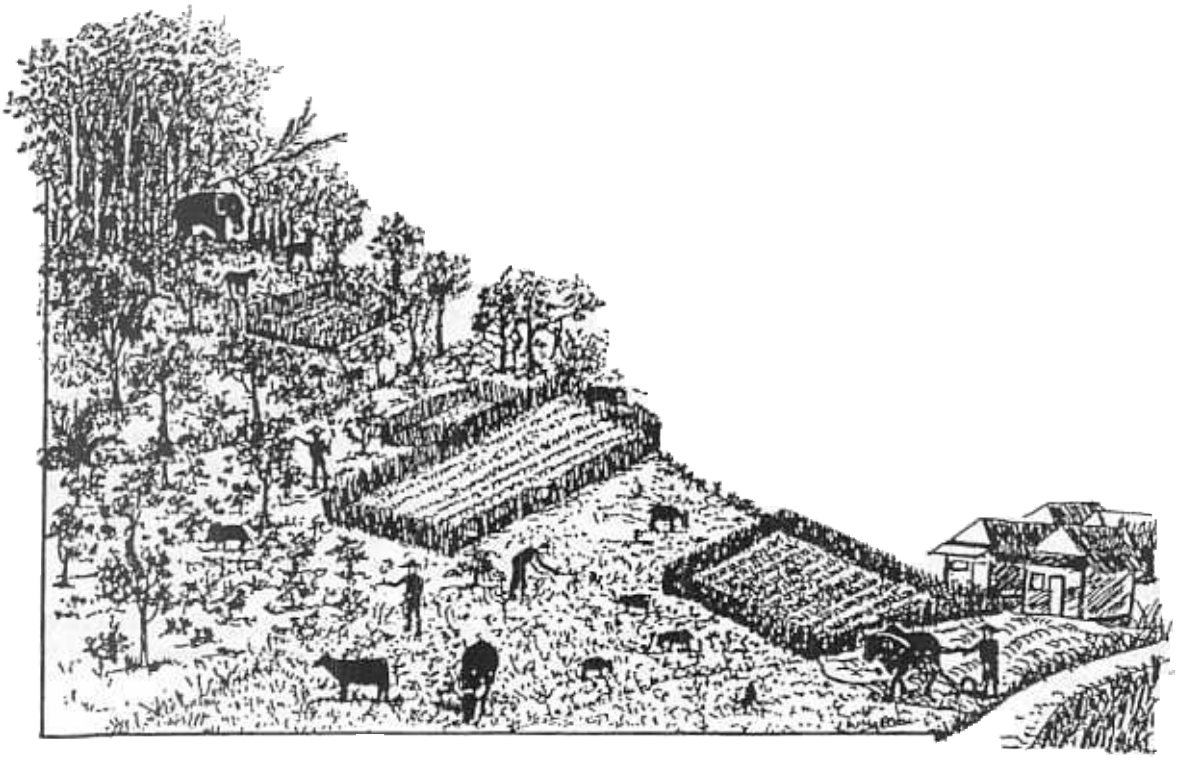

Figure 17. *Spatial Dynamics: Swidden Pests as a Function of Landscape Position*

The reality of wandering livestock also leads back to this paper's earlier discussion on the encouraging prospects of fallow enrichment with species that both rejuvenate depleted soils and offer fodder potential as well. Upland farmers universally recognize the cropping phase of the swidden cycle as the legitimate crop of economic value, and from which livestock must be excluded; during the growing season, livestock movement is thus more controlled. After crop harvest however, the newly fallowed land is considered to revert to open access grazing - and any fallow enriched with superior fodder species would be targeted by all the hungry livestock in the neighborhood, and quickly overgrazed. This scenario has been a major cause of failure of managed fallows in northern Thailand (Carson, pers. com.), the Philippines[29] (Balbarino, 1997) and elsewhere in the region.[30] The notion that swidden fallows are

---

[29] After years of failed attempts with herbaceous legume fallows, swidden farmers in western Leyte, have developed an appreciation for spiny *Mimosa invisa* C. Martius ex Colla, as a spontaneous fallow colonizer that requires no extra labor, rapidly accumulates biomass and smothers out weedy grasses, fixes N, and whose thorns discourage intrusion by hungry livestock (Balbarino, 1997). The biomass and contained nutrients thus stay in the field to the benefit of the land owner - rather than being harvested by his neighbors' cattle.

In an interesting contrast, farmers in Ban Den Village of Prae Province, northern Thailand, prefer spineless *Mimosa diplotrica* as a fallow species because of its greater ease of handling (Prinz and Ongprasert, 1997)

[30] This problem is of course not limited to the context of swidden fallows in upland communities; the dynamics would be identical if a lowland farmer attempted to grow dry season crops on paddy land - while all his neighbors' cattle are herded to the paddy fields to graze the newly available crop residues. Fencing responsibilities would again, rest solely with the land owner.

'idle' and subject to open grazing is thus a serious impediment to fallow management. Tenuous property rights to products from fallow land is clearly an important research issue.

iii) Farmer Solutions to Circumvent the Need for Fences

A review of farmer strategies to minimize livestock damage to crops suggests several concepts that may warrant consideration for wider dissemination as alternatives to routine fencing of all cropped land:

Maintaining a Spatial Barrier ...

The traditional response of many swidden communities has been to synchronize their swiddens in large contiguous patches, often covering entire hillsides, e.g., Karen and Lua' in northern Thailand. Bamboo poles or logs laid on the ground demarcate these communal swiddens into privately managed household allocations for private management. This offers numerous advantages in facilitating: communal work; easier vigilance against wildlife intrusion; joint maintenance of only a single access path; and most importantly to this discussion, makes it easier for the village's grazing livestock to be kept separated from its currently cropped fields. As the communal swidden rotates from year to year within the village territory, livestock generally follow one step behind, grazing crop residues and grasses as they are permitted access to newly fallowed land; the swidden system is thus comprised of a 3-phase 'food crops-grazing livestock-fallow' cycle. Further development of this traditional synergy between livestock and fallows provides a strategic point of intervention for improved livestock production.

Some farmers choose to open unfenced swiddens further from the village center where roaming livestock are fewer. Alternatively, other villages pursue a policy of confining cattle in enclosures far from cropping areas.[31]

Tethering ...

Tethering livestock may remove the need for fence construction, although labor will instead have to be directed at cut-and-carry of fodder to stationary animals, or periodically shifting their tethers to new sites so they have regular access to new grazing. A key difference is that adoption of tethering systems more equitably redistributes the labor burden from the land owner to the livestock owner. Swiddenists in Irian Jaya (Purwanto Y., pers. com.) and Kalimantan (Colfer, pers. com.) are reported to have developed careful practices of rotational tethering of pigs and buffalo/cattle respectively, in which animals are systematically rotated around fallows so all parts of the field benefit from dung deposits. This avoids the onerous task of backpacking dried manure from village corrals to distant swiddens. Supplementary feedstuffs imported from outside are channeled through the tethered livestock, providing both liveweight gains and accelerated recovery of the fallows' soil nutrient status.

In frontier areas of Trang Province, southern Thailand, rubber and palm oil plantations dominate the landscape and are the main economic crops routinely recognized as private property - and for which herders would be liable if their livestock inflicted serious damage. Non-traditional crops, such as bamboos or timber trees, are often interpreted as simply components of natural succession communities (particularly if planted in apparently unorganized agroforest combinations - rather than neat, easily identifiable, monoculture rows) - and thus subject to open access and potential use as livestock fodder. The land owner would indeed risk the ire of his neighbors by (in their view) unreasonably fencing this 'idle' land and denying their livestock grazing access. Similar social tensions arise around fruit trees and fish ponds; despite their location on private property and active management by a single household, the community would view them not as private investments - but *de facto* common property resources subject to open access rules. The *de joure* owner faces the untenable option of permitting open access and not harvesting any of the fruits of his labor - or protecting it and risking social ostracism or even violence within the wider community. Stories abound of exasperated farmers chopping down valuable fruit trees because they attracted too much unwanted attention and are more trouble than they are worth. Only after a critical mass are engaging in an enterprise will it eventually leave the open access domain and be recognized as subject to private property rights (Kurupunya, pers. com.).

[31] Hmong, however, often take chickens and pigs from the village compound to raise at their swidden sites as a deliberate strategy to isolate them from disease.

Live Fences ...
Although scattered examples exist of upland farmers managing *Gliricidia sepium, Leucaena leucocephala, Acacia insuavis, Jatropha curcas, Tithonia diversifolia*, etc. as barriers, the potential of multiple-use, living fences has not yet received adequate research attention in S.E. Asia. Rural African communities, faced with the historical need to develop thorny fences sufficiently impenetrable to discourage hungry lions that did not discriminate between livestock or human prey, illustrate what is possible and probably have much to teach S.E. Asia in that regard.

Unpalatability as a Crop Selection Criteria ...
Although many upland communities' concern for food security may compel them to persevere in growing food staples vulnerable to pillage by wildlife and livestock, it is nonetheless noteworthy that others integrated into market economies select cash crops less attractive to pests and then use revenues generated to purchase their rice needs. Minangkabau farmers in West Sumatra, for example, have responded to heavy crop losses from monkeys and pigs, by turning to sturdier tree crops (particularly rubber and cinnamon) and food crops such as chili and eggplant, that are not on the preferred menu of local wildlife.

iv) Need for Institutional Interventions
As resources permit and conditions demand, animal husbandry generally follows a trajectory of intensification that sees formerly free-ranging livestock gradually confined and subjected to more sophisticated management practices (i.e., Figure 6). Until then, the fencing issue is essentially a social problem that requires an institutional approach and an ethnic sensitivity on a case-by-case basis. Livestock tend to be privately owned and expanded animal husbandry may induce a marked increase in individualization in what have traditionally been remarkably egalitarian and community-minded societies. The inherent tensions between livestock and field crop sectors will inevitably cause more conflicts between households and give rise to issues of equity and social jealousies. These will represent more serious problems to villages that do not have a tradition of corresponding rules and regulations to guide conflict resolution.

4. CONCLUSIONS

Landlocked, with rugged terrain and few navigable rivers, the economy of Lao P.D.R. has historically been limited by its geographic isolation. With today's climate of warming international relations, trade liberalization and ambitious transportation projects, Laos is finding itself newly positioned as a crossroads between vast markets. With a conducive policy environment, the market economy should stimulate upland farmers to exploit their comparative advantage and expand the livestock sector of their farming systems. The 'low input-low output' approach that characterizes livestock husbandry in the Lao uplands offers wide scope for incremental improvements towards more intensive management systems. The Lao Department of Livestock and Fisheries is challenged in how to best assist this process with its limited resources.

Concurrent to these new opportunities for expansion of the livestock sector, larger political processes in Laos are imposing mounting constraints on traditional forms of swidden agriculture. The Lao government's recent decree that swidden cycles should not exceed three years is the latest of a string of policy interventions aimed at limiting, and eventually eliminating, what are officially viewed as primitive variations of land management characterized by elements of fallow and fire. Policies discouraging swiddening are being supported by the increasing role of the state in organizing access to resources. This has sparked a critical debate on whether fallows should be recognized as agricultural land under the customary tenure of swiddenists - or classified as state forestal land where further agricultural activities would be prohibited.

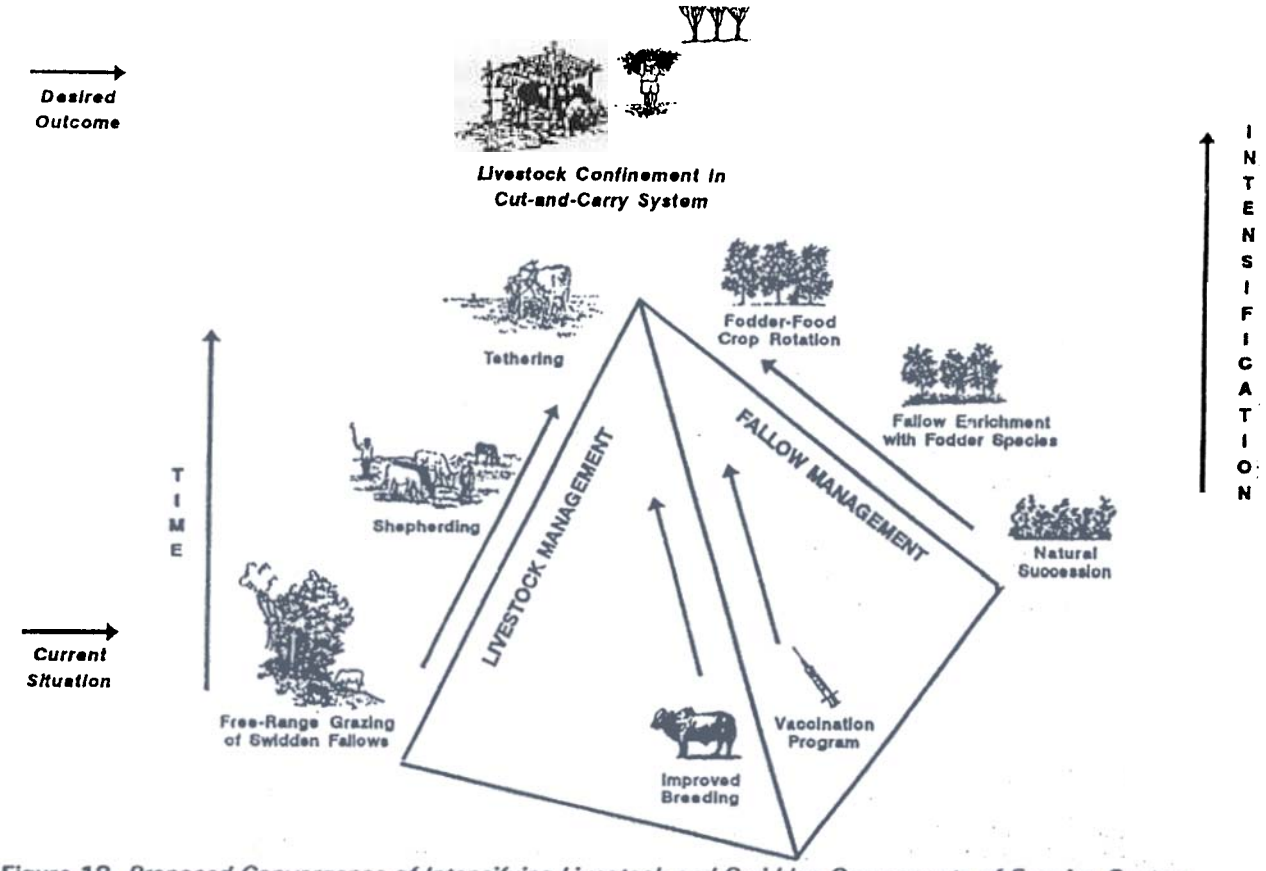

Figure 18 *Proposed Convergence of Intensifying Livestock and Swidden Components of Farming System*

Clearly, attempts to legislate swidden cultivation out of existence, in the absence of practical alternatives, is a certain formula for its rapid collapse. There is wide acceptance however, that broader, societal trends of: mounting population pressures; the globalization and marketization process; competing uses for limited land resources; and the privatization of land ownership, all converge on the need for intensification of swidden agriculture. The urgent need to increase the human carrying capacities of upland farming systems is clear. Regardless of the merits of the long-fallow forms of shifting cultivation of the past, we need to be thinking of pathways to stabilize and improve productivity of today's declining systems - preferably finding ways to build on indigenous practices. The relevant issue is not whether shifting cultivation should be allowed or prohibited - but how to intensify it in the reality of more mouths to be fed from a dwindling land base. This is a high priority research and development issue across many ASEAN countries.

This paper has discussed potentials for development of the livestock sector in the context of the shortened fallow variations of swidden agriculture that are now endemic to Laos and elsewhere in S.E. Asia's uplands. It has drawn from indigenous examples of fallow management, fodder production and fencing issues to argue the merits of developing improved husbandry of ruminant livestock in tandem with efforts to intensify swidden cultivation (Figure 18). This proposal focuses on the fallow period as the logical interface between the livestock and swidden components of upland farming systems - and the potential for complimentarity in efforts towards intensification of both. The fallow period is viewed as an underutilized resource that, with modest management interventions, could provide a happy combination of enhanced soil rejuvenation and fodder production. This concept has

a greater chance of farmer adoption because it is not new, but builds on and refines traditional practices to exploit the fodder potential of crop residues and fallow grasses with free-ranging livestock. Furthermore, it entails less risk since fallow enrichment allows the essential structure of the swidden cycle to remain intact and the cropping phase can continue without interference. Food security should not be threatened.

Equally important, as 'fallow' vegetation is managed in more deliberate ways, we move further away from the popular misconception that fallows are either abandoned agricultural land or degraded forest - but begin to see them more properly as a fodder/green manure phase within a systematic crop rotation. Indeed, this suggests that it would be more accurate, and strategic, to promote this concept under the rubric of a 'fodder-food crop rotation', and avoid the more ambiguous label of 'fallow management' and the considerable negative political baggage associated with swiddening. The philosophical underpinnings of most S.E. Asian governments' opposition to swiddening lies largely in rigid notions that equate fire and fallows with backwardness and forest destruction. Conversion of 'fallows' into a well-defined fodder component could be strategic not only in developing feed resources, but also in demarcating permanent land use and encouraging bureaucratic flexibility in interpretation of policies and laws. It holds promise to enlarge the democratic space for negotiation with state agencies on what constitutes 'agricultural land' and strengthen farmer claims to lands that they have traditionally managed.

Acknowledgements:
The author is grateful to ICRAF colleagues, Drs. Meine van Noordwijk and Thomas Tomich for contributing ideas to this paper. Warm thanks are also owed to Pak Wiyono of Biotrop ORSTRAM for developing many of the illustrations. Many of the insights reported here were accumulated during field work guided by Dr. John Graham and supported by the International Development Research Center (IDRC), Ottawa, Canada.

REFERENCES

Adchak, C.L. 1993. 'Effect of Different Rates of Inorganic Nitrogen in Combination with Chopped Wild Sunflower (*Tithonia diversifolia*, Gray) on the Growth and Yield of Cabbage. Abstract.

Agbim, N.N. 1987. 'Carbon cycling under *Chromolaena odorata* (L.) K. & R. canopy' in Biological Agriculture and Horticulture, Vol. 4, 203-212.

Agus, F. 1997. 'Intensification of indigenous fallow rotation using *Leucaena leucocephala*'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Balbarino, E. 1997. 'Farmer-improved short-term fallows using spiny legume benet (*Mimosa invisa* Mart.), in Western Leyte, Philippines'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Baxter, J. 1995. '*Chromolaena odorata* - weed for the killing or shrub for the tilling?'. Paper submitted to Agroforestry Today.

---- (Ed.) 1995b. '*Tithonia* - more than meets the eye' in ICRAF Updates, Sept. 1995.

Boonwat, L. 1994. 'A picture of shifting cultivation in the project zone' in Shifting Cultivation Systems and Rural Development in the Lao P.D.R.. Proceedings of the Nabong Technical Meeting held in Vientiane, Lao P.D.R. on July 14-16. 220-236.

Burgers, P. 1997. 'Commercialization and the stimulation of economically valuable species in the fallow vegetation by Bidayuh shifting cultivators in Sarawak, Malaysia'. Poster paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Cairns, M.F. 1994. 'Comparative analysis of agroecosystems of three case study villages in the buffer zone of Kerinci-Seblat National Park'. Chapter 2 in MES Dissertation, Faculty of Environmental Studies, York University, Canada. 73-208.

1994b. '*Eupatorium inulifolium*: Noxious weed or multipurpose shrub?'. Chapter 3 in MES Dissertation, Faculty of Environmental Studies, York University, Canada. 209-288.

·. 1997. 'Indigenous fallow management in Southeast Asia: New research exploring the promise of farmer-generated technologies to stabilize and intensify stressed swidden systems'. Paper presented at the international workshop on 'Green Manure-Cover Crop Systems for Smallholders in Tropical and Subtropical Regions' held in Chapeco, Santa Catarina, Brazil on April 6-12, 1997.

·. 1997b. 'Modification of fallow vegetation to increase swidden productivity: Understanding farmer strategies in Southeast Asia'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

1997c. 'Management of *Austroeupatorium inulifolium*-based fallows by Minangkabau farmers in Sumatra, Indonesia'. Poster paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Capundag, O.S. 1989. 'Effect of different levels of sunflower leaf meal in the meat quality of broilers'. Thesis for Bachelor of Science in Agriculture, Central Mindanao University, Musuan, Bukidnon, Philippines. March, 1989.

Carson, S. 1996. Personal communication.

Chazee, L. 1991. 'La diversite rurale du Laos a travers la vie de quelques villages ethniques'. Vientiane: UNCDF.

Cheva-Isarakul, B. 1996. 'The flow of cattle and buffalo towards Thailand' in Montane Mainland Southeast Asia in Transition. Proceedings of the Nov. 12-16, 1995 Symposium held in Chiangmai, Thailand. 233-245.

Colfer, C. 1996. Personal communication.

de Foresta, H. 1993. '*Chromolaena odorata*: Calamite ou channce pour l'Afrique Tropicale?'. Paper presented at 'Troisieme Atelier International sur la Lutte Biologique et la Gestion de Chromolaena odorata' held in Abidjan, cote d' Ivoire, Nov. 15-19, 1993.

and D. Schwartz. 1991. '*Chromolaena odorata* and disturbance of natural succession after shifting cultivation: An example from Mayombe, Congo, Central Africa' in Ecology and Management of *Chromolaena odorata* (Ed. R. Mumiappau and P. Ferrar). BIOTROP Special Publication No. 44. 23-41.

Derpsch, R. 1993. 'Descripcion de un sistema de produccion sostenible, basado en la siembra directa, en laderas con 100% de declive, desarrollado por un pequeno agricultor del Sur de Honduras'. Paper presented at the Latin American meeting on 'Plantio Direto Na Pequena Propriedade' held in Ponta Crossa, Brazil on Nov. 22-26, 1993.

Dove, M.R. 1986. 'The practical reason of weeds in Indonesia: Peasant vs. state views of *Imperata* and *Chromolaena*' in Human Ecology, Vol. 14, No. 2, 1986. 163-190.

Fahrney, K. 1997. Personal communication.

Field, S.P. 1991. '*Chromolaena odorata*: Friend or foe for resource poor farmers?' in *Chromolaena odorata* Newsletter, No. 4, May 4-7, 1991.

Food and Agriculture Organization of the United Nations (FAO). 1992. FAO Production Yearbook 1991, Vol. 45. Rome: FAO.

Garrity, D.P. 1996. Personal communication.

and A. Mercado. 1993. 'Reforestation through agroforestry: Market driven small-holder timber production on the frontier' in Marketing of Multipurpose Tree Products in Asia. (Ed. Raintree, J.B. and H.A. Francisco). Proceedings of an international workshop held in Baguio City, Philippines, on 6-9 Dec., 1993. Morrilton, Arkansas: Winrock International. 265-268.

Geilfus, F. 1994. El arbol al servicio del agricultor: Manual de agroforesteria para el desarrollo rural. -Tomo: Guia de especies. (2nd Edition). Santa Domingo: Enda-CATIE. 632-633.

Hairiah, K. 1996. Trip report to workshop on 'Cover Crops for a Sustainable Agriculture in West Africa: Constraints and Opportunities' held in Cotonou, Benin Republic on Oct. 1-3, 1996.

Hansen, P. 1996. Personal communication.

-----; H. Sodarak and S. Savathvong. 1997. 'Teak production by shifting cultivators in Northern Lao P.D.R.'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Hao, N.T.; H.V. Huy; H.D. Nhan and N.T.T. Thuy. 1997. 'Soil improvement and conservation using nho nhe bean (*Phaseolus calcaratus* Roxb.) in upland areas of northern Vietnam'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

IUCN. ----. 'Proposed protected areas in Lao P.D.R.: A guide for the planner who needs to know where these areas are'. Pamphlet prepared by Forest Resources Conservation Sub-Programme of the Lao-Swedish Forestry Cooperation Programme.

Keomukda, K. 1993. 'RIFS experience in alley cropping' in Shifting Cultivation Systems and Rural Development in the Lao P.D.R.. Proceedings of the Nabong Technical Meeting held in Vientiane, Lao P.D.R. on July 14-16, 1993. Vientiane, Lao P.D.R.: United Nations Development Program. 125-127.

Kieft, J.A.M. 1997. '*Sesbania grandiflora* (L.) Pior. as a farmers' answer on declining soil fertility in swidden agriculture in North Central Timor'. Poster paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Kurupunya, T. 1996. Personal communication.

Lao P.D.R. 1985. 'Population Census'. Vientiane, Lao P.D.R.

Lasco, R.D. 1997. 'The Naalad improved fallow system and its implications to global warming'. Poster paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

and P.D. Suson. 1997. 'A *Leucaena leucocephala*-based improved fallow system in Central Philippines: The Naalad system'. Paper presented at the International Symposium on 'The Science and Practice of Short-Term Improved Fallows in Humid and Sub-humid Tropics' held in Lilongwe, Malawi on Mar. 11-15, 1997.

M 997. 'The cultivation potentials of selected wild vegetables of Sarawak, Malaysi Poster paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Metzner, J.K. 1983. 'Innovations in agriculture incorporating traditional production methods: The case of Amarasi (Timor)' in Bulletin of Indonesian Economic Studies, Vol. 4, No. 3. Australian National University, Canberra.

Nagarajah, S. and B.M. Nizar. 1982. 'Wild sunflower as a green manure for rice in the mid country wet zone' in Tropical Agriculturist, 138. 69-80.

Ongprasert, S. and K. Prinz. 1997. 'Use and management of viny legumes as accelerated fallows in intensified shifting cultivation in Northern Thailand'. Poster paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Ormeling, F.J. 1955. The Timor Problem - A Geographical Interpretation of an Underdeveloped Island. J.B. Wolters, Groningen and Jakarta.

Oyen, L. 1995. 'Aggressive colonizers work for the farmers' in ILEIA Newsletter, Oct. 1995, Vol. II, No. 3. 10-11.

Pandeya, C.N. 1995. 'We love and protect it' in ILEIA Newsletter, Oct. 1995, Vol. II, No. 3. 8.

Pandosen, M.D. 1986. Potential of Wild Sunflower (*Tithonia diversifolia*) as an Organic Fertilizer. MS Thesis submitted to Benguet State University, Benguet, Philippines.

Piggin, C.M. 1997. 'The role of *Leucaena* in village cropping and livestock production in Nusa Tenggara Timor, Indonesia'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Poffenberger, M. and K. Suryanata. ----. 'Systems of agricultural production in Bali and Nusa Tenggara' in The Agriculture of Indonesia (Ed. C.R.W. Spedding). Oxford University Press.

Potter, L. and J. Lee. 1997. 'Selling *Imperata*: Managing grasslands for profit'. Poster paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Prinz, K. and S. Ongprasert. 1997. 'Use and management of *Mimosa diplotricha* var. inermis as a simultaneous fallow in orange orchards and upland annual crop cultivation in Northern Thailand'. Poster paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Purwanto, Y. 1996. Personal communication.

Ramakrishnan, P.S. 1993. Shifting Agriculture and Sustainable Development: An Interdisciplinary Study from North-Eastern India. Delhi: Oxford University Press

1997. '*Flemingia vestita*-based indigenous fallow management in N.E. India'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Rios, C. 1994. 'Boton de Oro *Tithonia diversifolia* (Hemsl.) Gray' in Arboles y Arbustos Forrajeros Utilizados en la Alimentacion Animal. Cali, Columbia: Fundacion CIPAV. 115-126.

and A. Salazar. 1995. '*Tithonia diversifolia* (Hemsl.) Gray: A protein source for the tropics' in Livestock Research for Rural Development 1995, Vol. 6, No. 3.

Roder, W.; B. Keoboualapha and V. Manivanh. 1995. 'Teak (*Tectona grandis*), fruit trees and other perennials used by hill farmers of northern Laos' in Agroforestry Systems. 27: 1-14, 1995.

-----; B. Phouaravanh; S. Phengchanh; B. Keoboulapha and S. Maniphone. 1993. "Upland agriculture: Activities by Lao-IRRI Project' in Shifting Cultivation Systems and Rural Development in the Lao P.D.R.. Proceedings of the Nabong Technical Meeting held in Vientiane, Lao P.D.R. on July 14-16, 1993. Vientiane, Lao P.D.R.: United Nations Development Program. 152-169.

S. Phengchnah; B. Keouboulapha and S. Manivong. 1995. '*Chromolaena odorata* in slash-and-burn rice systems of Northern Laos - Weed or useful plant?'

-----; S. Maniphone; B. Keoboulapha and K. Fahrney. 1997. 'Fallow improvement in upland rice systems with *Chromolaena odorata*'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Sajise, P.E.; R.K. Palis; N.V. Norcio and J.S. Lales. ----. 'The biology of *Chromolaena odorata* (L.) R.M. King and H. Robinson: Flowering behavior, pattern of growth and nitrate metabolism' in Philippine Weed Science Bulletin. Los Banos, Philippines. 17-24.

Sayre, E.V. 1997. Personal communication.

Scoones, I.; M. Melnyk and J. Pretty. 1992. The Hidden Harvest: Wild Foods and Agricultural Systems. A Literature Review and Annotated Bibliography. London: The Sustainable Agriculture Program, International Institute for Environment and Development.

Simaraks, S. 1988. Personal communication.

Slaats, J.J.P. 1993. 'The use of *Chromolaena odorata* as fallow in a semi-permanent cropping system in S.W. Cote d'Ivoire'. Paper presented at 'Third International Workshop on Biological Control and Management of *Chromolaena odorata*' held in Abidjan, Cote d'Ivoiere, Nov. 15-19, 1993.

Stoutjesdijk, J.A.J.H. 1935. '*Eupatorium pallescens* DC op Sumatra's weskust' (*Eupatorium pallescens* DC on the West Coast of Sumatra) in Tectona, Vol 28. 919-926.

SUAN; EAPI and Lao P.D.R. MAF. 1991. Swidden Agroecosystems in Sepone District, Savannakhet Province, Lao P.D.R.. Report of the 'SUAN-EAPI-MAF Agroecosystem Research Workshop' held in Savannakhet Province, Lao P.D.R. on June 20 - July 2, 1991. Khon Kaen, Thailand: Khon Kaen Press.

Subedi, N. 1997. "Shifting cultivation in Nepal'. Abstract.

Surata, I.K. 1993. 'Amarasi system: Agroforestry model in the savanna of Timor Island, Indonesia' in Savana, No. 8/1993. Kupang, Timor: Departemen Kehutanan Badan Penelitian dan Pengembangan Kehutanan, 2 Balai Penelitian Kehutanan. 15-23.

Susana, I.V.R. and B. Tangendjaja. 1988. 'Leaf protein concentrate (LPC) from *Calopogonium caeruleum* and *Tithonia diversifolia*' (Konsentrat protein daun (KPD) dari Kalopo [*Calopogonium caeruleum*] dan Titonia [*Tithonia diversifolia*]) in Proceedings of the Second National Seminar on Animal Husbandry and Farmers' Forum held in Bogor, Indonesia on July 18-20, 1988. 190-202.

Tangan, F.T. 1997. 'Wildfood plants: Alternative species from fallow lands of the Cordilleras in the Philippines'. Paper presented at workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' held in Bogor, Indonesia on June 22-27, 1997.

Tomich, T.P.; P. Kilby and B.F. Johnston. 1995. Transforming Agrarian Economies: Opportunities Seized, Opportunities Missed. Ithaca, New York: Cornell University Press.

Turkelboom, F.; K. van Keer; S. Ongprasert; P. Sutigoolabud and J. Pelletier. 1996. 'The changing landscape of the Northern Thai hills: Adaptive strategies to increasing land pressure' in Montane Mainland Southeast Asia in Transition. Proceedings of the Nov. 12-16, 1995 Symposium held in Chiangmai, Thailand. 436-461.

Tyler, S. 1996. Personal communication.

UNICEF. 1992. Children and Women in the Lao Peoples' Democratic Republic. Vientiane, Lao P.D.R.

van de Goor, G.A.W. 1953. 'An investigation on the relative value of various legumes and non leguminous plants as green manure' in Tehnik Pertanian, No. 3, Tahun ke II. March 1953.

van Gansberghe, D. and R. Pals. (Eds.). 1994. Shifting Cultivation Systems and Rural Development in the Lao P.D.R.. Proceedings of the Nabong Technical Meeting held in Vientiane, Lao P.D.R. on July 14-16, 1993. Vientiane; Lao P.D.R.: United Nations Development Program.

van Noordwijk, M. 1997. Personal communication.

Verliere, G. 1966. 'Valeur fertilisante de deux plantes utilisees dans les essais de paillage du cafeier: *Tithonia diversifolia* et *Flemingia congesta*' in The Cafe Cacao, Vol. X, No. 3. July-Sept. 1966.

Voss, J. 1997. Personal communication.