THE FAO GUIDELINES FOR LAND EVALUATION

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Summary

The FAO guidelines for land evaluation are a collection of concepts, principles and procedures on which an evaluation system can be developed, but it is not a system in itself. It differs from former approaches in that it does not limit to be a soil survey interpretation, but that it has a much larger scope, starting with the specific growth and production requirements of crops, either individually or in association or rotation (and therefore commonly termed land utilization types) for which the assessment is made. Such requirements involve not only soil, but also climatic, landform and socio-economic conditions.

The FAO approach is plant-specific and therefore starts with the identification of optimal and marginal crop growth requirements. Those are subsequently matched with

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the attributes of the land under consideration. The evaluation procedure can follow either a parallel or a two-stage approach, whereby first the physical potential is assessed, and then the socio-economic conditions are taken care of. In reality, most land evaluations have stopped at the level of the physical assessment.

The FAO evaluation procedure is a step-by-step approach including, for the physical evaluation, successively the definition of the land utilization type for which the assessment is made, the definition of the crop growth and production requirements, and their matching with the land data of the areas under consideration. This leads to a definition of suitability ratings and to the determination of suitability classes which, after a thorough field validation, reflect the production potential of the land. Various rating procedures can hereby be applied.

Though the FAO Framework for land evaluation has clearly stated that the integrated aspect of land use involves both physical and socio-economic criteria and parameters, most applications have mainly concentrated on an assessment of the physical potential of the land.

1. Introduction

The FAO land evaluation approach was presented for the first time at an expert consultation meeting in Wageningen, The Netherlands, in October 1972 where it was extensively discussed and further refined. It was published under the title "A Framework for Land Evaluation" in FAO Soils Bulletin 32 (FAO, 1976).

The FAO Framework is not a formal methodology but a collection of **concepts, principles and procedures** on the basis of which local, regional and national evaluation systems can be developed. The concepts and principles are universal and scale-independent, and they can be used to construct systems at all levels of intensity and for all kinds of rural land uses, provided the needs can be properly defined. Recommended procedures for a suitability classification of the land for specific uses are provided, but these are optional.

The value of the FAO Framework is not in the classifications that have evolved from it, but in the gradual development of a new paradigm for rationalizing the wise use of land resources. The FAO approach differs from most other land evaluation systems in three major aspects:

- While the former systems constituted often a direct follow up of soil surveys and soil inventory studies, becoming thus in the first place a **soil survey interpretation**, the FAO system started from the **other end**, i.e. the land use in terms of crops or other land use types, and from their direct requirements for proper growth and production. This led to the equal role attributed to climate, physiography and land management at the same level as soil. It resulted in a broadening of the concept of soil as the sole factor affecting land suitability, and led to separate definitions of land and soil. The framework included the concept of sustainability “avant la lettre” (as it was published ten years before the Brundtland address) and tried to incorporate economic considerations.

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- In contrast to most other classifications the FAO guidelines focused on the assessment **per specific crop or land utilization type**, each of them having particular requirements. Hence, they made a clear differentiation between broad land capability assessments and narrower crop-specific land suitability assessments, focusing on particular requirements. In other words the FAO Framework constitutes a kind of ecological analysis whereby land mapping units are evaluated with reference to defined land utilization types which incorporate also social, economic and technological aspects. This is in contrast with the current land capability assessments which deal usually with the grading of land according to the degree of (mainly soil) limitations to one or more land uses.
- The FAO guidelines introduced specific criteria related to **land qualities** that reflect the growth and production of plants, and to **land characteristics** that are land attributes that can meet those qualities. As land attributes can be measured, analyzed and directly observed - and thus quantified - the FAO concept urged for **more quantified data** in the assessment, in obvious contrast with the more interpretative and subjective character of the former classifications.

2. Basic Principles and Assumptions

A number of principles are fundamental to the approach and methods employed in land evaluation. These basic principles are:

- Suitability evaluation is always for a **specific kind of use**. This embodies the preliminary recognition that different kinds of land use have different requirements. This is in contrast with the USDA Capability Classification for example, where requirements remain general and are often not clearly defined. From this assumption it is obvious that at the **early stage** of the assessment a decision has to be taken with respect to the crop or land use type for which the evaluation will be made.
- The evaluation requires a **comparison of the benefits obtained and the inputs** needed for different land uses on different types of land. In other words, the suitability for each use is obtained by comparing the required inputs with yields or other benefits. This means also that highly productive land is not necessarily giving the highest benefits.
- The evaluation has to be made in terms which are relevant to the physical, economical and social context of the area concerned, and in this respect a **multidisciplinary approach** is necessary. This principle refers to the specific growth requirements as well as to their marketing value.
- The suitability assessment must refer to the use **on a sustained basis**. It is clear that short-term profitability must be disregarded if this leads to environmental degradation or to other adverse effects.
- An evaluation includes a **comparison of more than one single kind of use**. This means that the evaluation is only reliable if benefits and inputs from any given kind of use can be compared with at least one, and usually several different **alternatives.** Those may include the comparison of different crops within one management type, or may relate to different farming/cropping systems, and even come up with a choice between agriculture, forestry, ranching

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or other uses.

In this approach it is accepted that soil is no more the only medium for crop growth. Indeed, besides soil there are other relevant factors such as climate or management and technological aspects. Hence, a clear distinction has to be made between the **limited concept of soil and the broader concept of land**. FAO has defined these as follows:

Soil is a natural body consisting of layers or horizons of mineral and/or organic constituents of variable thickness, which differ from the parent material in their morphological, physical, chemical and mineralogical properties and their biological characteristics.

Land embraces all reasonable stable or predictable attributes of the biosphere above and below the earth's surface, including those of the atmosphere, the soil and underlying geology, hydrology, plant and animal populations, and the results of past and present human activity, to the extent that those exert a significant influence on present and future uses of the land by man.

3. Evaluation Procedure

3.1. General Principles

The FAO concept starts from the idea that the potential of land to produce crops is determined by the **combined effect** of biophysical, human and capital resources. The physical resources refer mainly to climatic conditions, landform patterns, soil and moisture properties, and fertility level; those are relatively **stable over time.** Socio-economic resources are, however, much **more variable**, mainly because technical know-how and availability of labor, land tenure systems, market prices, etc. may largely vary as a function of technological progress, economic developments or political decisions; the same variability holds true for capital resources which are inherently linked to land management and marketing of the produce.

In taking into consideration the factors above two different approaches can be used. In the **parallel approach** the analysis of the stable physical and the more variable socio-economic aspects is done concurrently. In the **two stage approach** a (semi-) qualitative evaluation of the physical potential is analyzed first, followed later (although not necessarily) by an economic and social analysis (Figure 1).

Both approaches have their adepts, though in reality the two-stage approach has been applied more often for the simple reason that the evaluation of the physical potential, based on almost invariable criteria, remains a constant on top of which the variable day-to-day conditions related to the socio-economic context can be added and updated. Moreover, physical criteria are usually easier to quantify - and thus to integrate into a numerical assessment - than socio-economic conditions which are often not easy to express into a single figure. In reality, therefore, most often the land assessment has stopped at the level of the physical evaluation.

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The FAO procedure of land evaluation is based on a **matching exercise** between crop growth (or land utilization type) requirements and the conditions, whether solely edaphic or global, i.e. including both the physical and socio-economic context. If those conditions fit perfectly well with the optimal crop production needs, then the land is considered suitable. The more those conditions deviate from the requirements, the less suitable the land is.

The FAO evaluation procedure is a **step-by-step approach** (Figure 2), and for the biophysical evaluation (left side of the figure) five consecutive steps can be distinguished. This methodology is scale-independent, and its principles can be applied in any area and at almost any given scale. The accuracy of input data varies, however, with the scale, and so does the accuracy and reliability of the output. For an evaluation at national scale where the main soil data base is a soil association map and where the agro-climate is defined in very broad regional terms, one can not expect that the suitability is defined with the same precision level as is the case for a village study, which delineates homogeneous soil units and refers to one single climate type.

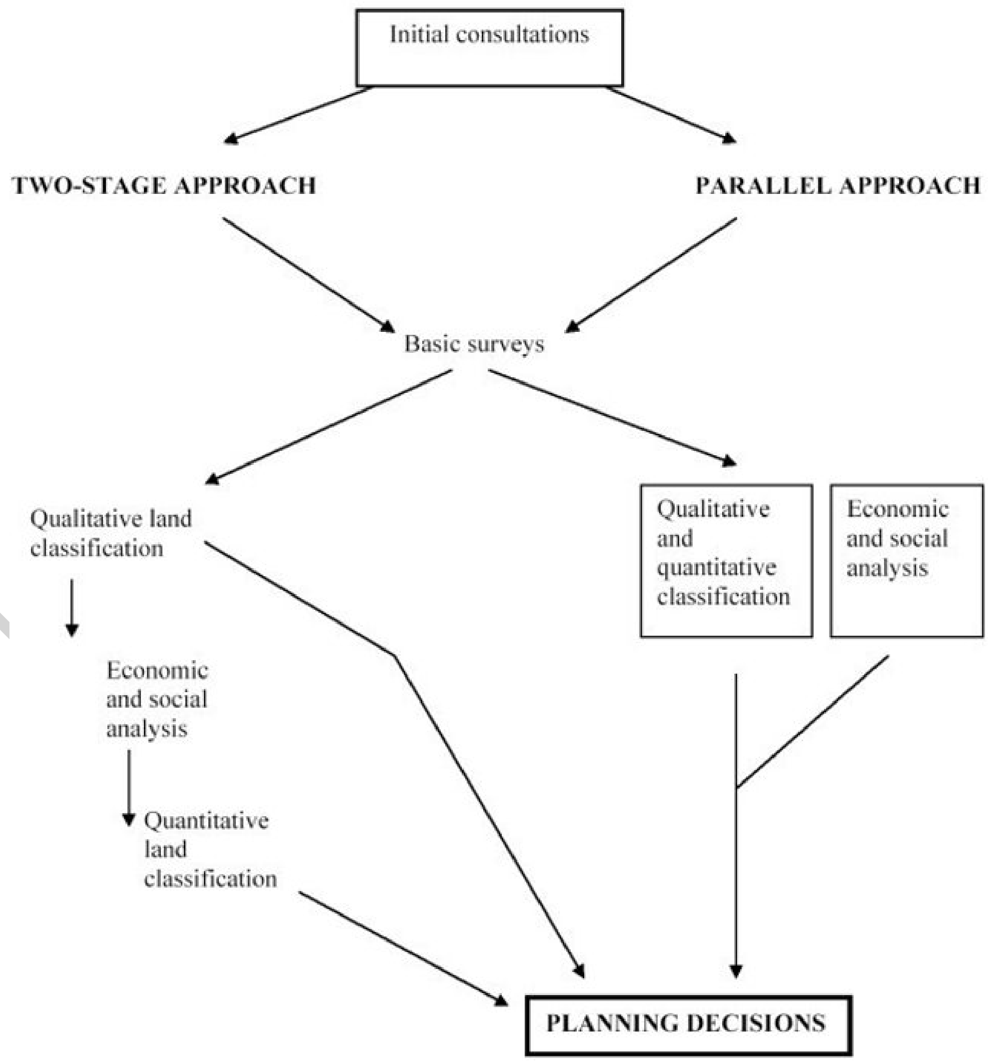

Figure 1. Two-stage and parallel approaches to land evaluation (FAO, 1976)

At the end of the evaluation procedure the land is given a preliminary suitability rating class for the land utilization type under consideration. If the procedure has followed a two-stage approach this preliminary classification has still to be tested on its socio-economic relevance. In line with the basic principles explained above, the exercise should be repeated for a number of different land uses before a final choice is made. In other words, the final assessment is only obtained after an iterative matching and validation of the preliminary rating.

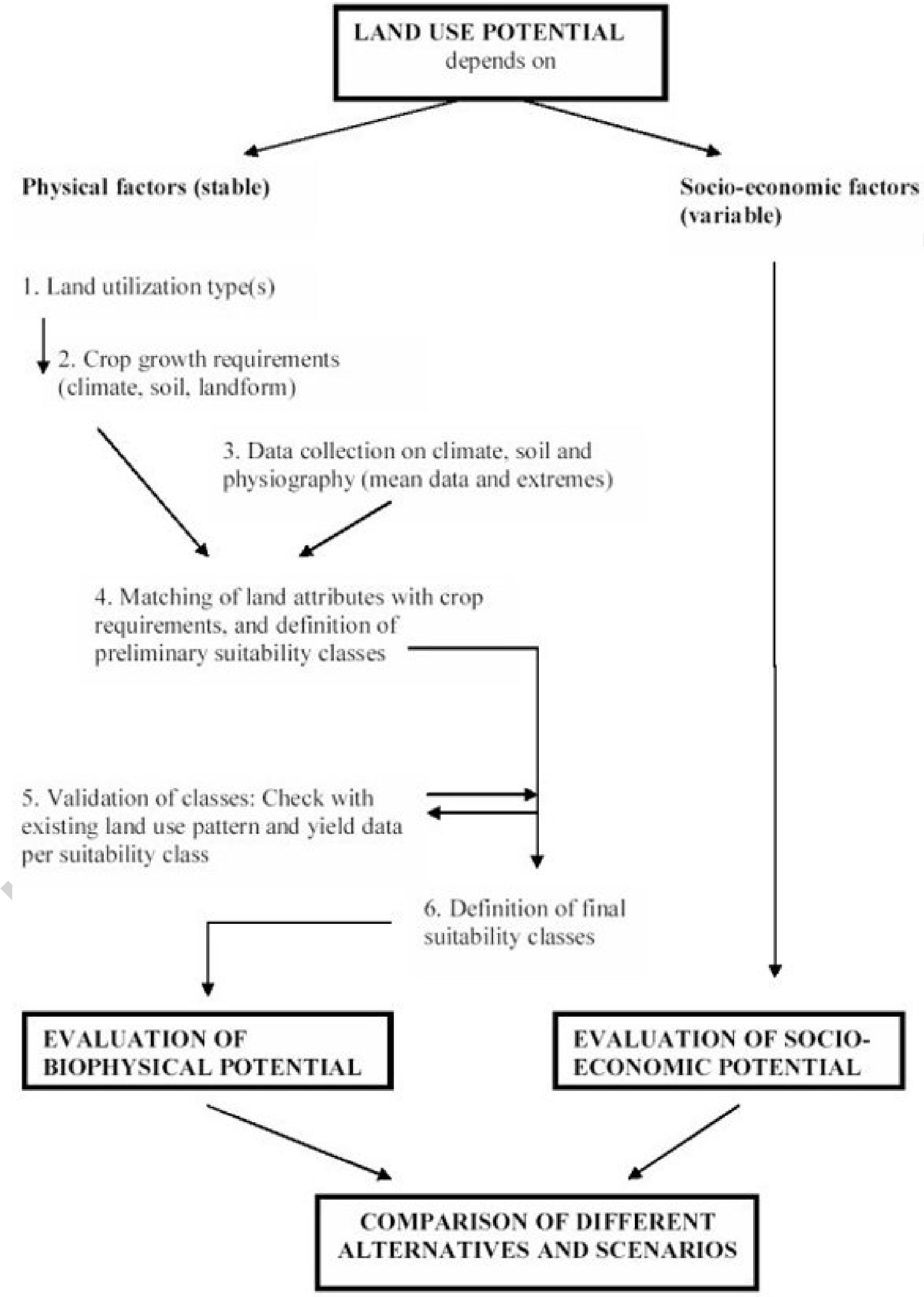

Figure 2. Step-by-step land evaluation approach (Verheye, 1986).

3.2. Land Utilization Types

As growth and production requirements vary per individual crop it is necessary to define from the **early beginning** for which crop - or land utilization type (LUT) in a more general sense - the assessment is required. A land utilization type *sensu FAO* (1976) refers to "any kind of land use described or defined in a degree of detail greater than that of a major kind of land use, which in itself corresponds to a major subdivision of rural land use, such as rain fed agriculture, irrigated agriculture, grassland, forestry, or recreation". A LUT may thus as well cover a food crop grown under a specific management system (subsistence cassava production by smallholders, without fertilizer use neither capital inputs), or a softwood timber plantation operated by a Government Department of Forestry, with high capital and advanced technology, or even a national park for recreation and tourism.

The definition of a LUT involves two components, related to the **crop** (or crop variety) and to its **management** respectively. Maize production in a subsistence agriculture system with little or no external inputs, is a completely different LUT than high-tech maize production using selected seeds, high fertilizer inputs, mechanized agricultural practices, etc. Though biophysical growth requirements for both LUTs will be rather similar, yield output levels should be much higher in the second case, as profitability can only be reached after a full coverage of the much higher input costs.

Land utilization types are not necessarily limited to situations in which only one kind of land use is practiced. A **multiple land utilization type** consists of more than one kind of use simultaneously undertaken on the same area of land, each use having its own inputs, requirements and produce. An example is a timber plantation used simultaneously as a recreational area.

A **compound land utilization type** consists of more than one kind of use undertaken on areas of land which for purposes of evaluation are treated as a single unit. The different kinds of use may occur in a **time sequence** (e.g. as in a crop rotation) or **simultaneously** within the same organizational unit. The former one refers to a cropping sequence involving successively wheat - sugar-beet - maize - grassland as often practiced in Europe, or an association of crops involving a cereal like maize/ sorghum intercropped with cowpeas, as occurring frequently in the tropics.

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Biographical Sketches

Willy Verheye is an Emeritus Research Director at the National Science Foundation, Flanders, and a former Professor in the Geography Department, University of Ghent, Belgium. He holds an M.Sc. in Physical Geography (1961), a Ph.D. in soil science (1970) and a Post-Doctoral Degree in soil science and land use planning (1980).

He has been active for more than thirty-five years, both in the academic world, as a professor/ research director in soil science, land evaluation, and land use planning, and as a technical and scientific advisor for rural development projects, especially in developing countries. His research has mainly focused on the field characterization of soils and soil potentials, and on the integration of socio-economic and environmental aspects in rural land use planning. He was a technical and scientific advisor in more than 100 development projects for international (UNDP, FAO, World Bank, African and Asian Development Banks, etc.) and national agencies, as well as for development companies and NGOs active in inter-tropical regions.

Parviz Koohafkan is the Chief Land and Soil Fertility Management Service of the Food and Agriculture Organization (FAO) and the Task Manager of Chapter 10 of Agenda 21 on Integrated Planning and Management of Land Resources. Dr. Koohafkan's interest is to broaden the land evaluation framework to include other goods and services of land, such as biodiversity, landscape and carbon sequestration in addition to conventional land suitability assessment for food production.

As the Chairman of the Vision Committee of the FAO-Netherlands International Conference on Multifunctional Agriculture and Land, he is also involved in promoting conservation agriculture, identification, assessment and support to globally important agricultural heritage systems and the preparation of the State of the World Land and Water Resources Report. One of his latest monographs is about "integrated watershed management and sustainable food production" which describes the historic evolution of the concept of watershed management in Europe and the transfer of this approach to developing countries.

Dr. Koohafkan is a national of Iran and obtained his Doctorate in Terrestrial Ecology from the University of Sciences and Techniques of Montpellier in France.

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