AB-DLO research for food production, sustainable land use and environment in developing countries

ab-dlo

Nota 17, Wageningen
March, 1995

The DLO Research Institute for Agrobiology and Soil Fertility (AB-DLO) is part of the Dutch Agricultural Research Department (DLO-NL) of the Ministry of Agriculture, Nature Management and Fisheries.
The institute was founded on 1 November 1993 by the amalgamation of the Centre for Agrobiological Research (CABO-DLO) in Wageningen and the institute for Soil Fertility Research (IB-DLO) in Haren.

The DLO organization generates new knowledge and develops and maintains the expertise needed for implementing government policies, for improving the agro-industry, for the planning and management of rural areas and for protecting the environment.

AB-DLO, with locations in Wageningen and Haren, will carry out research into plant physiology, soil science and agro-ecology with the aim of improving the quality of soils and agricultural produce and of furthering sustainable plant production systems.

Key areas of expertise in AB-DLO are: plant physiology, soil biology, soil chemistry and soil physics, nutrient management, crop and weed ecology, grassland research and agrosystems research.

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Preface

For many years, AB-DLO (and its predecessors) has carried out a substantial research effort for developing countries: about 30 project have been or are being executed. Generally, new projects make use of results, insights and contacts acquired in previous ones. The results of individual projects are generally well appreciated. However, the coherence between these projects has not always been obvious, and a strategy for initiating new projects was not spelled out. The merger of CABO-DLO and IB-DLO into AB-DLO, November 1993, provided another motive for stock taking. This notice provides a short overview of our approach to research and training activities for developing countries, plus brief descriptions of all ongoing activities.

J.H.J. Spiertz
director AB-DLO

F.W.T. Penning de Vries
programme leader

Research for developing countries

Our Strategic Plan confirms that Governments in developing countries and International Organisations are important target groups of the AB-DLO.

We have a long history of research and training projects that are executed by different departments, with different partners, and that address various problems in several agro-ecological zones in Asia, Africa and South America. The projects have in common the aim to improve and to make operational the understanding of sustainable production practices.

There are two motives behind the research: the major challenge of having to increase food and feed production roughly fivefold over the next 40 years in developing countries without over-exploitation of natural resources, and the expertise that AB-DLO has built up in this field. We intend to set up similar research for countries in East and Central Europe and the former USSR in the near future.

Themes

To increase production of crops is the first common theme of research projects. Specific issues are the genetic production potential, productivity per unit input (particularly nitrogen, phosphorus, water) for individual crops and for production systems (i.e. crops, rangelands, agro-forestry), and risk at field and farm level.

To ensure that productive systems are also sustainable, the vegetation dynamics and long-term physical, chemical and biological processes in soils are investigated. Special attention is given to the interaction between agriculture and the environment.

To identify optimal agricultural production systems at farm and regional level is the third common theme. This theme builds on the previous ones. Variables targetted for optimisation include agricultural productivity, risk level, environment, and economic performance.
The importance of constraints due to natural resources (such as surface water) and the macro-economic environment are investigated in scenario studies. Issues of scale receive special attention.

Approach

The approach is founded on systems analysis and simulation. Five steps in this methodology are:
- identify the system (e.g. a rice crop) and its environment (e.g. drainage water);
- describe the key processes and their relation to the environment;
- quantify key parameters;
- integrate new and old knowledge in models;
- use the model to predict how the system will respond to new situations (e.g. a new fertiliser regime, reduced supplies of irrigation water).

Large projects address all steps, smaller ones address only one or two. Optimisation and simulation are intensively used techniques. Data from field trials and observations are used to improve and test models. Projects with NARCs usually involve a training component.

Products

Six products arise from our research for developing countries:

1. *Methodologies to raise productivity.* We ascertain the biophysical potentials of annual production. Using yield gap analysis, we identify and quantify biophysical bottlenecks. Solutions for specific climatic and agro-ecological zones are defined in terms of optimal use of resources, such as water, nutrients, energy and genetic properties. The results are made available in reports, maps, data bases, and models. Desk research is accompanied by field experimentation on crops, soils, rangelands and agro-forestry systems.
2. *Methodologies to achieve sustainability.* We ascertain concrete opportunities and threats for the sustainability of agricultural production systems and their environments in different agro-ecological zones and for a wide range of management techniques. Sustainable use of natural resources, including nature, is addressed. The results are made available in reports, maps, data bases and models. Experimental research and monitoring at farm and regional scales helps to test new concepts.
3. *Strategies to stimulate rural development.* We establish options for agricultural land use, trade offs with respect to alternative development goals, and identify scenarios on how to stimulate farmers to adopt changes towards optimal land use. Results are made available as reports, publications, and recommendations to enhance public debate and to stimulate policy decisions. This involves desk and field research, monitoring and surveys.
4. *Short studies.* We give advice in the form of short desk studies, consultancies, training courses and backstopping of field staff from other institutes. We identify bottlenecks in increasing productivity, optimising resource use efficiency, achieving sustainability and stimulation of the rural environment, and we suggest options to eliminate such bottlenecks.
5. *Tools.* We produce manuals, models, expert systems, and data bases. These are made widely available. Courses facilitate the effective transfer of comprehensive tools to NARCs.
6. *Human resource development.* We transfer knowledge when implementing research projects on the optimal use of resources, the achievement of sustainability and the exploration of options for rural development. This transfer is needed to make best use of national and local capabilities and to ascertain continuity once a research project is completed. Training takes place in formal short, MSc and PhD courses in collaboration with local or international universities, and as in-service training.

Capacity

The research capacity at AB-DLO depends on funding by LNV, DGIS, EU and other donors and agencies. Funding agencies select one or more of our products for their projects.

For 1995-1998, LNV contributes funds for 7 staff members. In 1995, 7 more persons are supported by DGIS funds, 1 in EU projects, and 1 in a special LNV project. Co-operation with partners is the rule in these projects, but their research capacity is not included in these numbers.

Future

The capacity for agricultural research in most developing countries has grown significantly in the last 30 years. CGIAR-institutes now collaborate effectively with many NARCs. Facilities for communication are now within reach of nearly everyone. These three developments mean that our future projects will often be executed effectively in tripartite cooperations (with NARCs and CGIAR-institutes), with less direct involvement of AB-DLO staff in local experimentation.

NARCs and CGIAR-institutes also produce 'methodologies to raise production' and 'to achieve sustainability'. We will continue to associate our systems analysis and simulation approach with their research. Much less expertise exists in these organizations, and elsewhere, on optimizing agricultural production systems at farms and in regions, and on ecoregional approaches for rural development. We expect therefore that they will request this expertise for some time to come.

In response to these trends, we need to broaden the capacity of our development related research slightly. We will actively approach other donors. We will also develop alliances with key partners in Wageningen (including PE, IBN-DLO, LEI-DLO, SC-DLO and OE-WAU) and abroad (including ICASA and CIRAD).

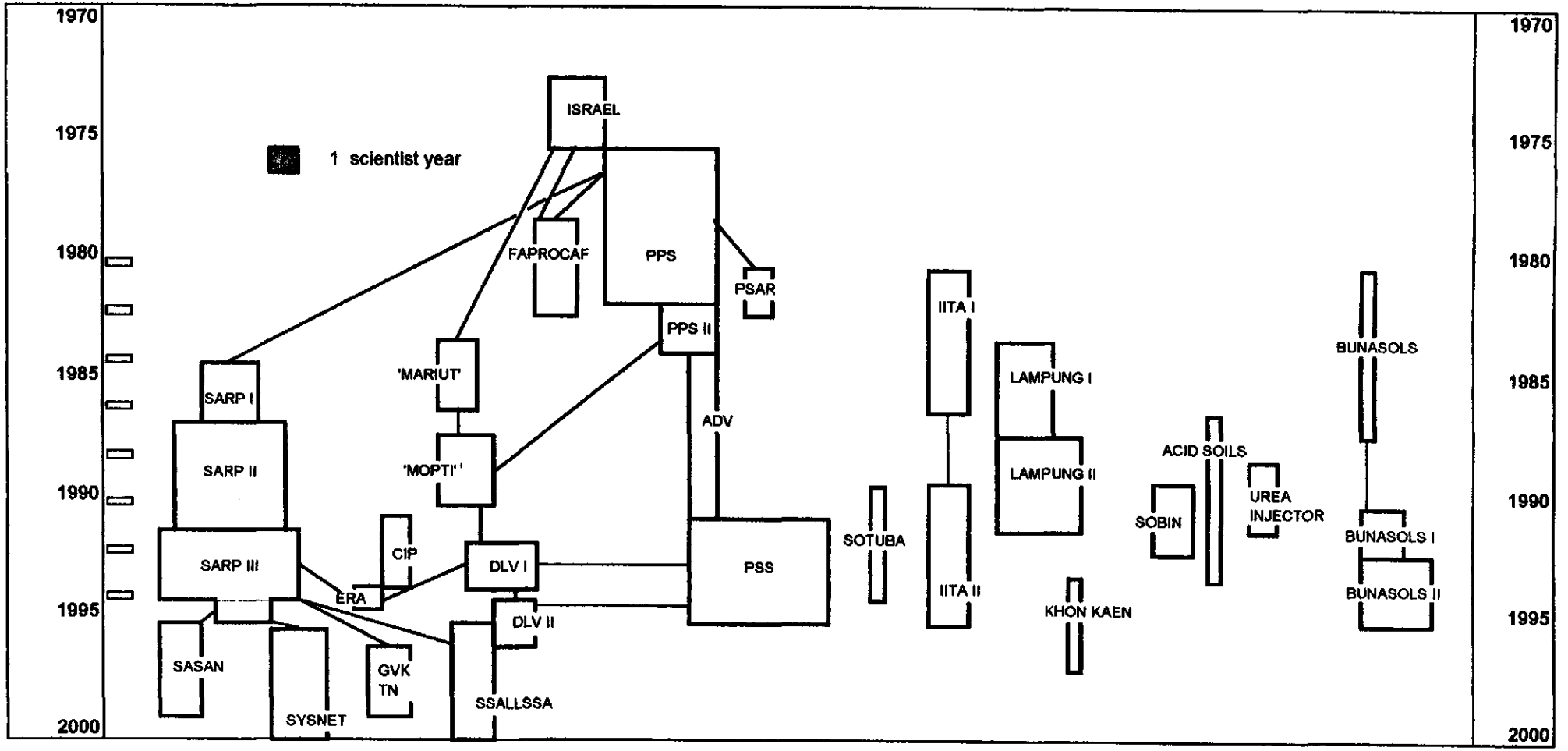
We encourage AB-DLO staff to accept temporary assignments at CGIAR-institutes or NARCs to ensure that we remain up to date on issues and improve our products.

Partners

Collaboration with partners in the Netherlands and abroad is a necessity. Collaboration with NARCs is necessary for a clear identification of key research issues and for the practical testing of suggested solutions. Collaboration with CGIAR-institutes is often very effective for reaching NARCs and for achieving thorough scientific interaction.

AB-DLO's collaboration with the Wageningen based graduate school for Production Ecology provides additional expertise for development related research and training. For certain research subjects, additional partners are needed with complementary expertise such as on geographic information, nature and socio-economics. Particularly the product 'strategies for rural development' requires extensive cooperation with economists at the farm and regional level.

Projects for developing countries in which AB-DLO (and its predecessors) and TPE-WAU are/were involved.



H. Drenth
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The historic context

The development of activities related to research and developing countries of the past two decades is shown in the figure on page 6. The size of the boxes is approximately proportional to the number of person-years in the projects.

The names of ongoing and submitted projects are explained in the following pages. For the past projects, one-line descriptions are given below. Either AB-DLO (or its predecessors), TPE-WAU, or both, have been responsible to lead and execute the projects. The set of small, unnamed blocks on the left points at short international courses to which we have contributed.

The past projects are (listed alphabetically):

ÅDV:	Advisory services for developing countries
CIP:	PhD project of AB-DLO, TPE-WAU and CIP on potato productivity.
ERA:	Symposium on Ecoregional Approaches, organized by AB-DLO, TPE-WAU and CIP on request of DGIS.
Faprocaf:	Research on irrigated agriculture in Peru, collaboration AB-DLO, Hebrew University and INIPA, Peru.
ISRAEL:	A study on rangeland production in semi-arid regions; collaboration of the Department of TPE with the Volcani Institute, Israel (1972-1976).
Lampung (I):	N utilization in traditional and improved systems of shifting cultivation in the humid tropics. Collaboration with Brawijaya University (Malang, Indonesia) and IITA. 1984-1987.
Lampung (II):	Nitrogen management in sustainable cropping systems on an ultisol. Collaboration with Brawijaya University (Malang, Indonesia). 1987-1991.
Mariut:	Research on land use planning in Egypts coastal zone, collaboration between AB-DLO and Cairo University.
Mopti:	Request of Mali to quantify scenario's for land development in Mali.
PPS:	Research on rangeland production in the Sahel, collaboration of AB-DLO, TPE and IER, Mali.
SOBIN:	An annotated bibliography of pre-independence soil literature of Indonesia 1890-1963. Collaboration with Centre for Soil and Agroclimate Research (CSAR, Bogor, Indonesia), ISRIC, PUDOC-DLO. 1990-1992.
Urea injector:	Test and introduction of a pneumatic urea injector in wetland rice. Collaboration with NMI, WAU (Agricultural Engineering) and LEI-DLO. 1989-1991.

Acronyms

AB-DLO	DLO-Research Institute For Agrobiology and Soil Fertility, and its predecessors CABO, IB, IBS, Wageningen, Netherlands
CGIAR	Consultative Group on International Agricultural Research, with 17 International Institutes
CIRAD	Centre International pour la Reserche Agronomique et le Dévelopment, Montpellier, France
CIAT	Centre for International Agriculture in the Tropics, Colombia
CIP	International Centre for Potato Research, Peru
DGIS	Directoraat Generaal Internationale Samenwerking, Ministry Foreign Affairs, The Hague, Netherlands
EU	European Union
IBN-DLO	Institute for Forestry and Nature Research, Wageningen, Netherlands
ICASA	International Consortium for Application of Systems analysis in Agriculture
IRRI	International Rice Research Institute, Philippines
IITA	International Institute for Tropical Agriculture, Nigeria
LEI-DLO	DLO Agricultural Economics Research Institute, The Hague, Netherlands
NARC	National Agricultural Research Centre in a developing country
NM-WAU	Dept. Nature Management, Wageningen Agricultural University, Netherlands
OE-WAU	Dept. Development Economics, Wageningen Agricultural University, Netherlands
PE	C.T. De Wit graduate school for Production Ecology, Wageningen
SC-DLO	Winand Staring Centre, Wageningen, Netherlands
TPE-WAU	Dept. Theoretical Production Ecology, Wageningen Agricultural University, Netherlands
WRR	Scientific Council to the Netherlands Government, The Hague, Netherlands

Short list of current projects

For a quick overview, of all ongoing and submitted projects are indicated:
code name (if any), full name, project leader or contact person, participating institutes and key issue. A description of these projects follows (Appendices A-J). For a complete description and project results, contact the project leader.

Consultancies and short desk studies are omitted.

Ongoing projects

1. **SARP** Simulation and systems Analysis for Rice Production, phase III.
   Ten Berge and Kropff. AB-DLO + TPE-WAU + IRRI + 15 NARCs. *Application of systems analysis for effective research on rice in Asia.*
2. **PSS** Sustainable agriculture in the Sahel-Soudan zone. Breman. AB-DLO + IER-Mali + NM-WAU. *Need for inputs to create sustainable and productive mixed farming systems.*
3. **DLV** Sustainable land use and food security, phase II. Van Keulen and Kuyvenhoven. AB-DLO + OE-WAU + 6 Dutch partners. *Optimal and sustainable land use systems, and policy instruments to achieve these.*
4. **BUNASOL** Support to the national bureau of soils in Burkina Faso. Neeteson. AB-DLO + BUNASOL-BF. *Reinforce the capacity of the national soil service.*
5. **IITA-HFS** Role of plant residues in soil management. Neeteson. AB-DLO + IITA. *Determine improved crop and soil management.*
6. **Acid Soils** Sustainable cropping systems in acid uplands. Whitmore. AB-DLO + NARCs + Wye College. *Improved crop and soil management.*
7. **DMHC** Improved farming techniques for cereal crops in West Africa. Reyniers. CIRAD + AB-DLO + IER + AFDC.

Submitted project proposals

1. **SSALLSSA** Strategies for sustainable land use in Lowland Savannas of South America. Penning de Vries. CIAT + AB-DLO + TPE-WAU + 6 NARCs. *Planning optimal use of Savannas and transferring of methodology .*
2. **SYSNET** Network for systems research to improve cropping systems in Asia. Ten Berge/Kropff. IRRI + AB-DLO + TPE-WAU + 15 NARCs. *Identifying optimal, intensive production systems in Asia.*
3. **SASAN** Systems Analysis and Simulation for Andean Natural resources. Haverkort. CIP + AB-DLO + 4 NARCs. *Identifying sustainable and productive farming systems in the Andes.*
4. **GfC-TN** Ground for Choices - Tamil Nadu. TN-Agricultural University. Penning de Vries. TNAU + AB-DLO + PE + SC-DLO. *Determining optimum land use scenarios for agriculture in South India.*

Appendix A

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Simulation and Systems Analysis for Rice Production, SARP, Phase III

2. GENERAL

- date submitted	July 5, 1991
- submitted by	AB-DLO
- project leader	H.F.M. ten Berge, M.J. Kropff
- department	Dept. Agrosystems Research
- DLO-program	110, 260
- executing departments, organisations	TPE-WAU, IRRI, and 15 NARCs
- funding/agencies	DGIS
- duration	1991-1995

3. SUMMARY

SARP is a collaborative project involving national rice research centres (NARCs) in Asia, the International Rice Research Institute (IRRI, Philippines), AB-DLO, and the Wageningen Agricultural University. The first project phase started in 1984. During Phases I and II (1984-1991) three international training programs were executed (1986-1987; 1988-1989; 1990-1991), aiming at the introduction of systems analysis methods, including simulation techniques, in the Asian rice research centres. About 100 researchers were trained, in interdisciplinary teams of 4-8 persons. Additionally, national training courses were held at later stages by IRRI and by the participating NARCs. Project Phase III aims at consolidating the participating teams, through collaborative research in selected Application Programs. These cover issues in breeding, input management (nitrogen; pesticides), crop rotations, agroecological zonation, and evaluation of the effects of climate change on rice production. Participating countries are India, China, Bangladesh, Indonesia, The Philippines, Malaysia, Korea, and Thailand.

4. PROBLEM TO BE SOLVED

Research for improved sustainable rice production has traditionally been empirical and site-specific. The use of systems research methods may drastically improve the efficiency by which the scarce resources available for agricultural research and development are used. This is especially so when applied in a network format, allowing the distribution of work load and enabling the development and testing of models across a wide range of environments.

5. OBJECTIVES

For project Phase III:

- consolidation of existing simulation teams in NARCs via collaborative applied research programs
- reinforcement of IRRI as a centre of expertise in rice crop modelling
- support of national training courses in systems methods
- transfer of research coordination activities to NARCs

6. RESULTS

Results are twofold: (1) increased systems research capacity in the region; (2) research outputs. The latter are presented in the form of scenario studies (climate change evaluation), maps (zonation studies), simulation models, expert systems (site-tailored nitrogen management), and other software such as a user friendly shell for model application. The results of experimental and theoretical work are also presented in the SARP Research Proceedings, a thematic series distributed to all 'rice libraries' and many others in the participating countries.

7. METHODOLOGY

See Summary

8. BUDGET

The total project budget is Dfl 7.142.899,- of which Dfl 5.920.364,- is financed by DGIS, and Dfl 1.222.535,- is provided by AB-DLO, IRRI and TPE-WAU. Approximately 200 person-years are input by participating NARCs over the four year duration of the project; this has not been included in the above figure.

Appendix B

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Sudano-sahelian Production (PSS) (optimum use of nutrients in animal husbandry)

2. GENERAL

- date submitted	1990
- submitted by	
- project leader	H. Breman
- department	Agrosystems Research
- DLO-program	260
- executing departments, organisations	IER, AB-DLO, NM-WAU
- funding/agencies	DGIS + AB-DLO + IER + NM-WAU
- duration	4.8 years

3. SUMMARY

a. Search for technical options and development strategies (socio-economic measures) to improve the access to fertilizers for more sustainable agricultural production in the Sudano-sahelian-zone, using animal husbandry as the point of entry.

b. Improving Malian agricultural research capacity.
The research focuses on maximal efficiency of nitrogen and phosphorus fertilizers, using elements from ecological agriculture to optimize these fertilizers. Next step concerns optimal use of the fodders obtained by livestock. The quantification of all factors involved and a study of their interrelations should allow the evaluation of potential interventions necessary to strengthen the sustainability of agro-pastoral systems, as well as the evaluation of alternative methods, taking into account the socio-economic conditions and the different goals of rural development.

4. PROBLEM TO BE SOLVED

Low soil fertility limits agricultural production in the Sahel even more than shortage of water. This situation deteriorates through overexploitation of natural resources. Causes are overpopulation and socio-economic conditions. Research questions are to which degree technical options may still improve the feasability of use of external inputs, and which socio-economic measures are needed for this goal. How to reinforce the local research capacity to become more independent.

5. OBJECTIVES

Contribute to the development of more sustainable agriculture in Sahelian countries. Reinforce the Malian research capacity.

6. RESULTS

- Identification of techniques for fodder production improvement and for feeding with improved efficiency of nutrients (N & P).
- Elements for rural development strategies.
- Research tools (e.g. crop- & animal production models; LP-MGLP models)
- Improved research infrastructures; Malian theses
- search for improved recovery of N & P for fodder production through combination of ecological and intensive agriculture
- search for optimal use of feed supplements in animal husbandry
- comparison of optimal use of internal and external inputs in crop- and animal production, in dependence of development goals, at national, regional and farm level
- modelling and simulation
- investments in infrastructure and in training

7. METHODOLOGY

The research activities are shared between four teams; three of them are based in Mali, one in the Netherlands. The team studying forage production focuses on the added value offered by leguminous species, perennial grasses and agroforestry. As far as the valorization of quality forage is concerned, the team studying forage consumption intends to verify and develop the relations between the quality of fodder and the quantity of feed intake, and between the quantity and quality of feed intake and animal production. In the evaluation of technical and socio-economic options, the team for modelling and system-analysis goes beyond the ratio costs/benefits. Multiple goal planning is one of the approaches used in this field. System-analysis and simulation models are used by all teams. The support team in the Netherlands plays a crucial role in modelling and simulations.

8. BUDGET

The total budget is Dfl 12.4 million, of which Dfl 10.5 million is financed by DGIS, and the rest by the Dutch institutes involved. The local infrastructure in Mali and more than 40 men-years are input by the IER; this has not been included in the above figure.

Appendix C

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Sustainable Land Use and Food Security phase II (DLV = Duurzaam Landgebruik en Voedselvoorziening in de tropen)

2. GENERAL

- date submitted	September 1994
- submitted by	AB-DLO
- project leader, intended	H. van Keulen (AB-DLO) and A. Kuyvenhoven (OE-WAU)
- department	Agrosystems Research
- DLO-program	260
- executing departments, organisations	AB-DLO, SC-DLO, LEI-DLO, TPE-WAU, OE-WAU, BG-WAU, AGR-WAU
- funding/agencies	DGIS and LNV-DWT
- duration	1995-1996

3. SUMMARY

The DLV-programme aims at the development of a general operational methodology that permits integration of agro-ecological and socio-economic information for the formulation, exploration en evaluation of policy options for sustainable land use and food security at regional and farm level. To achieve this goal extensive use is made of systems analysis, simulation and econometric methods.

4. PROBLEM TO BE SOLVED

The reason for the DLV-programme is that a need was felt for scientific support for rural development programmes in tropical areas to explore options for sustainable land use, and to analyse the effects of policy measures on land use, food security, income, employment and the degree of realisation of various social objectives. Most research efforts on land use in developing countries have a strong disciplinary or sectoral emphasis and do not pay enough attention to integration of agro-ecological and socio-economic aspects, while sustainability is affected by the combined effects.

5. OBJECTIVES

Identification of policy options for sustainable land use and food security.

6. RESULTS

- Combination of insights and knowledge from various disciplines in such a way that a surplus value can be obtained compared to a single disciplinary approach.
- Quantification of relevant land use processes.
- Generation of land use scenarios and identification of appropriate policy options to change land use.
- Identification of research priorities to improve or adapt technology in both socio-economic and agro-ecological terms.

7. METHODOLOGY

Three levels of analysis are used in the approach: field, farm and region. Agro-ecological land use processes are described at the field level using systems analysis and simulation techniques. At the farm level, linear programming and econometric techniques are used to estimate the effectiveness of policy instruments to induce land use changes. At the regional level Multiple Goal Linear Programming techniques are used to explore land use options given regional constraints and (at least partially) conflicting objectives.

8. BUDGET

0.6 MFl for 2 years

Appendix D

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Support to the "Bureau National des Sols" (BUNASOLS), research into soil-crop relationships in Burkina Faso

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2. GENERAL

- date submitted	1991
- submitted by	J. van der Heide
- project leader	J.J. Neeteson
- department	Soil and nutrient management
- DLO-program	DLO-260
- executing departments, organisations	AB-DLO (Agrosystems research), BUNASOLS and INERA (Ouagadougou, Burkina Faso)
- funding/agencies	DGIS
- duration	1993-1995

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3. SUMMARY

The reseach is performed to enable the "Bureau National des Sols" (BUNASOLS) in Ouagadougou (Burkina Faso) to supply farmers and policy makers with agricultural recommendations. A crop growth simulation model is being developed to calculate the effects of various cropping techniques on soil fertility and expected yield of cereals. Inputs to the model are extracted from a data base which includes soil data collected by BUNASOLS.

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4. PROBLEM TO BE SOLVED

The research is performed because the soil data collected by BUNASOLS could not be interpreted agriculturally.

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5. OBJECTIVES

Establishment of relationships between soil chemical and soil physical data and yields of cereals in Burkina Faso.
Improvement of the accessibility and use of soil data collected by BUNASOLS.

6. RESULTS

A crop growth simulation model with which the effects of various cropping techniques on soil fertility and expected yield of cereals can be calculated.
A data base which includes soil data collected by BUNASOLS. The data base is connected to the crop growth simulation model.

7. METHODOLOGY

Water - nutrient - crop yield interactions for Burkina Faso are studied in a topographical context. A simulation model is developed with which expected grain yield and risk of yield depressions in relation to nutrient and water supply can be calculated.

8. BUDGET

The project is financed by DGIS (in total DFL 1.5 million).

Appendix E

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE The role of plant residues in soil management for food production in the humid tropics (IITA-HFS)

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2. GENERAL

- date submitted	1990
- submitted by	J. van der Heide and L. Brussaard
- project leader	J.J. Neeteson
- department	Soil and nutrient management
- DLO-program	DLO-260
- executing departments, organisations	IITA Humid Forest Station (Yaoundé, Cameroon)
- funding/agencies	DGIS
- duration	1992-1995

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3. SUMMARY

The reseach is performed to get a better insight in the processes which regulate the decomposition of added or native plant residues in the humid tropics. The research is executed in Nigera (IITA's experimental station in Onne) and Cameroon (experimental station in Mbalmayo of the IITA Humid Forest Station).

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4. PROBLEM TO BE SOLVED

Agricultural intensification in the humid tropics results in shorter fallow periods which leads to enhanced degradation of soil fertility.

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5. OBJECTIVES

Investigation of decomposition and mineralization processes of added crop residues and native or planted fallow residu sources.
Studies on biotic activities involved in decomposition processes with particular emphasis on the role of soil macro- and mesofauna.
Establishment of the nutrient supply from plant residues to crops.

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6. RESULTS

Management strategies for handling crop and plant residues resulting in a more sustained food production on acid soils in the humid tropics.

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7. METHODOLOGY

Field and laboratory experiments are conducted in Onne (Nigeria) and Mbalmayo (Cameroon). The systems studied include maize/cassava intercropping, maize/cassava alley cropping, and maize and cassava grown in rotational systems.

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8. BUDGET

The project is financed by DGIS (in total DFL 1.8 million).

Appendix F

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Biological management for productive and sustainable cropping systems on acid soils in the humid tropics (ACID SOILS)

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2. GENERAL

- date submitted	1992
- submitted by	M. Van Noordwijk
- project leader	A.P. Whitmore
- department	Soil and nutrient management
- DLO-program	DLO-260
- executing departments, organisations	Khon Kaen University (Khon Kaen, Thailand), Brawijaya University (Malang, Indonesia), Wye College of the University of London
- funding/agencies	LNV, European Union (STD3)
- duration	1994-1997

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3. SUMMARY

The objective of the research is to develop productive and sustainable cropping systems on acid upland soils in the humid tropics. In these cropping systems the choice of practices to be used to add organic matter plays a central role. The project is executed at sites in Thailand and Indonesia.

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4. PROBLEM TO BE SOLVED

Agricultural intensification in the humid tropics results in shorter fallow periods which leads to enhanced degradation of soil fertility.

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5. OBJECTIVES

To develop integrated management practices using organic inputs and low input technology that will be of direct relevance to resource-poor farmers in the humid tropics. The experimental work will be focussed on the potential conflict between short-term and long-term benefits of organic inputs

6. RESULTS

Management strategies for productive and sustainable cropping systems on acid upland soils in the humid tropics. The strategies include a more effective use of native and added nutrient sources.

7. METHODOLOGY

The following topics will be studied at two experimental sites:

* quantification of C and N balance sheets,
* extension of a model on organic matter dynamics,
* assessment of the contribution of nitrogen fixation by legume cover crops and trees,
* quantification of the build-up and decomposition of soil organic matter,
* evaluation of the long-term C and N balance of selected cropping systems.

8. BUDGET

The project is partly funded by the European Union (EU contribution is ECU 400.000)

Appendix G

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Risque and intensification: relieving water and nutrient stress in cereal crops (DHMC)

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2. GENERAL

- date submitted	1992
- submitted by	CIRAD-CA + AB-DLO
- project leader	F.N. Reyniers, CIRAD-CA
- department	ASK (Dr. N.C. Stutterheim)
- DLO-program	260
- executing departments, organisations	CIRAD-CA (leader), IER (Mali), AFDC, AB-DLO
- funding/agencies	EU (STD-3)
- duration	2 years

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3. SUMMARY

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4. PROBLEM TO BE SOLVED

Arable cropping in the semi-arid regions of West and East Africa is very risky. Traditional varieties of millet and sorgho are managed effectively by local farmers but yields are very low. Improving the yield potential requires new management techniques that do not increase risk unduly. Standard agronomic research provides these results only slowly, so that the supplementary approach of systems analysis and simulation is called for.

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5. OBJECTIVES

To identify and test practical methods to improve productivity and reduce risks in rainfed production systems of sorghum and millet, using indigenous knowledge about traditional practices.

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6. RESULTS

To realize the objectives at a few locations in Mali and Zimbabwe, through effective collaboration between institutes from France (CIRAD), Netherlands (AB-DLO), Mali (IER), Zimbabwe (ADFC) and Italy (CeSIA).

7. METHODOLOGY

Field experiments and simulation studies go hand in hand. Models developed in Wageningen and by CIRAD will be compared and exposed to field data previously collected and in new trials. New field trials will collect data about fertilizer responses of the crops, and about photoperiod sensitivity. Some trials will be carried out in experimental fields, other in farmers fields.

Some training for IER and AFDC is foreseen.

8. BUDGET

200 k ECU (to CIRAD)

Appendix H

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Strategies for sustainable land use in the lowland savannas of South America (SSALLSSA)

2. GENERAL

- date submitted	September 1994
- submitted by	CIAT, Colombia
- project leader, intended	R. Vera (CIAT) and H. van Keulen (AB-DLO)
- department	Agrosystems Research
- DLO-program	260
- executing departments, organisations	CIAT, 4 NARCs, OE-WAU, PE
- funding/agencies	DGIS and/or EU
- duration	5 years

3. SUMMARY

4. PROBLEM TO BE SOLVED

The lowland savanas of South America provide an enormous potential for agricultural production. Their development could provide vast quantities of food and feed, and eliminate the need for clearing in rainforests. Current land use planning addresses insufficiently long term and regional strategies for development of these zones, and the integrated nature of the questions involved. Brasil, Bolivia, Colombia and Venezuela recognize the need for such studies, but do not have the capacity to do so, and neither does CIAT, that coordinates land use research in this zone. They requested the 'DLV' consortium to test and apply their concept of integrated analysis and scenario studies, and to develop jointly practical methods to guide the actual planning process in the different countries. This project proposal is an answer to this request.

5. OBJECTIVES

1. To determine potential production of different crops (including rice, soybean, maize), tree crops, rangeland and animal production, and the levels of inputs and outputs associated with it; aggregate these results according to agro-ecological zones and countries; and to optimize production in these zones with respect to specific goals (e.g. maximum productivity of labour or land). Non-agricultural use of land, such as for nature reserves and eco-tourism, will be included in the optimizations. The type of results resembles the original 'Ground for Choices' study. Sustainability of land use will be emphasized.
2. To determine what socio-economic environment should exist for farmers and other users of land to steer rural development in the direction of such optimum production and land use.
3. To train at least one research team (of 6 scientists) of each of the participating NARS and a land use methodology group at CIAT to establish agro-ecological potentials, to optimize for different goals, and to determine pathways from current to optimal future land use.

6. RESULTS

1. Maps and tables indicating optimal use of land for agriculture or other purposes, in which alternative goals are maximized. These will incude: maximum production, maximum income, minimum environmental damage). Results will be by agro-ecological zone; degree of detail will depend on availability of basic data.
2. Scenarios for each of the zones that indicate what socio-economic conditions are required to steer rural development towards optimum land use.
3. Trained teams in the participating countries and at CIAT, which can continue such studies independently of the project.
4. A formal methodology tested and applied to establish socio-economic conditions needed to steer rural development in the direction of desired goals and optimum land use.

7. METHODOLOGY

1. Crop simulation models are used to simulate potential production of crops and rangeland (CIAT, DLV, NARCs).
2. Input/output tables for non-agricultural land use are established (DLV, CIAT, NARCs)
3. Basic data on natural resources are collected, checked, and put into data bases and GIS (NARCs)
4. Optimizations are performed for each goal, by agro-ecological zone and for countries (NARCs, CIAT, Wageningen).
5 Results are discussed with stakeholders (NARCs, CIAT, DLV)
6. Early in the project, a course on optimization of land use is provided (based on 'QUASI'; Wageningen).
7. In the middle of the project, a course on farm household modeling is provided (DLV)

8. BUDGET

Total budget: 8 MFl. A donor is requested to provide 2 MFl for 2-3 Wageningen based scientists, that test and apply the DLV-methodology, are responsible for the courses, and interactions with CIAT. CIAT is the overall coordinator of the project; the 'DLV' project is the Dutch counterpart of SSALLSSA.

Appendix I

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE SYSNET: a systems research network for sustainable resource management and increased productivity of rice based systems in Asia

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2. GENERAL

- date submitted	October 1994
- submitted by	SARP Steering Committee IRRI-AB-TPE
- project leader, intended	-
- department	-
- DLO-program	260
- executing departments, organisations	AB-DLO, TPE-WAU, IRRI, NARCs
- funding/agencies	DGIS
- duration	

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3. SUMMARY

SYSNET aims at applying systems analysis methods to increase sustainable food production in Asian rice regions. It builds upon part of the already existing SARP systems research network, in close collaboration with IRRI. Key issues are the development of methods to optimize - for given local conditions - the use of resources, regional analysis and land use planning, and the development and transfer of methods for land use planning. An important aspect is here the integration of agroecological knowledge with socio-economic information.

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4. PROBLEM TO BE SOLVED

Increasing population and per capita income will push up the demand for rice by the year 2025 to 70 % above the current level. This increase will have to be realized in Asia, which takes care of 90 % of total world consumption, with less water, land, labor, and pesticides. Effectuating this requires a systems approach, aiming at optimization of resources for local conditions, but also at larger scale taking into account geographic patterns of natural resources and socio-economic conditions.

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5. OBJECTIVES

- Identification of local options to increase productivity and input efficiency of rice production systems;
- Indicate options for sustainable land use in Asian rice production regions, under conditions of rising food demands;
- Reinforce systems analysis capacity in national centres in the region

6. RESULTS

- Crop management packages (expert systems) for optimizing input efficiencies;
- increased efficiencies of water, nutrients and pesticides;
- regionally adapted varieties and integrated breeding programs;
- identified bottlenecks in agricultural production;
- quantification of impact of intensified systems on the environment;
- land use options under given socio-economic and environmental constraints;
- methodology for integrated analysis (agro-ecological, socio-economic)
- research capacity in systems analysis
- curricula on systems analysis at Asian universities

7. METHODOLOGY

See Summary

8. BUDGET

External budget requirement 4.75 M$

Appendix J

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Systems analysis for sustainable agricultural development in the Andean ecoregion (SASAN)

2. GENERAL

- date submitted	15 November 1994
- submitted by	H. Zandstra (DG CIP) A.J. Haverkort (AB-DLO)
- project leader, intended	A.J. Haverkort (AB-DLO)
- department	Crop and Weed Science
- *DLO-program*	260
- executing departments, organisations	CIP, AB-DLO, CONDESAN-partners in Bolivia, Peru, Ecuador, Colombia
- funding/agencies	DGIS ?, AB-DLO, CIP, CONDESAN-partners
- duration	4 years

3. SUMMARY

The SASAN project provides direct methodological support in systems analysis to CONDESAN (Consorcio para el Desarrollo Sostenible de la Ecoregion Andina). The ecoregional activities will concentrate on the cool tropical highlands of the Andes, stretching from Venezuela to Chile and Argentina. The initiative responds directly to Agenda 21 and to concerns about deterioration of land and water resources, the weak research infrastructure available to address these problems, and the extreme poverty that they cause.

4. PROBLEM TO BE SOLVED

Assessment how changes in social and economic conditions and technological innovations may affect production systems, their environments, and their actors. The use of systems analysis and modelling is well on its way in the Andean ecoregion, but the extreme fragility of the Andean ecoregional production systems calls for a more integrated approach involving different scales and other research techniques.

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5. OBJECTIVES

The project promotes and contributes to the generation and use of systems methodologies For sustainable rural development and the adequate use of natural resources in the Andean ecoregion. The methodology developed and used at the benchmark sites will be disseminated in the Andean ecoregion. This project's benefits will be extended to the highlands of Eastern Africa and the Himalayas through CIP

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6. RESULTS

a) Increased human resource capability for systems research,
b) Information and methodologies and
c) Publications

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7. METHODOLOGY

Extensive use will be made of
a) Networking through CONDESAN,
b) its Benchmark sites,
c) Training (at course and university degree levels) and
d) Reinforcement of current research at the participating benchmark sites

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8. BUDGET

The total costs of the project for a duration of 4 years including coordination, training and supplies amount to USD: 6.5 million, of which USD 3.9 is requested from DGIS.

Appendix K

PROJECT DESCRIPTION/PROJECT PROPOSAL

1. TITLE Ground for Choices Tamil Nadu (GFC-TN)

2. GENERAL

- date submitted	June 1994, to Tamil Nadu Ministry Agriculture.
- submitted by	Tamil Nadu Agric University (TNAU)
- project leader, intended	S.P. Palaniappan (TNAU) and F. Penning de Vries (AB-DLO)
- department	Agrosystems Research
- DLO-program	260
- executing departments, organisations	TNAU, AB-DLO, PE-and SC-DLO
- funding/agencies	DGIS and/or EU
- duration	3 years

3. SUMMARY

On the basis of inventories of land, climate, crop and freshwater resources, production potentials of a wide range of sustainable agro-ecological production systems will be determined. Also the levels of the main inputs required for production, and of by-products will be specified. Such results will provide a framework for planning of land use and of agriculture. In the course of the project, a TNAU-project team will be fully trained in the methodology.

4. PROBLEM TO BE SOLVED

The Tamil Nadu State Planning Commission requests specific and quantitative knowledge that can help to improve planning agricultural and industrial development of the State. While agriculture is rapidly increasing in intensity and diversity, there is a clear danger of overexploitation of natural resources, particularly of ground and surface water. Methods and data available in India address insufficiently the long term options for agriculture, and the integrated nature of the questions involved. TNAU desires to acquire the capacity to do so, and requested AB-DLO to assist.

5. OBJECTIVES

1. To determine the levels of potential production of 12 different crops (including rice, soybean, maize, cotton, fruit trees, and fish ponds), and the levels of inputs (fertilizer, water, labour) and outputs (yield, straw, leachate) at these yield levels for about 1000 districts in the state of Tamil Nadu; aggregate these data according to agro-ecological zones; optimize production in these zones with respect to specific goals (e.g. maximum efficiency water use).
2. To train a research team (about 12 scientists) of TNAU in the methodology.
3. To improve the current 'Ground for Choices' methodology with respect to specific aggregation and optimization issues.

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6. RESULTS

(refering to the objectives 1-3:)

1. Several scenarios of optimal use of land for agriculture, in which alternative goals are maximized. These will incude: maximum yield, maximum productivity per unit water, minimum environmental damage. Consequences of change in precipitation (climate change) will be quantified.
2. A trained team, that can continue this study by itself.
3. Technical solutions on regional optimization of water in multiple goal linear programming models.

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7. METHODOLOGY

1.1. Specific goals for future land use and agriculture, and specific potential agricultural activities for the known agroecological zones, are identified with all stakeholders.
1.2. Crop simulation models are adapted to suit the specific needs of the crops involved; for some activities (including tree crops and fish ponds) new models are to be developed (TNAU and Wageningen).
1.3. Basic data on natural resources are collected, checked, and put into data bases. Output of simulations at the crop level, for all districts, are input into a multiple goal LP model (TNAU).
1.4. Optimizations are performed for each goal, by agro-ecological zone and for the state (TNAU, Wageningen).
1.5. Results are presented to stakeholders and the State Planning Commission
2.1. Knowledge on crop simulation at TNAU is refreshed and expanded (with the TNAU-SARP team)
2.2. A course on optimization of land use is provided (based on 'QUASI'; Wageningen).
3.1. Optimization programming techniques are developed, tested and implemented (Wageningen).
3.2. Effective solutions to deal with data scarcity and uncertainty, and with aggregation issues (Wageningen).

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8. BUDGET

Total budget: 1.5 MFl. A donor is requested to provide 0.7 MFl for 2 Wageningen based scientists; the remainder provides funds for salaries and operational expenses, including training and PC's, in India.
