UNITED NATIONS

ECONOMIC AND SOCIAL COUNCIL

Distr.
LIMITED
E/ECWA/AGR/84/8
5 February 1985
Original: ENGLISH

ECONOMIC COMMISSION FOR WESTERN ASIA

GUIDELINES FOR THE INTEGRATED DEVELOPMENT OF MOUNTAIN FARMING AREAS

85-0126

Box 2

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Joint ECWA/FAO Agriculture Division
Baghdad, Iraq

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In preperation of this study, Mr. J. Blas acted as a consultant to the ECWA Secretariat. The views expressed herein do not necessarily reflect those of the United Nations Economic Commission for Western Asia.

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Guidelines for the Integrated Development of Mountain Farming Areas

INTRODUCTION

The procedures of integrated development of mountain farming areas start with planning the evaluation of this development, based on discussions between those who requested the evaluation and those responsible for carrying it out. The first step is to clarify the objectives of this planning exercise: the needs of the people that it is expected to fulfill, policy aspects and the kinds of land use and economic activities which are relevant for consideration. At the same time, any constraints to existing land use or land use changes are ascertained, e.g. that existing users of land may not be resettled. The organization responsible for the survey then conducts a rapid review of the physical, economic and social content of the area, and the kinds of data available, e.g. soil surveys, farm surveys, etc. This leads to the planning of the programme of work covering specifications of the results, information needs, surveys and studies required, staff, timing, and an estimate of cost. Three sets of field activities are then set in motion:

- studies of land utilization types and economic activities
- surveys of land units
- collection of economic and social data

The studies of land utilization types commence with a basic description of each alternative and first estimates of required inputs and expected outputs.

Parallel with the above, surveys and specialized studies

of land units are started. The purpose of these is to provide a mapped basis of relatively homogeneous areas of land, to which suitability for use will be related. The kind of land units chosen will vary with the objectives, ranging from grazing or forest types or land systems in a survey at national level to site classes, soil series, land facets or other more specific mapping units in detailed surveys for farm management.

The third set of basic studies is the collection of economic and social data needed for analysis of alternatives.

Following on from the description of land utilization types comes determination of their land use requirements. These are the sets of conditions needed for the successful operation of the land utilization type; an example is the terrain conditions favourable to alternative methods of harvesting. They include also the conservation requirements, the conditions necessary to avoid soil erosion, adverse effects on water flow regime, etc.

As the land units are surveyed, some of their land qualities and characteristics will have been determined; for example, slope angle may be employed as a basis for defining land units and is also one of the properties of those units.

Now comes the critical stage of land evaluation, the comparison of land use with land. At this point, the requirements of each of the defined land utilization types are known, and so are the relevant features of climate, slope, soils, etc. for each of the land units. The first stage of comparison is called matching, in which these two sets of data are combined. This is initially done by assigning factor ratings which indicate partial suitabilities based on each land quality considered.

These provisional suitabilities are then analyzed with respect to their environmental impact, economic consequences and social consequences. After the provisional suitabilities have been analyzed by these further means, the final land suitability classification is drawn up. This shows the suitabilities of each alternative kind of land use on each area of land.

The final stage is that of presentation of results. These include details of the land utilization types, together with land suitability maps. Comparison of requirements of use with properties of the land will lead to farm management specifications being drawn up. An analysis of the environmental impact of the possible changes is given, together with the results of the economic and social analysis of the various farming systems, including the level of farm income and the number of farms in the surveyed area.

From this broad introduction which delineates the methodological features of the problem and the possible solutions, it is now proposed that a specific procedure be followed for the integrated development of mountain farming areas while using mainly available methodologies within various FAO divisions.

First of all, this complex problem and its many aspects can be meaningfully reduced to four main fields as follows:

a) Environment field
b) Activities field
c) Technology field
d) Socioeconomic field

These fields are interrelated with several kinds of links

both directly and indirectly including the feedback effects. Furthermore, according to three main types of decision centres:

1) national
2) regional
3) farmer

the objectives and priorities of actions may differ leading to necessary negotiations for solving the inherent conflicts of interests.

However, before entering into the objectives and constraints of these three decision centres, it is required to constitute the data base represented by the four fields as denominated previously.

1. ENVIRONMENT FIELD

Mountain farming areas are primarily concerned with the broad and complex concept of watershed management which integrates several major components: conservation farming, forest management, pasture improvement, road stabilization, gully and torrent control, dam construction and embankments.

The first step is to plan an overall programme to be implemented over several years. Isolated operations do not give satisfactory results in watershed management. On the basis of an integrated development strategy, the whole of the territory to be managed should be sub-divided into small units to be more easily managed by the people directly concerned. Surveys at the national level should be used to determine the areas to be managed and to draw up an order of priority. In so doing, it is recommended to utilize satellite images and aerial photos. Applications of remote sensing data are particularly suitable for agricultural and land use planning, range management, forest management, soil resources, water resources,

and environmental protection. 1/

When a particular watershed area has been identified and its limits drawn up for integrated development, two inventories concerning the physical characteristics of climate and soils must then be undertaken at this regional level.

1.1 Climatic Inventory

Agricultural productivity from a given land utilization type can be analyzed as an input/output system. To achieve such an analysis on a quantitative basis, it is necessary to quantify the relationships between the biological (e.g. crop) and physical (e.g. climate, soil) components for the land utilization types under consideration. Such an approach in assessing crop/climate relationships provides a rational basis for land resource assessment and for planning the efficient exploitation of climatic resources for agriculture.

Temperature and water are the major climatic factors governing the climatic adaptability and distribution (both in space and time) of crops. In combination with solar radiation, these climatic factors condition the net photosynthesis and allow the plant to accumulate dry matter (and accomplish its necessary developmental stages) according to the rates and patterns which are specific to the main groups of cultivated plants as described in the FAO Report on Agro-Ecological Zones. 2/

1/ See "Satellite Remote Sensing for Planning and Development in the ECWA Region" by R.A. Pacheco and J.A. Howard. FAO, May, 1981.

2/ Report on Agro-Ecological Zones Project, Vols. 1 and 2. FAO, Rome, 1983.

We note from this FAO study that in the mountain farming areas of the ECWA region, two major climates predominate: i) the cool tropics, and ii) the cool sub-tropics. However, as one proceeds with a particular region it is advisable to collect data on the spot for identifying the components of the microclimate in relation with the crop requirements.

1.2 Soil Inventory

The FAO/UNESCO Soil Map of the World (FAO, 1969-80) has been used as the basis of many studies. The legend of this Soil Map comprises 106 different soil units (26 major soil units). The soil units adopted were selected on the basis of present knowledge of the formation characteristics and distribution of the soils covering the earth's surface, their importance as resources for agricultural production and their significance as environmental factors. The soil units have been defined in terms of measurable and observable properties of the soil itself and are combined into "diagnostic horizons" similar to the corresponding diagnostic horizons of the USDA Taxonomy.

Many of the properties are relevant to soil use and production potential and therefore have a practical application value. Consequently, the soil units which have been distinguished on the Soil Map of the World are of value in predicting possible uses of soils.

The complete definitions of the soil units are given in Volume I (Legend) of the FAO/UNESCO Soil Map of the World. It is recommended to make large use of it at regional level whenever a soil inventory has not yet been done or to complement the existing soil surveys in a practical methodological way to assess the best soil type utilizations.

2. ACTIVITIES

In the mountain farming areas, human activities relate mainly to plant and animal production and secondly to other activities such as cottage industries, trade or services.

2.1 Matching Land Use With Land

The first stage is to decide on the factor ratings for each land utilization type. A factor rating is a set of critical values which show how well one particular land use requirement is satisfied by a condition of the corresponding diagnostic factor. For example, for the land quality of soil rooting conditions, as measured by soil effective depth, a soil depth of over 150 cm might be rated highly suitable, a depth of less than 20 cm not suitable, with corresponding values for moderately and marginally suitable.

The factor ratings are set for each selected land quality in turn: e.g. rooting conditions, moisture availability, erosion hazard. Different utilization types will have different ratings.

After the factor ratings have been set for each land quality belonging to each land utilization type, they are compared with the corresponding conditions of the land units. This leads to a set of partial or component suitabilities, called land suitability ratings. These show suitability of a land unit for a specified land use, based on one requirement alone, e.g. suitability based on rooting conditions alone. Thus, if a land unit has soils with an effective depth of over 150 cm, the land suitability rating would be highly suitable. Another land unit, with an average soil depth of 10 cm, would give a land suitability rating labeled not suitable for the same use.

There are several methods for combining factor ratings, ranging from subjective judgement to various arithmetic procedures (outlined in an FAO publication) 3/. A subjective method may be possible where the evaluation is coordinated by a single experienced plant evaluator; there is the danger that the same rule may not be followed in all instances where it occurs. Precise rules are necessary for cases of classification by several members of a team, or by computerized methods.

2.2 Environmental Impact

Consideration of the environmental impact, or the probable consequences of land use change for the environment, should permeate the matching process and, indeed, the evaluation as a whole. Conservation requirements will have already been taken into account in determining the provisional land suitability classes. Its further consideration is recommended to obtain an overall view of environmental impact particularly on the following aspects: soil erosion, sedimentation, water flow regime, microclimate, vegetation, wildlife and fisheries.

With respect to each of these kinds of impact, the environmental effects of land use change can be either favourable or adverse. For example, establishment of forest plantations on marginal agricultural lands with degraded soils may lead to a build-up of humus and restoration of fertility. In most cases the environmental effects of forest land use are favourable as compared with non-forest uses, although there will be exceptions.

Detailed discussion of techniques for watershed management and conservation is given in FAO conservation Guides 1-4 and FAO Soils Bulletin 44.

3/ Watershed Management in Asia and the Pacific. Tech. Rep. FO: DP/RAS/81/053, FAO, Rome, 1983.

3. TECHNOLOGY

Having selected the plant and/or animal activities to be considered in an assessment, it is necessary to define the conditions under which they are to be produced or the level of technology to be employed. Without such a definition the evaluation is not valid, because suitability for a crop (for example) varies quite considerably according to the circumstances under which it is grown. Two simple examples serve to illustrate this point: a) lands with slopes of more than 14 percent, or of a very stony nature, are not normally suited to mechanical cultivation, but can be cultivated with hand tools and, b) very heavy soils, such as Vertisols, cannot be cultivated with hand tools, but are suited to mechanized cultivation. Thus, a description of the circumstances of cultivation is vital to any sound evaluation of land.

For an adequate description of any land utilization type, information on the following items is desirable:

- Produce, including goods (e.g. crops, livestock, timber), services (e.g. recreational facilities) or other benefits (e.g. wildlife conservation)
- Market orientation, including whether towards subsistence or commercial production
- Capital intensity
- Labour intensity
- Power sources (e.g. hand labour, draught animal, fuel using machinery)
- Technical knowledge and attitudes of land users

- Techniques employed (e.g. implements and machinery, fertilizers, livestock breeds, farm transport, methods of timber felling)

- Infrastructure requirements (e.g. agricultural advisory services)

- Site and configuration of land holdings, including whether consolidated or fragmented

- Land tenure, the legal or customary manner in which rights to land are held, by individuals or groups

- Income levels, expressed per capita, per unit of production (e.g. farm) or per unit area

It is important to gather this information as it can be observed actually in the studied area at one point in time, and furthermore, as it could be found on improved conditions later on, using for example results of applied research.

Two extreme cases of technological levels are given here for illustration. Observed concrete cases or improved situations may fall actually in between, but these may be kept in mind as a benchmark check list for data base collection.

Attribute	Low Level of Technology	High Level of Technology
Market Orientation	Subsistence production	Commercial production
Capital intensity	Low	High
Labour intensity	High, including uncosted family labour	Low, family labour costed if used
Power sources	Manual labour with hand tools	Complete mechanization including harvesting operations
Techniques employed	Local cultivars, no fertilizer, no pesticides, fallow periods	High yielding cultivars, Adequate fertilizer, pesticide application, no fallow periods
Infrastructure requirements	Market accessibility not essential, inadequate advisory services	Communications and market accessibility essential, high level of advisory services
Land holdings	Small, sometimes fragmented	Large, consolidated
Income levels	Low	High

These two levels of technology can be visualized as representing two points on a production/input curve, corresponding to no (or few) on-farm capital inputs and a high level of capital inputs. It should be emphasized that: i) better adapted agricultural activities can be more productive under specific environment conditions, and ii) individual country production systems occupy different positions on the production/input curve reflecting the level of technology currently being used.

When gathering data on the levels of technology, it is

recommended to use the Farm Analysis Package (FARMAP) 4/ designed by FAO for computer processing of farming systems survey data. The package is sufficiently flexible to capture and handle the diverse data needed for monitoring development or identifying agronomic, environmental, cultural, institutional and socioeconomic constraints of the farm household unit.

4. SOCIOECONOMY

Without consideration of economic and social aspects there could be no integrated development evaluation. However, economic and social analysis can take place at two levels: generalized and detailed. Some evaluations are designed to provide broad planning guidelines, without leading directly to investment decisions. In such cases the effects of possible agricultural activities changes may be considered at a generalized level. Consideration should be given to possible consequences for labour transport, population movements or settlement, subsistence requirements, land tenure, and the interests of minority groups. At the generalized level, economic and social analysis are closely related, and may be carried out as a single operation.

The position is different where evaluation is intended to lead to investment decisions. In this case, economic analysis is carried out at a considerably more detailed level, in terms of costs of inputs and predicted outputs from different economic activities.

Without such analysis there is no way of comparing the relative effects of different kinds of physical limitations such as slope, infertile soils, drought, etc. Social investigations

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4/ FARMAP - A General Introduction. FAO, Rome, 1983.

are also more detailed, since the livelihood of people is at stake.

4.1 Data Requirements for Economic Analysis

Data collection for economic analysis proceeds concurrently with natural resource surveys. This data includes markets and prices for products, and availability and costs of inputs of materials and labour.

The specific economic data requirements for land uses are the effects of variations in land qualities upon both inputs (quantities and costs) and outputs (quantities and revenue). Information on relative costs of inputs may be harder to obtain than for output and revenue. For example, it is certain that loading and harvesting costs will be substantially higher on steeply sloping land, but specific data may be difficult to find. The means for translating effects of land qualities into input costs lies in the detailed management specifications for land utilization types. These must be expressed in terms permitting conversion into costs, e.g. as hours of labour and of use for machinery, quantities of seedling, fertilizers, pesticides, etc. Here again, FARMAP can be utilized as a checking list of data identification, classification, tabulation, presentation and further analysis.

4.2 Methods of Social Data Collection

The procedures for social analysis are less formalized than in most other components of agricultural activities evaluation, requiring greater adaptation to local circumstances. What is essential is that there be a set of field survey activities directed towards this aim. A broad outline which may serve as

the basis for such activities is as follows:

i. Identification of Communities - these will include people's residence in the study area, possibly divided into different ethnic or cultural groups, and others with partial dependence on much land, including migratory peoples.

ii. Unstructured Interviews - these consist of free discussion with community leaders and local people in the identified groups, the aim being to ascertain in a general way their needs, aspirations and attitudes to proposed agricultural activities changes.

iii. Structured Questionnaire - based on the results from previous steps, a questionnaire is drawn up aimed at assessing the nature, strength and extent of the various aspects.

iv. Analysis for Data - the questionnaire results are tabulated and reviewed, to produce a summary of the present situation and attitude towards changes

v. Design - as part of the process of elaboration of land utilization types, appropriate measures to take account of social aspects are incorporated

vi. Acceptability - when the nature, extent and location of possible agricultural activities changes have been assessed, these proposed changes are explained to the communities affected to test whether they will be acceptable

5. DECISION CENTERS NEGOTIATIONS

As mentioned in the introductory section, the various choices of agriculture or economic activities in mountain farming areas are related to three main types of decisions centers located at national, regional and farmers levels. Let us consider each one of them first separately, before trying to synthesize the various outcomes in a negotiation process.

5.1 National Decision Centers

National Plans, Ministries, national policies in the field of Agriculture, Industry, Transport, Economy, Finance, etc. are concerned with economic activities of different areas related to national objectives and constraints either on a central planned basis or in a liberal way but with specific policies constraints taking the minimum forms of taxes or subsidies. This is the reason that mountain farming areas must be specifically put into the national priorities as concerned economic development identifying national measures concerning their integrated development.

The definition of their relative importance with regards to the national economy will help to measure their relative weight in terms of production, income, population etc., and will clarify the choices of national policy makers for allocation of resources according to their objectives for these mountain farming regions.

5.2 Regional Decision Centers

Administrative region may cover part or complete geographic regions as mountain areas. Also according to each country, the political weight of administrative region may vary in terms of

investment and policy measures for integrated development. Therefore, the regional decision centers (administration, communities, etc.) must be assessed in each particular case in order to determine the strength and the possibilities of using their own capacity to motivate the agents of the required changes of economic activities for developing the region.

In addition, in the area under study (e.g. watershed), there will usually be people living in the uplands and people living in the lowlands. Regional authorities are required to maintain a balance between the activities located respectively in these two parts of the watershed because of their respective influence upon each other. For example, when there is destruction of vast areas of uplands through erosion, then the lowlands are damaged by frequent floods, sedimentations and lack of drainage. To repair the damages already done and to comply with the laws of nature, broken by misuse of the land during generations, is a difficult undertaking. At the same time it is essential to provide adequate income and improved standards of living in the rural population of the mountain farming areas, which in some countries may contain more than half of the total population.

5.3 Farmer's Decision Center

Comprehensive watershed development by farmers will necessitate in most cases, basic changes in their traditional patterns of choices.

Increases in production can be expected mainly from higher yields through better soil management and soil conservation use of improved varieties, additional income from additional farm enterprises and other non-farming activities, better transport and marketing facilities, which will allow production of higher valued and perishable crops and remarkably higher cropping intensities. Radical

changes in the management practices used on the farms will have to be applied to fully benefit from these changed conditions.

At this level it is particularly important to obtain the full participation of farmers and their representatives to the proposed changes from applied research through extension services, or the proposed changes by farmers themselves who have already identified their problems and found solutions which may, however, require special external financing and assistance.

5.4 The Negotiation Process

The interrelationship between all field (environment, activities, technology, socioeconomy) and their components have to be carefully studied and final decisions have to be made, based on the principles of coordinated and comprehensive planning including the participation of the main decision centers concerned or their representatives.

Economic considerations will be a major factor in making decisions on action and timing. However, these decisions have to fit into the sequence of improvement activities required for the effectiveness and optimal benefits of all components in the framework of a comprehensive approach.

The evaluation of a plan of concrete actions is not solely based on economic criteria. Both tangible and intangible benefits have to be considered. Furthermore, there are other feasibility aspects not to be forgotten such as technical, managerial and institutional. Finally, it is important also to take into account various constraints such as government policy objectives, marketability of agricultural products, social and cultural constraints, local cooperation and others.

Integrated development of mountain farming areas through watershed management is a complicated undertaking. It will require a high grade of coordination and experience which can only be gained by actually doing the job. It is suggested that a relatively small sub-watershed (2000 to 5000 ha) be selected as the testing and training ground for planning and implementation. Based on the experience gained and the results achieved, activities can gradually be expanded.

It should be added that in the ECWA region, the complexity of the problem should not delay to start this kind of development operation, because of the urgency of the situation concerning national, regional and farmers levels.

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