Forages for Smallholders Project

A Proposal for:

Australian International Development Assistance Bureau (AIDAB)

Project Administrator:

CIAT

Centro Internacional de Agricultura Tropical
Cali, Colombia

Project Managers:

Tropical Forages Program
CIAT, Cali, Colombia

Division of Tropical Crops and Pastures
CSIRO, Brisbane, Australia

April 1994

Centro Internacional de Agricultura Tropical CIAT

PDO-L155

April 27, 1994

Mr. Keith England
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Southeast Asia Regional Program
AIDAB
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Dear Mr England

We submit a Draft Project Design Document for Phase II of the Forages for Smallholders Project for consideration by AIDAB. In doing so we wish to acknowledge the generous assistance of AIDAB to CIAT and CSIRO in funding Phase I of the Project.

CIAT has made a firm commitment to the improvement of forage genetic resources for farming systems in Southeast Asia by giving strong support to the first phase of the project and in seeking out and appointing an Australian scientist with outstanding experience of forage research and development and of the national institutions in the region.

Likewise our partner in the Project, the CSIRO Tropical Forage Genetic Resources Centre, has a long history of supporting other Australian Forage and Livestock Projects in Southeast Asia with the supply of forage germplasm and has staff with long experience in the region.

Phase II of the Project will build on the foundation laid in Phase I but with greater attention to technology transfer and the use of forages in contributing to more sustainable farming systems in the upland agricultural and forestry areas. Emphasis will also be placed on close liaison with other national and donor projects to achieve a flow-on and thus multiplier effect.

We look forward to your response to this proposal.

Yours sincerely

W. R. Scowcroft

Dr. W. R. SCOWCROFT
Deputy Director General–Research

Attachment

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DRAFT

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Acronyms

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AIDAB	Australian International Development Assistance Bureau
AMLC	Australian Meat and Livestock Corporation
ATFGRC	Australian Tropical Forages Genetic Resource Centre
CIAT	Centro Internacional de Agricultura Tropical
CSIRO	Division of Tropical Crops and Pastures Commonwealth Scientific and Industrial Research Organisation
DAST	Department of Agricultural Science and Technology, a unit of MAFI, Vietnam
DGLS	Directorate General of Livestock Services, Ministry of Agriculture, Indonesia
DLD	Department of Livestock Development, Thailand
DLVS	Department of Livestock and Veterinary Services, Lao PDR
FAO	Food and Agriculture Organisation
FSP	Phase I - Forage Seeds Project 1992-1994 Phase II - Forage for Smallholders Project 1995-1999
IFAD	International Fund for Agricultural Development
IRRI	International Rice Research Institute
MAF	Ministry of Agriculture and Forestry, Lao PDR
MAFI	Ministry of Agriculture and Food Industry, Vietnam
MARDI	Malaysian Agricultural Research and Development Institute
PCARRD	Philippines Council for Agriculture, Forestry and Natural Resources Research and Development
PPAEP	Pilot Provincial Agricultural Extension Project (a Philippines-Australia bilateral aid Project)
RG	Recipient Government
SCATU	South China Academy of Tropical Crops

Executive Summary

Background

Forages can be used for multiple purposes in agricultural systems. Though they are mostly thought of as a feed for livestock they also are important in natural resource management. Legumes and grasses can play a significant role in soil improvement and as ground covers and barriers for erosion and weed control. An important outcome of a pre-feasibility visit to Recipient Government (RG) countries was a desire expressed by both donor and national organisations to integrate forages into smallholder farming systems in order to create a more sustainable system of land management. Foresters spoke of the use of legumes for ground cover and weed control; agronomists to improve the fallow in shifting cultivation systems; both saw controlled livestock development as a useful form of farm diversification. It was also a general consensus that farmers would not adopt soil conservation measures without seeing some cash benefit. Livestock offer this possibility.

Ruminant livestock are an important component in most agricultural systems of Southeast Asia as draught animals and as a source of wealth and cash generation. Up to 50% of the cash income of smallholder households in some areas is from the sale of livestock. The main limitation to increased ruminant production is the lack of and poor quality of feed. There are limited areas for natural grazing land but there is opportunity to increase the amount and quality of feed within farming systems, e.g. to improve the fallow in sedentary and shifting upland agriculture, to develop improved forage-forestry systems, and to supplement crop residues with shrub legumes.

Phase I of the Project concentrated on introduction of species, in particular, for the more acid infertile soils of the region. Phase II will promote the evaluation and adoption of these newly introduced species by farmers into farming systems and extend activities to Lao PDR and Vietnam.

Project description

The goal of the Forages for Smallholders Project (FSP) is to increase agricultural productivity and soil sustainability on smallholder farms in Southeast Asia. The Project's purpose is to increase the availability of adapted forages and the capacity to deliver them to appropriate farming systems, in particular, agroforestry and other upland systems.

The objectives to achieve this are:

(i) to identify forages for different ecoregions in agroforestry, upland cropping and plantation systems,

(ii) to integrate forages into these different farming systems through participatory research and development (R&D),

(iii) to increase the capability of national staff through training and

(iv) to improve the effectiveness of the regional R&D activities through networking.

This will be achieved with inputs of a) experts with experience in forage agronomy and technology transfer supported by two organisations, CIAT and CSIRO, who hold large collections of tropical forage germplasm and who are world leaders in tropical forage agronomy; b) consultants with expertise in participatory R&D and multiplication of forages; c) training of Recipient Government (RG) scientists in forage agronomy and participatory research and d) collaborative R&D activities through a regional network.

Phase II of the project will build on the foundation established in Phase I which operated in Indonesia, Malaysia, Philippines and Thailand. Phase I achieved success in identifying adapted forage species, commencing to evaluate these with farmers and providing short-term training. Phase II will operate in seven countries with the main inputs going into Lao and Vietnam, Philippines and Indonesia, Thailand and Malaysia and South China in that order. The cost will be AU$4.3 millon spread over five years. A five year time frame is proposed because of the successive steps and magnitude of training in new methodology that need to be undertaken in order to ensure adoption of not only new forages but new forage systems.

Project analysis

Key issues affecting viability and sustainability of the project are achieving a suitable delivery system for new forages and forage systems and availability of trained personnel. The problems in transferring technology will vary between farming systems but will be related to the appropriateness of the technology, the methodology employed, the availability of seed or vegetative material and the tradition with respect to the use of forages and socioeconomic aspects of animal husbandry. It is considered that use of recent developments in participation of farmers in the R&D process as opposed to traditional demonstration and information delivery extension methods will play a key role. Further, by networking the R&D process it will be possible to share positive experiences between participants.

Organisations currently working in the area of resource management are creating a demand for forage legumes as a component of a sustainable farming systems in upland areas, e.g. in the development of agroforestry systems and in reforestation. Further, livestock development is now being given high priority by most governments in Southeast Asia. Indonesia, Thailand, Lao, Philippines and Vietnam are now self-sufficient in rice production and hence more resources are put into other sectors. Livestock is one of the main exports of Lao.

Project impact

The main target group is smallholder farmers in upland and forest areas where grasses and legumes can be used to stabilise soils and livestock are used for draught and cash income. In forested land in remote areas, livestock provide the only ready source of cash income due to difficulties in marketing perishable farm products. Increasing feed availability and feed value will allow greater productivity of livestock through stronger animals, more rapid turn-off and increased numbers. An increase in soil fertility and a reduction in erosion will result in increased crop yields and less time spent on weeding and feed gathering.

This increased productivity has the potential for a major increase in wealth at the household level and an impact on the balance of trade at the national level.

National institutions will benefit from the increase in personnel trained in forage agronomy and participatory research. It is likely that the project will also have an impact on integration of disciplines in other sectors.

Economic and financial analysis

The Project will not generate the need for large capital expenditure. There will be no recurrent costs at the end of the Project.

The project could have a considerable impact on the established Australian livestock trade with Southeast Asia. There are many recent instances of the inability of local farmers to cope with cattle imports because of the lack of provision for feed for them. Cattle have been returned by farmers in some instances and in others there has been death of stock through lack of feed.

The economic contribution to Southeast Asia will be more productive and sustainable agricultural systems.

Cross sector issues

There is expected to be a considerable benefit to natural resource management which will result in improved soil fertility, reduced erosion, fewer weeds and increased diversity of land use as agroforestry and livestock-forestry based systems are developed.

The project is gender neutral in the sense that whole households will benefit from an increase in wealth. Women and children are likely to benefit from a reduced input into gathering of feed for animals and reduced weeding in upland crops.

The project is aimed at improving the welfare of the poorest people in the agricultural sector. In particular, this applies to those in the upland partially forested areas, many of whom are ethnic minorities.

1. INTRODUCTION

1.1 Project origin

1.1.1 Recipient government request

The Regional Forage Seeds (FSP) project was set up as a result of a resolution by a regional meeting of government representatives from Malaysia, Thailand, Philippines, China and Sri Lanka requesting a Southeast Asian Forage and Pasture R&D network be set up under the auspices of CIAT and CSIRO (CIAT 1989) and the subsequent funding by AIDAB to a joint proposal by CIAT and CSIRO. The FSP commenced in January 1992 and was restricted to operation in Indonesia, Malaysia, Philippines and Thailand due to limited availability of funding. It is funded until December 1994.

In the PID document for Phase I it was anticipated that all activities could not be completed within a three year time frame and a subsequent phase would be necessary, in particular, to emphasise seed production and extension of adapted forages into smallholder systems (AIDAB 1992). In discussions with AIDAB in October 1993, it was suggested that Lao PDR and Vietnam be included in the preparation for Phase II. It was also suggested that a regional project should link activities closely with government and other development agencies in the Recipient Government (RG) countries.

Participants to the second regional meeting of the FSP held in the Philippines in October 1993 gave strong support for the continuation of FSP activities in the region. Other projects (e.g. the AIDAB funded PPAEP in the Philippines), other development agencies (e.g. European Community funded projects in Lao PDR, Philippines and Thailand) and international centers (e.g. IRRI) have also expressed the need for new forage materials, in particular, forage legumes, and strongly support the operation of the project in the region. They suggested the name be changed to the 'Forages for Smallholders Project' in Phase II.

Letters of support for a second phase of the FSP have been received from senior government officials in Indonesia, Lao, Malaysia, Philippines, (South) China, Thailand and Vietnam.

1.1.2 Earlier studies

A proposal to AIDAB to meet the need of forage germplasm introductions to Southeast Asia was made jointly by CIAT and CSIRO in 1990. AIDAB agreed to fund a 'Forage Seeds Project' in 1991 on the basis of a Project Outline. This was followed up by a visit to Indonesia, Malaysia, Philippines and Thailand by Program Leaders of CIAT and CSIRO in August 1991. Formal commencement of the Project was in January 1992 and the final draft of the PID was submitted in October 1992.

Phase I of the FSP has had success in identifying productive new forage species for different

farming systems in the four participating countries within the first two years of operation (FSP Six-monthly Reports, FSP Annual Plan 1994-95). Some of these have been multiplied and are being used by smallholders.

However, further regional evaluation is required of species introduced for the first time to the region, in particular, to appraise them in upland farming systems (both sedentary and shifting agriculture), for reclamation of degraded lands, in the development of agroforestry systems, and in the improvement of derived and natural grazing lands. It has become clear that participation of farmers in the evaluation and development process assures relevance and greater chance of adoption.

1.2 Preparation steps

1.2.1 Summary of special features

Phase I of the FSP aimed to increase feed availability for livestock within the present farming systems. Livestock are used primarily in Southeast Asia for draft and as a source of wealth. They are often a more important source of cash for a household than the subsistence food crops. The main factor limiting livestock production is a gross shortage of feed or high quality feed to supplement crop residues. In general, forages must fit into most farming systems as an adjunct to a cropping system - as part of a fallow/ley, border rows or as an associate crop (as in plantation and agroforestry systems) rather than grazed pastures.

Phase II of the FSP proposes to increase the use of improved forages in such farming systems in Southeast Asia by:

Introducing forage as a component of farming systems. Forages can contribute to soil improvement and erosion control as well as increasing livestock productivity through enhanced feed availability. There is opportunity to develop predominantly livestock-forestry systems in upland areas in Lao and Vietnam and in parts of Indonesia and the Philippines. The emphasis will be to use forages to enhance the natural resource base rather than to exploit it.

Using new sources of forage germplasm. The FSP is tapping sources of forage germplasm identified for acid infertile soils of the humid tropics by CIAT and forage germplasm that was selected on the basis of dry season performance by CSIRO. By evaluating forage germplasm from the genetic resource centres of CIAT and CSIRO over a wide range of conditions it will be possible to identify species for different environmental and farming system niches. Species that have very wide adaptation will receive particular attention.

Achieving adoption using participatory research. The FSP aims not only to identify forage germplasm but to achieve adoption of new forage species in Southeast Asia. Farmers will participate in the evaluation of forage species and as such will come to realise the value of forage as a 'crop' that produces benefits but also requires management input. Appropriate systems of multiplication by seed or vegetative cuttings will be developed hand-in-hand with

on-farm research. The project will focus on low-cost input systems.

There has been a considerable effort in evaluation of forages in Southeast Asia during the last 20 years. New species better adapted to the environment and local farming systems than the available commercial Australian cultivars have been identified in many instances. However, due to a lack of suitable seed multiplication technology coupled with on-farm evaluation which might lead to adoption, they were not exploited. Thus development projects continued to rely only on commercial cultivars from Australia some of which are suitable and some are not.

Networking of forage scientists with development projects. The FSP will capitalise on the experience of local forage scientists and examples of the successful integration of forages into farming systems by networking. The FSP will also rely on other development projects within the region to produce a multiplier effect from technology generated within the project.

1.2.2 Project preparation strategy

The present FSP was reviewed internally by Program Leaders from CIAT and CSIRO during a visit from 15 January to 10 February 1994 to the participating countries and Lao and Vietnam, which are also proposed for inclusion in Phase II (Annex 2.1). This draft was then prepared on the basis of:

(i) experience during Phase I of the FSP and

(ii) discussions with government officials and scientists in RG countries.

Their support has been given for the approach presented in this document.

1.2.3 Design options

There are limited options for an alternative design to the one outlined in this document. The present design employs a regional approach. The problems and opportunities are common throughout the region due to similarities in farming systems, though there are differences in climatic zones. A regional approach is both economical of resources and allows for exchange of experience and information between countries. It is not necessary to repeat all work in each country. There is a requirement for the RG's to contribute a reasonable share of resources. It does place a larger responsibility and burden on the manager in that negotiations for agreements and monitoring have to be carried out with each country. A bilateral approach would be more expensive.

The design also blends research and development and involves farmer participation. Opportunity will be taken more widely to implement the technology developed within the FSP in conjunction with other development agencies working in the region. This approach was successful in Phase I. Community development projects have strongly supported the FSP.

This design was developed during Phase I and proved to be successful. However, in Phase II more emphasis will be placed on extension and integration of forages into farming systems rather than research on evaluation.

1.2.4 Suggested appraisal method

Due to the technical nature of the project, appraisal should be carried out by technical personnel familiar with the needs and requirements of agricultural development in the region. If AIDAB does not have this capability at present, ACIAR would be a suitable organisation to appraise the Project.

A desk appraisal is suggested. A field appraisal is not warranted as there is reliable information in reports and the annual plans submitted by the project. An assessment of options was canvassed within a recent study report (Annex 2.1).

2. RATIONALE

2.1 Development opportunities

2.1.1 Description of development problems and opportunities

Tropical legumes and grasses can contribute to sustainability, particularly in upland farming systems. While leguminous cover crops have been used in tree plantations to contribute to soil improvement and weed control they have only been used in upland cropping systems to a limited extent. This reflects the lack of resources devoted to the upland cropping sector compared to the commercial plantation sector. Integrated farming system projects are identifying a similar need and potential in the upland cropping systems. There is now good evidence that forages, in particular legumes, offer a means of improving and stabilising the fallow or ley areas, reducing erosion and controlling weed growth for annual cropping areas. One example is the use of leucaena-based farming systems in Timor and Flores in Eastern Indonesia (Piggin and Parera, 1985) to rejuvenate degraded land through erosion control and soil improvement.

There is an increasing demand for forest products. In Lao, smallholders are being encouraged to plant forest trees for timber while in Vietnam large areas designated as forest are being returned to the care of individual families. Large agroforestry projects are being planned for the Philippines and Indonesia. Livestock offer a short term source of cash income for farmers investing in the long term in forestry development, while the forages themselves will contribute to reduced soil erosion and weed control.

Ruminant livestock are an important part of most smallholder farming systems, including forestry areas, in Southeast Asia and constitute 20-30% of small farm capital (FAO, 1989). They provide draught power, a source of savings, direct cash income and animal products. There is an increasing demand for livestock products due to a desire to improve human nutrition and increasing *per capita* income. However, with the exception of Lao PDR, target countries are net importers of meat, milk and other animal products. Now that food crop targets have been largely met in many countries, governments are giving higher priority to the livestock sector.

The over-riding factor in ruminant livestock productivity is the low amount and low quality of available forage, though incidence of diseases may also restrict production and marketing. Credit is now provided for cattle and buffalo purchase in some countries but often without the foresight of ensuring adequate feed for more livestock. Feed availability is the most common restriction to an increase in herd size (Anon 1975).

There is adequate evidence to show that forages introduced to Southeast Asia have resulted in increases in crop and animal production. Elephant, king and guinea grasses are used widely for intensive 'cut and carry' systems in the region. Introduced legumes have contributed to soil productivity and sustainability. In eastern Indonesia, the adoption of leucaena-based systems

of terracing and live fallow/ley have allowed the replacement of shifting agriculture with stable sedentary systems (Piggin and Parera, 1985). Introductions of stylos to China from Australia and CIAT have been successful both as green manures in orchards and as a source of processed feed for pigs and poultry.

The most productive tropical grasses have come from Africa and legumes from tropical America and are largely held in the Genetic Resource Centers of CIAT and CSIRO. Species native to Southeast Asia have had little commercial impact either in the less or the more developed tropical countries. However, the available introduced grasses and legumes in Southeast Asia are not suitable for the more acid infertile soils, for short term rotations in cropping systems for some dry season environments. There are now better accessions of some of the earlier introduced species because of greater disease resistance and higher feed quality.

Recipient countries differ substantially in their forage R&D capability which in part reflects their stage of development and in part the previous levels of assistance in development of forage agronomy. There is considerable capability in Malaysia and Thailand and in parts of China, Indonesia and the Philippines and at present a low capability in Lao and Vietnam. Through regional networking of R&D and in communicating this information, scientists from the more developed countries in the region can assist those in the less developed countries. A regional program can best allocate inputs where they are required and coordinate information-sharing between countries.

In all target countries the governments are actively promoting the cessation of shifting agriculture and adoption of sedentary forms or replacement. Viable alternatives have not been worked out. Crop-livestock and agroforestry systems incorporating livestock are attractive and potentially sustainable alternatives.

One problem is that many smallholders do not consider forage for livestock to be as important as their subsistence food crops even though livestock may make a large contribution to household income. New participatory research methodology offers a means of involving a farmer in the evaluation process and thus ensuring ownership of the results, the adoption of forages and their incorporation into farming systems.

Another deficiency has been that livestock departments, in which forage activities usually are located, often only target the livestock component of a farming system. Coordination of activities of all agricultural sectors at the Provincial and District levels is now occurring and should circumvent this shortcoming.

The FSP has a great opportunity to maximise its impact through collaboration with on-going projects. Many of these projects, both externally and internally funded, are seeking adopted forage materials for use in farming systems development. A list of these projects is presented in Table 1.

2.1.2 Target groups

Smallholder households are the main target groups for the FSP. Many of these are located in upland areas where there is little opportunity for off-farm employment. They are being pressured to reduce shifting cultivation and associated cropping on steep slopes and to adopt a more sedentary form of agriculture or turn to forestry systems. An agroforestry system with livestock producing cash flow while trees are maturing is one option under evaluation.

Alternative systems must generate immediate cash income for necessities such as clothing and school requisites for children. Conditions vary in the different countries but overall women and children will be major beneficiaries of any cash generated.

Other target groups are government research and extension staff who will be trained in forage agronomy and farmer participatory R&D methodology. Research and extension staff not directly involved in the Project will benefit from information exchange in the proposed forage R&D network.

2.2 Development priority

2.2.1 Recipient government perspective

The Recipient Governments have given strong support for continuation of the FSP (Annex 3.1).
They are now looking to a more sustainable use of upland areas, that is, areas not used for lowland rainfed or irrigated rice production. Most these areas are utilised under a sedentary or shifting form of agriculture which provides only subsistence living. The land is also degrading and a clean and constant supply of water for hydro-electricity generation and irrigation is under threat.
There is a policy to reduce shifting cultivation but alternative productive and stable technologies have not been devised. Agroforestry systems which use legumes and grasses to stabilise slopes and regenerate soil fertility are being considered by governments and donor agencies. There is both a lack of adapted species for such purposes and a lack of suitable methods of introducing them to farmers have not been employed. Farmers are unlikely to adopt these conservation measures unless they are profitable. Livestock can provide a visible cash benefit from the introduction of legumes and grasses, one that is much more obvious than the slow improvement of soil productivity.

Governments are now prepared to put resources into both natural resource management and livestock development in the target countries. In Indonesia, Philippines, Thailand and Vietnam, where rice production targets have been met, there is now focus on livestock industries to reduce imports of livestock products and the use of tree and herbaceous legumes for soil improvement. In Lao, the value of cattle and buffalo export ranks third behind timber and electricity. The government sees livestock development as contributing to export earnings, increasing the income of smallholders and as a component of a more sustainable agricultural

system in upland areas. An agroforestry system with grazing livestock in young teak plantations is being developed. In southern China, tropical forage legumes are being used to improve soil in orchards and as rations for pig production. In Malaysia, ruminant livestock production is seen as complementary to perennial tree crops. There is thus opportunity to introduce forage as a commercially viable component in these farming systems.

2.2.2 Australian country program perspective

In general, the Australian country programs include areas that support the development of more sustainable land resources in addition to direct contributions to agriculture.

In Indonesia, the FSP will complement Australian program input into the development of the livestock industries in the Eastern Provinces of Indonesia. It will also utilize the outputs of previous forage development projects funded by ACIAR and AIDAB.

In Lao, the FSP would be seen as complementary to the present Upland Project financed by a World Bank/AIDAB/CIRAD (Centre de Cooperation internationale en Recherche Agronomique pour le Developpement) consortium where the community development component involves livestock development activities. The FSP also builds on a previous Livestock Development Project funded by AIDAB.

In Malaysia and Thailand, AIDAB is discontinuing direct development grants. However, there has been considerable support in the past and Australia is now benefiting from the export of cattle and associated inputs to these countries. Some continued input into development of improved forages and monitoring of the feed situation will be of commercial benefit to Australia. In addition, these countries can now contribute to other countries in the region by way of technical and financial input. Personnel from Malaysia and Thailand are prominent in the FAO Working Group on Forages in Southeast Asia.

In the Philippines, the first phase of the FSP has closely supported the work of the AIDAB funded PPAEP project that operates in Bicol and Mindanao and will continue to do so in the second phase.

In South China, AIDAB assistance is presently concentrated in commercial situations, in the northern and western Provinces and in poverty reduction. However, support on forage development to the southern Provinces has been given in the past (e.g. in Hainan and Guangdong) and currently students from these Provinces are being supported in Australia. It will be of benefit to include China in the Network arrangement from the point of view of contributing some professional input to programs in China. In addition there is an opportunity for China to share its forage technology with other countries in the region.

In Vietnam, AIDAB have recently had their mandate expanded to include resource development and have been approached by other agencies to contribute in this area. The FSP is particularly relevant to such issues as the development of sustainable agricultural systems in the 'forest lands', the 'unused lands', (upland areas which were not incorporated previously in the main sector programs) and to rehabilitation of degraded lands.

Environmental issues. Tropical forages contribute to a more sustainable agricultural system through soil improvement, reduction of erosion and weed control. Thus the Lao-IRRI program on upland rice systems, which is strongly supported by the Lao Government, is placing a major emphasis on identification and incorporation of legumes into the upland cropping system. In Lao the fallow phase in shifting cultivation is largely Siam weed which has no commercial use. This program is strongly supported by the Lao government. No forests will be cleared for planting pasture in activities associated with the FSP. The combination of pastures with tree planting will facilitate re-afforestation in degraded areas. This development is already underway in the Philippines and Lao using forages introduced into the region through the FSP.

This Project addresses several of the issues raised in Agenda 21 at the United Nations Conference on Environment and Development, Rio de Janeiro 1992, namely, Promoting Sustainable Agriculture and Rural Development, Strengthening the Role of Farmers and Science for Sustainable Development.

Gender Issues. Participants and trainees will be selected on merit. However, gender equity will be promoted. The higher quality of improved forages will result in reduced workloads of women and children involved in the 'cut & carry' of feed for animals. Promotion of tethered animal systems will also reduce the work load.

Introduction of smallholder seed supply systems will add to cash income for the whole household. In some cases, there is the possibility of organising this through women's groups. In Vietnam, the Women's Committees have a large influence in the village councils on decision making.

In summary, there is no possibility of untoward detriment to either gender by the introduction of improved forages.

Poverty issues. The introduction of forages is aimed at increasing the welfare of smallholder families, particularly in upland systems where poverty is most pronounced. Forage seed production schemes offer a means of increasing the wealth of farm households. For example, in the Philippines smallholders are now producing seed of a new forage legume identified by the FSP and selling it to a reforestation project for use as a soil cover.

2.2.3 Australia, CSIRO and CIAT's capacity to cooperate

Australia has developed a high degree of expertise and experience in tropical forage R&D which can benefit livestock production and mixed farming systems in other tropical countries in the region. This expertise exists within CSIRO, the State Departments of Primary Industries and the Universities. Further, the Australian Tropical Forage Genetic Resource Center within the CSIRO Division of Tropical Crops and Pastures holds one of the largest collections of tropical forage germplasm and interacts with researchers throughout the tropical and subtropical world.

Likewise CIAT has a strong forage R&D Program and maintains a similarly large collection of tropical forage germplasm. CIAT has a mandate within the Consultative Group on International Agricultural Research (CGIAR) system for developing and maintaining forage genetic resources for the tropics, in particular for the more acid and infertile soils of the humid and sub-humid tropics. Thus, to a large degree, the two forage genetic resource collections complement one another, the CSIRO collection having concentrated on development for tropical and sub-tropical areas with an extended dry season. The germplasm collections of both organisations are supported by databases which can be used in identifying appropriate forage accessions for testing in different environments. Australia strongly supports the CGIAR system through direct core grants and funding special projects.

CIAT has experts with Asian experience in forage agronomy, in participatory research and gender issues, in social anthropology, in preparation of extension materials in Asian languages and in project management. Some relevant project experience sheets are included in Annex 4.1.

Further, there has been a long association of RG forage R&D workers in Southeast Asia with Australia through training and involvement in collaborative projects. A large proportion of the commercial forage seed used in Southeast Asia has been produced in Australia. Currently, the FSP, funded by AIDAB, is making substantial advances in demonstrating the potential for pasture development in the Philippines, Indonesia, Malaysia and Thailand. This Project has also been successful in getting seed of promising herbage species out to smallholder farmers, who are benefiting from the research.

2.2.4 Opportunities for mutual advantage

The proposed project will be of mutual benefit to Australia and the target countries in the Southeast Asian region through provision of improved forage for ruminant livestock. RG countries have been distributing cattle to smallholders through government and special projects. Australia has benefited through the development of a significant live cattle export trade to the region, with c. 160,000 head exported from Australia in 1992. A serious shortcoming in this exercise has been the distribution of livestock without adequate provision for the extra feed required. It is considered such an important issue by both the RG's and Australian industry that the Australian Meat and Livestock Corporation has officers or representatives stationed in the Philippines and Thailand to monitor the situation. Thus the livestock industries in both the donor and RG countries stand to benefit.

Experience gained in evaluating forages in the region will contribute to a greater understanding of the genetic attributes and adaptation characteristics of particular forage accessions and genotypes. Through the development of such knowledge and understanding there is potential for development of elite cultivars for target areas in both Australia and Southeast Asia.

The activities of the FSP will lead to close interaction between scientists in Southeast Asia and CIAT and CSIRO which will improve future communication and collaborative endeavours.

The Project will have a high Australian profile and content which will benefit Australia's image in the region. It is recognised by other donor agencies as meeting a real need in the region. Likewise the RG's will benefit from the projection of their culture and interests through popular reports in the Australian media.

2.3 Related Programs

Recipient government programs, donors active in the sector, and linkages to these programs and sectors are shown in Table 1. Additional information is given in the study report (Annex 2.1).

Table 1. Programs related to the FSP

Country	Program	RG/ Donor	Status	Linkages
Indonesia	Smallholder livestock development	IFAD	Begin 1995	Information exchange
	Forages under plantation crops	ACIAR	Finish 1994	Information exchange
	Integrated development project for smallholders	RG	Begin 1995	Collaboration
	Upland rice systems	RG/IRRI	Continuing	Collaboration
Lao PDR	Upland project	World Bank/AIDAB/CIRAD	Continuing	Supply of forages for community development activities
	Forestry cooperation	SIDA	Continuing	Collaboration in supply and evaluation of forages
	Lao-EC cooperation	EC	Continuing	" "
	Lao-IRRI	SDC	Continuing	Collaboration in introduction of forages into rice-based farming systems
	Smallholder livestock development	IFAD	Continuing	Collaboration in/open grassland improvement
	Forage evaluation	FAO	1994	Coordinate activities
Malaysia	Forages under plantation crops	ACIAR	Finish 1994	Information exchange
Philippines	Pilot provincial agricultural extension project	AIDAB	Finish 1996	Collaboration in extension of forages into smallholder systems and seed production
	Integrated rainforest management	GTZ	Continuing	Supply of adapted forages
	Bukidnon Forest Inc.	NZ	Continuing	Supply of adapted forage legumes
	Southern Mindanao Area	EC	Continuing	Supply of adapted forages and seed production
	Integrated farming systems -Matalom	IDRC/IRRI/FARMI	Continuing	Collaborative research on role of forages in upland systems
	Sustainable cropping systems	ACIAR/SEARCA	Continuing	Supply of adapted forages and information exchange
	Cattle distribution	Philippine Land Bank	Continuing	Supply of information and adapted forages
	Livestock development	ADB	Continuing	Information exchange
South China	Forage evaluation	SCATC	Continuing	Supply of forages and information exchange
Thailand	Greening NE Thailand	RG	Continuing	Supply of forage species and information exchange
	Monitoring livestock distribution	AUSTREX/AMLC	Continuing	Information exchange
Vietnam	Evaluation of fodder shrubs	ACIAR	Proposed	Collaboration
	Development of 'forest' land	SIDA	Continuing	Work in association
	Improvement of 'unused' land	Univ of Hanoi	Continuing	Contact institution and methodology

EC = European Community; GTZ = German Agency for Technical Cooperation; FARMI = Farm and Resource Management Institute;IDRC = International Development Research Corporation;SDC = Swiss Development Corporation; SEARCA = Southeast Asian Regional Centre for Agriculture; SIDA = Swedish International Development Assistance;For other acronyms see ABBREVIATIONS list.

2.4 Constraints, strategy and options

2.4.1 Constraints to development

Some forage introduction and evaluation has occurred in all countries but the use of improved forages by smallholders has been variable and usually low. Seven main areas of constraint have been identified and categorised as to those in which the project can have some impact:

Considerable impact

(i) *Availability of germplasm* for
- (a) infertile acid soils
- (b) tolerance of specific diseases and pests
- (c) dry season environments
- (d) forestry and agroforestry agricultural systems

(ii) *Delivery systems* for adapted forages.

Poorly developed delivery systems may be due to:
- (a) inappropriate technology for smallholder farmers,
- (b) inadequate seed or vegetative multiplication systems,
- (c) lack of an effective transfer technology,
- (d) no tradition of forages as a farm crop and
- (e) poor control of grazing animals.

(iii) *Availability of trained personnel for R&D.*

(a) There are insufficient technicians trained in forage agronomy and familiar with new extension methodology.

(b) Due to shortage of people, the trained staff may be moved or promoted to administrative posts.

(iv) *Effective communication*
- (a) between R&D workers in different sectors within countries and
- (b) between R&D workers within the region

Moderate impact

(v) *Poor integration of improved forage technology with other sector inputs.*

Within the region, R&D on forages is usually carried out within a livestock department with the focus primarily on livestock which are only one component of a farming system. Thus generation of new technology and its transfer may not take account of inputs from other sectors.

Little impact

(vi) *Government priorities and organisation*

In the past, governments in Southeast Asia have been primarily concerned with production of food grains and crops with an export potential. They now state that more attention will be given to livestock and forestry but the FSP will have little ability to influence that this actually does happen.

(vii) *Availability of financial resources*

Farmers often do not have finance or available sources of credit. When credit is available, it is often only given for purchase of animals and not for provision of forage.

The major specific constraints in the RG countries are:

Indonesia

Lack of an effective transfer technology and seed, inadequate germplasm, poor integration of improved forage technology with other sector inputs, training, communication between forage scientists in-country and government policy have all been constraints to forage adoption in one or other part of Indonesia.

Lao PDR

Lack of appropriate germplasm, lack of a tradition of forage as a crop, no tradition of forages as a farm crop, poor control of animals, lack of financial resources, shortage of trained personnel and poor integration of forage technology are the main constraints to adoption of forages in Lao.

Malaysia

Government priorities, alternative land use opportunities, lack of seed and ineffective transfer technology appear to be the main constraints to more widespread adoption of forages by smallholders in Malaysia.

Philippines

Lack of an effective transfer technology, poor integration of improved forage technology with other sector inputs and a lack of adapted germplasm for some soils are the main constraints in the Philippines.

South China

Forage adoption appears to be widespread. The main constraint to further development appears to be adequate germplasm for some situations, a still developing research base and limited interaction with other forage scientists.

Thailand

Poor execution of government policy, lack of communication between in-country forage scientists and poor integration of forage technology with other sector inputs appear to be the

main constraints in Thailand.

Vietnam
Government priorities and poor coordination of resources, lack of trained personnel in forage agronomy and technology transfer, lack of financial resources, poor internal and external communication and inadequate germplasm are the main constraints to forage development in Vietnam.

2.4.2 Key aspects of project strategy

The main focus of the FSP will be on those constraints where it is most likely to have impact, i.e. provision of suitable forages and their delivery to farmers, training and creating more effective information flow. The focus on identifying and delivery of forages will be at a farm level, whereas training and communication will have both a national and regional focus.

The FSP will concentrate its activities on a limited number of sites within each country. Widespread impact will be achieved through interaction with other development projects which are looking for the experience and expertise that is being created by the FSP.

The strategy to overcome constraints on which the FSP can make some impact is outlined below.

Constraints where a considerable impact can be made:

(i) *Inadequate germplasm*

Removal of this constraint was the main focus of the first phase of the FSP. The project has already identified appropriate germplasm to overcome some of the deficiencies of existing forages. Much of this came from CIAT and was not previously available in the region.

Some continuing input into introduction and evaluation of germplasm for different agroecosystems will be needed for:

- Lao and Vietnam which were not included in Phase I,
- farming systems where there is a need for more appropriate forage species e.g. for the fallow land in shifting cultivation areas, agroforestry and forestry,
- New material that becomes available from forage improvement programs elsewhere e.g. with *Leucaena* and *Arachis,*

In Lao consideration also needs to be given to a better appreciation of native grassland species in relation to improved species.

Promising species need to be increased or multiplied to make them available for larger scale evaluation with farmers.

(ii) *Poor delivery systems for adapted forages.*

The focus of Phase II will be to extend these improved forages into smallholder farming systems.

The need for appropriate technology will be handled by early evaluation of new forages on-farm with farmer participation. This will ensure that only appropriate inputs are used and that problems facing the farmer such as weed competition are considered. This approach will complement the use of Rapid Rural Appraisal (RRA) and experience of the FSP staff.

Forage development will mainly be considered as an additional or complementary form of land use, e.g. use of forages under tree crops or introduction of forages into the fallow/ley phase. Government policy to reduce rice production in upland areas will open up new possibilities for the use of forages in agroforestry systems. Farmers in the project areas will be encouraged to experiment with resource allocation.

Attention will be given to training technicians in the need to be aware of farmer needs and capabilities and how they can contribute to the research process. In some cases, demonstrations will be used to illustrate the value of improved forages to farmers. This can still be done on-farm with farmer participation but with some guarantee that income is not foregone.

There are many examples in Southeast Asia where farmers have come to accept forages as a farm crop that requires some inputs and management including the control of grazing animals. It will be valuable to take RG staff to view some of these examples.

High cattle prices provide the necessary economic incentive for change. Once farmers realise the value of improved forages and forage management they will be prepared to implement new practices such as control of cattle.

The FSP will concentrate its attention on on-farm evaluation and adoption to limited geographical areas or districts that represent a major land use system in the region. A multiplier effect will be ensured by linkage to other development projects.

(iii) *Shortage of trained personnel*

Personnel working with the FSP need to have had or to be trained in principles of forage agronomy, agroforestry and farmer participatory research. Training in forage agronomy will include the practical aspects of establishment and management of forage and also seed production and storage technology. Training in participatory research methodology will include development of local training materials.

Training will comprise in-country training working with FSP staff, short-term training of key personnel overseas, use of these persons to assist in-country training of other local staff, and provision of relevant literature in the local languages.

The Project will also ensure that persons sent for training are mutually acceptable to the FSP and RG and remain with it for the duration of the project.

(iv) *Communication*

There are good examples of adoption of appropriate forage technology by smallholders in certain parts of the region. Many forage workers are not aware of such examples because of poor and ineffective communication of results which are often not appropriate for scientific publications.

Likewise it is important to share experience of problems and approaches to solving these. The shortage of trained workers can be overcome to some extent also by those with more experience coming together with those who have had less experience. Regional meetings of those involved in the project will allow good interaction to develop between them. Such communication will reduce the extent of R&D that needs to be carried out within each country.

Together this suggests that there is good reason to form a formal regional network for all forage workers in Southeast Asia. A major FSP input would be coordination and production of a newsletter. A regional newsletter will keep persons informed of activities and new developments and facilitate informal exchange between forage R&D workers in the region. Additional funding sources would be sought to support major activities of this network.

There is also a need to facilitate communication of new ideas with farmers through field days, development of visual aids, and close interaction with development projects. In addition to a regional newsletter for forage R&D workers, an information news sheet will be prepared and sent to government organisations, donor and development agencies and projects operating within the region.

Constraints where a moderate impact can be made:

(v) *Poor integration of improved forage technology* with other sector inputs.

This constraint will be approached by deliberately associating the inputs from the FSP with integrated development projects supported directly by the national governments or other funding agencies. Forestry and agroforestry development projects will be targeted.

Constraints where little impact can be made:

(vi) *Government priorities and organisation*

There will be some opportunity to influence government policy on livestock development, in particular, the need to make provision for feed in cattle distribution schemes. This can take place at district, province and central government levels. The annual regional meeting would provide an opportunity for a open forum to present and discuss ideas. Project areas will serve

as a focus and demonstration for other areas in the country.

(vii) *Shortage of financial resources*

Suggestions can be made for opportunities for investment in forage development at the province level. It is at this level that coordination and allocation of funds takes place. Such ideas can be reinforced in discussions with central government officials.

Finally, all these constraints can be addressed through formal education. Opportunity will be taken to interact with agricultural college staff and students through visits to project areas, involvement in project activities by way of training and occasional lectures. AIDAB support will be sought to further the education of key RG personnel through post-graduate training once the Project is well established.

2.4.3 Commentary on the pace of implementation

The experience from Phase I shows that there has been significant progress in identifying adapted forages for different farming systems in Southeast Asia where previously there were constraints. Further, the initial experience in collaborating with integrated development projects suggests that this approach is successful in achieving adoption of forages by smallholder farmers. In particular, this applies where farmers participate in the identification and adoption process.

This participatory approach is more certain to have a lasting effect but is more time consuming than simply having demonstrations and producing extension leaflets. Further, in Phase II, the Project will be starting afresh in two countries, Lao and Vietnam, which lack trained people and supporting infrastructure. It will take time to train staff and develop self-sustaining national programs. From experience in Phase I and an appraisal of other development projects in the area, it is clear that lasting success comes from working within the organisational framework and capacity of the country to assimilate assistance rather than from setting up new structures. Thus a five-year project is proposed on the basis of:

(i) a demonstrated technical and organisational capability in Phase I
(ii) the number of steps needed from introduction to adoption and
(iii) the time it takes to develop and implement new technology using a participatory approach.

2.4.4 Lessons learnt from similar situations

CIAT has had experience in Regional networking in Latin America where a large impact in adoption of forages was achieved by working in collaboration with national programs through the RIEPT (International Network for Tropical Forage Evaluation) forage network. Regional activities such as this are designed to respond to the specific needs and problems of each

country. The type and level of each activity depends on the stage of development of each country's R & D programs. CSIRO has similarly had experience in research on forage evaluation in Southeast Asia and training of forage scientists. Useful forage species have been identified from its collection of forage genetic resources and adopted by livestock farmers.

The experience from Phase I of the FSP is that evaluation is best done under farmer rather than research station conditions and with the emphasis on introducing new forages as a component of existing farming systems. Working within the government framework facilitates access to sites, people and resources.

2.4.5 Key planning assumptions

The various governments are highly supportive of the FSP activities and have indicated continued support for a second phase. Counterpart scientists have been assigned to Phase I of the Project and local funds made available for a portion of the operational expenses. It is anticipated that this support will continue.

Another assumption is that superior varieties capable of overcoming environmental constraints of soil, climate and disease exist in the collections of forage genetic resource centers. Elite varieties have been identified for particular farming situations in Phase I but have not been looked for in others, e.g. the fallow phase in upland crop systems and some degraded forest lands.

It is possible that socioeconomic factors may prevent the changes in farming practices, e.g. controlled grazing of animals, which are necessary for the introduction and management of improved forages. The fact that traditional practices have been replaced in some areas in the region suggests that changes can be made in other areas. For example, the Lao in Thailand now control animals whereas those in the country Lao often do not control them.

2.5 Situation expected at the end of the project

2.5.1 Expected achievements

At the end of Phase II of the FSP it is expected that:

(i) forage varieties will have been identified for an extended range of agroecological zones and farming systems and will have been documented in reports and information booklets.

(ii) farmers in project areas of each of the target countries will have incorporated some of these varieties into agroforestry and upland farming systems and this information will have been communicated to other organisations through field visits and publications.

(iii) seed or vegetative material will have been produced locally by farmers and distributed on

a commercial basis for use by other farmers.

(iv) The use of these forages will have demonstrated the capacity to increase tree, crop and livestock production in the project areas to raise the income of farm households and will have had a positive effect on the welfare of women and children.

(v) That there will be a strong cadre of trained forage technicians in each country who will be able to continue the development of forage technology for smallholder farmers.

(vi) That there will be a functional R&D Forage Network for Southeast Asia for the exchange of information on new forage technology through a newsletter and regional conferences.

(vii) Australian live cattle exports will be well accepted by FSP associated farmers who have the appropriate forage technology to support introduced cattle.

3. PROJECT DESCRIPTION AND IMPLEMENTATION

3.1 Objectives

The **goal** is to increase agricultural productivity and soil sustainability on smallholder farms in Southeast Asia.

The **purpose** of the Project is to contribute to this goal by increasing the availability of adapted forages and the capacity to deliver them to appropriate farming systems, in particular, in agroforestry and other upland systems.

In brief, the **objectives** are:

(i) to increase the availability of forages for different ecoregions and farming systems within the Southeast Asia region,

(ii) to facilitate the integration of forages into smallholder farming systems,

(iii) to increase the capability of local staff in forage agronomy and technology transfer,

(iv) to facilitate and create effective information exchange systems on forage research and development and

(v) to ensure these above objectives are met through efficient project management.

These objectives were determined following discussions with government officials and development agencies in the target countries and take into account the experience obtained in Phase I of the FSP.

The Logframe matrix from which they are derived is shown in Table 2; the work breakdown structure detailing activities is shown in Figure 1. The focus on different agroecosystems and the degree of involvement in the activities will vary from country to country in the region depending on need and capability within each country (Tables 3 and 4). Decisions as to specific activities are seen to be the role of project management.

Table 2

Forages for Smallholders Project

Logical Framework Matrix

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Goal:			
To increase agricultural productivity and soil sustainability on smallholder farms in Southeast Asia	Increased animal production Improved forestry and agroforestry systems Improved crop productivity in ley/fallow systems Reduced erosion in uplands Increased farm disposable income	Government statistics & RRA Government statistics & RRA Government statistics & RRA Less rapid runoff & RRA RRA	That improved forage technology will be simple, cost effective and adopted by smallholders Effective information transfer to smallholders by national extension services is achieved
Purpose:			
To increase the availability of adapted forages and the capacity to deliver them to different farming systems, in particular, agroforestry and other upland systems	New forages introduced to project areas and adopted by farmers New awareness of forages by smallholders Committed and well trained local staff	Inspection of test sites and RRA Adoption as assessed by RRA Reports from Project and RG's	Satisfactory cooperation with RG's and related projects
Outputs:			
Forages available for different ecoregions and farming systems Forages integrated into smallholder farming systems Local staff trained in forage agronomy and technology transfer Information system on forage R&D Efficient project management	Superior forages identified New agroforestry and forage-crop systems adopted by farmers Nos. of local staff trained Effective communication within project region Outputs and activities achieved on schedule	Book of recommendations published and distributed Rapid Rural Appraisal Reports from RG supervisors Newsletters and regional meetings held Six-monthly and Annual Reports	Superior varieties can be sourced in forage genetic resource centers Socioeconomic risk factors that prevent change RG assigns staff Cooperation of RG agencies Adequate funding

Figure 1

Forages for Smallholders Project

Work Breakdown Structure Linking Project Activities to Project Outputs and Components

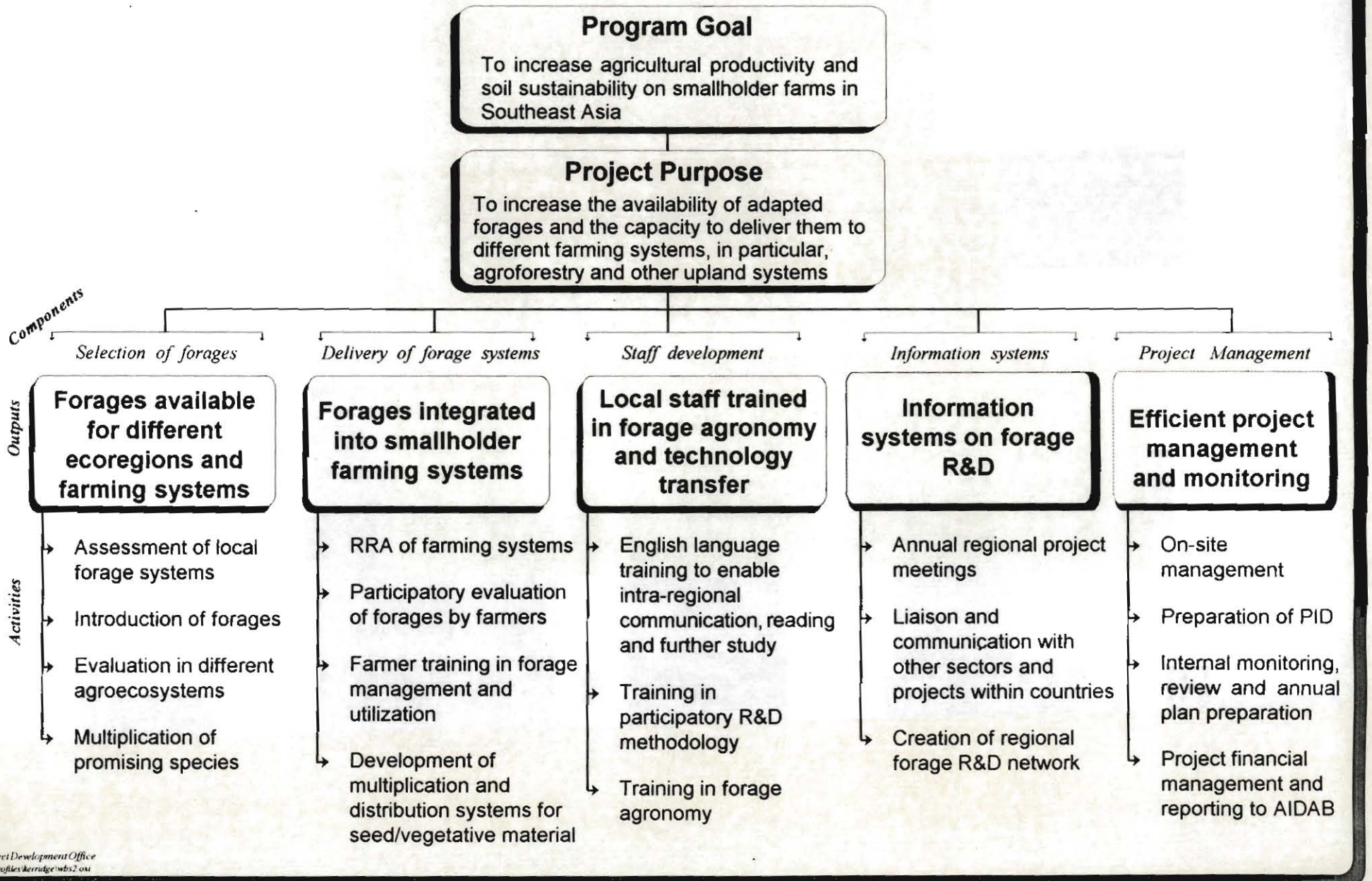


Table 3. Target agroecosystems for introduction of forages

	Indonesia	Lao	Malaysia	Philippines	S.China	Thailand	Vietnam
Agroforestry	***	***		***	**	*	***
Upland cropping systems							
Sedentary	***		*	***	**	***	**
Shifting		***					**
Plantation	**		***	**			**
Natural/ induced grasslands	*	**			**		**
Rainfed lowland rice systems	*	**	*	**		**	

Asterisks indicate degree of importance in each country for introduction and use of forages.

Table 4. Anticipated level of activities of FSP associated with different countries

Activity	Ind	Lao	Mal	Ph	S.C	Th	Vn
1.2 Assessment of local forage systems		**					*
1.2 Introduction and initial increase	**	***		**	*	*	***
1.3 Evaluation in different agroecosystems	**	***		***	*	*	***
1.4 Seed increase of promising lines	***	***	*	***	*	*	***
2.1 RRA of farming systems	**	***		***			***
2.2 Participatory evaluation of forages on-farm	***	***		***		**	***
2.3 Farmer training in forage management	***	***		***			***
2.4 Development of multiplication systems	***	***		***		**	***
3.1 English language training	*	**		*			**
3.2 Training in participatory research	***	***		***		*	***
3.3 Training in forage agronomy	***	***		***		*	***
4.1 Regional meetings	***	***	**	***	**	**	***
4.2 Facilitate internal communications	***	***	*	***	*	**	***
4.3 Regional R & D network	***	***	***	***	***	***	***
5. Project Management	**	**	*	**	*	*	**

Asterisks indicate level of activity.

3.2 Target groups

3.2.1 Intended beneficiaries

The main target group are smallholder households presently involved in upland shifting and sedentary agriculture where introduction of forages can stabilise agricultural systems and generate cash income through sale of cattle. The project is essentially gender neutral but women and children would benefit by a reduction in time devoted to feeding animals and from the resultant increase in farm income.

Another important target group are the technical staff of government departments whose capability to carry out further development work would be enhanced by training, through experience of working in the Project and from improved communication with other forage R&D workers in the country and the region.

Development projects in the region will benefit from the improved forage technology that is developed and communicated to them.

3.2.2 Others influenced

The Project would contribute to the improved nutrition of villagers and city-dwellers, through the provision of meat and dairy products. Increased trade in livestock will generate wealth for various sectors. The Project will facilitate the introduction of agroforestry systems which in turn will conserve groundwater, mitigate flooding and increase dry season stream flow.

3.3 Location, duration and phasing

The Project will operate in Indonesia, Lao PDR, Malaysia, Philippines, South China, Thailand and Vietnam.

RG staff associated with field operations of the Project will be located in:

Indonesia - near Samarinda in East Kalimantan and Sitiung in West Sumatra,
Lao -in the Provinces of Vientiane, Luang Prabang, Xieng Khoang and Cham Passak and the municipality of Vientiane,
Philippines -at Bicol, Matalom, Central and Southern Mindanao.
Thailand - Khon Kaen
Vietnam - four sites in the north and central regions

The Project will not be responsible for field operations in Malaysia or South China.

One Australian staff member will be located at IRRI, Los Baños, in the Philippines and the other with the Department of Livestock and Veterinary Services at Vientiane in Lao. The two Australian staff members will work as a team but with main responsibilities for different areas in the region. A major reason for separate location of the agronomists is that the Philippine based scientist will work mostly with forage varieties for acid infertile soils (largely derived from CIAT) and the Lao based scientist will work mostly with forages adapted to dry season environments (largely derived from CSIRO). Being located separately will result in closer interaction with counterparts in those areas, particularly in the two countries of location. The agronomists are likely to have complementary skills.

The location at IRRI will ensure good logistical support and security. The DLVS in Lao has offered to make office space available and has indicated that the new communication facilities being installed in 1994 will be available to the Project. The Lao-IRRI Project has offered back-up support. No security problems exist in the operational areas.

The duration proposed for the project is five years, from January 1995 to December 1999. A second Phase was anticipated during the planning for Phase I as three years was not considered adequate for achieving the goal of having selected forages widely adopted on smallholder farms (AIDAB, 1992). Phase I has been successful in identifying superior forages for adoption in Indonesia, Philippines and Thailand A further five years will be required for building on the achievements of Phase 1 in ensuring the adoption of forages in the target areas. This is because working through the existing structures, it will take time to implement farmer participatory R&D, train local staff for this role and develop self-sustaining national programs. In Lao PDR and Vietnam, the whole program of forage selection and delivery into the farming system will only commence in Phase II.

Phasing in the Project follows a logical process of introduction of forage germplasm, identification of adapted high-yielding accessions in target agro-ecosystems, on-farm selection with smallholder participation, production of seed and/or vegetative material of promising species for distribution, information transfer through workshops, booklets, brochures and posters to farmers and other sector staff, and linkages with other projects to obtain a multiplier effect. Training will accompany each main activity. Each stage takes 1-2 years, so in general it takes 5-8 years before introduced forages can be incorporated in farming systems. Involvement of smallholders in early stages of the selection process will lead to early identification of problem areas and thus an opportunity to review and focus the R&D activities.

3.4 Description of components, outputs, activities and inputs

3.4.1. Component description

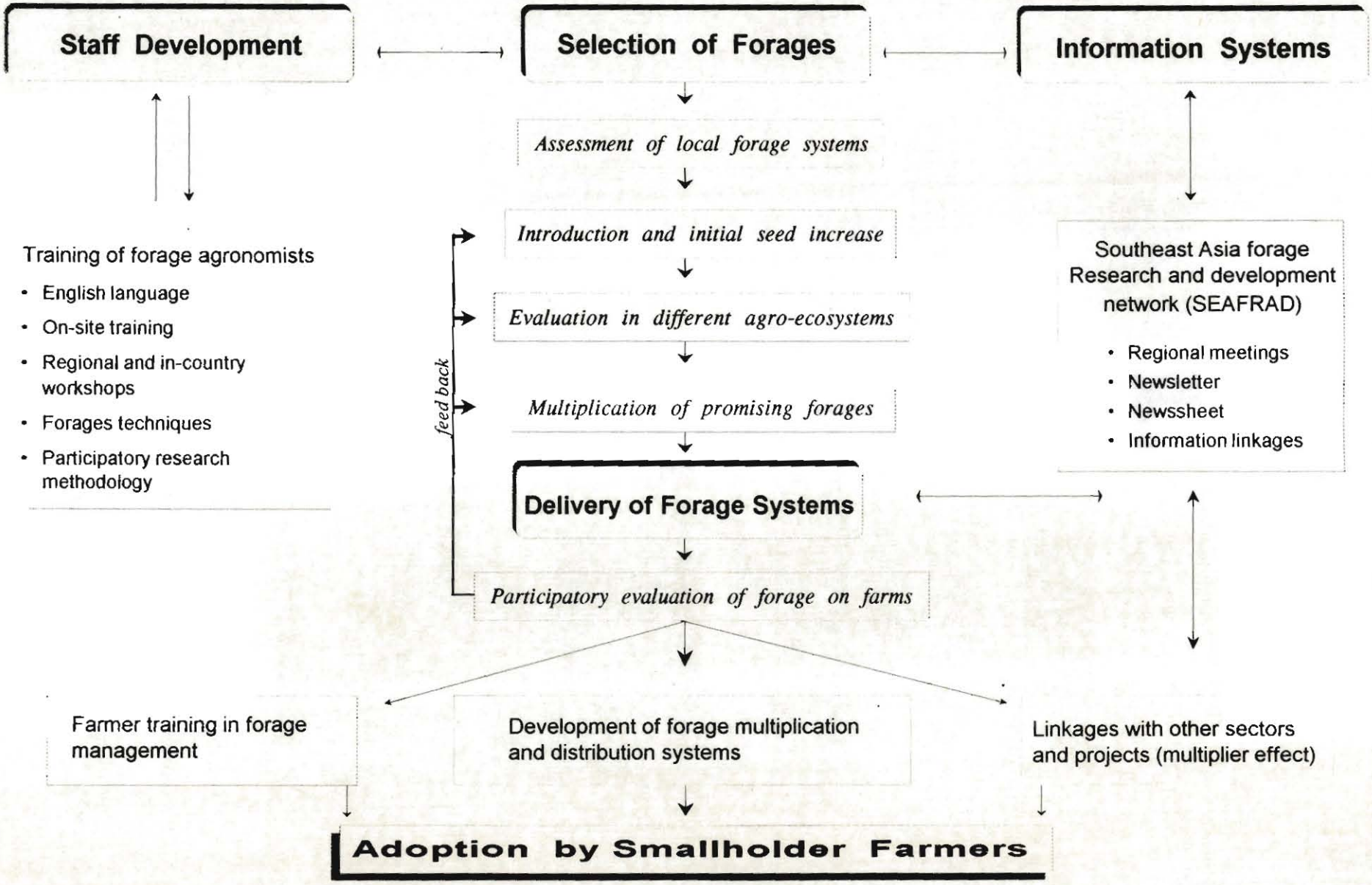
The five components of the Project are

(i) selection of forages
(ii) delivery of forages into farming systems
(iii) staff development
(iv) information system development
(v) project management.

Selection of forages must precede delivery of forages to farming systems. Staff development is necessary to accomplish these activities within the existing country structures. The development of information systems will hasten the flow of useful information during the development process and the transfer of information to other sectors and development agencies on which the project relies for a multiplier effect (Figure 2). Project management is required to ensure effective coordination of activities, that activities are carried out on schedule, and that there is sound financial management and regular reporting to AIDAB and RG's.

Figure 2

Linkages and Interactions between Activities - FSP



3.4.2 Expected outputs

The expected outputs are:

1. *Forages available for different ecoregions and farming systems*

Forages will have been identified and made available for different:

(i) ecoregions - from the humid tropics to seasonally dry tropics and from very acid infertile to moderately fertile soils and

(ii) farming systems - to include:

a) agroforestry areas
forages selected for ability to persist under shade and in open forage corridors between tree plantings,

b) upland sedentary or 'slash and burn' cropping systems
forages selected to improve the ley/fallow, for soil improvement and control of erosion and weeds,

c) natural/induced grasslands
forage legumes selected to supplement local grasses,

d) plantations
forages selected as groundcovers and for feed,

e) lowland rainfed rice
forages selected to supplement rice straw in the dry season and provide feed in the wet season for livestock in holding areas.

It is estimated that from 15-20 new forage varieties will be identified for use in farming systems in the target areas. The objective is not to identify large numbers of new forages but a limited number with broad adaptation. This will simplify their multiplication and adoption of them by farmers.

The characteristics of these forages together with their utility for different ecosystems and farming systems will be published in booklets in English and the local language and distributed to research and extension workers.

The identification of forages and their initial multiplication is a necessary precursor to the second output, the delivery of forage systems to smallholders.

2. *Forages integrated into smallholder farming systems*

Forage systems that are acceptable to farmers and which contribute to increased livestock productivity and soil sustainability for ecoregions and farming systems listed above will be available for wider use in the region.

This output will include a demonstration of the utility of a forage component within a farming

system, the ability of farmers to manage such systems and a capacity to multiply specific forages for use within a project area and for adoption in other areas.

This output will also serve as a demonstration or model of how new technology might be developed and adopted using farmer participation in the process of both development and adoption.

A key aspect will be seed and vegetative multiplication and the development of self-sustaining systems to ensure that multiplication is not a limiting factor.

By the end of the Project, farmers in 18 target areas will be benefiting from the introduction of new forages. At least two of these target areas in each of Indonesia, Lao, Philippines and Vietnam, and one site in Thailand will focus on the use of forages in agroforestry systems in upland areas which were previously forested but became degraded through shifting cultivation or other exploitive agricultural practices. These target areas will cover several ecoregions. At least 40 farms will be included in each target area.

This output will be verified through evidence of forage use in the target areas, field days, in booklets written for distribution to farmers and in RG reports.

A successful outcome will have achieved the main purpose of the project to increase the availability of adapted forages for different farming systems.

3. *Local staff trained in forage development and technology transfer*

An increased number of local staff skilled in the knowledge of forage agronomy and development of forage systems for smallholders will be available in each country.

The more senior staff involved in the project will be sufficiently proficient in English to enable them to participate in regional meetings and workshops, to read scientific literature, and communicate with other forage agronomists in the region. It is estimated that 12 persons will need to be trained to a medium level in English.

The staff involved in the project areas will have a sound knowledge of procedures for the establishment, management and multiplication of forages, agroforestry systems and will be able to communicate this to farmers. They will also have acquired skills in participatory R&D methodology and rapid rural appraisal.

It is anticipated that 2 of the more senior staff in each of Indonesia, Lao, Philippines, Thailand, Vietnam and South China who work in the target areas will have acceptable skills in English and high level skills in forage agronomy (Malaysia has this capability now). These persons will have conducted in-country courses in forage agronomy for a further 20 persons from each country. A further 4 persons from Indonesia, Lao, Philippines and Vietnam will receive training in other countries in the region or in Australia.

Two persons from Indonesia, Lao, Philippines, Thailand, Vietnam and South China will have received high level training in rapid rural appraisal (RRA) and participatory research methodology. They will be chosen on the basis of their ability to teach others and will have conducted in-country training for a further 10 persons from each country.

Preference will be given to training the same 'trainers' in both forage agronomy and participatory research.

There will have been a visit to Australia by selected personnel from each RG country to observe the integration of R&D activities on forages and seed production. Provision will also have been made for three selected personnel to attend the Tropical Forage Genetic Resources Workshop being held in conjunction with the International Grassland Congress in Canada in June 1997.

A successful outcome of training will have achieved the objective of increasing the capacity to deliver forage systems to farmers.

4. *Information systems on forage R & D*

Information flow within and between countries will have improved.

Those participating in the target areas and the RG authorities will have been well informed of the progress being made in the region and a selected group will have participated in the annual review of the FSP through attendance at annual regional meetings.

Within each country, a strategy will have been developed to ensure effective communication between persons and organisations involved in forage development as it affected the outcomes of the FSP.

A regional Forage R&D network will have been established.

This will be verified by distribution of reports of regional meetings to participants and RG authorities, by information circulars produced for each country and distributed to other sectors and development agencies, and by a regional newsletter published twice a year and distributed to all forage research and extension workers in the region.

This outcome is necessary to ensure activities of the FSP are widely understood, that new results and information are shared quickly so as to avoid duplication of effort, and to ensure that there is a strong multiplier effect through other projects.

5. *Efficient project management and monitoring*

A well managed project which delivers outputs on schedule.

A Project Implementation Document will have been prepared by the end of June 1995.

Project activities will have been monitored annually by Senior CIAT and CSIRO staff.

Six-monthly technical and financial reports will have been submitted by the end of August and the end of February each year.

The project will have been reviewed annually at the time of the regional meetings with participation of FSP staff and RG officers. The annual plan will have been submitted following this review and not later than the end of March each year.

3.4.3 Major activities and their scheduling

The major activities associated with the different outputs are shown in the work breakdown structure (Figure 1). The scheduling of these activities is shown in the Activity and Resources Schedule (Annex 1.1).

3.4.4 Inputs and their scheduling

Australian Government inputs to the Project would be:

Personnel
Two scientists qualified in tropical forage technology would be appointed, one to be based at IRRI, Los Baños, the Philippines, and the other at Vientiane, Lao PDR.

Technical assistance is required for seed production, processing and despatch from Brisbane.

Local technical assistance is required in the Philippines and Lao PDR for seed multiplication and underatking routine duties when the agronomists are travelling.

Secretarial and driver support is required at Los Baños and Vientiane.

Consultants are required for English instruction, assessment of native pasture composition, seed production technology, participatory research and development and rapid rural appraisal. Local consultants will be hired for English instruction. CIAT will provide experts and materials for the training in participatory research and development. An Australian consultant will be contracted for the training in seed production technology.

Personnel input is required at CIAT for financial and project management and monitoring of project activities and at CSIRO for project monitoring.

Procurement - requirements are:

A motor vehicle for Vientiane and a replacement vehicle for Los Baños. It is assumed that

vehicles can be maintained without replacement for 5 years.

Motor cycles for site activities in Lao and Vietnam.

Office equipment for Los Baños and Vientiane. This will include a computer, software, printer, fax machine and photocopier at each site.

Office supplies such small furniture items, stationary, computer supplies, maps and books will be required at each office location.

Seed of adapted Australian commercial cultivars for on-farm activities.

Field consumables such as fertiliser and small plot equipment for evaluation and on-farm activities.

Supplies will be required for newsletter and newsheet production and distribution.

Training materials will be developed and produced for the regional and in-country workshops and courses.

Training

This includes travel and accomodation costs associated with conducting on-site training, regional training workshops, in-country training courses, a vist to Australia and a visit to the Forage Genetics Workshop at the International Grassland Congress.

The costs associated with holding the annual regional meeting are largely those for travel and accommodation but include the publication of proceedings.

It is planned to hold an International Conference at the conclusion of the Project to more widely disseminate results and consolidate the regional networking.

Extension literature - pamphlets, brochures and posters will be produced and translated into local languages for distribution to extension workers and farmers. CIAT has a communications expert with 15 years of Asian experience and facilities at IRRI are also available to the Project.

Other

Operational costs for maintenace of field evaluation and multiplication sites and on-farm activities.

Production of Project Implementation Document and Project Completion Report

Vehicle operating expenses

Publication of booklet on native pastures of Lao and costs of species identification in Australia

Translation costs of producing regional course material in local languages

A revolving fund to initiate seed production by smallholders

Travelling allowances and transport costs for Australian and
RG officers while working on Project activities within coutries

Travelling costs to enable to Project agronomists to interact within the region

Travelling costs to allow the Project agronomists to visit their home institutions once a year to maintain contact and access new information.

Travelling costs to allow the Project managers to visit the region once a year

Office services including communications, electricity and overheads.

The Recipient Governments in Indonesia, Lao PDR, Malaysia, Philippines, Thailand, South China and Vietnam will provide the following:

Personnel (Professional)

Part-time inputs of present institutional staff

Procurement

Vehicles provided for supervision of field sites

Training

Facilities provided for meetings, seminars and field visits

Other

Drivers
Office stationary and equipment and utilities
Contribution towards fuel/vehicle operating costs
Local and international communications
Provision of experimental sites and facilities

The capacity of different governments to meet project costs will vary. Thus in Lao and Vietnam it will be necessary to make a contribution towards transport and travel costs.

3.5 Costs and financing

The estimated costs for Phase II of the FSP are shown in the Cost Schedule (Annex 2.2)

Calculated values include an estimate for inflation of 4% per annum and indirect costs of 12%. Total cost over 5 years is AU$4.3 million.

Allowance cannot be made for exchange rate fluctuations at this stage but adjustments should be allowed when there are differences (AU$ vs US$) greater than 3%.

No allowance has been made for contingencies.

3.5.1 Costs by component and year

A summary of costs by component is given in Table 5 and by category in Table 6.

TABLE 5 COST SUMMARY BY COMPONENTS

COMPONENTS	YR 1 94-95 QUARTER		TOTAL YEAR	YEAR 2 1995-96 QUARTER				TOTAL YEAR	YEAR 3 1996-97 QUARTER				TOTAL YEAR
	1	2	1	3	4	5	6	2	7	8	9	10	3
Government of Australia													
SELECTION OF FORAGES	79917	43917	123834	54917	52417	39751	39751	186835	56001	50001	33084	37084	176169
DELIVERY OF FORAGE SYSTEMS	25333	23333	48666	35833	27133	29200	28600	120765	91050	30750	43766	40166	205731
STAFF DEVELOPMENT	29000	52000	80999	96500	35400	33400	26700	191998	87500	33400	33400	46700	200998
INFORMATION SYSTEMS	34333	14333	52566	0	16833	34333	18233	69399	0	16833	34333	18233	69399
PROJECT MANAGEMENT	98583	14917	113500	35583	22917	63583	14917	136999	35583	22917	63583	14917	136999
Indirect costs	32060	17820	50348	26740	18564	24032	15384	84720	32416	18468	24980	18852	94716
TOTAL	299225	166319	469912	249572	173263	224297	143583	790716	302548	172367	233145	175951	884012
TOTAL (including inflation - 4%)			476632					822344					954732
Recipient Governments													
SELECTION OF FORAGES	12000	12000	24000	12000	12000	12000	12000	48000	12000	12000	6750	6750	37500
DELIVERY OF FORAGE SYSTEMS	10050	10050	20100	10500	10500	11100	11100	43200	11100	11100	13500	13500	42900
STAFF DEVELOPMENT	0	0	0	0	4000	4000	2000	10000	0	4000	4000	2000	10000
INFORMATION SYSTEMS	0	5250	5250	0	5250	0	5250	10500	0	5250	0	5250	10500
PROJECT MANAGEMENT	3900	2700	6600	3900	2700	3900	2700	13200	3900	2700	3900	2700	13200
TOTAL			55950					124900					114100

TABLE 5 COST SUMMARY BY COMPONENTS

COMPONENTS	YEAR 4 1997-98 QUARTER				TOTAL YEAR	YEAR 5 1998-99 QUARTER				TOTAL YEAR	YR 6 99-00 QUARTER		TOTAL YEAR	TOTAL COST
	11	12	13	14	4	15	16	17	18	5	19	20	6	AU$
Government of Australia														
SELECTION OF FORAGES	45084	29584	21918	21918	118503	28418	16418	13918	13918	72670	19918	13918	33835	711846
DELIVERY OF FORAGE SYSTEMS	66466	44166	55633	50833	217097	66833	50833	51833	51833	221330	59833	51833	111665	922854
STAFF DEVELOPMENT	25000	32400	32400	26200	115998	25000	32400	32400	26200	114998	25000	20000	44999	749990
INFORMATION SYSTEMS	0	16833	34333	18233	69399	0	16833	34333	18233	69399	0	56833	56833	386995
PROJECT MANAGEMENT	35583	22917	63583	14917	136999	35583	22917	63583	14917	136999	28583	36917	65500	726995
Indirect costs	20656	17508	24944	15852	78960	18700	16728	23528	15012	73848	16000	21540	37540	419842
TOTAL	192788	163407	232809	147951	736956	174532	156127	219593	140111	689244	149332	201039	350371	3918522
TOTAL (including inflation - 4%)					825390					799522			420446	4299067
Recipient Governments														
SELECTION OF FORAGES	5250	5250	3300	3300	17100	2850	2850	1350	1350	8400	900	900	1800	136800
DELIVERY OF FORAGE SYSTEMS	13500	13500	13500	13500	54000	13500	13500	13500	13500	54000	13500	13500	27000	241200
STAFF DEVELOPMENT	0	4000	4000	2000	10000	0	4000	4000	2000	10000	0	0	0	40000
INFORMATION SYSTEMS	0	5250	0	5250	10500	0	5250	0	5250	10500	0	5250	5250	52500
PROJECT MANAGEMENT	3900	2700	3900	2700	13200	3900	2700	3900	2700	13200	3900	2700	6600	66000
TOTAL					104800					96100			40650	536500

TABLE 6 COST SUMMARY BY CATEGORY AND RG CONTRIBUTION

CATEGORY	YR 1 94-95 QUARTER		TOTAL YEAR	YEAR 2 1995-96 QUARTER				TOTAL YEAR	YEAR 3 1996-97 QUARTER				TOTAL YEAR
	1	2	1	3	4	5	6	2	7	8	9	10	3
Government of Australia													
Personnel	136166	95499	231665	115833	101499	130166	93499	440996	109833	99499	130166	93499	432996
Procurement	64000	6000	73900	28500	10100	400	4100	43100	60900	2900	2800	4100	70700
Training	20000	30000	53000	38000	12600	33200	6600	90400	37400	12000	33200	26000	108600
Other	44000	17000	61000	40500	30500	36500	24000	131500	62000	39500	42000	33500	177000
Indirect Costs	31700	17820	50348	26740	18564	24032	15384	84720	32416	18468	24980	18852	94716
TOTAL	295865	166319	469912	249572	173263	224297	143583	790716	302548	172367	233145	175951	884012
TOTAL (including inflation - 4%)			476632					822344					954732
Recipient Governments													
GOI	8100	8850	16950	8100	10850	8100	8850	35900	8100	10850	6300	7050	32300
GOL	3450	4200	7650	3450	6200	3600	4350	17600	3600	6350	3150	3900	17000
GOM	400	750	1150	400	750	400	750	2300	400	750	400	750	2300
GOP	5700	6450	12150	5700	6450	7700	6450	26300	5700	6450	6500	5250	23900
GOSC	2100	2550	4650	2100	2550	4100	2550	11300	2100	2550	1200	1650	7500
GOT	3500	3750	7250	3500	3750	3500	3750	14500	3500	3750	7000	5250	19500
GOV	2700	3450	6150	3150	3900	3600	6350	17000	3600	4350	3600	6350	11600
TOTAL			55950					124900					114100

TABLE 6 COST SUMMARY BY CATEGORY AND RG CONTRIBUTION

CATEGORY	YEAR 4 1997-98 QUARTER				TOTAL YEAR	YEAR 5 1998-99 QUARTER				TOTAL YEAR	YR 6 99-00 QUARTER		TOTAL YEAR	TOTAL COST
	11	12	13	14	4	15	16	17	18	5	19	20	6	AU$
Government of Australia														
Personnel	85833	93499	130166	93499	402996	85833	93499	130166	93499	402996	85833	105499	191332	2102980
Procurement	30400	2900	2800	4100	40200	28000	2900	400	4100	34400	14000	2500	16500	278800
Training	7400	12000	34400	6000	59800	5000	12000	32000	6000	55000	5000	40000	45000	409400
Other	48500	37500	40500	28500	155000	37000	31000	33500	21500	123000	28500	31500	60000	707500
Indirect Costs	20656	17508	24944	15852	78960	18700	16728	23528	15012	73848	16000	21540	37540	419842
TOTAL	192788	163407	232809	147951	736956	174532	156127	219593	140111	689244	149332	201039	350371	3918522
TOTAL (including inflation - 4%)					825390					799522			420446	4299067
Recipient Governments														
GOI	6300	9050	5400	6150	26900	5400	8150	4500	5250	23300	4500	5250	9750	145100
GOL	3150	5900	2700	3450	15200	2700	5450	2700	3450	14300	2700	3450	6150	77900
GOM	400	750	400	750	2300	400	750	400	750	2300	400	750	1150	11500
GOP	4500	5250	5900	4650	20300	3900	4650	5300	4050	17900	3300	4050	7350	107900
GOSC	1200	1650	3200	1650	7700	1200	1650	1200	1650	5700	1200	1650	2850	39700
GOT	3500	3750	3500	3750	14500	3500	3750	5500	3750	16500	3500	3750	7250	79500
GOV	3600	4350	3600	6350	17900	3150	3900	3150	5900	16100	2700	3450	6150	74900
TOTAL					104800					96100			40650	536500

3.5.2 Financing arrangements

At the beginning of each financial year the GOA through AIDAB will send the agreed total budget estimate for the financial year to CIAT. CIAT will then disperse funds to CSIRO to cover expenditures for which CSIRO has responsibility. CIAT will assume responsibility for monitoring all expenditures and reporting back to AIDAB.

The RG's will make funds available for payment to RG staff involved in the project and meet expenditures agreed to by them in separate Letters of Understanding.

3.5.3 Recurrent cost implications

The project will not generate recurrent costs to the Government of Australia following the completion of the experiment.

Any capital items will have been fully depreciated over the five years of the project.

3.6 Organisation and management

The overall management structure is shown in Figure 3.

3.6.1 Responsibilities and management

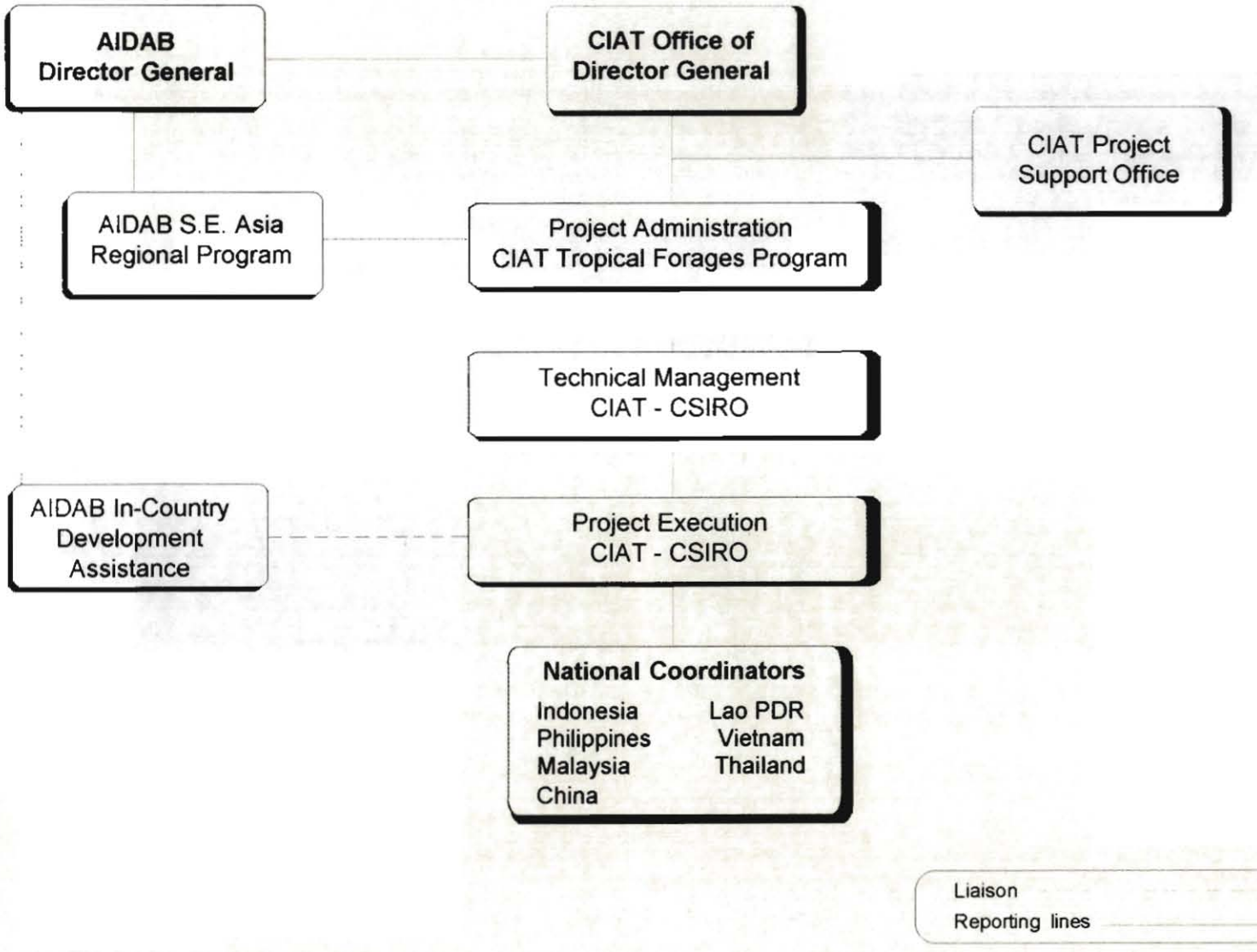
CIAT will be the Project Administrator and have the overall responsibility for the project and will report to AIDAB six-monthly in February and August each year. An annual plan will be submitted by the end of March each year.

The project will be managed jointly by CIAT and CSIRO through an annual review of the project and joint discussions at the time of the regional meeting. The Leader, Tropical Forages Program at CIAT and the leader of the ATFGRC-CSIRO together will have this managerial responsibility and be designated Project Managers.

CIAT and CSIRO will each take administrative responsibility for the Senior Agronomists to appointed by them - CIAT for the position in Los Baños, Philippines, and CSIRO for the portion in Vientiane, Lao PDR. Duty statements are attached (Annex 1.4).

Figure 3

Project Management



3.6.2 Coordination arrangements

All activities of the two Senior Agronomists will be coordinated. Firstly, coordination will be initiated by themselves through regular communication, a joint visit to target areas in the different countries early in the Project and decisions taken at the time of the annual regional meeting. All correspondence concerning their work schedule and activities associated with the project will be copied to each other as well as to their respective administrative supervisors.

Secondly, the Project Managers will review coordination of activities at the time of the annual regional meeting.

Six monthly technical reports and the technical aspects of the annual plan will be prepared jointly by the two Agronomists in Southeast Asia, sent to the Project Managers for comment and then for final review and submission by the CIAT Administrator.

Coordination of FSP activities with the nominated RG executing agencies in Indonesia, Malaysia, Philippines and South China will be the responsibility of the CIAT appointed agronomist and for Lao PDR, Thailand and Vietnam the responsibility of the CSIRO appointed agronomist. However, it is planned that both agronomists will contribute to activities in all countries dependent on their area of expertise and availability.

3.6.3 Institutional changes required

No institutional changes would be required.

3.6.4 Staff and training

RG staff development will be an intrinsic component of the Project.

3.6.5 Local participation

The FSP would operate within the structure of the Recipient Governments. RG counterparts would be appointed or assigned by arrangement between the FSP and the executing agency of the RG. Such personnel would not be funded by the Project, apart from operating expenses.

The involvement of local staff is a strong feature of the FSP. All activities, except for some initial introduction and multiplication activities, will involve participation of local staff.

During the annual regional meetings a forum will be held to allow more widespread participation of prominent national staff.

3.6.6 Use of local or Australian non-government organisations

The Project will be implemented through government organisations but there will be close interaction with donor agencies and NGO's in technology transfer.

3.6.7 Procurement arrangements

This will follow normal commercial practice. In the Philippines, purchases will be made through the International Rice Research Institute (IRRI) which has contracts for bulk purchase of vehicles and major items. This avenue will also be investigated for Lao where IRRI has a Special Project.

3.6.8 Marketing arrangements for products

Products of the Project will be forage varieties introduced into RG farming systems. Seed of these varieties will be marketed locally and be priced according to supply and demand.

To a limited degree, seed will be purchased and sold by the Project to promote adoption and distribution of elite varieties.

3.6.9 Implementation procedures

The Project Implementation Document will be prepared and submitted to AIDAB by the end of June 1995.

Prior to June 1995, Letters of Understanding between CIAT, the executing agency for the GOA, and the nominated RG agencies will be negotiated.

3.7 Monitoring arrangements

3.7.1 Scheduling of major tasks

The major activities identified in the logical framework matrix (Table 2 and Figure 1) are scheduled in Annex 1.1.

The first major task will need to occur prior to initiation of Phase II. This would be the appointment of an agronomist to be based in Lao PDR and negotiation with IRRI for continuance of an existing arrangement for basing an agronomist at IRRI, Los Baños, Philippines. These arrangements would be initiated promptly after approval of the Project by AIDAB.

3.7.2 Monitoring framework

The monitoring responsibility will rest with the Project Administrator. Half-yearly technical and financial reports will be submitted to AIDAB by the Project Administrator at the end of February and the end of August each year and an Annual Plan by the end of March in 1996 and the three following years.

The Project Managers will review the Project activities each year at the time of the annual regional meeting. This will enable first hand feedback to be obtained from RG officials. The annual meeting location will be rotated between countries. The Managers will also visit target areas within the country where the meeting is being held. These findings and also reports of consultants contracted for specific tasks will be incorporated into the Annual Plan submitted in March of each year. AIDAB would be invited to send a representative to each regional meeting to participate in this annual review.

3.7.3 Performance indicators

Performance will be assessed using verification criteria as defined in the Logical Framework Matrix and will be reported in half-yearly technical reports and in the Project Completion Report.

Participatory Rapid Rural Appraisal will be utilised in determining needs and preferences of smallholders, their response to the potential of the new technology and their reactions to its adoption.

Impact of the Project will be evaluated towards the end of the Project. It would be anticipated that the impact would occur sooner in Indonesia and the Philippines , which have benefited from longer input by the FSP, than in Lao and Vietnam. Continued impact is expected in Malaysia and Thailand and a limited impact in South China.

Impact will be evaluated using:

- Government statistics
- Inspection of test sites
- Awareness of forages by smallholders
- Reports from Project and RG's
- Publications
- Reports from District Officers.

Participatory Rapid Rural Appraisal will be used to determine:

- Number of smallholders growing forages selected by the Project for livestock feed
- Number of smallholders growing seed of Project forages
- Increased cash income associated with growing forages
- Attendance at field days and workshops

3.7.4 Monitoring and evaluation plan

The Annual Plan, which will include references to the annual review referred to above, will form the basis for monitoring performance.

3.7.5 Performance reporting

The Six-Monthly Technical and Financial reports will provide an indication of performance

3.7.6 Project Completion Report

A draft project completion report will be submitted by December 1999.

4. OUTCOME OF DESIGN ISSUES ADDRESSED

The preparation for Phase II of the project is considered to be Phase I, together with the visit by Senior CIAT and CSIRO staff in January and February 1994.

Important achievements during Phase I of the FSP were

- the screening, selection, multiplication and distribution of forage varieties adapted to different agro-ecological zones,
- testing of improved varieties in smallholder farming systems,
- establishment of linkages between national agencies, development projects and the FSP, and
- training of personnel involved in forage research.

One major strength was the collaborative nature of the project, working with and through NARs, and the linkages to regional development projects. These used forage technologies developed by the FSP and distributed promising forage varieties to a much larger number of smallholder farmer families than would have been possible within the FSP alone. These have been summarized in Six-Monthly Reports of Phase 1.

4.1 Feasibility

4.1.1 Technical

Experience in Phase I indicates that the approach to research and development is appropriate to each country situation. The research focus will be on low-cost input technologies appropriate to smallholder farming systems and on low fertility soils for which there have hitherto not been suitable forages.

Phase I of the FSP has identified a range of forage varieties suitable for smallholder farming situations. Incorporation of forages into cropping systems enhances soil fertility, reduces weeds and minimizes soil erosion during the fallow periods. An example is the use of *S. guianensis* CIAT 184 as cover legume to control weed regrowth during forest establishment at Bukidnon in the Philippines. The FSP has endeavoured to use local personnel within government and development organisations. Training of these personnel in forage science (adaptive trials, seed production and farmer participatory research methodology) is essential to raise the capability of NARs to conduct forage R&D. Training of key personnel in Philippines or Australia, who then conduct in-country training for a larger number of staff with assistance from the FSP, is an efficient use of training resources. The approach is innovative in that forages are being introduced, not only for livestock feeding but also for improved management of the soil and water resources. There is negligible technical risk.

4.1.2 Financial

The project will not generate a need for large capital expenditure by Australia or RG countries. There will be no recurrent costs at the end of the project. The project will not itself be involved in marketing of goods except for small amounts of forage seed production supported by revolving funds. All RG countries have indicated support for the project and thus the viability is not likely to be affected by financial constraints.

4.1.3 Economic

Economic benefits will flow from improving the effectiveness of on-going projects and increasing farm output. There is a large demand by projects working in upland areas, with the aim of reducing shifting cultivation, for forages to protect soil from erosion and to improve the soil fertility status of fallow land. Also there has been an increased demand for cattle for draught and for use in meat and milk production. This shortage of cattle has resulted in several cattle distribution schemes in Southeast Asia which have had mixed success due to a shortage of fodder. Thus increased use of forages will lead to diversification of income through improved animal productivity and to longterm benefits on land sustainability. Further, there is an opportunity for collaboration and achieving multiplier effects. This collaborative approach with NARs and other development agencies is seen as crucial for adoption of new varieties with spill-over and multiplier effects.

4.1.4 Institutional

During Phase I a large number of research and development organisations expressed interest to collaborate with the FSP and use the new forages being identified. However, the capacity of institutions to conduct appropriate research on their own and then deliver adapted varieties to the farm level is weak, particularly in Lao, Vietnam and Indonesia. Training in both forage technology and technology transfer is therefore seen as an important activity in Phase II. Working with institutions in target countries will develop their capacity and thus ensure sustainability of the inputs by the FSP.

4.1.5 Social and cultural

Forages need to be appropriate for particular farming situations and to fit into existing cropping, livestock and agroforestry systems. The involvement of farmers in the selection of adapted varieties through participatory research methods ensures social and cultural fit and is therefore crucial for the success of the project.

4.1.6 Gender

In Phase I of the FSP female researchers had a major input into the design, supervision and conduct of experiments in Thailand, Malaysia and the Philippines. This will continue in Phase II and it is also envisaged that women will have a major role in the delivery of adapted forage

varieties to farmers. The technology is essentially gender neutral and will benefit households through generating higher cash flow. Labor input by persons harvesting and feeding forages will be reduced.

4.1.7 Environmental

Beneficial environmental impacts will be an improvement of soil fertility through the incorporation of forage legumes and increased nutrient cycling through the presence of animals and reduced soil erosion in cropping systems through incorporation of forages in the fallow period ensuring that a vegetation cover is present at all times. Increasing forage supply in the dry season, when feed is limiting, will reduce the pressure on communal grazing land. This needs to be accompanied by changes in management of cattle to ensure that cattle numbers and grazing are controlled. The FSP places particular emphasis on forage species diversity to minimise the risk of reliance on single species.

4.1.8 Poverty

The beneficiaries of the Project are smallholder farming families. Many of these are located in upland areas where cash income and opportunities are lower than in the more intensive lowland areas. The R&D focuses on low-cost technologies which in most cases require no input of capital by farmers. The R&D is designed to increase forage quality and productivity, particularly during periods of feed shortages. This will increase animal production and enhance diversification, thereby providing greater and more stable farm income.

4.2 Sustainability

4.2.1 Key Issues

The key issues are:

(i) to ensure that there is adoption of forages that are shown to be adapted both to the environment and farming systems. Farmers and industry will then ensure continued use, and

(ii) to impress on recipient governments that persons trained in forage technology generation and transfer continue to be employed for that purpose.

If the adoption of forages can be shown to be beneficial both in contributing to land sustainability and for increasing livestock production, then there will be widespread support of the technology by RG's and smallholders.

4.2.2 Activities and processes incorporated in design

Activities are to train persons in appropriate technology transfer methodologies and involve

farmers in the R&D process. Training of key personnel, who then conduct in-country training for a larger number of staff with assistance from the FSP, will increase the capacity of the local R&D institutions to conduct forage research and deliver improved forage material to the farm level. Collaborative R&D work with NARs during the Project will ensure "on the job" training. The FSP will promote the development of local smallholder seed production and multiplication industries to ensure sufficient material to meet the demand for new forage species created by their perceived benefits. A regional forage research and information network will ensure spill-over effects and mutual assistance within the region. Multiplier effects will be achieved by collaboration with national and regional development projects.

4.3 Commerce and trade

As well as the indirect benefits that accrue to Australia as a result of an increase in the disposable incomes of the poor in developing countries, Australia has a direct benefit from the significant export of cattle and sheep. In 1992, Australia exported approximately 160,000 cattle to the Southeast Asian region. Most of these cattle were distributed to smallholders and in some cases adequate feed was not available. An improved feeding situation will increase the success of these schemes. Thus there is the potential for expansion of cattle exports to the region. Other spin-offs may be a demand for pasture seed from Australia and increased access by Australian businesses to the agricultural sector. Recently, interest has been expressed by an Australian pasture seed producer in obtaining starter seed of the most promising forage species for commercial seed production.

4.4 Australian capability

The FSP is a joint project between CIAT and CSIRO because of complementary expertise and forage germplasm which exists in the two centres. CSIRO's resources in terms of forage germplasm and expertise are particularly strong on low fertility soil in seasonally dry tropics and subtropics, while CIAT's strength is on acid, low fertility soils in humid and sub-humid tropics. Both climatic areas occur within the Project region and a joint Project ensures optimal use of resources.

4.5 Risks

Risks of catastrophic proportions are highly unlikely. The Project will minimise risks by promoting species diversity. This will avoid the risk of disease or insect damage to forage species. Reliance on single species, as was the case with the multipurpose tree *Leucaena leucocephala* in the 1980s, can have disastrous results. In Southeast Asia, *Leucaena leucocephala* stands were devastated by the psyllid insects in 1986, which suddenly spread from Central America and which previously had not been a serious pest. The economic damage caused by the psyllid in Southeast Asian countries was estimated as US$ 525 million in the first year of the infestation alone (Heydon and Affonso, 1991). The FSP will contribute to reducing the likelihood of a similar disaster by introducing a range of forage species including multipurpose trees, thereby reducing the reliance on particular species.

4.6 Overall Assessment of Feasibility

The most important achievement of the FSP Phase II will be the adoption of new forage species in forestry, agroforestry and upland smallholder fields together with a technology developed for efficient and economical seed production and propagation. Leguminous forages will contribute to increased crop yields through improved soil fertility, breaking disease cycles, and will reduce the danger of erosion by providing a permanent soil cover. A strengthened livestock component enhances the opportunity for diversification of smallholder production systems, providing greater stability of economic returns. The Project expects to develop a network of well trained staff who will continue the R&D necessary to deliver improved forages to the farm level and ensure the sustainability of the FSP activities.

5. EXPECTED BENEFITS

5.1 Development impact

5.1.1 On the people

The adoption of improved forages will diversify and improve farm income for smallholder families farming upland forestry and agricultural areas. This will be achieved by:

(i) an increase crop yields through the introduction of forage legumes in cropping systems which will improve soil fertility, break disease cycles, and reduce soil erosion and competition from weeds,

(ii) an increase animal production through improved feed quality and quantity and

(iii) increased opportunities for additional income e.g. through the sale of forage seeds.

5.1.2. On the national economy

The national economies of the RG's will benefit through:

(i) an increase in crop and animal production and the re-afforestation of degraded lands and

(ii) the development of trained staff and a network of scientists who collaborate on solving mutual problems

5.1.3 On the environment

The impact on the environment will be through more stabile farming systems in upland forestry and agricultural areas due to improved soil conservation, increased soil fertility and reduced run-off of rainfall.

5.2 Trade and commercial benefits to both countries

Australia will benefit directly from an increase in export of live cattle and sheep to Southeast Asia (In 1992, this amounted to export earnings of over A$ 50 million). It will benefit indirectly as a result of an increase in the disposable incomes of the poor in developing countries and thus greater opportunities for trade.

Australian tropical pasture research and development will benefit from availability of performance data in different agroecological regions of Southeast Asia.

The RG countries will benefit from greater disposable incomes of smallholder farmers.

5.3 Political benefits

Australia will benefit from an appreciation by people in Southeast Asia of the willingness of the Australian Government to assist in solving development problems of the region as a whole and from involving the RG countries in the design and monitoring of the Project.

The RG countries will benefit from the financial contribution of Australia thus allowing them to more fully utilise their available resources.

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