1121 92 - 4/164

Cropping systems
Latin America, Colombia, savannas, associations, legume, grazing effect, CIAT

GROF, B.

PERFORMANCE OF THREE *CENTROSEMA* SPP. AND *PUERARIA PHASEOLOIDES* IN GRAZED ASSOCIATIONS WITH *ANDROPOGON GAYANUS* IN THE EASTERN PLAINS OF COLOMBIA.

Trop. Agric. (Trinidad), 68, 4, 1991, pp. 363-365

The most important factor limiting animal production in the vast savannas (Llanos and Cerrados) of tropical America is the poor nutritive value of native grasslands and monospecific sown grass pastures. A fundamental approach in correcting these nutrient deficiencies is to establish improved pastures that are based on tropical legume and grass mixtures.
Over a three-year period, *Centrosema acutifolium* CIAT 5277, *C. arenarium* CIAT 5236, *C. macrocarpum* CIAT 5065 and *Pueraria phaseoloides* CIAT 9900 were evaluated under grazing. Each legume was associated with *Andropogon gayanus* cv. Carimagua 1.
The experiment was conducted in Eastern Plains of Colombia.
The experiment was sown on a prepared seedbed in June 1982. There were two replicates of the four pasture treatments in a randomized complete block design.
The two replications were grazed separately by five criollo x zebu cross-bred heifers which was equivalent to two animal units ha^{-1} for seven consecutive days. The plots were then rested for 42 days during the dry season and a rotation was employed during the wet season.
The persistence of *C. acutifolium* was attributed to its stoloniferous growth habit. This legume exhibited tolerance of grazing and drought and has resistance to pests and diseases. The four legumes evaluated under grazing failed to produce soil seed reserves for recruitment of new plants and this contributed to the general decline in legume contents. *Pueraria phaseoloides* (Roxb.) Benth. showed poor tolerance of drought and *C. macrocarpum* Benth. was adversely affected by grazing and low soil fertility. *C.arenarium* Benth., the least palatable species in the experiment, has proved to be unsuitable for grazing utilization.
It can be concluded that under the management treatments superimposed on the experiment, regeneration of legume from soil seed reserves has not occured in any of the grass-legume associations, and this contributed to the general decline in legume contents.
Of the legumes evaluated, only *C. acuticolium* has a stoloniferous growth habit, and its persistence and tolerance of grazing was attributed to this trait. This legume has tolerance of drought and has excellent resistance to pests and diseases.

1122 92 - 4/165

Cropping systems
Asia, India, field trial, intercropping systems, mulch, barley, lentil, flax, yield, irrigation

MANDAL, B.K. and S.K. MAHAPATRA

BARLEY, LENTIL, AND FLAX YIELD UNDER DIFFERENT INTERCROPPING SYSTEMS.

Agronomy J., 82, 1990, pp. 1066-1068

This study was conducted to determine the productivity of intercrops, barley + lentil and barley + flax as compared to monocrops of barley, lentil and flax as influenced by the level of irrigation and mulch.
Six-rowed barley (*Hordeum vulgare* L.) was intercropped with lentil (*Lens culinaris* Medik) and flax (*Linum usitatissimum* L.) with two levels of irrigations [(i) zero and (ii) one irrigation applied 35 d after planting] and two levels of mulch [(i) no mulch and (ii) rice straw mulch at the rate of approximately 7 Mg/ha^{-1}]. Monocrop of each species were also grown.
Information on intercropping of barley with lentil and flax is very limited. Barley, lentil and flax are grown under rainfed conditions with limited water supply. Productivity per unit area could be increased through the use of suitable crops with higher yield stability and appropriate intercropping. In the winter dry season the amount of irrigation water available is very limited and in some areas only a single irrigation may be available. Limited irrigation of crops like barley, lentil, flax and conservation of water with mulches may make the difference between an uneconomical and an economical crop yield.
In this study the seed yield of the monocrops were higher than their intercrop yields. Intercropped barley yielded 73 to 81% of the yield to monoculture. Intercropped lentil yielded 30 to 34% of the yield of monoculture, whereas intercropped seed yield of flax ranged from 27 to 31% of monoculutre. Yield increased from one application of irrigation ranged from 12 to 21% of zero irrigation. The increase in yield due to straw mulch was 11 to 17% higher over no mulch. The barley-lentil intercrop recorded higher values of land equivalent ratio (LER) and monetary advantage (MA), and had higher intercropping advantage of area time equivalent ratio (ATER) than the barley-flax intercrop.
This study indicated that in areas having no irrigation, straw mulch could be utilized for conservation of soil moisture which can increase yields of crops like barley, lentil and flax. One irrigation along with straw mulch was found to be the best for all these crops. Barley + lentil intercropping was preferable to barley + flax intercropping in the study area.

1123 92 - 4/166

Cropping systems
Asia, India, field trials, dryland, intercropping, oilseed, pulses, safflower, biological potential, economics

RAFEY, A. and N.K. PRASAD

BIOLOGICAL POTENTIAL AND ECONOMIC FEASIBILITY OF INTERCROPPING OILSEEDS AND PULSES WITH SAFFLOWER (*CARTHAMUS TINCTORIUS*) IN DRYLANDS.

Indian J. of Agric. Sciences, 61, (12), 1991, pp. 893-897

An experiment was conducted to explore the feasibility of growing 3 other oilseeds as well as a pulse crop in association with safflower at different row spacings.
The experiment was conducted during the winter seasons of 1985-88. The soil was clay-loam with 25.5% clay, having low water-holding capacity.
The treatment of 3 row spacings (40, 50 and 60 cm) of sole 'A 300' safflower and 4 pure crops.
These were intercropped with safflower at 40, 50 and 60 cm row spacings, comprising 19 treatments. These were put in randomized block design, replicated thrice.
The low water-holding capacity and soil fertility along with low irrigation potential have compelled selection of a crop that could be suitable for growing under adverse situations in drylands. Safflower (*Carthamus tinctorius* L.) and some other oilseed and pulse crops, which are more drought resistant and have the capacity to grow well even under low soil-fertility conditions can be the ideal ones for a sustainable cropping system under dryland conditions. For increasing the production of oilseeds and pulses, intercropping of these crops may be a viable agronomic practice to take greater production from a unit of land during a cropping period.
In this study it was shown that although significant differences were noticed in yields under all the systems, sole chickpea gave the maximum grain yield (960 kg/ha), which was statistically equal to that of chickpea sown between 60 cm (900 kg/ha) and 50 cm (890 kg/ha) row spacings of safflower. The intercropping of linseed between 40 cm (860 kg/ha) and 50 cm (790 kg/ha) row spacings was also found statistically similar. It shows that narrow spacing of safflower is better for linseed and wide spacing for chickpea.
The individual yields of safflower were not significantly affected under the 2 narrow spacings (40 and 50 cm) with linseed and under all the spacings with chickpea, which were further evident from the partial land-equivalent ratio of safflower (0.66-0.81) obtained under these combinations.
The partial land equivalent ratio of intercrops, particularly of rapeseed (0.64-0.75), indicated their superiority in different associations with safflower. The overall land-equivalent ratio was the highest (1.34) under the association of linseed intercropped with 40 cm row spacing of safflower.

The relative crowding coefficient of safflower in associations with linseed and chickpea (KSi > 1) also indicated an advantage derived from safflower under these associations.
The sole crop of chickpea gave significantly higher net return than the other cropping systems. Intercropping of safflower with almost all the intercrops gave significantly better net return than sole safflower. Intercropping of linseed between 40 and 50 cm row spacings and that of chickpea between 50 and 60 cm row spacings gave statistically equal net returns. The net return derived from investment per unit input further revealed the superiority of sole chickpea to the rest of the systems, which gave maximum net return/Reinvestment.
Pure chickpea gave very high net return (30.8%) compared with pure safflower. The net returns from intercroppings were negative compared with sole crops of linseed, rapeseed and chickpea.
The maximum monetary advantage was recorded in association of linseed sown between 50 cm and chickpea sown between 60 cm row spacing of safflower.
It was concluded that safflower may be intercropped with linseed at a narrow spacing (40 cm) and chickpea may also be intercropped with safflower at wider spacing (50 or 60 cm) to get greater advantage than sole safflower but not compared with sole chickpea and linseed.

1124 92 - 4/167

Cropping systems
Latin America, Colombia, CIAT, legumes, sole cropping, intercropping, cassava, marginal soils

HEGEWALD, H.B.

SCREENING OF DIFFERENT TROPICAL LEGUMES IN MONOCULTURE AND IN ASSOCIATION WITH CASSAVA FOR ADAPTION TO ACID INFERTILE AND HIGH AL-CONTENT SOIL.

Beiträge trop. Landw. Vet. med., 28, 3, 1990, pp. 283-289

In this study 9 tropical grain legumes with 165 cultivars were screened or adaption to a low pH (3.9-4.1) and a high Al content in mococulture and in association with cassava.
In the monoculture experiment, the following grain legumes were tested: mung beans (*Vigna radiata*), cowpeas (*Vigna unguiculata*), pigeonpeas (*Cajanus cajan*), jackbeans (*Canavalia ensiformis*) as non-climbing, and winged beans (*Psophocarpus tetragonolobus*) and sword bean (*Canavalia gladiata*) as climbing species. The plot consisted of a double row 3.75 m in length, with a distance between rows of 0.6 m, and within rows 0.19 m.
In the mixed cropping experiments, the climbers winged bean and velvet bean were not tested, while soybeans (*Glycine max*) and non-climbing lima beans (*Phaseolus lunatus*) were added. The grain legume collection was planted in association with cassava (cv.CMC 84). 9 cassava plants were planted with one row of legumes on both sides. The fertility level of the plots was extremely low, only 500 kg/ha of lime was applied. The pH of the soil was even lower than in the monoculture screening experiment.
Good results have been obtained in multiple range cropping of cassava and common beans (Phaseolus vulgaris), but other tropical legumes, especially cowpea (*Vigna unguiculata*), are needed in cassava intercropping systems for climatic and soil conditions, under which beans do not grow well. This is the case on soils with low pH, low fertility, and high Al and/or Mn content, which are widely distributed in the tropics. An example of these conditions is the soil of the CIAT experimental station Quilichao in Colombia.
On this soil, common beans only grow when high levels of lime and fertilizer are supplied. Other legumes with tolerance of high levels of Al and Mn and low fertility show vigorous growth and high yield even at a very low level of purchased input. Although lower in nutritive value than common beans, their protein contents make them valuable complements to the high calorie producer cassava.
In this study with little or no fertilization the yields were low. The only acceptable yield was obtained from cowpea (*Vigna unguiculata*), averaging 1.1 t/ha in monoculture and 0,45t/ha in association with cassava. In the latter case, the cassava yield decreased by 26%. The other legumes - except for the velvet bean (*Stizilobium derringianum*) - were low yielding or without any

yield, but some of them increased the tuber and starch yield of cassava.
It may be concluded that in selecting grain legumes for association with cassava, it is relatively safe to do this selection in legume-monoculture screening trials as a first step to eliminate materials with a low potential. Particularly on acid, infertile soils, the overriding factor will be that of adaption to adverse soil conditions; growth will be somewhat reduced and growth habits and therefore competition with cassava will not be serious. Nevertheless, legumes with intense early flowering (and maturity) appear to be most suitable, since early flowering reduces excessive vegetative development unfavourable for cassava yield formation, and early pod filling enables the legume to escape serious shading by cassava.

1125 92 - 4/168

Cropping systems
Asia, India, study, field trial, intercropping, peanut, pigeonpea, sunflower, finger millet, irrigation, planting geometrics, yield

SANKARAN, V.M. and G. KUPPUSWAMY

INTERCROPPING STUDIES IN PEANUT (ARACHIS HYPOGAEA L.).

J. Agronomy & Crop Science, 168, 1992, pp. 34-36

With a view to study the effect of intercropping and plant geometrics in peanut cv. VRI-1, a field experiment was conducted at Area Agronomic Centre, Tamil Nadu, India, during winter season 1989.
Three intercrops viz., pigeonpea, sunflower and finger millet were tested at two plant geometrics viz., paired rows of 40/20 cm and 45/15 cm.
Peanut is a major oilseed crop in India with an annual production ranging from 5 to 7.5 mt. over the last decade. With the increase in the cost of inputs like seeds, fertilizers and labour, there tends to exist a declining trend in monetary return from rising a pure crop.
Significant difference in pod yield of peanut among various treatments was observed. Intercropping with pigeonpea did not affect the pod yield of peanut significantly. Sunflower or finger millet as intercrop drastically reduced the pod yield of peanut. Plant geometrics, though influencing the growth characters, such as, plant height, LAI, failed to alter the pod yield. Larger competition free period of peanut and pigeonpea, and the potentiality of pigeonpea, by virtue of deep root system, to forage nutrients in deeper layers were attributable to less competitive effect of this intercrop on the base crop. In peanut intercropped with sunflower and finger millet, the growth, yield attributes and yield of the base crop, peanut, were greatly affected, obviously due to the competitive effect of these intercrops for light and nutrients.
When peanut kernel equivalent for different intercropping situations was considered, peanut intercropped with pigeonpea at 45/15 cm paired row registered higher equivalent yield of 2221 kg ha^{-1}. Same treatment also recorded the highest net profit (Rs 13901 ha^{-1}) followed by peanut intercropped with pigeonpea at 40/20 cm paired row (Rs 12633 ha^{-1}). Raising sunflower or finger millet as intercrops drastically reduced the net income over pure crop. Return per rupee invested was high (2.17) in peanut + pigeonpea at 45/15 cm paired row. Peanut intercropped with sunflower or finger millet recorded less return per rupee invested when compared to pure peanut.

1126 92 - 4/169

Cropping systems
Asia, India, field trial, intercropping, groundnut, rainfed conditions, oilseed crops, planting patterns

DAYAL, D. and P.S. REDDY

INTERCROPPING OF RAINFED GROUNDNUT (*ARACHIS HYPOGAEA*) WITH ANNUAL OILSEED CROPS UNDER DIFFERENT PLANTING PATTERNS.

India J. of Agricultural Sciences, 61, (5), 1991, pp. 299-302

An experiment was conducted to evaluate the intercropping systems with oilseed crops, viz. sunflower (*Helianthus annuus* L.), sesame (*Sesamum indicum* L.) and castor (*Ricinus communis* L.) with groundnut by changing the crop geometry without reducing its plant population.
The experiment was conducted during the rainy seasons of 1986 and 1988. The soil was clay loam, having organic carbon 0.96%, low available P (5.6 kg/ha) and medium available K (165.2 kg/ha). The experiment was laid out in randomized block design with 3 replications.
Groundnut (*Arachis hypogaea* L.) is grown mostly under rainfed conditions during rainy season. The wider spacing recommended for cultivation of groundnut made it possible to grow an intercrop with many other annual oilseed crops. Intercropping with groundnut increases production and monetary returns compared with sole cropping. Selection of proper plant geometry and compatible crops in an intercropping system is highly beneficial. With the availability of new high-yielding, short-duration varieties of oilseed crops having different types of canopy structure, it is possible to design the suitable intercropping system with groundnut.
In this experiment the intercropping system increased the oil yield (30.5%) and monetary returns (15.3%) compared with the sole crop of groundnut. By growing castor in the intercropping system, the maximum loss in yield was of groundnut pods (22.3%), followed by sunflower (14.8%) and sesame (9.4%). Irrespective of the cropping system and season, the paired-row planting consistently gave higher yield (23.4%) of groundnut than the normal planting.
Pooled data on monetary returns showed significant differences in both the years. Groundnut (paired-row) + sunflower recorded 18.8 and 34.3% higher returns than the sole groundnut planted under paired-row and normal planting respectively. Thus the study revealed that intercropping of groundnut (paired-row) with sunflower could be recommended for getting higher oil yield and monetary returns in the Saurashtra region of Gujarat.

1127 92 - 4/170

Cropping systems
Asia, Philippines, IRRI, field trials, intercropping, rice, mungbean, plant interactions

AGGARWAL, P.K. et al.

RESOURCE USE AND PLANT INTERACTIONS IN A RICE-MUNGBEAN INTERCROP.

Agronomy J., 84, 1992, pp. 71-78

The objective of this study was to compare above-and below-ground interactions between intercropped upland rice and mungbean, and to examine their effect on N uptake and crop productivity.
The yield advantage of any intercrop is attributed to below- and above-ground plant interactions. These interactions may be competitive, neutral, or complementary. The relative importance of below- and above-ground intercrop interactions is likely to vary depending upon the temporal and spatial differences in resource use by component crops.
In this study the authors used above- and underground partitions, residue removal, and plant removal to investigate the interactions between upland rice (120-d crop duration) and mungbean [*Vigna radiata* (L.) Wilczek, 65-d crop duration].
Nitrogen uptake by intercropped rice (33,4 and 41,1 kg N ha^{-1}) approximated that of sole rice (35,4 and 38,1 kg N h^{1}). Intercropped rice yielded 73 to 87% of sole rice and intercropped mungbeans yielded 59 to 99% of sole mungbean. Root barriers did not affect rice N uptake or dry matter accumulation prior to the maturity of the mungbean, but reduced N uptake, dry matter, and grain yields substantially by the time of rice harvest. Sole rice with every third row removed at mungbean harvest had N, grain, and dry matter yields similar to the intercropped rice with every third row occupied by the legume. Sole rice with every third row vacant during the entire growing season yielded similarly (2.6 Mg h^{-1}) to sole rice (2.3 Mg h^{-1}) and intercropped rice (2.0 Mg h^{-1}). There was no evidence that N transfer from the legume to the rice increased N availability to rice above that expected with a sole rice crop with the same planting scheme. Rice yield compensation in the intercrop was apparently due to the increased soil volume for N extraction and increased aerial space available after mungbean harvest.
It can be concluded that above-ground interactions between the crop species were not important determinants of relative crop performance at row spacings used in this study. Below-ground crop interactions were found to be the dominant factors. When the root systems of the two crops were confined by root barriers, no effect was observed on mungbean yields, but rice N uptake and yield were reduced substantially.
The intercropping of a 120-d rice with a 60-d duration legume offers potential to better utilize space and nutritional resources in low input cropping systems.

1128 92 - 4/171

Cropping systems
Australia, field trial, intercropping, cassava, legume, component crops

CENPUKDEE, U. and S. FUKAI

CASSAVA/LEGUME INTERCROPPING WITH CONTRASTING CASSAVA CULTIVARS. 1. COMPETITION BETWEEN COMPONENT CROPS UNDER THREE INTERCROPPING CONDITIONS.

Field Crops Research, 29, 1992, pp. 113-133

In this paper, cassava/pigeonpea intercropping was examined under two growing conditions in which the competitive ability of pigeonpea was different. Cassava/soybean intercropping was examined in only one situation.
In the work reported in this series of two papers, various cassava cultivars were intercropped with either of two legume species to identify physiological and morphological characteristics of cassava which are suitable for different types of intercropping.
Seven contrasting cassava cultivars were grown in sole-cropping and in intercropping with soybean and with pigeonpea. In cassava/pigeonpea intercropping, time of pigeonpea sowing and plant density were altered in two experiments. In Experiment 1, four rows of pigeonpea were sown between cassava rows at cassava planting. In Experiment 2, two rows of pigeonpea or soybean were sown at 35 days after cassava planting.
In Experiment 1, cassava emerged later than pigeonpea.Canopy width of cassava did not increase once the cassava interrow was occupied by pigeonpea. Total dry-matter production of all cassava cultivars was severely affected in intercropping by the time of pigeonpea harvest. Subsequent recovery was slow and final tuber yield in all cultivars was less than 25% of the corresponding yield in sole-crop.
When the competitive ability of pigeonpea was reduced in Experiment 2, only a short cassava cultivar was affected severely by pigeonpea, and its recovery was poor after pigeonpea harvest. Tall cultivars gradually became much taller than pigeonpea, and in most cultivars tuber yields were reduced by only up to 30%. The pigeonpea was almost completely suppressed by these cassava cultivars, and its seed yield was very poor. It was concluded that the two species competed with each other for too long, and there was yield loss of cassava/pigeonpea intercropping over sole-cropping with any cassava cultivars, except one (MCol 1468) which was strongly competitive and produced a full cassava yield in intercropping.
This study has highlighted the need to develop intercropping systems that enhance productivity through the efficient sharing of resources (in this case, radiation). Excessive competition between component crops for the same resource can lead to unproductive systems.

1129 92 - 4/172

Cropping systems
Australia, field trial, intercropping, cassava, genotypes, soybean, pigeonpea, selection criteria

CENPUKDEE, U. and S. FUKAI

CASSAVA/LEGUME INTERCROPPING WITH CONTRASTING CASSAVA CULTIVARS. 2. SELECTION CRITERIA FOR CASSAVA GENOTYPES IN INTERCROPPING WITH TWO CONTRASTING LEGUME CROPS.

Field Crops Research, 29, 1992, pp. 135-149

In the work reported here, 18 diverse cultivars were used in sole-cropping, and in intercropping with soybean and pigeonpea. The objectives of this work were to determine if selection criteria could be developed using characteristics obtained in sole-cropping, and if these were different for different associated species.
An experiment was conducted to determine selection criteria for cassava genotypes for intercropping with legumes using 18 cassava cultivars which are contrasting in canopy size. Two legume crops were used; one a short-statured, quick-maturing soybean, and the other, a tall, late-maturing pigeonpea. They were sown at 37 days after cassava planting in double rows between cassava rows.
Intercropped soybean had little adverse effect on crop growth and tuber yield of cassava, and in some cases it enhanced tuber yield of cassava cultivars with small compact canopies. The effect of cassava on soybean yield was least with short-statured, small cassava cultivars as solar radiation available to the soybean was highest. As the canopy development of cassava was hardly affected by soybean in any cultivars, the selection of cassava genotypes can be made in sole cropping with selection criteria of high tuber yield and narrow canopy width measured at about 90 days after cassava planting.
Intercropped pigeonpea had an adverse effect on canopy development and tuber yield of cassava, particularly of short-statured cultivars. Whilst tall cultivars with spreading canopy were least affected by pigeonpea,they reduced seed yield of pigeonpea to a very low level. It was therefore difficult to determine cassava types suitable for this intercropping.
The results of this experiment suggest that for cassava/pigeonpea intercropping, selection can be made in sole-cropping for high tuber yield and also for height which should be at least similar to that of the anticipated associated crop. Because of prolonged competition between the two species, the balance of competitiveness of the component crops can be easily altered by cultural modification. It is therefore important to identify competitiveness of component species using a few cassava cultivars under typical growing conditions for the intercropping before a large-scale selection programme is carried out.

1130 92 - 4/173

Cropping systems
Latin America, Costa Rica, CIAT, beans, varieties, resistence breeding, green revolution, traditional production systems

PACHICO, D. and A. VAN SCHOONHOVEN

A POST-GREEN REVOLUTION STRATEGY FOR THE IMPROVEMENT OF SMALL FARMER-GROWN COMMON BEANS.

Trop. Pest Management, 35, (3), 1989, pp. 243-247

This paper outlines the post-Green Revolution strategy of the CIAT Bean Program, then presents a case study from Costa Rica illustrating how it has worked in practice.
The Green Revolution's fertilizer responsive rice and wheat varieties had a major impact on production, but they created great controversy due to concerns about their adoption by resource poor farmers.
The short stature, highly tillering new rice varieties contributed to outbreaks of the brown planthopper in some Asian countries. The new varieties were selected for performance in favored conditions of high fertility and timely irrigation, situations that often failed to correspond to the reality faced by small farmers.
The CIAT Bean Program has focused on disease resistance breeding, with selection for performance under low input conditions and adaptation to farmers' current production systems. This strategy was chosen to make new bean technology more accessible to resource poor farmers in low income countries than had been the products of the Green Revolution approach of selecting for maximum yield under optimum high input conditions. A case study of adoption of new disease resistant bean varieties among small farmers in Costa Rica shows that the disease resistance strategy has resulted in varieties that improve productivity even in farmers' traditional shifting cultivation system. Many small farmers are finding it advantageous to intensify management in order to raise the gains from the new varieties. Such success in a disease resistance, small farm-oriented crop improvement program, depends critically on strong national agricultural research capacity, and a continuing commitment to deploy new resistance sources in locally adapted materials.
Gains made through the resistance strategy will necessarily remain vulnerable to being overcome by pathogenic variability or to newly emerging problems, but due both to the broad genetic variability upon which bean production is based, and also to the decentralized breeding strategy which targets specific genetic material to each particular production problem, production environment and grain type, such vulnerability will express itself only locally, and therefore ensure stable total production. A major part of the impact of CIAT's program may be the avoidance of substantial production reductions rather than the enjoyment of spectacular production increases.

V AGROECOLOGY

1131 92 - 5/107

Agroecology
Review, Asia, India, rural development, common property resources, benefits, traditional management, public interventions, productivity, management systems, investment needs, technology focus, user groups, IIED

JODHA, N.S.

RURAL COMMON PROPERTY RESOURCES: A GROWING CRISIS.

Gatekeeper Series No. 24; Internat. Inst. for Environment and Development (IIED), London, UK, 1991, 16 pp.

Common property resources (CPRs) are in decline throughout the developing world.
CPRs continue to be a significant component of the land resource base of very many rural communities. But they are threatened by neglect, over-exploitation, under-investment and expropriation.
This paper, by focussing on India, documents micro-level evidence on the contribution of CPRs to poor people's livelihoods, their steep declines in area and production over the last 40 years, the collapse of traditional management systems, and the pauperisation of the poor.
The author makes suggestions for immediate action to offset some of these alarming trends.
In detail the following aspects are discussed in this paper:
- Benefits of CPRs
- Quantifying benefits
- Depletion of CPRs
- Physical degradation of CPRs
- CPRs and pauperisation
- Privatization and the poor
- CPRs productivity
- The traditional management systems for CPRs
- Adaptation by the rural rich
- Adaptation by the rural poor
- Future prospects

  The future prospects of CPRs are closely linked to an appreciation of their contributions, and changes in the public approach to strengthen them. Some areas requiring immediate attention are as follows:

  . Positive CPR policies: Restricting the further decline of CPR areas should be the major component of CPR development. Promotion of user groups be a solution to this.
  . Investment needs: For sustained and effective contribution of CPRs, increases in their productivity is essential. This requires rapid regeneration, through protection and regulated use, and provision of substantial investments into CPRs.

  . Technology focus: The rehabilitation of CPRs as productive social assets needs a new technological focus in terms of species, inputs, and technical methods of resource management. Besides productivity we must emphasize the diversity and usefulness of products.
  . Management and regulation: The rehabilitation of CPRs is less of an investment-cum-technological problem and more of a resource management problem. This cannot happen unless the CPRs are reconverted from 'open access resources' to 'common property resources'. In operational terms this would mean the re-establishment of usage regulations and user obligations towards CPRs.
  . User groups: The institutional arrangement to fulfil such requirements can take the form of CPR-user groups. There are no unique models to pattern such groupings in dry areas.

The two relevant features which have emerged as by-products of the recent development history of India, and which may obstruct the growth of user groups are: the ever-increasing tendency of the state to expropriate the initiative and activities which belong to people, and the increased internal differentiation of rural communities and its impact on the operation of village-level initiatives. Despite such potential obstructions, the success of recent initiatives in the management of community resources by user groups and NGOs do inspire considerable hope for the resources and for the poor who rely upon them.

1132 92 - 5/108

Agroecology
Review, book, Peru, Africa, Burkina Faso, Mali, Kenya, Latin America, Asia, Indonesian Sri Lanka, environmental management, agricultural development, land management, legal aspects, economics, project approaches, case studies

SAVENIJE, H. and A. HUIJSMAN

MAKING HASTE SLOWLY: STRENGTHENING LOCAL ENVIRONMENTAL MANAGEMENT IN AGRICULTURAL DEVELOPMENT.

Publ. of the Royal Tropical Institute (KIT), Amsterdam, The Netherlands, ISBN 90-6832-040-8, 1991, 232 pp. + appendices

This book deals with environmental management of smallscale agriculture in marginal areas.
Approximately 60% of the developing world's poorest people live in highly vulnerable ecological areas. In many of these areas degradation of natural resources and ecosystems has become a major problem and, in many instances, immediate action appears to be essential.
In many areas of the world natural resources are under strong pressure; quality is rapidly declining due to overexploitation and improper management. The nature and extent of environmental degradation differs from area to area, but the underlying problem in developing countries is the same.
Environmental implications are usually insufficiently taken into account in decision making.
Based on a two-day workshop held 1990 in Amsterdam, the book contains knowledge from almost 40 Dutch specialists and includes case studies from six African, Asian, and South American countries.
The authors plead to build on existing institutions, going ahead only with the support of the population and with institutionally viable programmes that fit the society.
In part I, the first chapter gives an overview of issues discussed in more detail in succeeding chapters, which consider local environmental management development from several perspectives.
Part II provides cases based on a number of projects (in Burkina Faso, Indonesia, Kenya, Mali, Peru, and Sri Lanka), which focus on approaches to environmental management in various geographical, ecological and socioeconomic situations. These case studies illustrate the great diversity seen not only in environmental problems, but also in approaches being used to solve these problems.
In this book, emphasis is given to the small scale agricultural sector in marginal areas, where environmental degradation is most evident. The contributors specifically address the organizational and institutional aspects of environmental management.
Incorporating local information in policy, planning and implementation decisions is a precondition for long-term sustainability.

1133 92 - 5/109

Agroecology
Review, book, sustainable development, low-external-input agriculture, farmer, agroecosystems, ecological principles, technologies, participatory technology development, techniques and practices, ILEIA

REIJNTJES, C. et al.

FARMING FOR THE FUTURE: AN INTRODUCTION TO LOW-EXTERNAL-INPUT AND SUSTAINABLE AGRICULTURE.

The MacMillan Press Ltd., London, UK, ISBN 0-333-57011-1, 1992, 162 pp + appendices

In recent years, the negative environmental and social impacts of high-external-input agriculture have become increasingly obvious.
The call for sustainable agriculture is increasing.
'Farming for the future' examines the strategies and techniques of low-external-input and sustainable agriculture (LEISA) in the tropics. It is based on eight years' work by the Information Centre for Low-External-Input and Sustainable Agriculture (ILEIA) in conjunction with the ETC Foundation in the Netherlands.
The scientific principles behind the various LEISA systems and techniques have been analysed, with the advisory support of staff members from the Agricultural University of Wageningen and independent professionals.
The focus in this book is on farmers who presently operate with low levels of external inputs, either because they are not available or because they are too costly. The intention is to provide background theory, practical ideas and sources of further information for persons and organisations who are working together with such farmers in trying to solve technical problems and open up potential at the farm level. The solutions to farmers' problems is as diverse, complex and site-specific as their farming systems, but the principles involved in finding the solutions will be of wider validity.
The first part of the book provides background information about the need for sustainable agriculture, and draws attention to the central role played by farmers in achieving it.
Part II draws from scientific agroecological findings to give the theoretical background of sustainable agriculture.
Part III draws from field experiences in developing smallholder agriculture to show how the process of technology development by farmers can be linked with the insights of agroecological science in a participatory approach to development which strengthens farmers' innovative capacity and complements other methods of technology development.
The rather extensive appendices are intended to provide some technical information as well as further sources of information, in order to support fieldworkers and farmers in their combined efforts.

Appendix A presents a selection of some technical options for LEISA development.
A glossary of key terms used can be found in Appendix B, and sources of further information are indicated in Appendix C.
The central concern of the book is how development workers can assist small-scale farmers in making the best use of low-cost local resources to solve their agricultural problems. Emphasis is on methods of Participatory Technology Development (PTD) to find site-specific solutions and to raise the overall productivity of farming in a sustainable way.
The authors have taken an interdisciplinary approach, providing a broad framework of background theory as well as practical ideas and sources of up-to-date information. Numerous examples from the field are given to illustrate key principles and techniques of LEISA.
'Farming for the Future' is written for agricultural development staff in extension, research and training. The book should also be of great interest to lecturers and students of agriculture and rural development, as well as to research scientists and to planners and donors of agricultural and related projects.
This book is an excellent source of information for the newcomer to the aspects of sustainable development as well as for the veteran practitioner and planner.

1134 92 - 5/110

Agroecology
Latin America, Caribbean, case studies, natural resources, environment, public policy, NGO's, DESFIL

GAMMAN, J.K.

PUBLIC POLICIES AFFECTING NATURAL RESOURCES AND THE ENVIRONMENT.

A Publ. of the Development Strategies for Fragile Lands (DESFIL), 3, Washington D.C., USA, 1990, pp. 6-7

In recent years, national governments in developing countries and development assistance agencies have adopted new policies to protect limited or fragile natural resources. In many instances, these policies are failing. This paper explores reasons for these policy failures.
Limited or fragile natural resources should not necessarily be left undeveloped in their natural state. When development does occur, however, natural resources that are affected should be protected from needless damage and degradation. This approach, in turn, may hinder future economic growth.
The case studies describe what happened when attempts were made to protect natural resources associated with large development projects on the Eastern Carribean islands of St. Kitts, St. Lucia, and Barbados. In each case, a benign resource use supported by environmental policies or legislation competed with a more destructive use of the same resource. In each case, the more destructive resource use was adopted. The research differentiates between organized interest groups and stakeholders - that is, unorganized groups that stand to gain or lose in common ways because of the way resources are allocated. Those parties who are included or who are left out of development decisions are described, as is the working of interest group politics - how decisions are made and who is represented or is not - on the three islands.
The research supports the thesis that the relationship between interest groups within a country and a policy-making process that excludes key stakeholders causes decisions to be made that override environmental policies. The failure of environmental policies can be explained by examining the way interest groups use their relationships with political leaders to exert control over the development process.
National political leaders want to maintain their power. They do this by supporting large development projects that are environmentally destructive but highly visible to voters. Civil servants seek to enforce policies that protect fragile natural resources but depend on politicians for their jobs. This dependency prevents them from enforcing environmental policies. Major stakeholding groups, including resource users (farmers, herders, fishermen, and charcoal producers) and local nongovernmental organizations (NGO's) are generally excluded from

the decision-making process. This relationship hinders the implementation of environmental policy.
New public policies, often required by donor agencies as conditions of development assistance, fail because they do not take account of political, cultural, and economic conditions at the local level.
A more open system of policy making also has to consider the relationship between local cultural norms and politics and the culture of decision making. Culture and political decision making are inseparable. Politics in many developing countries are intensely personal; they are affected by a history of dependency, insularity, and distrust of outsiders. Innovation in policy making requires that politicians and civil servants take risks, which is difficult to do without upsetting political leaders. The important role of opposition politics is often not understood by outsiders.
In addition to the obstacles created by national politics and the culture of decision making, there are other reasons why public policy initiatives, such as environmental policies, fail. The research concludes that donors need to undertake specific efforts to improve the implementation of environmental policy by increasing their understanding of four key factors: politics within host countries, politics within donor agencies, the culture of decision making, and the reliance on short-term development strategies.

1135 92 - 5/111

Agroecology
Review, sustainability, developing countries, human development, agricultural sector, training, economy theory, systems approach, holistic thinking

WOODS, B.M.

HUMAN DEVELOPMENT AND SUSTAINABILITY.

In: Proc. of the Seventh Agric. Sector Symposium - Sustainability Issues in Agricultural Development - The World Bank, 1818 H Street, N.W. Washington, D.C. 20433, U.S.A., 1987, pp. 80-91

Sustainable development requires the necessary human skills, attitudes, motivation, understanding, leadership, organizations, policies, plans, and administrative and financial systems for whatever activities are involved - as well as the necessary infrastructure, funds, and physical inputs.
Despite all the resources and dedication that have been applied to development, shortcomings in "institution building" and "human resource development" remain, and a great many well-intended projects and programs have failed to be sustainable as a result.
A better understanding of the reasons for this persistent difficulty in development would be half way to its solution.
This paper addresses this issue and draws together the separate conclusions of authorities in a variety of relevant fields. They show the reason to be simple, but the solution to affect some of the underlying assumptions and philosophies on which development assistance has been based.
The paper considers findings in the agricultural sector; it touches on economic theory; examines the learning process on which human development depends, and how this has been approached in "development"; and it describes an underlying cause of a pervasive problem.
The paper summarizes that one can view the human development required for sustainability first in the context of what is needed within the agricultural sector, and in the context of what is needed for the total universe of learning on which development depends and then concludes within agricultural sector:
- that the staff profile, skills, language, and perceived role of the sector have led to great emphasis on the technical/physical, and economic/financial dimensions of agricultural development, but excluded equal attention to the human dimension;
- that development has to be effective in the human dimension to achieve sustainability, but prevailing conventional wisdom and the mental programming of most development planners and practitioners which derive from traditional education systems currently prevent wide success in that dimension;
- that the imbalance between the three dimensions through "reprogramming" of those involved in the sector can be corrected;

- that there is a need to focus on the root cause of the problem which lies in the reductionism of traditional educational systems, and in agricultural education especially.

Beyond the agricultural sector there are other essentials, ingredients of sustainable development on which the sustainability of agricultural development depends. These include particularly the extent to which development approaches deriving from the technical sectors now in place are unable to deal with the whole spectrum of adult learning needed for development. The addition of the organizational structures, expertise and resources needed to achieve this whole spectrum of adult learning offers new opportunities for investment and for success in development. But it calls for a move toward holistic systems approaches and away from the reductionist thinking styles which have dominated development assistance to date.

1136 92 - 5/112

Agroecology
Review, book, sustainable development, human life, sustainable society, ecological diversity, carrying capacity, integrated systems, nature conservation, energy, agriculture, forestry, water, industry, implementation strategies

IUCN/UNEP/WWF

CARING FOR THE EARTH - A STRATEGY FOR SUSTAINABLE LIVING.

Publ. of IUCN/UNEP/WWF, Gland, Switzerland; ISBN 2-8317-007-4; 1991, pp. 185 + annexes

The Earth has its limits; with the best technology imaginable, they are not infinitely expandable. To live within those limits and see that those who now have least can soon get more, two things will need to be done: population growth must stop everywhere, and the rich must stabilize, and in some cases reduce, their consumption of resources.
The unprecedented increase in human numbers and activity has had major impacts on the environment.
The capacity of the Earth to support human and other life has been significantly diminished. In less than 200 years the planet has lost six million square kilometres of forest; the sediment load from soil erosion has risen three-fold in major river basins and by eight times in smaller, more intensively used ones; water withdrawals have grown from 100 to 3600 cubic kilometres a year.
Atmospheric systems have been disturbed, threatening the climate regime to which we and other forms of life have long been adapted. Since the mid-eighteenth century, human activities have more than doubled the methane in the atmosphere; increased the concentration of carbon dioxide by 27%; and significantly damaged the stratospheric ozone layer.
The strategy in this book deals with a kind of development that provides real improvements in the quality of human life and at the same time conserves the vitality and diversity of the Earth. The goal is development that meets these needs in a sustainable way. Today it may seem visionary, but it is attainable. To more and more people it also appears the only rational option.
Most current development fails because it meets human needs incompletely and often destroys or degrades its resource base.
This book has three parts and comprises 17 chapters. While linkages are indicated by a system of cross references, it is an imperfect system and it would be useful to read preferably the whole text.
'Caring for the Earth' sets out a broad and explicit world strategy for the changes needed to build a sustainable society.
Any strategy has to be a guide rather than a prescription.
The principles and actions in the strategy are described in broad terms. They are meant to be interpreted and adapted by each community. The world needs a variety of sustainable societies, achieved by many different ways.

'Caring for the Earth' is intended to be used by those who shape policy and make decisions that affect the course of development and the condition of the environment.
Sustainable living must be the new pattern for all levels: individuals, communities, nations and the world. To adopt the new pattern will require a significant change in the attitudes and practices of many people.

1137 92 - 5/113

Agroecology
Review, manual, guidelines, case studies, development workers, natural resources, environmental conditions, agricultural practices, economics, sociology, cultural aspects, market, people, livestock husbandry, crop husbandry, fisheries, forestry, horticulture, education, research, information networks, VSO

AMERENA, P.

AGRICULTURE AND NATURAL RESOURCES: A MANUAL FOR DEVELOPMENT WORKERS.

Publ. by Voluntary Service Overseas, 317 Putney Bridge Road, London SW15 2PN, UK, ISBN 0-9509050-3-8, 1990, 92 pp. + appendices; price: £9.95, hardback looseleaf

The aim of this manual is to provide development workers with practical guidelines and background information to facilitate the evaluation of Agriculture and Natural Resource requests.
Agricultural projects often fail because farmers are unreceptive to changes which will be bad for them; and there have been numerous instances of technologically and culturally inappropriate agricultural development schemes in the past.
For any development scheme to be sustainable, the right questions must be posed at the planning stage and the beneficiaries should be involved in the decision-making.
Based on their considerable practical experience Voluntary Service Overseas (VSO) has prepared this manual to help their field staff appraise and describe requests for assistance in the agricultural and natural resources sector. It is an useful practical guide which will be of value to any development agency or organization.
The book is based on over 20 years of VSO experience in 25 developing countries and is divided into four sections:
- Appraising requests,
- Practical examples of country programme initiatives,
- Factors affecting the success or failure of development workers and
- Sources of information.

An extensive appendix deals with the recruitment of natural resource personnel in the UK.
'Agriculture and Natural Resources' extensively covers the questions to be asked when assessing different types of natural resources programmes, and offers a framework for deciding which forms of outside skill may be appropriate.
The greatest proportion of the manual is devoted to the key tasks of defining and evaluating requests for assistance and to recruiting the right people. It sets out some key questions which will help the 'non-expert' to identify the nature of the job and the specific qualities and skills needed.
'Agriculture and Natural Resources' is published by VSO as part of the ECOE Programme (Evaluating and Communicating our Overseas Experience).

1138 92 - 5/114

Agroecology
Review, booklet, environmental guidelines, humid tropics, resettlement projects, environmental principles, checklists, environmental assessment, FAO

BURBRIDGE, P.R. et al.

ENVIRONMENTAL GUIDELINES FOR RESETTLEMENT PROJECTS IN THE HUMID TROPICS.

FAO Environment and Energy Paper No. 9, FAO, Rome, Italy; ISBN 92-5102754-4; 1988, 67 pp.

The environment has become one of the principal concerns of the late 20th century. Recently there has been an increasing focus on the potentially negative effects of development activities on the environment. A new science, Environmental Impact Assessment (EIA), has come into being to deal with conflicts between the interests of development and environment.
The Food and Agriculture Organization of the United Nations (FAO) has produced a report 'Environmental guidelines for resettlement projects in the humid tropics' which attempts to help the specialists who formulate resettlement (the relocation of individuals, families, or villages) and other development projects.
Resettlement refers to the relocation of individuals, family groups or entire villages.
These guidelines deal mainly with planned resettlement, however they can be used to review spontaneous resettlement activities.
Over 90% of the forecast increase in world population is expected to occur in the developing nations. Many of these nations are located in the humid tropics where there are major constraints on the intensification of land use and the sustainable development of resources. Resettlement is one of the major options available for coping with the increasing population; however, due to the fragile environment very careful planning will be required to implement successful resettlement schemes.
Where environmental assessments indicate resettlement as feasible, great care must be taken to avoid the creation of adverse environmental impacts through poor project design or management which may reduce the sustainability of projects and could foreclose future development opportunities.
These guidelines are designed to serve two purposes.
Its first part is devoted to an overview of resettlement projects in the humid zones, and the second identifies the environmental principles for the formulation and assessment of these projects.
In practice, both purposes serve to improve the sustainability of resettlement projects, the returns from the capital invested, and the conservation of natural resources.
Emphasis is therefore placed on the identification of key factors which have a major influence on the successful formulation, design, implementation and on-going management of resettlement

projects. If these factors are addressed early in the project formulation process, potential adverse impacts can be avoided or reduced to acceptable levels through improved project design.
Checklists are provided in assisting project formulators in identifying the key factors applicable to resettlement projects and to consider issues, outside their disciplines, which could be affected by their decisions.
The 67-page booklet is the ninth in the FAO Environment and Energy papers and contains a full bibliography of source material.

1139 92 - 5/115

Agroecology
Review, book, tropics, Latin America, Africa, Asia, tropical forests, deforestation, projects, case studies, forest conservation, sustainable agriculture, natural forest management

GRADWOHL, J. and R. GREENBERG

SAVING THE TROPICAL FORESTS.

Earthscan Publication, London, U.K., 1988, 207 pp., USD 12.95

A lot of books and articles have been published in recent years deploring the loss of tropical forests. "Saving the Tropical Forests" is one of the few publications, however, that offers tangible suggestions for mitigating the problem.
The introductory sections of the book provide a brief but accurate sketch of tropical deforestation, its causes, and its potential consequences. But the real value of the publication lies in the presentation of 38 project case studies that provide examples of positive approaches to tropical forest conservation. An underlying theme of the case studies is that, to survive, forests must be used for the benefit of people. Discussion centers on project activities in the lowland, humid tropics, with a primary focus on Latin America (two-thirds of the case studies are from the tropics of the New World). Addresses of individuals familiar with each case study and lists of recommended references are provided for readers who want to learn more about specific efforts.
The case studies are arranged in four categories: management of forest reserves, sustainable agriculture, natural forest management, and tropical forest restoration. Each section includes a summary of the elements of each project's success. These summaries indicate that nearly every project emphasizes early and direct economic benefits for local people (even in forest reserves), small-scale initiatives, and active local participation in planning and implementation.
The book presents a wide range of project activities, but several important strategies for saving tropical forests are neglected. The authors recognize, for example, that misgided government policies are a principal cause of deforestation, yet the book fails to discuss any ongoing effort to bring about reform of forest policy (for example, the Tropical Forestry Action Plan or the efforts of the International Tropical Timber Organization). Another strategy that deserves greater attention is environmental education. Although some case studies highlighted in the book have small components on environmental education, none of the broad-based campaigns of public awareness initiated by nongovernmental organizations in tropical countries is discussed. In addition, almost no attention is given to forest plantations that are intensively managed, even though this strategy may be one of the best for relieving pressure on remaining natural forests.
Readers intimately familiar with specific projects presented in the book will discover some inaccuracies in the descriptions and

some embellishment of project accomplishments. The authors acknowledge that the project descriptions are not intended to be exhaustive studies; rather, they are meant to spark debate and further research. In that respect, the book is likely to be highly successful. It is not a blueprint for halting the destruction of tropical forests, but it does an excellent job of stimulating readers to think about solutions and opportunities.

1140 92 - 5/116

Agroecology
Review, book, guide, practitioners, environmental economics, economic appraisal, sustainable development, project planning, environmental effects, environmental policy

WINPENNY, J.T.

VALUES FOR THE ENVIRONMENT, A GUIDE TO ECONOMIC APPRAISAL.

Publ. by HMSO, P.O.B. 276, London SW8 5DT, UK; ISBN 0-11-580257-6; 1991, 277 pp., UKL 14.95

'Values for the environment' provides advice to economists and other professionals in applying economic values to the environmental effects of development projects, using cost benefit analysis as the decision framework.
The book begins with an assessment of what sustainable development implies in practice. The case for putting economic values on environmental effects, while recognizing the problems this involves, is the subject of Chapter 1. Chapter 2 describes the environmental problems of a number of different habitats and identifies the main functions of the environment for mankind. Chapter 3 introduces the main economic techniques available to value these functions and Chapter 4 reviews how far they have been tried in practice. Chapter 5 is laid out for the benefit of project planners and appraisers. It gathers together, sector by sector, environmental effects to be aware of, and a judgement about which of them can be valued, and how. A broader and more general picture is presented in Chapter 6 which is concerned with the impact of various kinds of policy on how projects perform.
The book is mainly addressed to practitioners in, or concerned with, developing countries, from which most of the illustrative, case-study material is drawn.
Abstract from SPORE

1141 92 - 5/117

Agroecology
Review, book, developing countries, alcohol fuels, biomass sources, ethanol production, methanol production, environmental impact, economics, sociology

BOSTID

ALCOHOL FUELS - OPTIONS FOR DEVELOPING COUNTRIES.

Publ. by Nat. Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418; ISBN 0-309-03386-1, 1983, 106 pp.

This report summarizes information on alcohol fuel technologies for planners, investors, and technical assistance agencies in developing countries. Although the information is primarily aimed at the non-technical reader, it does include some details of the technologies; references are included for those who wish more specialized information.
In developing countries, government and industry are considering the use of locally produced alcohol fuels to reduce the burden of foreign exchange payments for petroleum products; some have already begun constructing facilities to produce alcohol fuels from indigenous materials.
To substitute alcohols for petroleum fuels must create diverse considerations:

- The technical capability exists to substitute the lower alcohols, methanol and ethanol, completely or in substantial part for all types of liquid fuels currently derived from petroleum.
- The technical capability exists in almost all countries to produce ethanol from a broad spectrum of renewable biomass resources, specifically from many varieties of plants and from agricultural, food processing, and urban wastes. The components in these raw materials from which ethanol may be produced are sugars, starches, cellulose, and hemicelluloses.
- In many situations, alcohol fuels may be the most convenient alternative to gasoline, but on a small scale there may be other energy sources that require less capital, organization, and management.
- The economic consequences that can ensue from adopting biomass-based alcohol fuels must be carefully analyzed; for example, positive indirect-economic factors associated with the replacement of imported petroleum by a home-based fuel industry as opposed to the possible negative effects on food prices and energy costs in different sectors.
- The environmental implications of a biomass-based alcohol fuel strategy are far-reaching but little understood. They range from the extremely damaging, such as deforestation to produce the wood needed for a cellulose-based alcohol industry, to beneficial, such as improved forest management practices leading to higher productivity with better ecological balance. The energy plantation approach to biomass production raises

questions about vulnerability to pests, water requirements, and pollution by runoff.
- The substitution of alcohols for petroleum-based vehicle fuels can affect air quality. Although evidence suggests that the overall results may be beneficial, experience with alcohol fuels is too limited to permit unequivocal conclusions.
- The most critical effects are likely to result from the way in which production of alcohol fuels benefits those involved. The adoption of a biomass-based alcohol fuel policy will have other social impacts, depending on which of these two extremes tends to predominate, and will particularly affect land use and ownership.

Finally it can be stated that developing countries must develop or expand their own capabilities to monitor and audit their energy needs, assess their biomass resources, weigh competing requirements, define fuel markets, and evaluate the technologies needed to convert local resources into fuel to meet local needs. These countries should also identify and evaluate, to the extent possible, all potential impacts economic, environmental, and social arising from the implementation of a biomass-based alcohol fuel strategy.

1142 92 - 5/118

Agroecology
Review, book, developing countries, renewable resources, technology transfer, sustainable development, social needs, energy technologies, technical factors, cultural acceptability, economics

BOSTID

DIFFUSION OF BIOMASS ENERGY TECHNOLOGIES IN DEVELOPING COUNTRIES.

Publ. by National Academy Press, Washington, D.C., ISBN 0-309-03442-6, 1984, 95 pp. + bibliography

This report is concerned with the factors that influence the introduction and diffusion of selected biomass-based renewable energy technologies in developing countries.
This book is also based on visits to seventeen developing countries in the course of this study to observe renewable energy projects. The countries are: Brazil, Colombia, Dominican Republic, Ethiopia, Fiji, Honduras, India, Indonesia, Jamaica, Mauritania, Papua New Guinea, People's Republic of China, Philippines, Sri Lanka, Tanzania, Thailand, and Upper Volta. Selected observations based on these visits are incorporated into this report.
The technologies discussed in this book include the generation of biomass through fuelwood plantations and agroforestry and the use of biomass in improved cooking stoves, charcoal manufacture, thermal gasification, and the production of biogas and fuel alcohol. These were selected because of their relevance to agricultural productivity and the dependence of the poor on biomass as an energy source.
For each of these technologies, the technical, economic, social, and cultural factors affecting their introduction and diffusion are considered.
The report also covers the nature of the diffusion process, energy and development, needs of the rural and urban poor, the characteristics of the technologies, and their feasibility and acceptability by the poor. Further, developing country experience with these technologies is briefly described, followed by conclusions and recommendations.
The term diffusion applies both to dissemination of information about a new technology and dissemination of the technology itself; for instance, new cooking stoves.
Meeting the energy needs of a country through biomass-based technologies will not in itself significantly reduce a nation's petroleum use. Most of the poor already rely heavily on biomass sources - firewood, charcoal, agricultural residues, and dung - and will probably continue to do so. The value of the various technologies described lies in increasing the availability of the materials currently in use, ensuring that they are used effectively, and providing alternative employment opportunities.
New technologies that mesh with indigenous systems of resource allocation, work organization, goods distribution, social and

authority structures, and prevailing values and religious beliefs have the best chance for success.
Concluding, it can be stated amongst other that:
- All biomass-based energy technologies have inherent limitations in supplying national energy needs, and it is difficult for planners to make informed judgements about appropriate mixes of these technologies for different situations.
- Maintenance of the environment, revegetation, protection of forest resources, and diffusion of suitable biomass technologies are problems that are too large and complex to be tackled only by individuals and small communities. They must be the responsibility of society as a whole.
- Many aspects of biomass-based energy technologies are highly location-specific. A great deal of local experience with these technologies is required to make informed judgements about their potential to contribute to national energy budgets.
- Although the use of renewable energy technologies remains very limited compared with the needs, there are some striking examples of success.

Development assistance and funding agencies require predominantly economic information on the returns from investment in the proposed projects. To make assessments of funding needs for these technologies, however, technical feasibility studies will be required to provide data on benefits and returns at both the national and community level. Technical and sociocultural details, in addition to economic data, will be necessary.

1143 92 - 5/119

Agroecology
Review, book, case studies, Asia, India, Philippines, Bangladesh, Africa, Sudan, Ethiopia, Mali, projects, developing countries, international cooperation, guidelines, IFAD

MADELEY, J.

WHEN AID IS NO HELP: HOW PROJECTS FAIL, AND HOW THEY COULD SUCCEED.

Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK; ISBN 1-85339-077-1, 1991, 125 pp. + appendices

The book tries to show why most of the projects are not achieving their aims, but it looks too at those which are having success, examining what is going right as well as wrong.
This book is critical of certain IFAD and United Nations Development Fund for Women (UNIFEM) projects.
This book considers official aid projects that have tried to help the poorest. It shows that despite such attempts, most of the poorest are still losing out which means that the global aid effort is failing in perhaps its most crucial task: helping the neediest. The book looks closely at such projects in Mali, the Philippines, Bangladesh, Nepal and India. It probes the reasons why well-intentioned projects are failing to try and pinpoint the exact nature of the problem and the implications for policy.
The book also looks at official aid projects in Asia and Africa, where assistance is getting through to the poorest peoples and it looks at why these are working. The poorest often lose out in aid projects because they are not aware of their possibilities. As the book shows, non-governmental organizations can play a role here.
Part 1 is an overview of aid and the poorest; Part 2 presents case studies of how aid is failing to reach them. The shorter Part 3 looks at examples of how aid is reaching some of the poorest in Asia and Africa, and at the contribution of NGOs.
The book asks what are the lessons of experience and draws conclusions as to how official aid needs change to help the poorest:
- A project must devote careful, patient and painstaking attention to detail. The people must be consulted at the design stage and genuinely participate in the process of the project.
- Too many projects are insufficiently grounded in poverty considerations. Projects must genuinely correspond to local realities.
- Projects must involve non-governmental organizations at the design stage wherever possible.
- Training people in organizational skills can form part of project design.
- Projects must ensure that technology is low cost, human scale and appropriate.

- Projects must aim to raise the level of rural development in poor communities.
- projects must carefully assess whether local institutions are suitable.
- Community-based health structures should be in place before new technology comes in.
- Projects must treat people as partners.
- Low-cost credit programmes must be supported.
- Projects must not gamble with the people involved.

The book contributes to a better understanding of the issues indicated and helps towards removing the obstacles that stand in the way of getting aid to the poorest.

1144 92 - 5/120

Agroecology
Review, book, ecological zones, natural resources, human environment, food, environmental impact, high-input agriculture, pollution problems, food contamination, land-use, desertification, shifting cultivation, legislative aspects

FAO

NATURAL RESOURCES AND THE HUMAN ENVIRONMENT FOR FOOD AND AGRICULTURE.

FAO Environment Paper No. 1, FAO, Rome, Italy; ISBN 92-5-100967-8; 1980, 62 pp.

FAO has prepared this report on Natural Resources and the Human Environment for Food and Agriculture.
This publication is the first in the technical series on natural resources and the human environment.
This report is an attempt to focus on global level population pressure, natural resources use and management, with particular reference to increased food and agricultural demand and environmental issues.
The demand on the natural resources that sustain man's existence has increased enormously with the unprecedented rise in numbers that has occurred in recent times.
The past population growth has already placed considerable pressure on natural resources, and has in many cases led to their degradation and depletion. In the future this pressure will become even greater.
At the global level, the world's natural resources appear to be adequate for mankind's likely needs. However, they are unevenly distributed in relation to the population and its demands on them, and their utilization thus creates environmental problems in particular areas.
In developing countries, the major environmental concern is not so much the pollution of natural resources as their degradation or depletion. The rapid increase in the population of these countries has placed great pressure on natural resources. The consequent drive to intensify production has caused the dislocation of traditional agricultural systems, and has led to sometimes hasty attempts to replace them by modern agricultural systems and technologies that are not compatible with the prevailing ecological and socio-economic conditions.
Although the environmental problems of the developed and developing countries are different, their experience in overcoming them could be mutually beneficial. There are a number of main types of action that are required at the national and regional levels for the assessment of natural resources and for their rational management so that the demands on them can be met on a sustained basis:
- It is necessary to reduce the knowledge gaps in the assessment of natural resources, by means of adaptive research on the

introduction of new technologies in traditional agricultural systems.
- A further requirement for the improved assessment of natural resources is the development of coherent networks of data on these resources.
- There is a need for integrated land use planning.
- It is important to concentrate the intensification of agricultural production as far as possible in the most suitable areas. This will reduce the pressure on marginal lands which are ecologically fragile and subject to rapid degradation if they are exploited beyond their productive capacity.
- A further requirement is the promotion of well-adapted systems of production that integrate modern technology with the traditional systems of resource management.
- It will be necessary to develop adequate rural institutions and infrastructures, including extension, credit and marketing services that are adapted to the needs of small farmers.
- It is necessary to develop a legal system to define the rights and duties of individuals or groups in relation to the utilization of natural resources in the light of their ecological limitations.
- Education on the better management and conservation of the natural resources used in agriculture is another requirement.

With respect to the existing degradation and loss of natural resources, the highest priority attaches to the control of soil erosion, soil salinity and desertification and the conservation of fish stocks and of genetic resources. Soil erosion must be controlled and eroded land reclaimed on a watershed basis, through appropriate practices for the management and conservation of soil and water resources. Salinization should be controlled and saline soils reclaimed through proper irrigation practices and drainage systems. Desertification control requires the management of vegetation according to ecological principles, including massive programmes of reforestation. The pressure on marine fish stocks can be reduced not only by agreed international measures but also by the development and promotion of aquaculture. A further major priority is for the conservation of endangered genetic resources.
This report is not exhaustive. It is a first approach and will need to be progressively improved and refined. Although global in scope, it uses illustrations and draws on specific data from a number of countries. It also provides a framework for other similar studies at national, regional, and village levels.

1145 92 - 5/121

Agroecology
Review, book, world development, environmental priorities, markets, sanitation, water, air pollution, energy, industry, land-use, environmental policy, resource management, greenhouse effect, biological diversity, economics, development indicators

WORLD BANK

WORLD DEVELOPMENT REPORT 1992 - DEVELOPMENT AND THE ENVIRONMENT.

Publ. by Oxford University Press, Inc. 200 Madison Avenue, New York, USA; ISBN 0-19-520876-5, paperback, 1992, 178 pp. + appendices

Recent years have witnessed rising concern about whether environmental constraints will limit development and whether development will cause serious environmental damage, impairing the quality of life of this and future generations.
Environmental values have been neglected too often in the past.
This report explores the relationship between development and the environment. It describes how environmental problems can and do undermine the goals of development.
The report also explores the impact of economic growth on the environment. It identifies the conditions under which policies for efficient income growth can complement those for environmental protection and identifies trade-offs.
Because this report is about development and the environment, it focuses primarily on the welfare of developing countries. The most immediate environmental problems facing these countries are unsafe water, inadequate sanitation, soil depletion, indoor smoke from cooking fires and outdoor smoke from coal burning.
Industrial countries have a crucial role to play in helping to improve the environments of developing countries:
- Developing countries need to have access to less-polluting technologies and to learn from the successes and failures of industrial countries' environmental policies.
- Some of the benefits from environmental policies in developing countries, the protection of tropical forests and of biodiversity, for example accrue to rich countries, which ought therefore to bear an equivalent part of the costs.
- Some of the potential problems facing developing countries - global warming and ozone depletion, in particular-stem from high consumption levels in rich countries; thus, the burden of finding and implementing solutions should be on the rich countries.
- The strong and growing evidence of the links between poverty reduction and environmental goals makes a compelling case for greater support for programs to reduce poverty and population growth.
- The capacity of developing countries to enjoy sustained income growth will depend on industrial countries' economic policies; improved access to trade and capital markets, policies to

increase savings and lower world interest rates, and policies that promote robust, environmentally responsible growth in industrial countries, will help.
Policy reforms and institutional changes are required to bring about accelerated development and better environmental management. The main message of the report is therefore the need to integrate environmental considerations into development policymaking.
The report also argues for a careful assessment of the costs and benefits of alternative policies, taking account of uncertainties and irreversibilities that may be associated with ecological processes.
This report includes the World Development Indicators, which give comprehensive, current data on social and economic development in more than 180 countries and territories. These data will also be available on diskette for use with personal computers.

1146 92 - 5/122

Agroecology
Discussion, low external-input, agriculture, community ecology, species interaction, non-renewable sources, intercropping, polyculture systems, pest, diseases, cover crops, environment changes

GLIESSMAN, S.R.

SPECIES INTERACTIONS AND COMMUNITY ECOLOGY IN LOW EXTERNAL-INPUT AGRICULTURE.

American J. of Alternative Agriculture, II, No. 4, 1987, pp. 160

External production inputs have contributed greatly to the remarkable increases in crop yields achieved during the past several decades. These inputs take many forms, including fertilizers, pesticides, irrigation water, various soil amendments, machinery and labour. Most of these inputs have been developed to both stimulate farm system output as well as replace materials that have been removed with the harvest. Limited concern has been given to the long-term availability of these inputs as long as farming produced a net profit. Relatively little attention was paid to understanding the biological and ecological bases of interactions occurring within the cropping system as long as such interactions were not considered detrimental to yields. But today agriculture is confronted with the need to assess the long-term sustainability of its production practices. It must consider the availability and cost of inputs and the impacts of conventional practices on the environment, food safety, and the quality of life for people involved in food production and consumption. In essence it is now as or more important to understand agroecosystems processes that promote productivity in the short term and sustain it over the long term than it is to concentrate on how much is produced.
Polyculture systems can be managed for nutrient cycling efficiency and pest and disease regulation using knowledge of multi-trophic level interactions and application of recent developments in mutualism and competition theory. A mechanistic model of additive and removal reactions on the environment is proposed as a means of studying species interactions.
The agroecosystem can be examined as a complex set of species assemblages with many levels of organization that build upon the basic understanding of the ecology of interactions at the individual organism level, emerging at the ecosystem level to understand the dynamics of what makes the entire system function. This is especially important as the understanding of ecosystem level processes of sustainable agriculture then interface with yet more complex aspects of the social and economic systems within which agroecosystems function. Eventually such an integration of social system and ecological system knowledge about agricultural processes will not only lead to a reduction in external inputs used for maintaining productivity, but will also permit the

evaluation of such emergent qualities of agroecosystems on long-term environmental quality, the importance of the human element to production, the long-term effects of different farm input/output strategies, and the relationship between economic and ecological components of sustainable agroecosystem management.
It is time to redirect a large portion of the resource that have generated all of the knowledge about single-species cropping systems towards the integration of both ecological and agronomic knowledge, with a broader goal of developing the ability to quantify the ultimate mergent quality of the agroecosystem - its sustainability. This is an extremely complex process, requiring a systems-level approach and the interaction of many disciplines, but with the outcome of being able to understand where and how effective change in agriculture can come about.

1147 92 - 5/123

Agroecology
Latin America, humid tropics, lowlands, review, conference, natural resources, development strategies, protected areas, ecotourism, nontimber forest products, indigenous agriculture, pastures, plantation agriculture, plantation forestry

CARLS, J.

DEVELOPMENT STRATEGIES AND NATURAL RESOURCE MANAGEMENT FOR HUMID TROPICAL LOWLANDS.

Report of Humid Tropical Lowlands Conference; Development Strategies for Fragile Lands (DESFIL), Panama City, Panama, 1991, 11 p.

Tropical deforestation is one of the major fragile land issues of the 1990s. Therefore, in late spring 1991 a conference has been organized in Panama, to examine strategies for and management approaches to the sustainable development of humid tropical lowlands in Latin America and the Caribbean.
The technical sessions are summarized as follows:
- Topics addressed under the "Stewardship of the Forest Lands" were agroforestry, biosphere reserves, conservation of biological diversity, and protected areas.
- A panel of Panamanians was then discussing management aspects of "Panama's National Parks".
- "Promising Timber Management Strategies" was the subject of session III. Different managment practices in Costa Rica, Mexico and Ecuador were discussed.
- Session IV dealt with "Nontimber Forest Products and Extractive Reserves". In this session about 25 presentations on a variety of related subjects such as the Brazil nut industry, extractive reserves in Guatemala, palm products from Colombia, the value and diversity of plant medicines in Mexico, and the prospects of ecotourism in Costa Rica were discussed.
- In session V "Secondary Forest Management" speakers were invited to present papers on secondary forest ecology, line planting, silvicultural experimentation, and secondary forests in Trinidad.
- The final technical session was entitled"Implications of Forest Land Conversion". Papers covered four topics:
  . indigenous agriculture,
  . pastures,
  . plantation agriculture and
  . plantation forestry.

The main results and conclusions are summarized as follows:
The causes of nonsustainable use of tropical forest resources are grouped in three broad categories:
- Poverty
- Ignorance

- Institutional failure, which has two facets: market failure and policy failure.

High deforestation is an outgrowth of the interaction among these causes.
The necessary reforms for correcting institutional failures, particularly policy failures, are correction of constant underpricing of tropical forest resources, initiation of environmental accounting within national income frameworks and reduction in infrastructure projects encroaching upon tropical forests.
Activities designed to cope with natural resource degradation such as incentives for reforestation and soil conservation, should be functionally integrated into a particular country's economic development model.

A broad definition of "protected areas" must be used to describe examples that range from low impact agriculture to national parks. The "protected areas" and "natural parks" concept are accepted in Latin America as important tools for the establishment and management of large areas. The basic requirements for developing the human and physical infrastructure for managing natural parks areas are listed in priority order:
- On site staff with professional training in sufficient quantities.
- Organizational and management planning.
- Protected area policy, law policy, law regulations and fee collection.
- Environmental education outreach programs.
- Research facilities.

A diverse array of products can be extracted from "protected areas" without adversely affecting the ecosystems: medicine, germplasm, fruits and nuts, craft materials, products for industrial uses, for instance fiber, ornaments, fish/game, etc.
Small-scale, tropical rainforest cultures developed a complex system of subsistence technologies that have permitted hundreds of years of continuous exploitation of the forests. Political, economic and technological changes in the last two decades, have disturbed these traditional patterns of exploitation.
The protection and management of the tropical lowlands must therefore involve the participation of the peasants and indigenous societies that exploit these fragile areas.
Indigenous management appears to be the next best thing to primary forests for species diversity, and the best for ethnobotanical species.
Apart from extracting products from forests, there exists the chance to enhance ecotourism as an instrument of sustainable development. In future, it is essential to guarantee that a certain amount of this money will be channeled to the conservation of nature.

1148 92 - 5/124

Agroecology
Latin America, Costa Rica, development strategies, environmental management, land settlement, crop diversification, community development, road rehabilitation, AID

TOLISANO,J.

ENVIRONMENTAL MANAGEMENT OF THE NORTHERN ZONE CONSOLIDATION PROJECT IN COSTA RICA: STRATEGIES FOR SUSTAINABLE DEVELOPMENT.

Publ. of Development Strategies for Fragile Lands (DESFIL), Washington, D.C. 20001, 624 9th Street, N.W., 1989, 138 pp. + annex

This paper highlights a field review and technical analysis of a project in the Northern Zone of Costa Rica.
The evaluation team addressed the following environmental management concerns:
- Support to land settlement and titling,
- Support to crop diversification,
- Support to community development,
- Support to road rehabilitation/upgrading.

The project is expected to amplify the economic bases for the productive and sustainable development of the Northern Zone of Costa Rica through the following activities:
- Increasing non-traditional export-oriented crop production
- Developing a self-financed system for road maintenance and rehabilitation
- Supporting basic social infrastructure improvements, including potable water projects, schools, and community health centers
- Consolidating current settlement activities through land purchases, titling services and integrated management plans for settlement areas.

In terms of population distribution and per capita income, the Northern Zone of Costa Rica represents one of the least developed regions in the country.
Ecologically, the Northern Zone includes a wide variety of life zones and biological communities. Using the Holdridge system of life zone classification, which integrates climatic, vegetative and other critical factors, at least seven distinct ecological zones can be identified in the project area.
The high rainfall, combined with a wide range of available habitats has encouraged a significant degree of biological diversity in this region, both in terms of plant and animal communities.
The activities for environmental management include measures to facilitate the following:
- Land-use planning and monitoring of environmental conditions
- Watershed management
- Community-based production forestry
- Conservation of wildlands and wildlife
- Environmental education and extension.

1149 92 - 5/125

Agroecology
Latin America, Bolivia, project evaluation, environmental assessment, environmental strategy, technical assistance, training, community participation, rural communications, natural resource management, pesticide pollution, USAID

EHRLICH, M. et al.

ENVIRONMENTAL ASSESSMENT: THE VALLES ALTOS PROJECT IN BOLIVIA.

Publ. of DESFIL, Washington, D.C. 20001, USA, 1988, 28 pp.

The AID Andean Regional Environmental Adviser determined that the planned Chapare Regional Development Project Amendment for the Valles Altos region in the department of Cochabamba, Bolivia, required an environmental assessment (EA) before implementation of the project.
The need for an EA was determined by the fragile balance of the natural and agricultural ecosystem in this arid zone near Cochabamba and by the degraded nature of parts of the region. The area shows extensive over-grazing, steep and often eroded slopes and severely salinized soils in some parts.
As a result of the study, it was decided to amend the project paper and to expand the geographical focus of project activities to the Valles Altos region of the department of Chochabamba. This will be done to help encourage a large number of Chapare farmers and laborers who, having migrated to the Chapare from the Valles Altos in large numbers during the last several years, are now returning to their places of origin.
It is hoped that these farmers will forsake their involvement in coca production and processing as control activities proceed. The effort will be a large-scale test of a model of integrated investments to improve the social and economic development potential of selected areas of origin, to accelerate return migration, and to increase retention of the existing populations. If successful, the funding of a much larger effort to expand the impact of these activities to more areas will be considered.
For strategic and practical purposes, the implementation of the environmental/resource management strategy involves immediate activities, pre-investment studies, and technical assistance.
Essential preliminary activities are the relatively detailed land capability assessment and the hydrological studies needed before investments are made in irrigation systems.
The environmental strategy consists of the following major components:
- Early collection of baseline data on those resources and systems that are essential to planning, or that may be altered by project activities. Examples of these data types are water quality, flow rates, and sediment loads for potable water and irrigation activities; land-use capability assessments for potential agricultural and natural resources protection activities; floristic, faunistic, and habitat distribution data

for activities required to protect or restore endangered or critical ecosystem components.
- Continuous or periodic monitoring of water, soils, and biotic elements that may be adversely affected by project activities, or changes that may adversely affect sustainable continuation of project activities.
- Environmental education of local residents.
- Reforestation of upland areas for work production, soil conservation, and water retention. This will include both plantations of native species and exclosures where feasible, to allow for the regeneration of native biotic communities and to protect and increase diversity in these xerophytic forests.
- Institutional support to develop the human resource base.
- Support to the implementation of rural infrastructure activities such as roads, irrigation systems, hydroelectric power development, and riverine protection works with goals of assuring utilization and minimizing environmental impacts.
- Establishment of management plans for the protection of ecosystems, communities, and species that are endangered or threatened.