CHAPTER II

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 Population Growth, Economic Development and Technological Change

There are some theories stating that population growth is a requisite for economic development and that pressure on the land forces development of more productive economic systems (Boserup, 1965). Some spoken of as the neo-Malthusian theory, holding that population growth as a result of economic development and that population growth and population pressure may hamper economic development. because gains in productivity are continually offset by demands of the expanding population and because of expanding population contain a larger share of dependents. since their age distribution contains a much higher proportion of very young people than does a non-growing population (Kunstadter, 1978).

To address forest related socio-economic problems and issues such as deforestation, land use conflicts, livelihood security, environmental crises caused by both market and policy failures. However, land degradation appeared and people had to change the technology which their use to adapt within the land situation. particularly within the shifting cultivation systems.

Shifting cultivation has a prominent position in most explanations of forest depletion and environmental destruction. It is a very general term, with different connotations for different stakeholders.

Shifting cultivation is usually described in terms of technologies and methods applied, cultivation cycles, slope gradients and crop produced.

In Table 2.1, the major systems of supply of vegetable food are ranked according to intensity of land use, with the most extensive systems at the top, and the most intensive at the bottom. The most intensive agricultural systems are annual cropping, in which a crop is shown or planted each year, leaving only a few months

for fallow, and multi-cropping, in which the same piece of land bears more than one crop each year without ever being left in fallow (Boserup, 1981).

Table 2.1 Changing System after Doing Shifting Cultivation

	System	Description
G	Gathering	Wild plants, roots, fruits and nuts are gathered
FF	Forest-fallow	One or two crops followed by 15-25 year fallow
BF	Bush-fallow	One or two crops followed by 8-10 year fallow
SF	Short-fallow	One or two crops followed by one or two year fallow
AC	Annual cropping	One crop each year with only a few month fallow
MC	Multi-cropping	Two or more crops in the same fields each year without any fallow

2.2 Deforestation

2.2.1 Definition of Deforestation

A predominant view, accepted by the FAO, considers deforestation as 'a complete clearing of tree formations (closed or open) and their replacement by non-forest land use'. Firstly, this definition does not view as deforestation the removal of plant associations not classified as forest. Secondly, and most fundamentally, serious forest damage caused by excessive logging, wood gathering for both domestic and commercial purposes, fire and livestock grazing is not considered as deforestation unless it results in total conversion of forest to other land uses (FAO, 1988).

Degradation of forest through logging will result in a modified forest structure and composition. From a resource point of view, the vegetation remains in logged-over forest has little economical value, but the land may still have value for agriculture or other uses. On the other hand, if the logged-over forest is subsequently cleared for shifting or permanent agriculture or transferred to other non-forest uses, removal of forest cover is total, and the area clearly deforested.

2.2.2 History of Deforestation

Deforestation has occurred since long time ago in the past when man learned how to use fire as means to clear forest. The history of tropical deforestation may be divided roughly into two periods, the first spanning a period of about 400 years when the European colonial powers occupied most of the tropical world, and the second spanning a period of only a few decades when Europe retreated from the tropics after the Second World War and their former colonies emerged as newly independent states (Ooi Jin Bee, 1993).

During the colonial era, the initial impacts on the forest was the exploitation of the forest products (gums, resins, incense woods, nuts, rubber, etc...), and animal products (animal skins, rhinoceros horns, live animals such as elephants and birds) to the expanding market of Europe, and later, the USA.

The greatest impact during the period of the colonial rule on the rain forests was the clearing of forested land for agricultural development. In Southeast Asia some forested land was cleared by the local population for cash-cropping, mainly spices, even before the Portuguese, Spanish, Dutch and British colonialists entered the region (Ooi Jin Bee, 1993).

During the post colonial and post Second World War period, there was an enormous change in both western and tropical world. The most significant change was the increase of the world's population – from 2.5 billion in 1950 to 5 billion in 1988 (Ooi Jin Bee, 1993).

To cope with the huge increase of the population, countries have to rely upon the exploitation of the available resources, including the forest resources. Large areas of forests were cleared for expanding the agricultural land, and to provide the foreign exchange from exporting the valuable hardwoods. Also forest area were cleared for the development of the infrastructure and settlement areas.

Table 2.2 Rate of Deforestation in Developing Countries

Developing countries in	Rate of deforestation (hectares / year)	Sources
Asia	4 million	FAO, 1979
Africa	2 million	FAO, 1979
	3.7 million	Myers, 1980
	4 million	Synnot, 1977
Latin America	5 to 10 million	FAO, 1979
All developing countries	7.3 to 20 million	Dept. of State, 1980
	11.3 million	Hadley & Lanly, 1983
	18 to 20 million	Myers, 1983

2.2.3 Causes of Deforestation

The regional impact, processes and dynamics of deforestation vary widely from countries to countries and even within a country. The causes, however, are now well known, and can be listed broadly as follows (Ooi Jin Bee, 1993):

1) **Clearing of forest to release land for shifting cultivation and permanent agriculture.**

This process is very much related to the population pressure and it occurs almost in all countries with a rapid population growth rate, a high population density and poor alternative employment opportunity.

Allen and Barnes (1985) concluded that population growth was related to agricultural expansion, which in turn was related to forest loss, and that this correlation was stronger in Asia and Africa than in Latin America.

In Southeast Asia (including Papua New Guinia) shifting cultivation, not limited to that with long fallow periods as practised by hill tribes but including that practised by migrant squatter farmers of recent origin as for example, the Kaingineros of the Philippines was responsible for 49% of the total area deforested (Lanly, 1983).

2) Clearing the rain forest to release land for cattle ranching and pasture development.

Deforestation for cattle ranching takes place in both Central America and the Brazilian Amazon, but the causes in each region are different. In Central America the underlying factor responsible for the expansion of cattle ranching since the 1960s is the strong economic stimulus generated by the United States market, which takes in 90-95% of the region's beef export (Ooi Jin Bee, 1993). Browder (1988), basing his figures on the 1980 Landsat monitoring programme of vegetation cover alteration, estimates that pasture formation would account for more than 72% of the total deforested area in the Brazilian Amazon.

3) Logging and firewood gathering

With reference to the definition of deforestation adopted by the FAO (defined as the complete clearing of tree formation and their replacement by some other use of the land), neither logging nor firewood gathering causes deforestation rather degradation of the forest. But if the degradation is subsequently further intensified either through natural causes or by human activities, the area can in fact become deforested.

Although the logging does not directly cause the deforestation, its operation facility such as the logging road, can be used by the farmers who then complete the process of deforestation.

A more direct deforestation caused by the logging is the logging for woodchips. This kind of logging involves the clear-felling of selected areas. In Papua Guinea, woodchip operations involve 67,000 hectares (ha) of mixed hardwood forest, while in the Philippines nearly 200,000 ha of dipterocarp and pine forests were set aside as a logging concession to produce raw materials for pulp, paper, cellophane and rayon manufacture (Ooi Jin Bee, 1993).

2.2.4 Consequences of Deforestation

Rapid deforestation is widely believed to be accompanied by many undesirable environmental consequences as well as serious negative socio-economic impacts for important social groups (Solon & Krishna, 1990).

1) Environmental consequences

Deforestation creates many far-reaching consequences:

a) Countless species of forest plants and fauna become extinct, or are endangered with the destruction of their habitats. Deforestation also deprives many local people of traditional medicines and food sources.

b) Deforestation increases the run-off rainfall and intensifies the soil erosion, which then in turn silts the riverbeds, lakes and reservoirs. Increasingly devastating floods in Bangladesh and northern and eastern India are widely believed to be closely connected with deforestation in the Himalayan headwaters of these drainage basins (Rieger, 1976)

c) Climate changes and deforestation are interrelated in complex ways (Solon & Krishna, 1990). Forest is the biggest natural sink in which the atmospheric carbon is stored. The destruction of forest means the destruction of the natural storage of atmospheric carbon. This will result in increasing the carbon in atmosphere, which in turn increases the global warming.

2) Social consequences

The environmental consequences are, to some extent, linked to the social consequences. For example. the soil erosion, flooding, ground water depletion and silting as a result of deforestation can directly influence agricultural productivity, thereby affecting household food supply, health and nutrition (Solon & Krishna, 1990).

Forests in developing countries are serving as sources of food supply, building material, traditional medicines and income for the poor local community. Different types of fruits, nuts, leaves, roots and

shoots are periodically collected by local people for home consumption as well as for marketing for additional income. When the forests are converted to other land uses, the life-support system for the poor local community is lost.

2.2.5 Deforestation Situation in Laos.

As mentioned earlier, Laos is located in Southeast Asia between Vietnam, Cambodia, Myanmar, China and Thailand. The country occupies a total area of 236,800 sq. km of which 230,800 sq. km is land area. The country is administratively divided into three regions: northern, central and southern regions.

In the northern region where the terrain is very hilly, the main agricultural production is relied on the slash and burn cultivation, whereas in the central and southern regions where the terrain is flat and the infrastructure is well developed, the agricultural production is the permanent type: paddy rice, fruit crop, etc..

Based on the reconnaissance survey made in 1960 by the Canadian team, the forest cover was estimated at 70%. However, according to the nation-wide reconnaissance survey made in 1982, the total current forest area decreased from 11.6 million ha (49.1%) in 1982 to 11.2 million ha (47.2%) in 1989 (NOFIP. 1992).

During the period 1960 till 1973, the deforestation in Laos was mainly caused by the war, non-sustainable commercial logging and shifting cultivation. Large area of forest in the north of Laos were destroyed by the bombs dropped by US air planes.

Since 1975, the major causes of deforestation in Laos are shifting cultivation and non-sustainable commercial logging. In the north, the deforestation is mainly caused by shifting cultivation. In the central and southern regions, the main cause of deforestation is the non-sustainable commercial logging.

In the study area, the principal causes of deforestation are the shifting cultivation and small scale logging operation for both commercial purpose and housing within the village itself. Since 1989, shifting cultivation has been considered as an only cause of deforestation, but at the limited extent because lots of supports were given to the villagers in order to stabilize the farming system and thus reduce the pressure on forests.

2.3 Land Degradation

The term land, as employed in land evaluation, land use planning, etc., has a wider meaning than just soil. It refers to all natural resources which contribute to agricultural production, including livestock production and forestry. Land thus covers climate and water resources, landforms, soils and vegetation, including grassland resources and forests (FAO, UNEP, 1994).

Land degradation is the temporary or permanent lowering of the productive capacity of land (UNEP, 1994). It thus covers the various forms of soil degradation, adverse human impacts on water resources, deforestation, and lowering of the productive capacity of range-lands.

Land degradation has both on-site and off-site effects. On-site effects are the lowering of the productive capacity of the land, causing either reduced outputs (crop yields, livestock yields) or the need for increased inputs. Off-site effects of water erosion occur through changes in the water regime, including in river water quality, and sedimentation of river beds and reservoirs. The main off-site effect of wind erosion is over blowing, or sand deposition.

The occurrence of deforestation is widespread and extremely serious in the region. It is not independently assessed here, in view of more detailed treatment in the current FAO forest resources assessment 1990 project. Deforestation is also discussed as a cause of erosion.

The causes of land degradation can be divided into natural hazards, direct causes, and underlying causes. Natural hazards are the conditions of the physical environment which lead to the existence of a high degradation hazard, for example steep slopes as a hazard for water erosion. Direct causes are unsuitable land use and inappropriate land management practices, for example the cultivation of steep slopes without measures for soil conservation. Underlying causes are the reasons why these inappropriate types of land use and management are practiced; for example, the slopes may be cultivated because the landless poors need food, and conservation measures are not adopted because these farmers lack security of tenure.

Unsuitable land use is the use of land for purposes for which it is environmentally unsuited for sustainable use. An example is forest clearance and

arable use of steeply sloping upper watershed areas which would have more value to the community as water sources, managed under a protective forest cover.

In the past, shifting cultivation was a sustainable form of land use, at a time when low population densities allowed forest fallow periods of sufficient length to restore soil properties. Population increase and enforced shortening of fallow periods have led to it becoming non-sustainable. Shifting cultivation is found in the hill areas of northeast India, where it is a cause of water erosion and soil fertility decline.

Inappropriate land management practices refer to the use of land in ways which could be sustainable if properly managed, but where the necessary practices are not adopted. An example is the failure to adopt soil conservation measures where these are needed. It can also refer to land use which is ecologically sustainable under low intensity of use but in which the management becomes inappropriate at higher intensities. Examples are shifting cultivation and the grazing of range-land.

Farmers will be reluctant to invest in measures to conserve land resources if their future rights to use these resources are insecure. Two kinds of property rights lead to this situation, tenancy and open access resources.

Despite efforts by legislation and land reform programs over many years. tenant occupation of farmland is still very widespread. The landowner is now frequently from the cities, and the land is farmed by tenants paying some form of rental. Relations between landlord and tenant are often good, and the tenant in fact remains on the same farm for many years. However, such tenants lack the incentive to maintain the land in good condition, being interested mainly in the immediate harvest. Open access land resources are those which anyone, in practice the poor and otherwise landless, can use, without rights of continuing usufruct or tenure. This applies mainly to forest lands, nominally under government ownership but which are settled on a squatter basis.

There is a distinction between common property and open access resources. In common property resources, use is restricted to members of a community, village or clan, and is subject to constraints, socially applied. For example, pastorialists often have customs for when certain areas must be rested from grazing, villages restrict the cutting of communal woodland. On open access land there are no such constraints.

With no legal basis to their use, incentive to farm the land other than for immediate needs is completely lacking.

For historical and socio-political reasons, when land is more valuable then property rights over natural resources in many developing countries are ill-defined, insecure, and unforseeable, and in many cases totally absent. Insecurely held resources include agricultural land, public forest land and forest resources, irrigation systems and water resources, coastal zones and fishery resources, and other environmental resources. Resources over which property rights are not established and to which everyone has free access are known as open-access or common property resources. Common property must be distinguished from communal property, which is well-defined and enforceable.

Table 2.3 shows four property-rights regimes of natural resources recognized by property theory. Forests and forest land claimed to be the property of the state often turn out to be open-access resources with the result that forests are depleted, due mainly to the lack of organizational capacity on the part of government to effectively manage the resources (Oya, 1998).

Table 2.3 Property-Rights Regimes of Natural Resources

Property-Rights Regime	**Main Features**
Open-access	Free-for-all; resource-use rights are neither exclusive nor transferable; these rights are owned in common but are open-access to everyone (and therefore to no one).
State property	Ownership and management control is hold by the nation state or crown; public resources to which use-rights and access rights have not been specified.
Communal property	Use-rights for the resource are controlled by an identifiable group and not privately owned or managed by government; there exists rules concerning who may use the resource, who is excluded from using the resource, and how the resource should be used; community-based resource management systems; common property.
Private property	Right to make exclusive use of the resource is held by an individual person or a firm. Right to exclude others from using the resource is exercised. These rights are recognized and enforced by the state.

In the study area, there are forest lands which are managed by the village community as communal property and plantations and fields for agricultural purpose as private property since land-forest allocation implemented in 1996. Before land-forest allocation scheme implemented in this village forest land was managed by Xieng Ngeun District Agriculture and Forestry Office, the forest land was classified as state property. Agricultural land looked like open access, excluding paddy field which was private property.

2.4. Sustainability in Land and Resources Development

There is widespread divergence in what is meant by sustainability or sustainable development (SD). Ecologists talk about SD in terms of resources and waste management. Economists talk about basic needs, income and well-being. Demographers and biologists talk about carrying capacity. The most popular definition of sustainable development was given by the Brundtland Report which said it is "meeting present needs without reducing the options for further generations" (Mahesh Banskota, 1998).

The definition of sustainability used in this research is: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Pearse, Markandya and Barbier, 1989). It contains two key concepts:

1) The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
2) The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

Sustainable agriculture is a system that 'can evolve indefinitely toward greater human utility, greater efficiency of resource use and a balance with the environment which is favorable to humans and most other species' (Pearse, Markandya and Barbier, 1989).

Sustainable development involves devising a social and economic system which ensures that these goals are sustained, i.e. that real incomes rise, that

educational standards increase, that the health of the nation improves, that the general quality of life is advanced.

We thus define agricultural sustainability as the ability to maintain productivity whether of a field or farm or nation, in the face of stress or shock, where productivity is the output of valued product per unit of resource input.

"Sustainable development", "sustainable growth" and "sustainable use" have been used interchangeably, as if their meanings were the same. They are not. "Sustainable growth" is a contradiction in terms: nothing physical can grow indefinitely. " Sustainable use" is applicable only to renewable resources: it means using them at rates within their capacity for renewal. "Sustainable development" is used in this strategy to mean: improving the quality of human life while living within the carrying capacity of supporting ecosystems".

Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation.

Living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability. Yet many of us live beyond the world's ecological means, for instance in our patterns of energy use. Perceived needs are socially and culturally determine, and sustainable development requires the promotion of values that encourage consumption standards that are within the bounds of the ecological possible and to which all can reasonably aspire.

Economic growth and development obviously involve changes in the physical ecosystem. Every ecosystem everywhere cannot be preserved intact.

The loss of plant and animal species can greatly limit the options of future generations; so sustainable development requires the conservation of plant and animal species.

A pursuit of sustainable development requires a production system that respects the obligation to preserve the ecological base for that development.

2.5 Lessons Learnt from the Research Stations

2.5.1 Upland Rice Improvement

Upland rice is the dominant staple of shifting cultivators, but yields of upland rice have generally been low, less than 1,000 kg/ha. Improving this productivity has been widely believed to be central to the solution to sustainable mountain land use. Thus, increasing the yield of upland rice has been the target of many development projects. However, trying to get highland farmers to "improve" their upland rice production is probably among the most difficulties of agricultural extension efforts. The commonly held belief that fertilizers are not used because they are not cost-effective has been proved with an economic analysis. Although the relative importance of upland rice to the overall productivity of the farming system has declined, many farmers still grow some upland rice in order to provide a degree of food security, even if only to provide 1-2 months supply.

Farmers' appreciation of the residual values of cash crops is now often highly developed. Job's tear and corn are commonly believed to be good for the yield of the upland rice that succeeds them. But most of research try to use agro-forestry techniques to improve soil degradation and increase productivity.

2.5.2 Land Development

To sustain the land quality for providing good productivity, concept of watershed management and soil and water conservation techniques should be used. The five classes of watershed management system (WSC) are differentiated as follows:

WSC1: Protected or conservation forest and headwater source

Protected forest areas that include the headwaters of rivers. These areas are usually at high elevations, have very steep slopes and should remain under permanent forest cover.

WSC2: Production forest

Production and/or commercial forests with soil and water conservation restrictions are usually at high elevations with steep to very steep slopes. Landforms usually result in less erosion than WSC1. The areas may be used for grazing or crop production if accompanied by strict soil protection measures.

WSC3: Agro-forestry

This class includes uplands with steep slopes and less erosive landforms. Areas may be used for commercial forests, grazing, combinations of trees and agricultural crops; and application of appropriate soil conservation measures is required.

WSC4: Upland farming

This class is gentle sloping land suitable for row crops, fruit trees, and grazing with moderate need for soil conservation measures.

WSC5: Lowland farming

This class includes gentle slopes or flat areas suitable for paddy rice cultivation or other agricultural uses with few restrictions.

Table 2.4 below shows the criteria for watershed and slope classification used in Thailand (especially in Huay Hong Krai Project)

Table 2.4 Criteria for Watershed and Slope Classification

Watershed Classification	Code (WSC)	Slope (%)
Protected or Conservation Forest and Headwater Source	1	>45
Production Forest	2	36 – 45
Agro-Forestry	3	26 – 35
Upland Farming	4	13 – 25
Lowland Farming	5	<12

With this above criteria, they recommended to use WSC3 and WSC4 with careful Soil and Water Conservation System, particularly Vegetation Method (see Appendix 2).

2.6 Reviews of Related Studies

In the report entitled "Slash and Burn Agriculture: the Continuing Dilemma" John Evenson from the Nabong Agriculture College Project in Laos reviewed the present state of knowledge on land-use particularly shifting cultivation through a global perspective, emphasizing some particular aspects with direct implications for Laos. Essentially based on the recent annotated bibliography on shifting cultivation and alternatives by Robinson and Mc Kean (CAB/CIAT, 1992), the report includes the following conclusions: agro-forestry is not alternative solution to shifting cultivation supported by many published examples of success; the few successful examples of intensification involving a change to mechanization have occurred on better quality soils; successful intensification usually only occurs in areas close to markets; agricultural development has tended to move first into full tillage systems before minimum tillage is considered; more work needs to be done on mulching and green manure crops practices; more work is needed in farmer participation; more work is needed on the availability of suitable plant species and more work is needed on the integration of livestock. It is not agreed only that agro-forestry is not an alternative solution to shifting cultivation, contradiction to my experience worked with the FAO/UNDP project "Forest Development and Watershed Management in Northern Laos" from 1982 to 1989. It is clear that farmers seem to agree on the fact that continuation of the traditional shifting cultivation practices in the area will cause further decrease of forest cover, increased soil erosion and deteriorating living conditions. Although, the situation and responses in the villages were somewhat different, most farmers showed the terracing system as introduced by the project was largely unsuccessful as farmers could not sufficiently involved in the process of deciding whether terraces are needed and in the affirmative which type. The farmers often replied that the type of terraces provided did not match their specific requirements. Moreover, weed infestation is a serious problem on these terraces. The agro-forestry system techniques could be more suited and easily accepted by the Khamu farmers.