

In this file, you'll find a copy of the program of the thematic day, followed by the abstracts of the different presentations. The difference between the abstracts given here and those given in the program of the day, what you received before, is the highlighted keywords and/or key phrases (typed in red), what the speakers emphasized on during the presentations. The presentations (PowerPoint, "pdf" files) are included in separate folders, named after the speakers.

The program:

- 9:30 Reception of participants, with coffee/tea
- 10:00 **Prof. Dr. Martin Hale** (Head Research, and Deputy Rector), welcomes you (on behalf of ITC rector Prof. Dr. Martien Molenaar)
- 10:10 **Dr Abbas Farshad**² (Organizer) will welcome you, followed by a short explanation of the programme (overview of the day)
- 10:25 **Em. Prof. Dr. J.Bouma** (Wageningen University): Land evaluation: experiences of the past are the key to the 21th century
- 11:45 **Dr Jetse Stoorvogel** (Wageningen University): From land evaluation towards integrated assessment: Tradeoff analysis
- 11:05 Pauze
- 11.35 **Dr Anne Gobin** (Katholieke Universiteit Leuven Research & Development, GEO-Institute): Land evaluation; towards a revised framework
- 11:55 **Dr David Rossiter** (ITC): Thinking small in land evaluation is beautiful: lessons from the ALES project
- 12.15 **Em. Prof. Dr. Johan Bouma** (chair of Jubileumcommissie NBV): Preparing ourselves for the 75th anniversary (in 2010) of the Dutch Soil Science Society
- 12:25 Hissink Prize (presented by the chair of the jury and vice-president of NBV: **Dr Boris Jansen**)
- 12.30 Presentatie door **Hissinkprijs winnaar**
- 12.50 Lunch (sandwich & drinks)
- 13:40 **Dr Bert Toxopeus** (ITC): The status of pasture and grazing in land evaluation (a Kenyan case study)
- 14:00 **Em. Prof Dr Paul Driessen** (ITC): Land use systems analysis; difficulties faced
- 14:20 **Prof. Dr Eric Smaling** (ITC): The role of land evaluation in chain research – the case of Brazilian soybean, using nitrogen as a marker
- 14:40 **Prof. Dr Bob Su** (ITC): The issue of water in land use planning at ITC
- 15:20 **Dr Thomas Gaiser/ Karl Stahr** (Universities of Bonn/ Hohenheim): Land evaluation; successes, failures, current relevance, and new ideas (no abstract received)
- 15:40 Tea/ coffee break¹

¹ While having your coffee and/or tea you can attend demonstration stands, set up in the hall, where coffee is served. Very grateful to Dr Dinand Alkema and Drs Joan Loijen who accepted my invitation to present the demo's (on flood modeling, and on spatial multivariate criteria evaluation=SMCE).

² Abbas Farshad, ITC Building 4-037, tel. 0031 53 4874318

- 16:10 **Dr Kees de Bie** (ITC): The “Challenge” of the Land Evaluation Toolbox; The Need to Fine-tune it’s Use and Functionality
16:30 General discussion
17:00 Wrap up session (ITC will invite you for a drink)
17.10 Algemene LedenVergadering NBV
17.30 Session closed

Land evaluation: experiences of the past are the key to the 21th century.

By: Prof. Dr. J.Bouma (Wageningen University)

Publication of the **Framework for Land Evaluation in 1976 has been a milestone for pedology and land use research.** The systematic confrontation of what the land has to offer with what any particular type of land use requires, was a new concept at the time. Also, defining indicators, such as land qualities in terms of land characteristics, was a refreshing change over descriptive schemes in use at the time. Now, thirty years later, demands by society have changed while science has been transformed by information technology and technical developments. **Our way of dealing with land use studies must certainly change but we have to be careful now that we preserve the good things of the past** and don’t throw the baby out with the bathwater.

Land use studies are highly politicized and often involve interaction with various stakeholders, policy makers and scientists, the latter not necessarily soil scientists. Increasingly this occurs in so called Communities of Practice (CoP) where joint learning is a key objective. The role of scientists within CoP’s is still not clear and the object of much trial and error. **The Royal Academy of Science (KNAW) has made a proposal for a new approach to land use studies that is based on specific national and international (EU) environmental laws and regulations.** The proposal combines the three-layer model of the “nota Ruimte”of the Ministry of the Environment (2004) and the seven soil functions from the EU Soil Guideline (2007), including the DPSIR approach (distinguishing drivers, pressures, states, impacts and responses when dealing with land use change).

Soil input is crucial here. Rather than emphasize **use of simulation models**, more emphasis is needed on monitoring and observation methods that truly represent real field conditions and on **using soil data in pedotransferfunctions.** Classic soil survey information is quite useful here also for the CoP’s when communicating soil expertise to its non-scientific members.

From land evaluation towards integrated assessment: Tradeoff Analysis

By: Dr Jetse Stoorvogel (Land Dynamics Group, Wageningen University)

For a long time, land evaluation has been the broadly accepted procedure towards land use planning. The starting point for land evaluation has always been the natural resources which were matched in terms of the land qualities with the land use requirements of various actual and alternative land utilization types. Interesting enough

actual land use and particularly its spatial distribution is only considered in a limited way. As a result we often see a large gap between the results of land evaluation studies and actual land use. After the land evaluation, we are faced with a major challenge how to make the step from current land use to our evaluation results. An alternative approach towards land evaluation is to take current land use as the starting point and to evaluate what is currently going on in a region. Describing the land allocation and land management decisions of the farmers in a quantitative way allows us to evaluate alternative scenarios of policy and management interventions. Such an integrated assessment of agriculture opens new perspectives to the general concept of land evaluation. The Tradeoff Analysis System (TOAS) is one of the models for such an integrated assessment. TOAS is based on a spatially-explicit econometric simulation model estimated on observed decision making of a population of farmers. The system integrates this econometric simulation model with a crop growth simulation model to indicate the production potential of a particular field and environmental impact models for the evaluation of management decisions. With actual land use as the starting point of the analysis TOAS is directly suitable to evaluate the effect of various policy and management interventions. This will be shown with various examples from Ecuador, Senegal and Kenya.

Land evaluation: towards a revised FAO framework

By: Dr. Anne Gobin, Spatial Applications Division, Katholieke Universiteit Leuven Research & Development, Belgium

The 1976 FAO framework presented the state-of-the-art of land evaluation and was based on six principles for a systematic biophysical and socio-economic assessment of the potentials for specific land uses likely to be relevant to a particular area. The framework resulted in subsequent guidelines for land evaluation for potential productivity (based on agro-ecological zoning), rainfed agriculture, extensive grazing, irrigated agriculture, forestry and steep lands. Not surprisingly, the main concepts and principles of the original framework remain valid today. However, other concepts have evolved or emerged since then.

The goods and services of the land that are related to its multiple functions or benefits as well as the sustainability of its use need to be addressed in order to reflect current concerns related to environmental degradation, climate change, social equity and economic growth. New tools to conduct land evaluation have become available and the need for a participatory approach has been recognised. These were compelling reasons to revise the 1976 FAO framework and extend it to link environmental concerns and issues of sustainable livelihood to the basic concepts of the original Framework. The principles were extended where needed, and two principles were added to integrate stakeholder participation and cross-scale reconciliation. Likewise, the procedures were reviewed in order to include more explicitly stakeholders' concerns and environmental services. Based on the revised principles and procedures an outline for a revised framework for land evaluation is presented. Some of the concepts and procedures will be illustrated with recent studies and examples from a study in south eastern Nigeria.

Thinking small in land evaluation is beautiful: lessons from the ALES project

By: Dr David Rossiter (ITC, Enschede)

At a 1986 workshop on quantified land evaluation, Armand Van Wambeke of Cornell University demonstrated the idea for a PC-based expert system to assist the land evaluator. Soon after the author was hired to realize this, leading to the Automated Land Evaluation System (ALES) program. This DOS-based program was refined until 1996, after which the author moved to ITC. **ALES was and continues to be used by its intended audience (FAO-style development projects). Despite a long list of publications and projects, results on the ground are disappointing. The principal reasons are: (1) fossilized thinking by the land evaluator, using prepared lists of LUT and matching tables, rather than adapting to the actual land evaluation needs; (2) refusal or laziness to use the extensive economic land evaluation features of ALES; (3) bureaucratic mentality towards land evaluation as a desk exercise. These are not faults of ALES, which is simply a tool, but perhaps ALES could not find a way to break the already-technocratic approach of most projects that applied the FAO mentality.** ALES may even have given some support to this approach with its seemingly "objective" outputs; as Van Wambeke concluded his 1986 talk, **"beautiful may be dangerous"**. However, there are some real successes with ALES; we will try to determine what made these different, and consider the road ahead.

Land evaluation of rangelands for better management, A case in the Amboseli ecosystem – Kenya

By: Dr. A.G.Toxopeus (ITC, Enschede)

The Amboseli ecosystem is a semi-arid rangeland with the Amboseli NP in the centre of it. **Limited forage and water availability for both wildlife and livestock as well as expanding agricultural activities are the main topics causing conflicts between conservationists and the local population.** Furthermore, the ecosystem shows severe degradation due to overgrazing, resulting in dust storms and desertification. Therefore, a proper land evaluation is needed to be able to cope better within a changing environment.

In this presentation, the modeling system developed focuses on the **main source of impact, which is considered to be the competition between wildlife and livestock for forage and water, especially during the dry season.** The model will give the user an evaluation of the actual situation. By changing variables it is possible to run different management simulations to improve the situation. The user can carry out any other simulation or combination of simulations he likes, in the end **the model will evaluate in what way the ecosystem will probably respond to the management options selected.**

Land Use Systems Analysis; difficulties faced

By: Prof. Dr. Paul M. Driessen (ITC, Enschede)

Land Use Systems are unique combinations of one Land Utilization Type practiced on one Land Unit. Land Use Systems Analysis (LUSA) quantifies the physical aspects of primary production with the aim to judge the adequacy of land use at a specified place and time.

Land Use Systems are dynamic: both Land Unit specifications (soil/land data, weather data) and the Land Utilization Type (crop data, management data) vary over time. This

implies that the adequacy of e.g. management in a given Land Use System can only be judged if a time/site-specific reference performance is calculated as well (i.e. the performance under assumedly “ideal” management with which the actual system performance can be compared).

So far LUSA has been successfully applied to “production situations” with annual food or fibre crops and with fertilizer application, crop protection and harvest methods assumed “non-limiting”; crop performance is solely dictated by crop properties and by the temperature and the availability of solar radiation and water. Models that support land evaluation studies typically describe organ mass increments during successive one-day time intervals in the crop cycle. Note that basic input data must pertain to the actual land use system. This means that “standard” soil data determined on “normalized” soil material in buffered solutions cannot be used. Weather data must be actual data (long-term averages are frequently used but are merely estimates and introduce error) and crop data must be variety-specific.

Note furthermore that Land Use Systems analyses are in fact point analyses; they hold for an area that is determined by the size of the (“homogeneous”) Land Unit or of the field(s) on which the Land Utilization Type is practiced (whichever is smaller). Regionalization of such point analyses is not always straightforward.

Despite these difficulties, results obtained so far are most encouraging. It is expected that even better results will be obtained in the future as algorithms and basic data quality improve.

The role of land evaluation in chain research – the case of Brazilian soybean, using nitrogen as a marker

By: Prof. Dr. Eric Smaling (ITC, Enschede)

Soybean (*Glycine max*) is a booming crop in Brazil. In 2004/5, the export value was equivalent to 9 billion US \$, covering almost one-third of the total agricultural export and over 10% of total Brazilian exports. Out of 50 millions tons of soybeans produced in 2004, around 75% leaves the country (50% beans, 50% oil + meal), mainly to China and the European Union. Soybean cultivation in Brazil is expected to expand further in the next decades, responding to growing demand in Asia. Soybean cultivation can also be regarded as part of a larger chain, including Conversion of forest and savanna land, Cultivation of soybean, Transport & Processing, Animal and Human Consumption, and Waste Disposal.

A study was done for FAO, trying to calculate nitrogen (N) flows in this chain, for three time periods (1993-1995; 1998-2000; 2003-2005). Results will be presented at the NBV meeting.

Land evaluation can play a major role in at least three of the chain compartments, but only if applied in a modern, multi-disciplinary fashion.

- **Conversion:** what is the ‘value’ of forest and savanna vis-à-vis the expected money value of the same land producing soybeans, i.e., the ecosystem services provided by the Amazon forest versus the ecosystem goods provided by the soybean plants?

- **Cultivation:** how to optimize soybean productivity on the land opened up for this crop? A classical matching procedure, supported by climatic, agronomic and economic models
- **Animal production systems:** incoming soy meal produces pig and chicken meat and eggs, but also manure. Can this manure be safely recycled on the land available? Will it not affect the environment adversely? How much N is transported over large distances?

Finally, scenarios can be run that favor either economic or environmental goals, or look for the optimal situation.

In chain research, land evaluation can become an auxiliary tool in strategic stakeholder dialogues.

The issue of Water in land use planning at ITC

By: Prof. Dr. Bob Su (ITC, Enschede)

Water is a crucial element in land use planning. Due to the spatial and temporal variations of water cycle components, the techniques for quantification of such variability can vary from case to case on the basis of the availability of data. In this contribution, we will demonstrate some recent methodology on the basis of satellite observation that can provide scale independent spatial-temporal estimates of the some water cycle components. A case study for drought monitoring in the DRAGON project will be presented.

Medium scale applications of different land evaluation approaches in tropical regions: Experiences from Africa, South America and Central Asia

By: Thomas GAISER and Karl Stahr

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Several land evaluation methods have been developed in the past decades and applied in tropical regions (Klingebiel, 1961; FAO, 1976; Sanchez, 1982; Sys et al. 1993, Gaiser et al. 2005). The scope of this contribution is to summarize the achievements and lessons learnt from ten years experience with the application of land evaluation approaches in South America, Africa and Central Asia.

The evaluation exercises focused mainly on the evaluation of land with respect to its suitability for rainfed agriculture covering a wide range of food crops. However, in some case land evaluation was extended to the assessment of erosion risk, the estimation of crop yields, diffuse emissions or carbon sequestration under changing management or climate conditions. Since the spatial scale of the evaluation exercises was always in the range of 1:1 Mio to 1:200.000, in the first place a database system had to be established including spatial information about climate, soils, terrain and management conditions. Data storage, management and processing was carried out in the SLISYS environment (Soil and land resources information system). Databases have been built up for Benin Republic (SLISYS-Benin), Niger (SLISYS-Niger) and Chad (SLISYS-Chad)

in West Africa, a medium scale river basin in Uzbekistan (SLISYS-Chirchik) and two states in the Northeast of Brazil (SLISYS-Piau  and SLISYS-Cear ). The data structure for soil and climate data uniformly followed the SOTER approach (ISRIC 1993). Crop and management data were stored in different tables, depending on the methods and models used. For static suitability evaluations with respect to rainfed crops, the Land Suitability Classification (LSC) method was applied which is specifically characterized by its capacity to evaluate land for specific crops (Sys 1993). Different approaches to calculate the land indices were compared with real crop yields and the necessity of adaptation of the method to local crop varieties or cultivars in Niger Republic and NE Brazil has been demonstrated. A modification of the LSC framework was used to evaluate land for different soil conservation techniques. Crop yield assessments were made both using the parametric LSC method as well as the agro-ecosystem model EPIC (Erosion Productivity Impact Calculator).

In view of soil erosion risk assessment, two different methods have been applied: The SOTER Water Erosion Assessment Program (SWEAP) and the Erosion Productivity Impact Calculator (EPIC) were used to estimate erosion risk and mean annual topsoil losses in Benin and Niger Republic as well as in the state of Ceara (Brazil). **Problems of the verification of land evaluation results at the regional scale are discussed as well as the restriction of some methods with respect to the limited temporal and spatial resolution and the high spatial and/or temporal variability of soil, climate and management conditions. Therefore, calibration and validation of the implemented models are necessary and new models have to be integrated.**

The “Challenge” of the Land Evaluation Toolbox; The Need to Fine-tune it’s Use and Functionality

By: Dr. Kees de Bie (ITC, Enschede)

Driven by **Technology Transfer (TT) logic**, from the 1960’s onwards, **Land Evaluation (LE) techniques were developed to (i) re-use elsewhere acquired soil and agronomic knowledge and (ii) to address specified regional sustainability issues (land utilization problems)**. Through the assessment “on paper” of the expected performance for specific tracts of land of alternative/improved Land Utilization Types (LUTs) as compared to the current ones, the TT-logic was used to generate both biophysical as socio-economic ratings to indicate possibilities for land utilization improvements.

Several assumptions are often made without much further considerations like: (i) LE-findings are sufficiently indicative and validation of results is not required and (ii) all relevant aspects of LUTs and soils are fully considered and understood (including interactions). Method problems also exist like: (i) are “Key Attributes” the fundamental LUTs characteristics or are they query-statements for pre-selection of alternative LUTs, and (ii) are mainly crops evaluated or LUTs described by a generalization of the foreseen operation sequences. Several questions thus arise like “Is LE really suitable for Land Use Planning?” and “Who can really benefit from LE?”....perhaps LE is an ideal tool for agronomic research stations as an “educated” filter mechanism to derive choices for their short-to-long term (expensive) research agenda?

Noting that farmers carry out operations to reduce impacts on productivity/ sustainability caused by e.g. yield limiting and yield reducing land aspects, and that often obtained yield levels in many developing countries are 50-80% below economic feasible levels,

the question arises if LE is the correct toolbox to assess how to improve current LUTs. CPA offers through Comparative Performance Analysis of actual data covering the full heterogeneity of a study better results on which planning, extension, and research agendas can be based...but CPA can not evaluate alternatives that are not encountered in a study area! However, additional LE-tools can fill-in the gap of finding and evaluating through TT, possible alternative (potential) management options to combat yield limiting/reducing land aspects and land sustainability issues to improve existing LUTs. This will not consider any more full land use conversions (from one major LUT to another one) but will focus only on rewarding land use (management) modifications for a given LUT.

As noticed, we tried to touch on a wide range of issues in the field of “land evaluation for land use planning”(LELUP). It is shown that when talking about the “land evaluation for land use planning” not only soil/crop issues are the issues, but also other important biophysical as well as socioeconomic-derived issues (e.g., fauna, flora, water, social, economic, cultural and political settings) are vital. Discussion when limited to the FAO framework for land evaluation is deemed to focus mainly on “matching”, but also on “land utilization type”, “land use system”, “land quality”, “land characteristics”, “key attributes”...etc. Should we solely stick to the biophysical aspects of the land we are then too short in defining the ‘land utilization types”, using such key attributes as farm size, land tenure, farm power, labor intensity, capital intensity...etc.

In the copies of the abstracts (here attached), what you also received as to the program of the day, some keywords (mostly key-phrases, which were emphasized on during the presentation) are highlighted in red color. In the end, during the discussion and wrap out session, it was tried to look back to the presentations and see whether some conclusions can be drawn. In the available short time, and in the absence of a few speakers who had left already (very much to my regret) the following points were touched upon:

Scale, one of the main issues in any landscape related aspect (ref. Eric Smaling and Bob Su), is often overlooked, not only by laymen, but also by the specialists. A semi-detailed soil map, for instance, is expected to provide information on farm lying, irrigation, reclamation, and fertility, all at parcel level. This indirectly means that either the awareness on the issue of variability is poor, or it is neglected altogether (ref. David Rossiter). Or point data is used to analyze land use systems...etc (ref. Paul Driessen and Thomas Gaiser).

Scale is not a confined issue of the biophysical maps (GIS layers) but it is also a valid issue at decision making level, in both land evaluation as well in land use planning (e.g., for land allocation (ref. Joan Looijen).

Land evaluation (LE) and land use planning (LUP) are often **interchangeably used**, while knowing that the same FAO (of the framework for land evaluation) considers the LE as the 5th step in the LUP process (ref. Jetse Stoorvogel). Farmer’s perception is often compared with the results of land suitability (evaluation= LE) maps prepared by the expert. Often it is concluded that they are not similar, simply because the expert has done land evaluation on the basis of matching between land qualities/ land characteristics

(supply) and a number of selected land use requirements (demand), which are resulted from the adaptation of the theoretical knowledge (literature review-based) to the prevailed conditions in the study area (ref. Thomas Gaiser). The farmer obviously has gone steps further, not only because he knows the crop variety and, to a certain extent, its physiological habits, but also because he has got further into the process of land use planning (decision on land allocation...etc). Here again, scale is involved too!

Should we deny the role of the participatory approach to land evaluation, that is, neglecting the stakeholder involvement (ref. Jetse Stoorvogel), we have done a classical exercise, with no practical value in the real world.

Considering that LE (FAO-oriented) is on the basis of matching between the supply and the demand, the problem of data compatibility arises. Are the data on the side of supply (the land) compatible with the data on the demand side (the LUT)? (ref. Kees de Bie). In the supply side, are we considering all land components equally? What about the water (ref. Bob Su)? Often, **too many assumptions** are formulated to comply with a refusal and bureaucratically done land evaluation (ref. David Rossiter).

Is matching required everywhere (Eric Smaling and Bert Toxpeus)? Soybean can be a booming crop in Brazil, but what about its sustainability (as one of the principles of LE)?

Don't we expect too much from the land evaluation (the FAO framework)? It is probably good to also convey the statement Jetse Stoorvogel made, namely: "that there are many questions (in various cases) means that there are many tools (in the toolbox)", of which a selection should be made (Thomas Gaiser).

Two more questions were to extract from the presentation of Kees de Bie? Is **soil survey interpretation the same as land evaluation** (ref. Johan Bouma)? Are **soil surveyors pushing to make land evaluation theirs?** Although time did not allow to discuss these questions in depth, the few words which were thrown on can be elaborated on further. Besides, reference can be made to the discussion paper published in 1991 in *Advances in Soil Science* 15, by Cees van Diepen et al.. Land evaluation, although has its bed in soil science, as a follow up of any soil survey, is a multidisciplinary activity/ process. Besides the definition of "soil survey" in the *Soil Survey Manual* the FAO soil bulletin No. 8 on "soil survey interpretation and its use" is an example to refer to in order to find the answer to this question. Soil surveyors are instructed not stop with their job once the soils are mapped, but complete the job with the soil survey interpretation, where next to the suggestions on the suitability (of the soils) for the current (and also potential) use, also some recommendations on applying fertilizers are given (USDA, 1951).

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