloids are plantigrades, they did not substantially harm the grass, even in cases of overgrazing.
Of the total Andean land area, the part which may be continuously cultivated is very restricted because of the limitations imposed by climate, topography and drainage. Fragmentation is the norm, and most of the fields are small lots, frequently with a slight to moderate topographical slope. The locations where cultivation is possible attract high concentrations of population which presently depend on subsistence agriculture, using all the available land.
The technology employed is usually very traditional, based upon human labor, some animals for planting and harvesting, and vegetables leftover plus animal manure for fertilization. In some of the drier areas irrigation is used to improve crop yields.
Since, for most of the highlands, agriculture is limited to a subsistence level, farmers use neither chemical fertilizers nor products to control pests and diseases. Depending upon the type of soil and economic demands, a farmer may fallow up to seven years in order to re-establish natural soil productivity. The poverty of the Andean farmer forces him to use the natural fallow system even though his small landholdings and the climatic restraints on agricultural productivity demand that he makes the fullest possible use of his fields.
The traditional land-tenure system in many areas has been one of the principal causes of severe environmental problems. The unequal land distribution has forced the less privileged inhabitants to support themselves on poor lands often inappropriate for agriculture. This has kept the peasant population in poverty, ignorance, and segregation from modern society. The process which led to poor use of land has been exacerbated and retained because there is no equilibrium between human population and available natural resources. Thus, one of the fundamental reasons for the general poverty and over-exploitation of the resources has been the traditional pattern of resource allocation, particularly land.
In the Central Andes, an important component of an integrated land-use policy which focuses on environmental problems is a harmonious and permanent relationship between people and their ecosystem. This requires that four objectives be achieved: 1) complete information about the economic potential of the Central Andes, including details on the quantity, quality, location, and state of conservation or damage for each unit of land; 2) rational conservation of the environment on the basis of land-use potential; 3) improved education in support of rational land use; and 4) adequate protection of the scarce and fragile resources in order to restore the original productivity of those lands that have been exhausted or unfavorably altered.
When the actual practices of land use and conservation are considered, it is obvious that certain lands will require particular attention. These include: 1) unexploited lands for which it will be necessary to determine whether special treatment

would permit their economically sound exploitation; 2) land which is restricted in productivity by particular physical, chemical or biological conditions; and 3) lands where improper use interferes with their stability.
Since an integrated policy would be designed for the eventual improvement of the social and economic situation of the local people, it is absolutely necessary that the governments involved provide and finance the necessary technological resources on a continuing basis. This would be needed to achieve both proper levels of land use and adequate protection of the natural and renewable resources of the Central Andean region.

3 88 - 1/3

Traditional land-use systems
Asia, Nepal, survey, traditional farming, mechanization, cropping intensity, yields, income employment
TUDASAINI, S.P.
Farm mechanization, employment, and income in Nepal: traditional and mechanized farming in Bara District.
IRPS, 38, 1979, pp. 1-9

Farm mechanization in the developed countries has occurred primarily as a response to high and rising wage rates. The recent spread of tractorization into countries with low wage rates such as India, Pakistan and Nepal raises various questions. This paper attempts to answer those questions in the context of the Nepal Terai.
A survey of traditional and mechanized farms in Bara District, Nepal, was conducted to assess the impact of mechanization on cropping intensity, timeliness, yields, income, employment, and efficiency.
Five different types of farmers, traditional with bullocks, pump-set owners, tractor owners, tractor hirers, and tractor and pump-set owners were identified and studied to trace differences in farm employment and income. A sample size of 20 or 21 was randomly drawn from each of the five specified types of farmers and 102 farmers from Bara District in the central Terai of Nepal were interviewed to gather necessary information.
The five specified types of farmers differed from each other in basic characteristics, such as cultivated area, expenses for improved inputs, investment in machinery and tools, and education of the farm operators. Most traditional farmers were part owners of land in contrast to most machine users, who were full owners. The differences in expenses for improved inputs, value of machines and tools, and education between the traditional farmers and all other categories were large, indicating much poorer access to capital inputs of any type on the traditional farms.
Assessment of the quality of land preparation performed by the tractor was based on the farmer's judgement of degree of weed infestation immediately after transplanting, crop stand, and yield. Weed infestation was less on farms plowed by tractors as reported by most tractor users. Most tractor users also reported

better rice and wheat stands and higher rice and wheat yields after use of the tractor for land preparation. Crop yields showed that both rice and wheat yields were higher on mechanized than on traditional farms. But the simultaneous arrival of biological (modern varieties) and chemical (fertilizers, pesticides, etc.) innovations on mechanized farms makes it difficult to attribute higher yield and better crop stand solely to tractorization. Pump-set owners had lower yields for rice but marginally higher yields for wheat than the tractor as well as tractor and pump-set owners, despite the fact that tractor owners used almost the same level of improved inputs and tractor and pump-set owners used substantially higher levels than pump-set owners. Thus, there was no clear evidence to support the hypothesis that tractors improved yields. Tractors could not be clearly linked with any on-farm labor displacement and pump-sets were found to raise farm employment. Tractor ownership allowed large farms to achieve higher cropping intensity through speedy and timely operations. Increased cropping intensity appeared to put a premium on timeliness for large farms, but did not seem important for small units. Tractorization permitted the farmer to nearly eliminate bullocks.
The highest levels of efficiency were achieved by pump-set owning and tractor hiring farms rather than large tractor owning farms.

4 88 - 1/4

Traditional land-use systems
Asia, Sri Lanka, dry zone, paddy rice, traditional irrigation, fertilization, sustainability
PALM, O. and DE SILVA, M.A.P.
Nutrient cycling in paddy rice of a traditional farming system, Dry Zone, Sri Lanka.
Trop. Agric. (Trinidad), 64, 1987, pp. 129-132

Sri Lanka, like most Asian countries, depends on rice as a staple food. During thousands of years rice has traditionally been cultivated both with large-scale, complex irrigation systems and with small village tank systems in isolated areas.
Even though there has been an extensive modernization of agriculture, many of the old traditional village-tank-based irrigation systems are still in operation. These traditional small-scale systems, often including 30-200 families, involve a combination of shifting cultivation and irrigated paddy rice production. They have shown a remarkable sustainability over time and have survived even when the large-scale ancient irrigation systems have collapsed.
Most of the current knowledge about rice, especially in relation to nutrient turnover, comes from modern systems and often from outside the tropics. The aim of the present preliminary study has been to highlight some aspects of traditional, non-fertilized paddy rice cultivation, in relation to soil nutrient availability and N-uptake by rice plants. Such data are important for an evaluation, for example, of nutrient economy in traditional vs intensive rice cropping systems.

The studied village is located south of Anuradhapura, in North-Central Province, within the Dry Zone of Sri Lanka. The village is a traditional so-called Purana village with a village tank irrigation system. Annual rainfall in the area is about 1300 mm, concentrated in one major period (October-December), the Maha season, and one minor period (April-May), the Yala season. Available N, P and exchangeable K, Fe and Mg in the soil and subsequent N-uptake by rice plants (Oryza sativa), as well as biomass production, were studied in farmers' non-fertilized fields. Soil organic matter increased during the season from 2.5% to 3.0%, probably due to rice litter, root biomass production, and dead weeds and cyanobacteria. Soil NH_4^+N decreased during the first 1.5 months from 24 to 3 kg/ha and was at harvest time 1 kg/ha. N uptake by rice plants ranged from 54 to 107 kg/ha. Mineralization of soil organic matter is the major source for N in this traditional farming system. P, K, Fe and Mg decreased only marginally during the growing season and the amounts were not limiting to growth; N seems to be the yield-limiting soil nutrient.
In the Dry Zone of Sri Lanka, water is the most important production-limiting factor in rice cultivation. Every effort to save water with unchanged yield is important. If enough land is available as well as a possibility to store water from one season to another, one way of saving water as well as being an alternative to fertilizer use can be a more active use of fallow periods to build up soil organic matter content. In most of the traditional small-scale irrigation systems, it is observed that the land-use intensity for paddy rice production is rather low, due mainly to large variation in precipitation amount and cultivation pattern between seasons. In the investigated area most farmers also cultivate land under more than one irrigation reservoir. This situation could make it possible for farmers to adjust the cultivation pattern to store water in one reservoir with the land fallow and cultivate under other reservoirs and then alternate between seasons. This would probably lead to much the same total land-use intensity due to better-filled reservoirs, which would make the irrigation safer as well as leading to a higher total yield.

5 88 - 1/5

Traditional land-use systems
Europe, Portugal, study, rural development, traditional society, part-time farming
CAVACO, C.
A agricultura a tempo parcial: expansão, diversidade e significado economico, social e geographico em Portugal (Part-time farming: its development, diversity, geographical and socioeconomic significance in Portugal).
Economia (Portugal), 5 1981, pp. 271-313

The purpose of this work is to introduce the reader to the study of part-time farming in Portugal. The author starts with a reference to the ancient and the present expansion of this system of organizing the agricultural economy at the microeconomic level in general terms. The analysis goes back to the rather autocratic traditional society in Portugal. The author attempts to evaluate the importance of part-time farming as a means of restraining or encouraging rural development. This role has brought to it the interest of supranational organizations concerned with economic, social and ecological questions. References are made to the studies and directives of OECD, FAO and EEC, and to some aid measures to the agricultural policies of some countries, viz. Austria. With regard to Portugal, the author underlines the FAO program which includes the execution of regional monographs in significant areas following a definite project. Portuguese statistical data at the "concelho" level are analysed in relative terms, keeping in mind that these values cannot be relied upon too heavily, especially those regarding the farms with an area of 20 hectares or more.

6 88 - 1/6

Traditional land-use systems
Africa, Zambia, study, traditional farming systems, rural development, strategies
ESSER, D.
Traditional farming systems and strategies for rural development: the case of the Kaonde in Chizela-District, North-Western Province, Zambia.
Diplomarbeit, Gesamthochschule Kassel, Fachbereich Internationale Agrarwirtschaft, 1987, pp.,143

The thesis is based on a field study by the author in Munyambala, a cluster of villages in Chizela District in northwestern Zambia. In 1980 the District became part of the project area of the "Integrated Rural Development Program", supported by the Federal Republic of Germany. The most important element of the project is the Lima program to promote small-scale farming. Through this program, the farmers, who so far produced almost exclusively for subsistence through traditional shifting cultivation, are introduced to cash-cropping and semipermanent farming, using commercial inputs on a credit basis. On small fields (0.25-1 ha), they may grow a cash crop of their choice, in practice mostly maize and, to a lesser extent, rice and groundnuts. The marketing is also assisted by the project. This program is intended not only to increase agricultural output in the area, but also to raise the standard of living of the small-scale farmers and thus reduce migration.
The new semipermanent farming system is being introduced into Munyambala, while the traditional shifting cultivation continues to assure subsistence. Starting with the hypothesis that under the prevailing conditions in Munyambala - free access to land, low population density and very limited use of capital in the traditional farming system - human labor is the factor which most limits production, the attempt was made to find out whether the Lima

cash-cropping system results in a diversion of labor from subsistence cultivation, and what effects this has.
The survey showed that the Lima program was not the only possibility for many households to earn a cash income. Even among the farmers participating in the program, only a minority seemed to derive most of their income from the program. Some households, especially those headed by elder men, earned a fair amount of money by producing a substantial surplus of sorghum within their traditional farming system, for which there was a local market.
This raises the question whether the Lima program allows farmers in Munyambala to use extra labor capacities more efficiently than would be possible through their traditional farming system. An attempt was therefore made to compare the economics of production of the two farming systems, whereby the productivity of labor is regarded as the main criterion.
The reason why only few farmers produced a surplus within their traditional farming system, although this system appears to be more advantageous in many respects, can be found in the limited market for sorghum: the local market, where high prices are paid, is rather small, and marketing via official channels is far less interesting on account of the lower official producer prices.
It was found that the areas where sorghum can be grown with good yields are limited, and that the miombo needs considerable time to regenerate. Therefore, with the present concentration of population, an extension of production would require intensification of the traditional system. The Lima system, however, cannot presently be regarded as an alternative, as it cannot meet the subsistence needs and as it is not stable in the long-term. A decline in the content of organic matter cannot be prevented and acidification occurs, at least as long as liming is not practised, which, however, might have other disadvantages. Furthermore, the Lima system is heavily dependent on commercial inputs and involves considerable risks.
As the possibilities of intensifying the traditional farming system are limited, it is suggested that the productivity of the Lima system should be increased and that sorghum should be integrated into the system. Other elements of the traditional farming system could also be integrated. It should be especially ensured that:
- the whole growing period is better used by intercropping;
- a large quantity of organic matter is returned to the soil to maintain an adequate humus level;
- the soil is kept covered in order to preserve soil physical structure, to reduce leaching and to suppress weed growth;
- soil fertility should be maintained as far as possible by biological means (intercropping and/or crop rotation with legumes).

Permanent or semipermanent systems of cultivation will probably be adopted only if mechanization becomes feasible.

7 88 - 1/7

Traditional land-use systems
West Africa, Nigeria, field trials, traditional groundnut systems, labour, improved systems,
ABALU, G.O.I. and ETUK, E.G.
Traditional versus improved groundnut production practices: some further evidence from Northern Nigeria.
Expl. Agric., 22, 1986, pp. 33-38

Groundnut (Arachis hypogaea) was first introduced into Nigeria in the early sixteenth century. Today, a wide range of locally adapted varieties are grown there, small-seeded runners and bunch varieties of various seed and pod types making up the main grain crop.
The crop is usually grown in mixtures with millet or sorghum, but small plots of sole crops are not unusual. Farmers prefer to grow groundnuts in mixtures because a mixture of two or more crops which grow most rapidly at different times almost always produces more total output than the same area of sole crops, whatever the level of management. Crops may differ in the time at which they grow most rapidly because of differences in time at maturity when sown at approximately the same time (millet with sorghum, groundnut with sorghum) or because they are sown on different dates (groundnut or sorghum with cowpea). Mixtures which include groundnuts give more total output than sole crops at low nitrogen levels even if their growth patterns are similar.
The practices of a random sample of 400 groundnut farmers from Hunkuyi village, on the Zaria-Kano main road, were studied in 1976 and 1977. They were divided into four major subgroups on the basis of their preferred cropping method, namely those who grew sole crop groundnut and those who grew groundnut/sorghum, groundnut/sorghum/cowpea or groundnut/sorghum/millet mixtures. The sole crop groundnut farmers were further divided at random into two groups, one of which received all the items needed for improved sole crop groundnut production while the other used their accustomed practices.
The traditional groundnut cultivars are postrate runners, but varying proportions of `improved' erect types have been added to the crop populations. The density of sole crops ranges from 20,000 to 40,000 plants/ha.
In the cereal/groundnut mixtures, the cereals are tall local varieties and are sown as early as possible with the first rains, with little or no land preparation. The sorghum and millets have different growth periods and therefore mature at different times. The seeds of sorghum are sown at wide spacings along the bottom of old furrows approximately 2 m apart to give a total cereal population of between 4,000 and 10,000 plants or groups of plants per ha. Three to four weeks after sowing, the field is weeded and the ridges split and re-formed. Groundnuts are then sown between the cereal rows to give a total population of around 40,000 plants per ha. The advantages are that cultivation of the land is delayed until the ground is soft. If both sorghum and millet are grown,

they usually alternate in rows across the ridges. Typically, groundnuts go into these mixtures at 30-50 cm spacing to give 15,000 - 30,000 groundnut plants per ha. When cowpeas are found in the mixtures, they are usually late-sown and late-maturing photo-sensitive varieties which replace some of the groundnuts and are quite often planted randomly where the groundnuts have failed to germinate or become established.

The improved methods for groundnuts are based on a recommended improved erect variety, the seed of which is treated with Aldrex T and sown in stands 23 cm apart on ridges 90 cm apart. The fertilizer recommmendation for those farmers using the improved technology was 125 kg single superphosphate per ha in furrows before the ridges were split. Precise instructions were also provided with respect to recommended times for weeding and harvesting. The experiments were all managed by the farmers. Plot sizes were not restricted, so that the various crop enterprises were realistically compared under the farmers' conditions of production.

The improved and traditional sole crop groundnut farmers employed 77% and 87% more hired labor, respectively, than those who grew mixtures (53%).

It would appear that the amount of capital and the proportion of income invested in the fields is quite small. Physical capital in the studied villages consisted mainly of traditional hoes, machetes and annual crops. No farmer in the survey owned or used a working bull. No mechanical equipment of any kind was used. On the other hand, capital spent on factors of production was more substantial.

Estimates of returns per ha for the five different crop enterprises, together with their standard deviations, clearly show that the improved methods are more profitable than the traditional methods of growing the crop.

However, the farmers in the area have other objectives besides the maximization of net returns per unit area. For example, they may wish to maximize the profit on the most limiting resource, which may be land, hired labor, family labor or labor used during a specific critical period such as the months of June and July. The improved methods give the largest return to total labor but the groundnut/sorghum/millet mixture give a larger return to June-July labor. Thus, the market shortage of labor during June and July probably forces farmers to choose the groundnut/sorghum/millet mixture rather than the improved sole crop technology, even though the latter gives a larger return per unit area and per man-hour. Also, since the traditional methods were used on larger fields, farmers employing them faced a greater labor constraint, and so would find the traditional methods more suitable.

A farmer faced with the option of switching from his traditional methods of cultivation to the improved methods would also consider the stability of his returns. A comparison of coefficients of variation, expressed as a percentage of the net return, shows that the return per unit area using the improved methods was the least variable among all the enterprises being compared, although there was an 18% chance that a farmer adopting these methods would not break even. This compares favorably with the risk of loss associated with the traditional method of growing groundnuts in

sole stands (36%), also it does not compare so favorably with the groundnut/sorghum/millet and the groundnut/sorghum mixtures. The high chance of losing money on the groundnut/sorghum/cowpea mixture may arise because of the high risks associated with growing cowpeas, which can suffer up to 90% loss if the crop is attacked by pest and disease.

Care should be exercised in interpreting these results, as the variation in yield, and hence income, is likely to be greater when conditions differ more widely than in the examples considered here.

8 88 - 1/8

Traditional land-use systems

Asia, Sumatra, land-use pattern, shifting cultivation, ecology, farming systems, erosion, socio-economic analysis, monocropping, mixed cropping, plantation crops, crop protection, extension, homegardens

BALZER, G. et al.

Shifting cultivation in West Pasaman, Sumatra (Indonesia). Schriftenreihe des Fachbereichs Internationale Agrarentwicklung, No. 102, SLE, Berlin, 1987, pp. 216

This study was conducted on behalf of the Indonesian-German Regional Development Project (ADP/PDP) West-Pasaman, Sumatra and deals with the prevailing farming systems (especially shifting cultivation) in the north-western part of the project area and with their implications for the natural and economic environment. In order to guarantee that future project activities be adjusted to the shifting cultivators' needs and the area's resource potential, data collection focused on an overall socioeconomic analysis of shifting cultivator households as well as on a regional and farm level assessment of the farming systems in terms of ecology and economy.

The natural vegetation is characterized by vast areas under secondary forest, while grassland (Imperata cylindrica) and primary forest make up only 2% each. 12% of the total area is presently cultivated, in most cases successive to secondary forest.

Agriculture is dominated by upland farming of non-permanent crops (ladang) and tree crops cultivation (kebun), each covering about half of the cultivated land. Main products are upland rice, groundnuts and patchouli for ladang and rubber, coffee and palm sugar for kebun farming. Wet-rice cultivation (sawah) is limited to a few villages and is, therefore, of no importance in the study region.

The predominant farming system is a combination of ladang and kebun enterprises. In more than 70% of the cases, the area under kebun is larger than that under ladang.

Most peasants manage two plots, one with annual food or cash crops in shifting cultivation, the other with perennials. In general, these two farming systems are well balanced in order to avoid

labor peaks and to ensure food supply as well as regular cash income.
Ladang farming exists only in the form of shifting cultivation. The average duration of the cultivation period is 2.7 years while the fallow period amounts to 7-8 years (9-11 years one decade ago). In general, ladang plots stretch within an area of maximal one hour's walk from the village. Clearing is still done with hand tools and it is, in most cases, completed by burning.
Apart from monocropped rice and patchouli, various more complex ladang cropping patterns were found and analysed. However these systems are either regionally concentrated (e.g. rice-groundnut rotation, rice-patchouli relay cropping) or of minor importance (rice intercropped with maize and/or chilli).
The spatial distribution of rubber depends mainly on the existing transport facilities. Most stands show a dense understorey of shrubs and secondary trees species and therefore resemble secondary forest quite closely. The local varieties can be considered as improved and yield some 1,000 kg/ha on average.
Because of the high labor flexibility and the low establishment costs, rubber production fits well into the farming system. It gives good returns of Rp. 3,500 per working day, and is the source of nearly half the cash income for the respective households.
Sugar palms play an important role for peasants in particular parts of the area. In most cases, exploitation is limited to trees which grow wild. Nevertheless, they are considered to be in the possession of individual households, and trees or single fruit-bearing branches are frequently sold or rented out. From one tree, 360-480 kg sugar can be produced per year. As the processing of sugar shows significant economies of scale (transporting and cooking the sap), the income per day and per tree depends strongly on the total number of trees. The net income ranges from Rp. 120,000-230,000 per tree or Rp. 1,400-3,800 per day.
If tree crop production succeeds ladang farming, the vegetation and function of a fallow is partly substituted.
With respect to ecology, three different types of kebun production could be found:

- Extensively managed rubber stands on medium slopes which show good adaptation to the environmental conditions and make a sustained management of soil properties possible.
- Mixed systems (coffee/cinnamon, occasionally combined with patchouli) often on steep slopes. These systems are highly susceptible to soil losses. They are only acceptable at a higher elevation and with less precipitation and if additional measures are taken to improve the soil cover.
- Pure and mixed kebuns in the lowlands which provide enough protection to maintain the natural potential regardless to the species.

The annual income per household amounts to Rp. 820,000 (U$ 1= Rp. 650,000) and a monetarized subsistence income of Rp. 170,000. About 80% of the total income is derived from agricultural activities. Main non-agricultural income sources are trading and wage labor.
More than 50% of the total income originates from plant production. Within this source of income, upland crops like rice,

patchouli and groundnuts have a share of about 50%; 45% comes from tree crops and the remaining 5% from wet rice production.
The degree of commercialization is quite high: 75% of the total income is realized in cash. This is mainly due to the great importance of tree-crop and patchouli production.
Low farm-gate prices and high prices for inputs are the main problems faced by peasants living in the most remote areas.
The analysis has shown that the typical farming system of shifting cultivators (including ladang and kebun farming systems) is presently not at the verge of breakdown.
Therefore, the proposals do not aim at the introduction of a completely new farming system, but at the modification of the existing one in order to improve the living conditions and at the same time ensure the future ecological stability.
On steep slopes, a modified production technique is proposed in order to reduce erosion.
On flat or medium slopes, a prolonged cultivation period and shorter fallow period should be attempted by a combination of:

- adequate use of modern farm inputs
- the introduction of mulching
- leguminous crops
- elements of agroforestry.

An integrated system of improved homegardens, intensified chicken keeping and promotion of small fish ponds should be propagated in order to improve the nutritional status of the people.

9 88 - 1/9

Traditional land-use systems
Developing countries, agricultural development, projects, land use, land tenure, design, decision making
NORONHA, R. and LETHEM, F.J.
Traditional land tenure and land-use systems in the design of agricultural projects.
World Bank Staff Working Papers, No. 561, 1983, XV + 53 pp.

The paper provides agricultural project designers with an analytical basis for examining traditional land tenure and land-use systems, and suggests how to make operational use of such information for key project decisions. It argues that the feasibility of implementation depends on farmer behavior, which is often determined by traditional tenurial and land-use patterns, even where these are not reflected in formal legislation. Understanding these patterns helps project designers to ascertain whether land would be available for the project; the impact of the proposed inputs and the likelihood of their acceptance; how the inputs should be introduced, who is likely to adopt them and the distribution of benefits; the availability of labor; and whether traditional forms of organization could be used within the project. Such knowledge would further aid in solving problems of project location, improving security of tenure, changing traditional tenure and use patterns where necessary and ensuring organizational measures, and resolving potential conflicts between traditional systems and

formal legislation. The paper concludes that there is the need for the early involvement of anthropologists and lawyers at the stage of project identification. In addition to the main text, designed for lawyers, anthropologists and agriculturalists involved in project work, a summary is included for national and international agency and consultancy staff and decision makers.
Abstract from CAB

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Traditional land-use systems
West Africa, book, review, ecology, food production, indigenous agricultural extension, farming systems, green revolution, cropping systems
RICHARDS, P.
Indigenous agricultural revolution.
Hutchinson & Co, Conway St. 17-21, London W 1 P6 JD, UK;
ISBN 0-09-161321-3, 1985, 192 pp., Dfl. 34.50

This book gives a very practical but also theoretically very important contribution to the discussion of the role of indigenous agricultural knowledge and its relation to agricultural development, extension and research. On the basis of a thorough analysis of some West African cases, Richards argues that intellectuals, development agencies and governments have all pursued environmental management problems at too high a level of abstraction and generalization. Many development problems are localized and specific, and require local, ecologically particular responses. Development workers should seek situation-specific programs and should rely much more than at present on existing local skills and initiatives. Evidence suggests that smallholder environmental management is dynamic and innovative, and not merely adaptive. This is not to argue that "peasant agriculture" needs no inputs or assistance from the formal research sector but to point out that a thorough ecological understanding of the aims and methods of small-scale producers is necessary if inputs from scientific research and development agencies are to complement and augment local trends and interests. On the basis of an analysis of practices of soil conservation and fertility management in shifting cultivation systems and of intercropping practices, estuarine cultivation, floodplain and valley-bottom cultivation and runoff farming in wet agriculture, Richards argues that small-scale farmers have already laid some of the foundations for an indigenous agricultural revolution. They have developed systems which may be viewed as a resource, a wealth of ecological experience and expertise.
West African food-crop producers are inventive, but development agencies rarely harness this inventiveness because they misunderstand the nature of both the agriculture and the politics of communities where food production is a major interest.
Past failure to support indigenous initiatives in these areas has had profound consequences for the present food production crisis in the region. Agricultural research efforts must be a partnership

between "formal" science on the one hand and "community ecological knowledge" on the other.
Research should therefore be location-specific and comprehensive. Extension workers and researchers could carry out on-farm experimentation. This method, which is basically a top-down research model that tries to secure interest, help and feedback from the farmers, has an inherent contradiction: the farmers' enthusiastic involvement is sought, but in a context in which the scientist is still clearly in charge. Experiments within the experiment as a result of farmers' ideas are not welcome.
Richards points out that farmers themselves have considerable research capacities. He substantiates this on the basis of two cases: one about how farmers know, select and experiment with rice varieties in Sierra Leone; and one where farmers in southern Nigeria had knowledge on the life cycle of the variegated grasshopper to an extent that they were able to anticipate some (but not all) pest control recommendations developed by a research team.
Since farmers carry out experiments, extension workers need to be trained to observe, value, record and evaluate informal sector innovation. They might then assist in the more rapid diffusion of such innovations, either by incorporating them into their own repertoire of recommendations, or by creating opportunities for farmers to exchange ideas directly. This could be done by organizing local field days and farmer workshops or any other method of "sideways extension".
Richards propagates the participatory research approach, where the problem definition and perhaps most of the research itself is undertaken by appropriate user groups. The role of the scientist is that of a consultant: to collaborate rather than to direct.
Successful participatory research depends on two key factors:
1. the existence of strong local organizations capable of formulating problems and carrying out part of the research and development activities;
2. contact between scientists/consultants and user groups on a regular and continuing basis, which implies decentralized research activities and a willingness by the researcher to live and work under village conditions.

The book concludes with an annotated checklist designed to assist agricultural extension workers to assess local skills and research and development priorities and open up possibilities for "sideways extension" and participatory research.
Although the book was written on the basis of West African experiences, it is also recommended for persons interested in agricultural development in other parts of the world.
Abstract by Bertus Haverkort, ILEIA