

ATLANTIC ZONE PROGRAMME

**Report Nr. 1
Working Document 16**

WORKPLAN 1991-1993

**A methodology for analysis and planning
of sustainable land use, a case study
in Costa Rica**

**Turrialba
February 1992**

**CENTRO AGRONOMOICO TROPICAL DE
INVESTIGACION Y ENSEÑANZA - CATIE**

**UNIVERSIDAD AGRICOLA
DE WAGENINGEN - UAW**

**MINISTERIO DE AGRICULTURA Y
GANADERIA DE COSTA RICA - MAG**

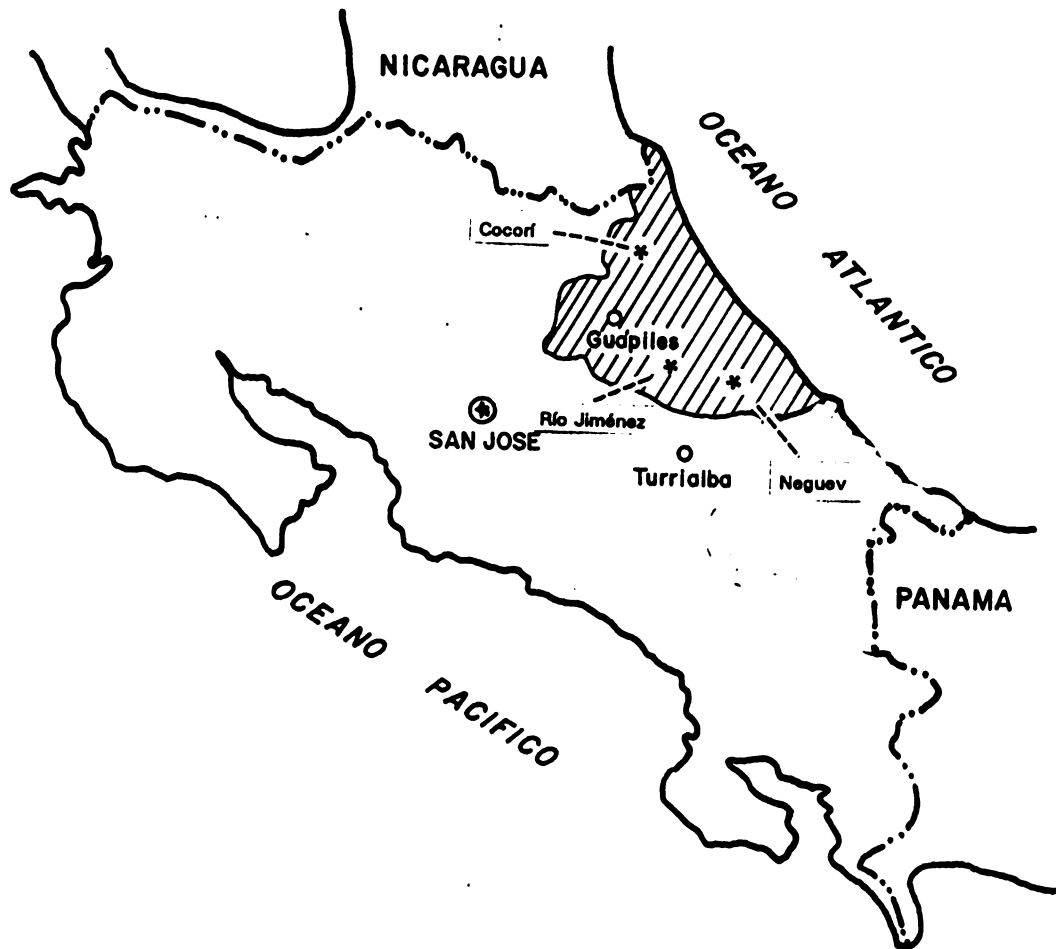


Figure 1. Location of the study area.

PREFACE

General description of the research programme on sustainable Landuse.

The research programme is based on the document "elaboration of the VF research programme in Costa Rica" prepared by the Working Group Costa Rica (WCR) in 1990. The document can be summarized as follows:

To develop a methodology to analyze ecologically sustainable and economically feasible land use, three hierarchical levels of analysis can be distinguished.

1. The Land Use System (LUS) analyses the relations between soil type and crops as well as technology and yield.
2. The Farm System (FS) analyses the decisions made at the farm household regarding the generation of income and on farm activities.
3. The Regional System (RS) analyses the agroecological and socio-economic boundary conditions and the incentives presented by development oriented activities.

Ecological aspects of the analysis comprise comparison of the effects of different crops and production techniques on the soil as ecological resource. For this comparison the chemical and physical qualities of the soil are examined as well as the pollution by agrochemicals. Evaluation of the groundwater condition is included in the ecological approach. Criteria for sustainability have a relative character. The question of what is in time a more sustainable land use will be answered on the three different levels for three major soil groups and nine important land use types.

Combinations of crops and soils

	Maiz	Yuca	Platano	Piña	Palmito	Pasto	Forestal I II III
Soil I	x	x	x		x	x	x
Soil II						x	x
Soil III	x			x	x	x	x

As landuse is realized in the socio-economic context of the farm or region, feasibility criteria at corresponding levels are to be taken in consideration. MGP models on farm scale and regional scale are developed to evaluate the different ecological criteria in economical terms or visa-versa.

Different scenarios will be tested in close cooperation with the counter parts.

The Atlantic Zone Programme (CATIE-AUW-MAG) is the result of an agreement for technical cooperation between the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), the Agricultural University Wageningen (AUW). The Netherlands and the Ministerio de Agricultura y Ganadería (MAG) of Costa Rica. The Programme, that was started in April 1986, has a long-term objective multidisciplinary research aimed at rational use of the natural resources in the Atlantic Zone of Costa Rica with emphasis on the small landowner.

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ABSTRACT

The workplan 1991-1993 explains the activities for the second phase of the Research programme in the Atlantic Zone of Costa Rica.

The core of the Programme consists of the development and testing of a methodology for analysis and planning of sustainable land use both in ecological as economic terms.

The researches activities for 1991-1993 builds on the results of the first phase (1987-1990) and will further consist of a combination of modeling, experimentation and multiple goal planning. Three hierarchical levels of analysis are distinguished:

- The Land Use System level, examining relations between different soil type and crops.
- The Farm System level, analysing decisions made at the Farm household level regarding farm activities.
- The Regional level, analysing agroecological and socio-economical boundary conditions at regional scale.

Apart of publications, use of Geographic Information Systems will be made to present the results of relevant development scenarios for case study areas. PhD and MSc students from Costa Rica and the Netherlands will participate in the research.

The programme is realized within the framework of the agreement between the research parties:

- CATIE : Centro Agronomico Tropical de Investigacion y Enseñanza
- MAG : Ministerio de Agricultura y Ganaderia
- UAW : Agricultural University of Wageningen

Research, Education and Development Support are the main objectives of this agreement. The approach for the realization of this objectives is explained in this workplan.

EXTRACTO EN ESPAÑOL

El plan de trabajo 1991-1993 explica las actividades para la segunda fase del Programa de Investigación en la Zona Atlántica de Costa Rica.

El núcleo del Programa consiste en el desarrollo y prueba de una metodología para análisis y planificación del uso sostenible de la tierra tanto en términos ecológicos como económicos.

Las actividades de investigaciones para 1991-1993 se construyen sobre resultados de la primera fase (1987-1990) y consistirá más adelante de una combinación de modelación, experimentación y planificación de metas múltiples. Tres niveles jerárquicos de análisis son distinguidos:

- El nivel del sistema de uso de la tierra, examinando relaciones entre diferentes tipos de suelos y cultivos.
- El nivel de sistemas de fincas, analizando las decisiones hechas en la finca a nivel de grupo familiar respecto a las actividades de la finca.
- El nivel regional, analizando las condiciones de los límites agroecológicos y socioeconómicos a una escala regional.

Aparte de las publicaciones, se hará el uso del sistema de información geográfico para presentar los resultados de desarrollo de escenarios relevantes para casos de estudio de áreas. Estudiantes de PhD y MSc de Costa Rica y de Holanda participarán en las investigaciones.

El Programa es llevado a cabo dentro de un marco de trabajo del convenio entre los partidos de investigación

- **CATIE** Centro Agronómico Tropical de Investigación y Enseñanza
- **MAG** Ministerio de Agricultura y Ganadería
- **UAW** Universidad Agrícola de Wageningen

Investigación, educación y apoyo al desarrollo son los objetivos claves de este convenio. El acercamiento para la realización de estos objetivos es explicado en este plan de trabajo.

1. INTRODUCTION

The workplan 1991-1993 encompasses a new stage of the Agricultural Research Programme in the Atlantic Zone of Costa Rica.

Like the first workplan, prepared in 1987, the activities in this period will also be realized within the framework of the agreement between the cooperating parties: Centro Agronomico Tropical de Investigación y Enseñanza (CATIE), the Agricultural University of Wageningen (UAW) and the Ministerio de Agricultura y Ganadería (MAG). This agreement was signed in 1986 and forms the basis for the UAW activities in Costa Rica oriented towards Research, Education and Development support.

The central component of the workplan of the second phase forms the research programme: A methodology for analysis and planning of sustainable land use, a case study in Costa Rica which was approved by the cooperating parties in 1990. To enable the realization of the other components education and development support, "letters of intent" were prepared to ensure the cooperation with other national and private institutions of the country.

Typical features of the research area in Costa Rica comprise of the following:

- A humid tropical climate with a rainfall surplus over evaporation of about 3000 mm, spread over all 12 months of the year
- Soils of vulcanic origin
- Recent and ongoing colonization and related rapid deforestation
- Strong influence of (multi)national companies oriented towards export of bananas and other agricultural products.

The location of the study area is presented in Figure 1.

2. BACKGROUND

The activities of the programme during the first period, 87-90, were oriented towards problems of structural transformation of agricultural development in the Atlantic Zone of Costa Rica, with the ultimate aim of providing relevant insights needed for agricultural planning purpose. Within this context the aspects of sustainable land use, small farmer development and rapid deforestation were to be highlighted (v.d. Sluis 1987).

A baseline study was executed, focussing on aspects of:

- The land as a natural resource;
- Land use and farming;
- Socioeconomic and institutional frame work.

Thus valuable insights were obtained that provided the basis of further specific studies.

Apart from fruitfull working relations with the counterparts and related institutions, the first phase of activities resulted in approximately 75 reports and multidiciplinary publications; detailed and semidetailed soil and land suitability maps with their corresponding data bases, and three seminars, one in the Netherlands and two in Costa Rica.

The information collected from 87-90 constitute for the basis of the work plan for the second phase: A methodology for analysis and planning of sustainable land use.

3. OBJECTIVES

The general objective of the work plan is three fold:

- a) To execute a multidiciplinary research programme;
- b) To provide education for students from the Netherlands, Costa Rica and other countries;
- c) To desiminate research results to the broadest possible audience and support agricultural development activities in the study region.

On the basis of the approved research programme the following immediate objectives are formulated:

1) Research

- Development of a methodology for the analysis and planning of ecological and economical sustainable land use
- Testing of alternative scenarios for (sub)regions of the Atlantic Zone in Costa Rica.

Main tools of the methodology to be developed and tested are a combination of modeling, experimentation and multiple goal planning, resulting in alternative scenarios and computer generated thematic maps.

By its nature, this research implies a multi and interdisciplinary approach.

2) Education

- The research component will be supported by PhD and MSc studies, realized by students from the Netherlands (\pm 15/year), from CATIE (\pm 5/year) and from Costa Rica (\pm

5/year), using facilities of the research station Los Diamantes (MAG) in Guápiles and of CATIE in Turrialba. Furthermore, visiting staff members of the Wageningen University will present specific courses and presentations related to the research programme.

3) Development support

Working relations with other development activities in the area are ensured by means of "letters of intent" with the participating agencies.

A number of staff members of MAG and CATIE participate in research activities and monthly meetings are organized with professionals of the Department of agriculture to exchange intermediate results of the ongoing research in the Atlantic Zone.

Working relations will not only be maintained with Costa Rican institutions, but also with some Agricultural Research Institutes in the Netherlands (DLO), engaged in the same problemacy, contacts will be strengthened (research programme on sustainable land use and food production DLV).

4 TARGET GROUP

As the research programme is oriented towards economically feasible and ecologically sustainable land use, both on small scale and larger regional scale, the audience that can make use of the results is found at corresponding levels.

- At the small scale farm level the target group is found in individual farmers, entrepreneurs specialized in specific crops as well as extension services and farmers groups. Examples of this audience and how they are reached are the following:

Field experiments regarding sustainable fertilizer applications are conducted in farmers fields, the results are directly discussed with the cooperating farmer.

The same accounts for experiments conducted at entrepreneurs specialized in certain crops.

The participation in the Area Piloto project; the Area Piloto project is organized by the joint services of MAG, intends to improve farm productivity in a specific region (located in the area under study). In the project there is a strong interest in the expert systems to be developed by the programme and also for the multiple goal programming at farm level which is strongly linked with this expert systems.

Presently non traditional crops for export are marketed through cooperatives of small producers. Cooperatives are also active in forestry since incentives for forest

management or reforestation are often only granted to organized farmers. Marketing studies and forestry studies are to be made in cooperation with these cooperatives. Results will be discussed with these farmers groups.

- At (sub) regional level the target group consists of national, regional and private organizations engaged in agricultural development. Examples are the National institute of Geography (IGN) and Servicio Nacional de Conservación de Suelos y Aguas (SENACSA). Both institutes are strongly interested in the Geographic Information System to be developed for the presentation of thematic maps as a basis of regional planning.

SEPSA, the planning division of the ministry of agriculture is interested in the multiple goal planning model for regional land use.

The Atlantic Zone division of MIDEPLAN (Ministry of planning) is presently cooperating in collecting information and it will participate actively in the formulation of development scenarios to be tested.

The private organization IUCN (Union Mundial para la Naturaleza) is presently engaged in the planning of sustainable land use in a buffer zone around two National parks connected by a wild life corridor. Both parks are located in the study region of the programme.

A number of students of National universities are interested to participate in the research and contribute with there MSc thesis to the programme.

CORBANA the private institute that not only supports national banana producers but also promotes (commercial) diversification of agricultural production, supports the research programme with laboratory and experimental facilities in their test farm. The expert systems for crops are of direct interest of this institute.

With most of the above named organizations "letters of intent" for exchange of information exist.

Regarding the contract partners: CATIE has a strong interest in the multidiciplinary approach towards sustainability as it is also a main objective of its programme II. Specially regarding the integration of forestry systems in the farm operations and land use systems, a main research activity of CATIE, mutual participation is being developed.

Together with the research department of MAG and with CATIE expert systems are to be developed for a number of relevant crops. Existing knowledge at the research station "Los Diamantes" complemented with joint field research will

provide the basis for this systems to be used by the extension service of MAG. The directors of Programme II (CATIE) and of research (MAG) are represented in the "Steering committee" (see organization)

5. OUTPUT

Apart from the information that will be shared with the target groups, an important output will materialize in publications generated by the PhD and MSc studies.

PhD study subjects that support the multi-and interdisciplinary research are the following:

A: Soil and land use

- Satellite images and land use (J. Huising)
- Landscape and soil genesis (A. Nieuwenhuysen)
- Organic matter development and deforestation (E. Veldkamp)
- Improvement of pasture by means of legumes in the Humid Tropics (M. Ibrahim)

B: Crops and land use

- Modeling of crop production in relation to sustainability (D. Jansen)
- Decision support systems for some tropical crops (J. Arze)
- Forestry in farming systems (to be appointed 1991)

C: Economy and sociology in farming systems

- Economic analysis of land evaluation and land use planning (R. Schipper)
- Sustainability concepts and practices (R. Alfaro)
- Land tenure and land use (W. Brooijmans)

Furthermore two fellowships were submitted for external financial funding that may be awarded in 1992.

MSc studies will be linked to the above mentioned PhD studies and are otherwise selected by the supervisors of departments of the University, CATIE programmes and other cooperating institutes in Costa Rica. The total output of these studies is estimated at 15 per year.

Some intermediate results of the PhD studies and some MSc studies will be presented in International journals and symposia in the form of short publications (estimated at 8 per year).

The research work will be concluded with a workshop in Costa Rica (1993) and a workshop publication describing the methodology and presenting the results of different scenarios for case studies in Costa Rica.

All publications and reports will be distributed by means of a series in the Spanish or English language with summaries in both.

6. IMPLEMENTATION OF THE RESEARCH

The workplan for the research activities is based on the document "Elaboration on the VF research programme in Costa Rica", prepared by the working group Costa Rica of the Agricultural University of Wageningen (Dec. 1990). The document is summarized as follows:

6.1 Research approach

To develop scenarios for sustainable and economically feasible land use, three hierarchical levels of analysis can be distinguished.

1. The Land Use System (LUS) analyses the relations between soil type and crops as well as technology and yield.
2. The Farm System (FS) analyses the decisions made at the farm household regarding the generation of income and on farm activities.
3. The Regional System (RS) analyses the agroecological and socio-economic boundary conditions and the incentives presented by development oriented activities.

1: The Land Use System level (LUS)

For the analysis of the LUS systems the performance of 9 crops are studied on 3 soil types as presented in a matrix (Figure 2)

Figure 2. Combinations of crops and soils

	Maíz	Yuca	Platano	Piña	Palmito	Pasto	Forestal		
							I	II	III
Soil I	x	x	x		x	x			x
Soil II	?				?	x			x
Soil III	x			x	x	x			x

The selection of soil types is based on the soil map and land classification, prepared during the first research phase the characteristics of the soil types are.

Soil type I : Young Holocene soil deposits with good drainage properties

Soil type II : Young holocene soil deposits with poor drainage properties

Soil type III: Old pleistocene soil deposits with reduced fertility

The crops are selected on the basis of their typical occurrence in the study region and the perspectives for future development. They represent a division in annuals and perennials. Forestal I indicates remnants of natural and secondary forest with restricted logging; II indicate reforestation with multipurpose trees and III agroforestry systems.

For each indicated matrix unit data will be collected, by means of experiments or study of existing materials regarding potential and actual production. In this context simulation models will play an important role. Specific attention will be given to depletion of nutrients by crops and/or by leaching, changes in soil physical properties after deforestation as well as pollution through fertilizers and biocides.

2: Farm System level (FS)

At FS level, farm activities and corresponding household budgets will be analyzed at selected sample farms. From this analysis models will be composed representing typical farms for representative combinations of soil conditions, farm size, location, land tenure and other criteria that will appear to play a significant role. These models will be of a linear programming type with multiple goals, allowing for the analysis of different development scenarios at farm level.

An important contribution towards the aspect of sustainable land use planning at farm level will be obtained from the study of activities and attitudes at the farm level oriented towards durable land use. A focus will be made on the movement of nutrients within the farm.

The information collected at LUS level will be integrated into the farm system level by means of expert systems, representing plant-soil-productivity relations for different levels of farm technology.

3: Regional System level (RS)

At the regional level, the question is what determines current land use beyond the farm household decisions. Information collected at the LUS and FS levels, complemented with information obtained by the regional base line survey (1987-1988), will be compared to the incentives for production and sustainability presented by governmental agencies and institutions. Also the activities of (multi)

national agricultural corporations and existing marketing constrains for products will be evaluated in this context.

Parallel to this analysis the effect of ecological events like vulcanic eruptions, flooding and related sedimentation and soil formation processes, typical for the region, will be analysed in perspective of sustainability in longer terms.

Multiple goal planning based on realistic scenarios and the presentation of thematic maps by means of GIS (Geographic Information Systems) will be tested at this regional level for being effective planning tools.

6.2 Research activities

With the dead-line for the presentation of results, fixed for December 1993, the research activities to arrive at this results are designed accordingly (see also time schedule). The activities are divided in three groupes:

Group I : Soil-water-nutrient-plant group

Group II : Farm system group

Group III : External socio-economic conditions and longterm ecological events group.

For group I the activities consist of data collection and simulation by means of computer-models. The research items to be dealt with are the following:

- Definition and mapping of relevant soil groups.
- Analysis of field data to determin physical soil properties and drainage qualities for each soil group.
- Analysis of field experiments on soil fertility and fertilizer efficiency.
- Potential and limited yield modeling for identified crops and soil groups (figure 2).
- Definition of improved crop production technologies.
- Evaluation of sustainability aspects for identified crop and soil group combinations, considering physical and chemical properties of soils, soil pollution and soil erosion for actual and potential production technologies.

In group II research is based on information collected at farms by means of questionnaires complemented by observations of farm activities. Farms are selected in settlement areas (Neguev), old non settlement areas (Río Jimenez, colonization history of more than 70 year), and recently colonized areas (Cocorí) in which forestry plays an important role. On the basis of this information, a

multiple goal analysis for typical farms in the region will be developed.

Activities include:

- Selection of farms and monitoring of households during one year.
- Development of expert systems for relevant crops, based on farm analysis, plant-soil relations (group I) and different production technologies.
- Development of linear programming models for typical farms of the region.
- Monitoring and analysis of sustainability concepts and practices at farm level, and the evaluation of different farm technologies in this context.

The work in group III consists of defining the regional boundary conditions in which farm activities take place.

Activities include the following:

- Inventory of land tenure and land tenure laws;
Off-farm labour relations and mobility;
Demography and immigration;
Government policies and incentives for producers.
- Marketing situation for selected products.
- Evaluation of longterm ecological events.
- Sustainability concepts of governmental agencies and corporations.
- Preparation of scenarios for sustainable land use in cooperation with the pertaining institutes (governmental and private).
- Preparation of a multiple goal programme for testing of scenarios.
- Preparation of the Geographic Information System (GIS) for the thematic map presentations.

For the activities of the three groups only limited use can be made of readily available methodologies. New methodologies need to be developed, especially regarding the linkage of results of soil-plant relations, farming systems and regional planning, oriented towards sustainability. Some concepts for this methodologies are described in the so called LEFSA sequence (Land evaluation and farming systems analysis for land use planning, Fresco et al 1990). These concepts are to be tested and further refined. Sustainability need furthermore to be related towards time frames in which activities at land use system, farm and the regional level take place.

The development and testing of these new methodologies forms to a large extent the challenge of the multi- and interdisciplinary research programme.

7. TIME SCHEDULE

Given the above description of objectives, target groups and research activities, it is obvious that a strong mutual dependency exists regarding information and data, generated in each group.

Many activities that involve collection of primary data are to be carried out by PhD and MSc students that are only available for certain time periods. The simulation models to be used at the different research levels (soil-plant; farm system; regional system) need to be identified or/and developed simultaneously with the primary data collection.

As soon as possible a method has to be developed on how this different programmes communicate with each other (interfacing or otherwise) to enable the final testing and presentation of scenarios for sustainable land use.

The time schedules presented in figure 3 (a,b,c,d) are based on this simultaneous activities and further allow for the preparation of the workshop presentation in December 1993.

Figure 3a. Time schedule (general)
Phase II Atlantic Zone Programme

Time base	Over all	Cases			MGP	GIS
		LUS	FS	RS		
1991/5	Workplan Formulation	Formulate forestry contribution				
7		Farm monitoring Rio Jimenez				
9	Formation	Formulate marketing contribution				Introduction
11	Scenario group				DLV* input planning	Siesta in C.R.
1992/1		First model run LUS				Test run available data
3		Farm monitoring forestry			first run	Regional
5	Testing first draft senarios	Cut off farm monitoring Neguev; Rio Jimenez				Test run Neguev Rio Jimenez
7		First run expert systems				Test run other areas
9		First run forestry systems				
11	Second draft senarios	Conslusion field work, reporting			Second run	Users guide GIS/Siesta
1993/1		Invitation workshop Final senarios			Third run	
3		Participation Symposium Neth. (Methodology)				
5		Workshop reporting			Presentation case studies	
7						
9						
11						

1994

- * LUS = Land Use System
- FS = Farm System
- RS = Regional System
- MGP = Multiple Goal Programming
- GIS = Geographic Information System
- DLV = Research programme on sustainable land use and food production (Netherlands)

Figure 3b. Time schedule soil-plant group I (LUS)
 (---|---|---) connection points for MGP see 3a)

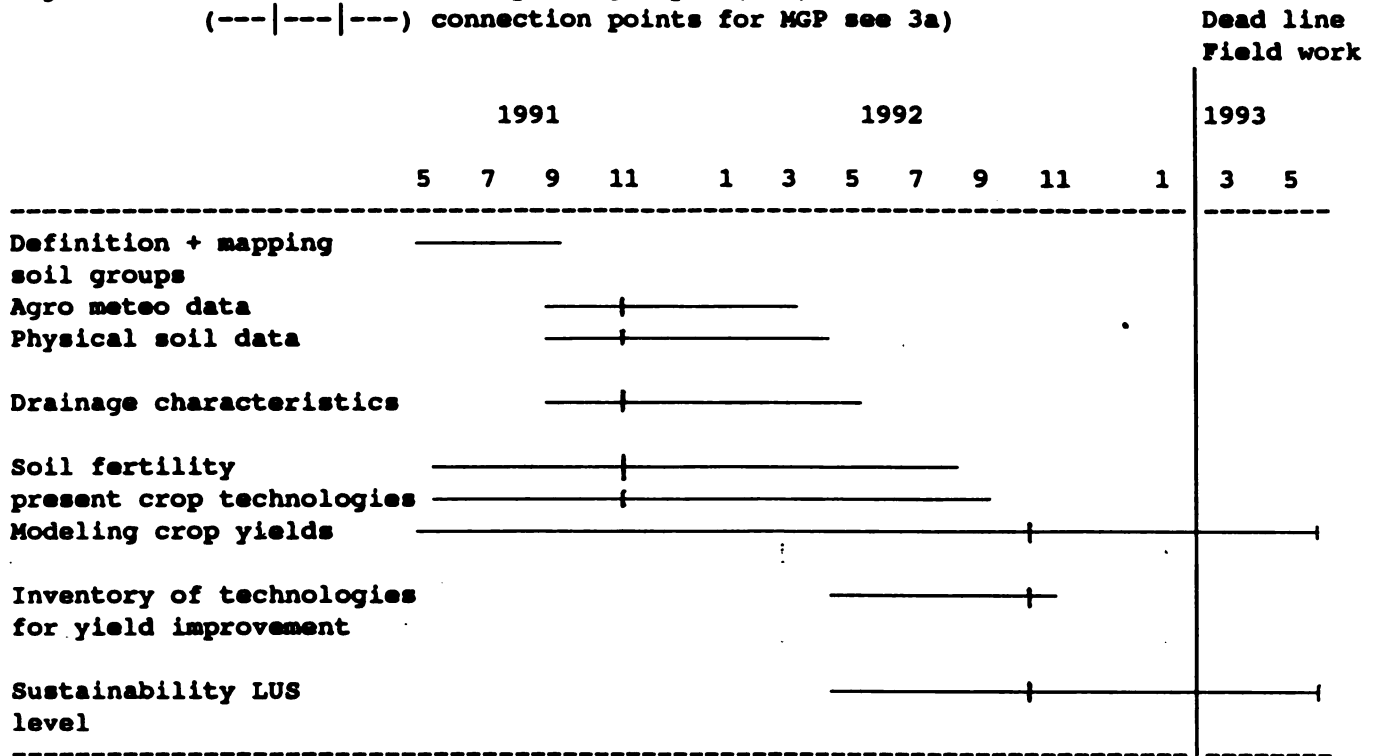


Figure 3c. Time schedule Farm - Systems. Group II (F.S)

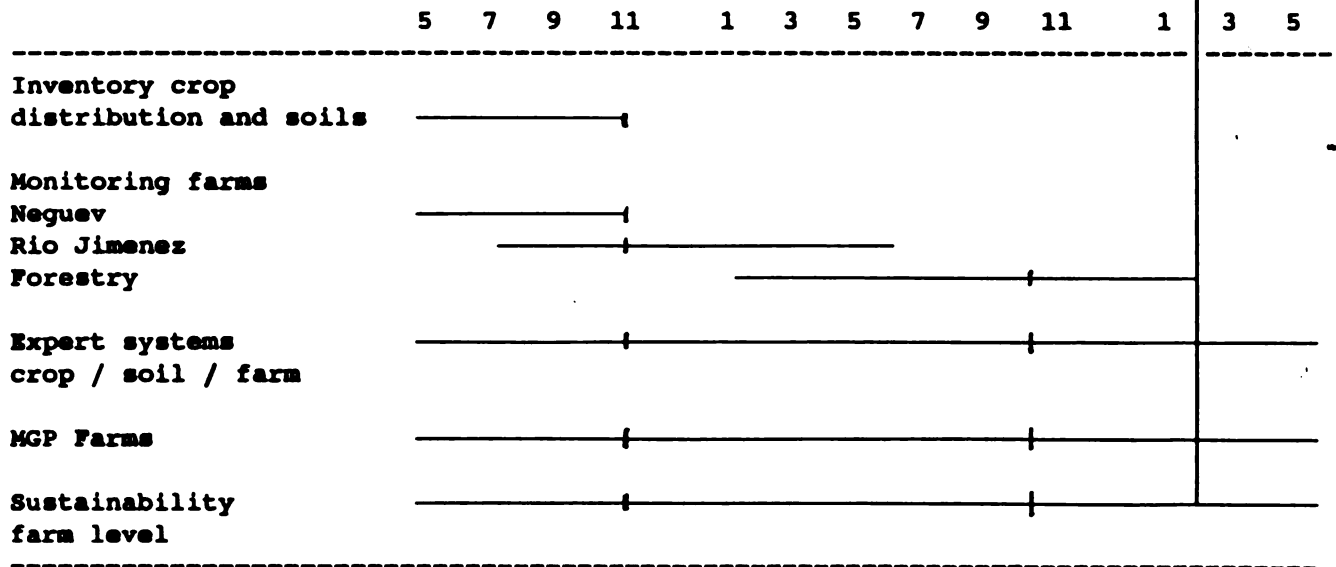
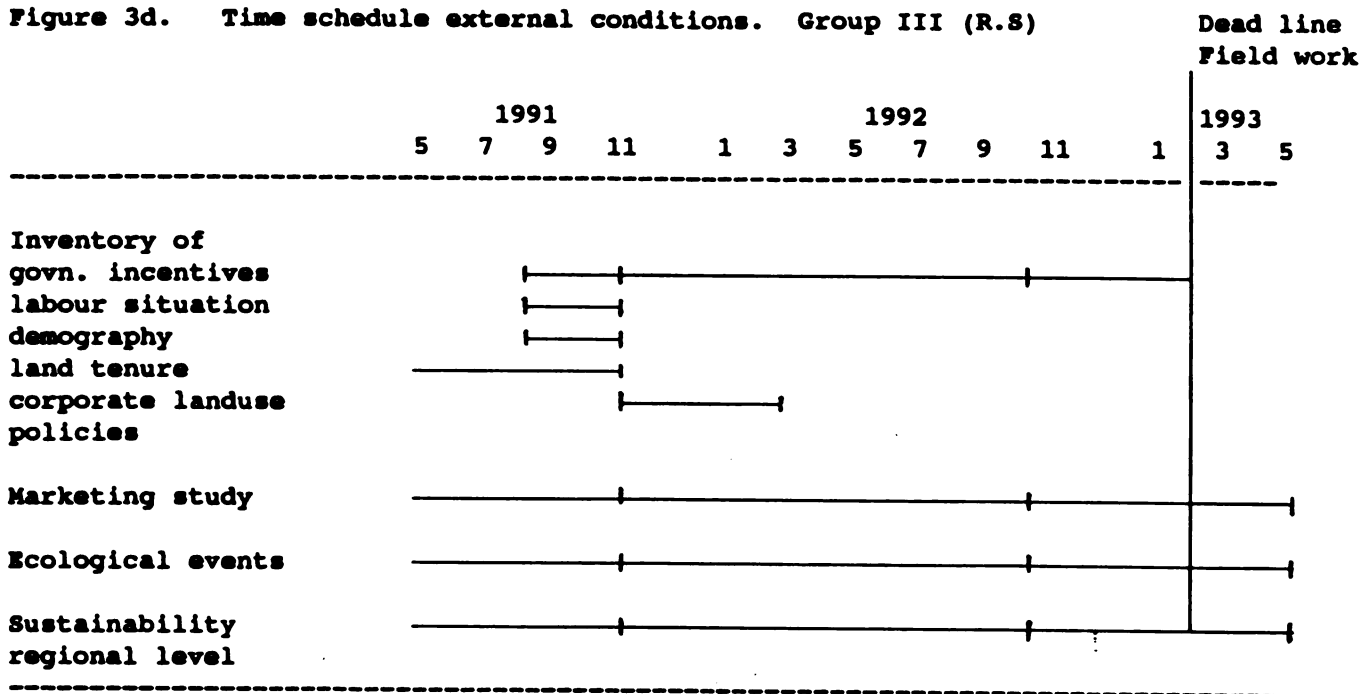


Figure 3d. Time schedule external conditions. Group III (R.S)



8. ORGANIZATION

Steering committee

The research programme is supervised by representatives of the research partners.

For CATIE, MAG and UAW the steering committee consist of the director of Programme II; the director of research and the chairman of the working group Costa Rica, respectively this steering committee meets twice a year.

Field team

In the realization of the programme the field team plays the central role: the team consists of a coordinator and two scientists from the UAW on assignments of long duration (3 years); the coordinator is member of the working group Costa Rica of the UAW. The field team consist further more of a changing number of PhD and MSc students from CATIE, MAG and the UAW.

A number of staff members of MAG are engaged in the field research on part time basis.

The field team has offices in Turrialba and Guapiles and is supported by an administrative staff.

Laboratory analysts are contracted by the field team for extended periods and work in the soils laboratory of MAG.

Research support

Research guidance and support is coordinated in the Netherlands by the working group Costa Rica representing 7 departments of the UAW that are engaged in the research programme.

Furthermore a number of 33 researchers and laboratory analysts of the UAW are participating in the research on limited time basis. Their contribution is oriented towards preparation and guidance of PhD students, selection and preparation of MSc students and consultancy missions to Costa Rica on specific subjects identified by the field team.

Also CATIE staff members participate in guidance of student research and consultancies on specific aspects.

Complementary research

Research activities that can not be carried out by the multidisciplinary team, and services from third parties like registers for land tenure, are contracted out.

9. BUDGET

The budget proposal for the research programme comprises the expenditures related to the field team activities and the travel costs for researchers coming from the Netherlands. A complementary budget, representing salary, installation and accommodation costs, of the permanent field staff of the UAW is not included. The same accounts for the PhD and MSc fellowships. The complementary budgeted accounts for ± Dfl 500.000 per year.

Regarding the work budget for 1991 of Dfl 558.000, of which 66.500 was transferred to cover commitments of the year 1990, the following main components can be indicated:

- Running cost of the research station (incl. personnel, office cost; transportation, etc)	65%
- Missions UAW personnel	16%
- Services to counterparts and others (incl. courses, fellowships, publications)	19%

Some expenditure on missions can be attributed to courses and seminars, given by staff members of the UAW on missions. The same accounts for some costs of the research station that can be seen as service to researchers of CATIE and MAG, as well as members of the National Universities.

The target distribution of funds for the years 1992 and 1993 will be:

65% research station

20% services

15% missions.

Total expenditure for 1992 and 1993 will be slightly less as field work as well as the investment costs for equipment will be deminishing. In 1993 more funds are required for printing and courses (workshop).

Research programme budget

Item	Subject	1991*	1992	1993
2241.3	Personel (Costa Rica)	145.000	145.000	150.000
2241.4	Travel expensses	10.000	10.000	10.000
2420.0	Office inventory (>1000)	10.000	10.000	5.000
2430.0	Vehicles (>1000)	20.000	7.500	5.000
2510.0	Office rent	20.000	22.000	22.000
2520.0	Office equipment	20.000	10.000	10.000
2530.0	Transport running cost	40.000	45.000	35.000
2540.0	Office running costs	23.000	25.000	25.000
2550.0	Research materials	31.000	15.000	15.000
2590.0	Other running costs (lab.)	63.500	60.000	55.000
2212.0	Ticket costs field team	5.000	8.000	10.000
2215.5	Travel expenses field team	5.000	8.000	10.000
2213.3	Ticket cost missions	55.000	50.000	50.000
2215.1	Travel expenses missions	27.000	25.000	25.000
2260.0	Work contracted out (CR)	7.500	25.000	15.000
2216.1	Printing costs (maps, reports)	55.000	20.000	30.000
2612.0	Ticket costs fellowships	5.000	10.000	10.000
2613.0	Travel costs fellowships	6.000	12.000	12.000
2650.0	Courses	<u>10.000</u>	<u>15.000</u>	<u>25.000</u>
		558.000	522.500	519.000
2690.0	Contingency of exchange rates 10%	56.000	52.000	52.000

* Including transfer 66.500 (1990)

** Exchange rate 1/6/91: 1US\$ = 1.93 DFL