PART 3

METHODOLOGIES AND THEIR APPLICATION

Chapter 7

LAND USE AND NATURAL RESOURCE-BASED INSTRUMENTS

7.1 Land evaluation methodologies

Increasing attention is being given to the suitability of different forms of land use. Many of the methods have their origins in land evaluation. Over the past 40 years, a range of methods for physical land evaluation have been developed (and are reviewed by Dalal-Clayton and Dent 2001, and Dalal-Clayton et al. 2002). These try to explain and predict the potential of land for one or more uses by systematic comparison of the requirements of land use with the qualities of the land. The end product is an index of potential performance in terms of *capability* to support broadly defined categories of use, *suitability* for some specified land use, or *productivity* (e.g. crop yield) of a specified land use. In this way, the range of feasible land use options may be identified. Where economic appraisal has been demanded, this has been tacked on without much change in procedure, either from natural resources specialists or economists.

The best known and most widely used method of land evaluation is Land Capability Classification, originally developed by the United States Soil Conservation Service in the 1930s to interpret soil maps for farm planning. It has been adopted and, sometimes, modified by survey organisations in many developing countries. The definitive account is given by Klingebiel and Montgomery (1961). Another system, also developed in the USA, is the land classification system of the Bureau of Reclamation of the US Department of the Interior (USBR 1953), developed for planning irrigation projects.

A main principle of the FAO framework for land evaluation (FAO 1976) is that evaluation is for a specified *land use type* - a system of management relevant to local conditions in terms of the physical environment and social acceptability - so the first step is to identify and define promising land use types and establish their land requirements.

Other approaches to land suitability assessment include a range of parametric methods (the best known being the Storie Index Rating (Storie 1978)), and various process (or simulation) models to predict, for example, crop production, risk, or inputs needed for a particular land use type.

A somewhat different question is whether or not the land has the capacity to meet the demands for products and services, now and in the future. This relates to land use policies to cope with population growth, other changes in demand, climatic change and technological change. The question has been approached by comparing needs or production targets for commodities and services with the capacity of the land to satisfy them; measuring the degree to which needs may be met and the flexibility of land use options in meeting the needs. Several recent attempts at strategic evaluation of land resources have used multiple goal programming, *e.g.* to assess scenarios for development in Canada (Smit and Brklacich 1984) and the European Community.

7.2 Land use sustainability analysis (LUSA)

The Department of Science and Technology in India, working with UNDP, has developed a simple procedure to assess land use sustainability, covering ago-eco-socio-economic dimensions. It is effectively a form of land evaluation in which physical threats/hazards have been identified (eg drought, soil erosion, excess percolation under irrigation, and under-developed/privileged population), and indicators for these then ranked in order of the ease of obtaining data (Adinarayana, undated). A subtractive procedure is then applied to de-rate any partcel of land under consideration according to the severity of the limitations, arriving at a six-fold classification comparable to the well-known land capability classification used in the USA (USDA date), but with additional loops to accommodate rice and irrigated land. The defining values for each class are locally calibrated and the result is expressed with up to three degrees of confidence, depending upon the completeness and quality of data used in the assessment, eg “not better than Class C – with one degree of confidence”.

On the basis of the identification of hazards, the rural planner can design management packages to combat the threats to the sustainability of the desired land use, or recommend an alternative land use.

7.3 Sustainability assessment of farms

The Swiss College of Agriculture is developed ***response-inducing sustainability evaluation (RISE)*** as an indicator-based instrument for comparative evaluation, advice and planning of farms for sustainable production and development. It considers the principles of ISO norms and is claimed to be internationally applicable to different production systems and frame conditions following testing on farms in Brazil, China and Switzerland (www.sfiar.infoagrar.ch/documents/posters/rioplus11/fritz_haeni.pdf).

The model is based on 12 indicators:

- *Ecological*: energy use, water consumption, soil conditions, biodiversity, emission potential, plant protection, wastes and residues;
- *Cash flow*: farm income, investments, local economy;
- *Social situation*: situation of farmer’s family and employees.

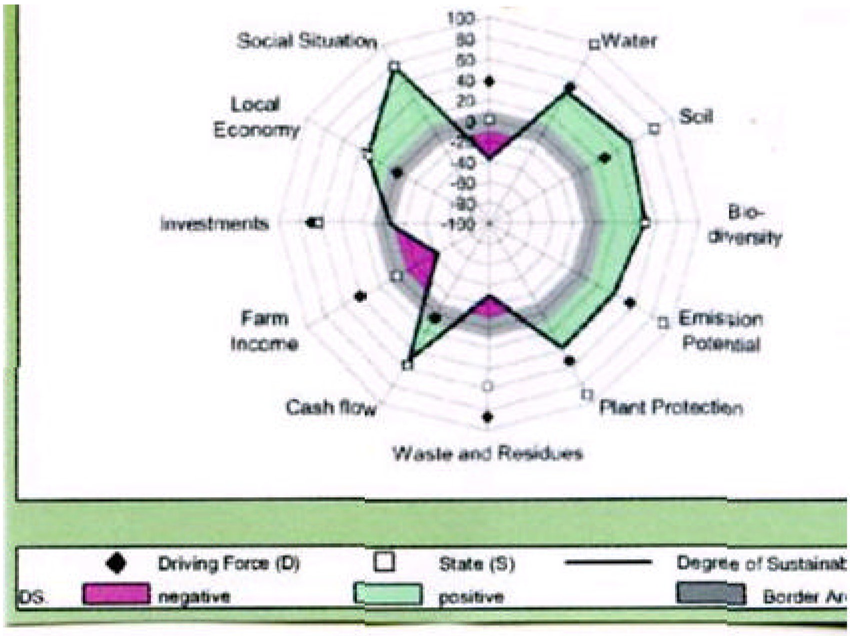
The analysis covers a period of one year and also involves undertaking a profile of strengths and weaknesses for: stability of social, economic and ecological framework; animal health and welfare; risk management; and ‘grey energy’ in machines, buildings and external inputs.

The model combines a systems and analytical approach by evaluating both the (actual) ‘state’ (S) (eg nitrogen and phosphorus balance) and the pressure or ‘driving force’ (D) (eg input of nitrogen and phosphorus) for each indicator. The difference between these two indicates the ‘degree of sustainability (DS = S–D) for that indicator. A high D is likely to result in a low S over time. D thus allows consideration of long-term trends and risks which are crucial for considering sustainability in an operational context.

D, S and DS of all indicators are shown in a sustainability polygon (Figure 7.1*)*. An ideal situation is represented by a regular band of positive values for DS rather than maximum values for individual indicators. Individual indicators are considered sustainable if DS is above +10. The whole farm is considered sustainable when no indicator has a DS below –10. Interpretation of the results permits identification of strong and weak aspects of the farm and steps needed for improvement.

Figure 7.1: Sustainability polygon for a Swiss mixed farm

(Source: www.sfiar.infoagrar.ch/documents/posters/rioplus11/fritz_haeni.pdf)



Note: Farm has 18 dairy cows and 5 different crops (19 ha).

7.4 Sustainability assessment of renewable energy projects

A recent initiative in the UK explored the development of an appraisal framework for renewable energy projects. It was undertaken by Land Use Consultants and Ecotec Consulting for ETSU[1] and the English Countryside Agency. An objective-based appraisal framework was sought (i.e. based on existing national policy objectives relating to sustainable development and renewable energy technologies) that:

- Provides a transparent means of comparing positive and negative effects at a variety of scales;
- Takes into account social and economic as well as environmental effects;
- Draws on the Quality of Life Capital approach - developed by the Countryside Agency, English Heritage, English Nature and the Environment Agency and capable of considering social, economic and environmental effects at a range of different scales. This approach addresses why particular resources are important and the nature and significance of the benefits they provide, which then enables more sensitive project development and appraisal (see www.qualityoflifecapital.org.uk)

The appraisal framework comprises a series of steps which were tested, as they were being developed and evolved, through a series of fictional case studies (summarised in Box 7.1 and Figure 7.2).

[1] ETSU: A renewable and energy efficiency organisation, now incorporated in Future Energy Solutions, launched in 2001 as part of AEA Technology, UK.

Whilst the framework was developed to focus on the design and appraisal of renewable energy projects, it might also be applicable at the renewable energy policy level, and also has potential in relation to other types of development.

Box 7.1: Proposed steps in sustainability assessment of renewable energy projects

1. *Review national and regional policy statements* to compile a list of policy objectives relevant to renewable energy development;

2. *Apply the Quality of Life approach* to define categories of 'benefit' associated with each of the objectives (this can be compared with the process of identifying 'indicators' with which to measure success in achieving policy objectives);

3. *Characterise the baseline situation* (existing situation without the proposed development) to identify benefits (or disbenefits) currently provided (see example in Table 7.1).

4. *Apply the Quality of Life evaluation criteria* to determine the significance of each of the benefits defined in the previous step. These questions consider:
   - the scale at which the benefit is of policy importance:
   - its significance at that scale:
   - the trends in the supply of the benefit set in the context of any targets that have been set:
   - the potential to achieve the same benefits but in a different way.

   In the light of answers to previous questions, determine how the benefit should be managed;

5. *Use more locally-specific objectives* to judge the effects of a proposed renewable energy development. To what extent does the proposal meet local objectives? Is it likely to result in the creation of a new benefit/disbenefit, and an increase/reduction in existing benefits/disbenefits

6. *A second round of appraisal* to determine the relative and absolute significance of the benefits/disbenefits by conducting using the Quality of Life Capital evaluation criteria.

7. *Assess the extent to which the renewable energy proposal can be modified* to reduce disbenefits or increase benefits.

Source: www.dti.gov.uk/energy/renewables/publications/pdfs/researchreport

Figure 7.2: Sustainability appraisal for renewable energy projects

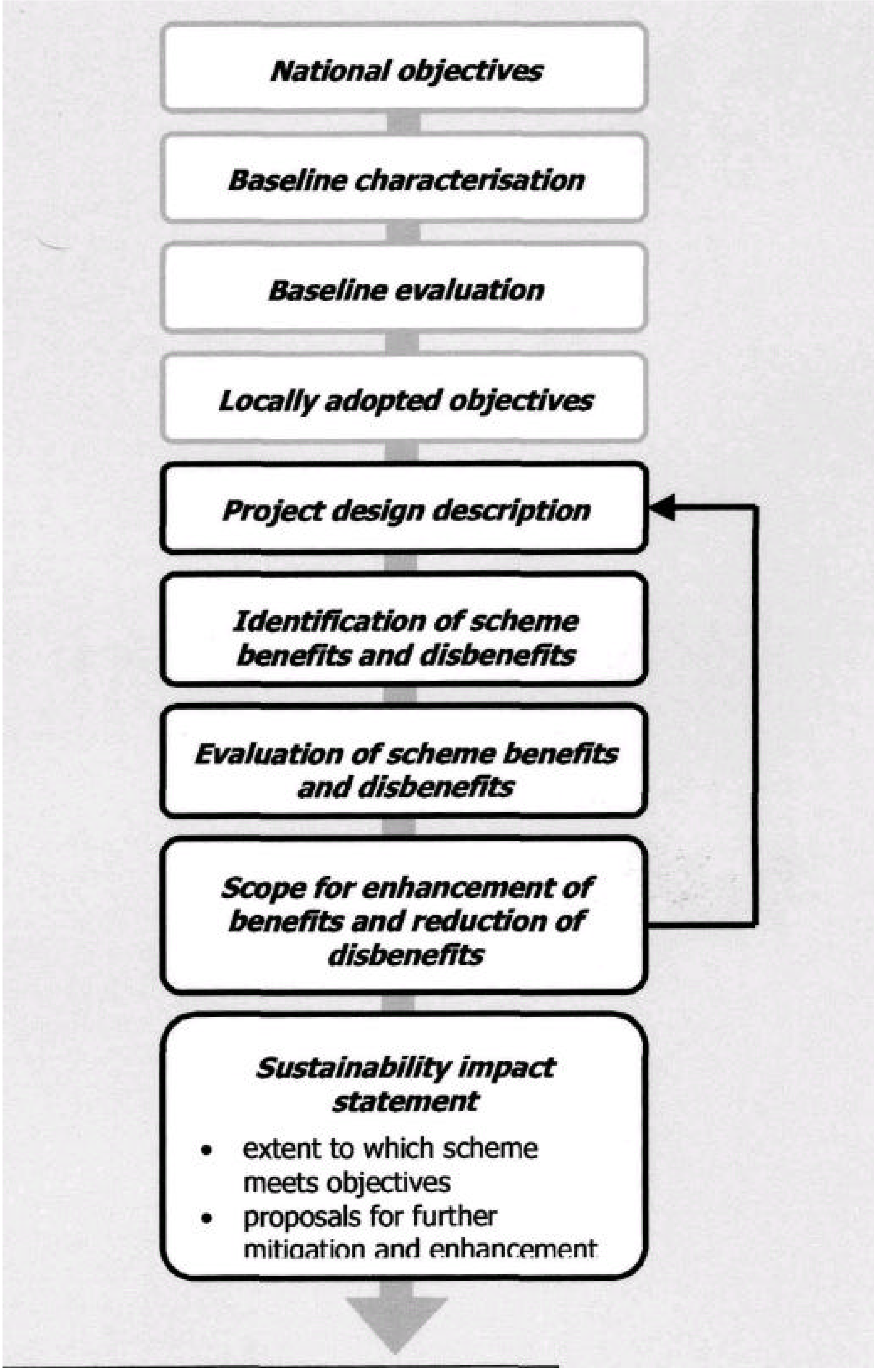


Table 7.1: Objectives, benefits and disbenefits and potential data sources relating to renewable energy: some examples

(Source: www.dti.gov.uk/energy/renewables/publications/pdfs/researchreport)

Objective	Baseline dis/benefit categories	National Information Sources	Regional Information Sources	Local Information Sources
To do more with less, making better use of resources	Existing resource use per unit of output (e.g. energy use per unit output)	Digest of United Kingdom energy Statistics (DTI) / UK Energy Sector Indicators (DTI)	Regional Development Agencies	
To produce goods and services that meet consumers; needs and can be used efficiently	Existing consumer needs (e.g. for 'green energy')	National consumer surveys (government / market research companies). Published 'lifestyle' data	Government Offices for the Regions – Regional Planning Guidance – energy demand	Primary research – consumer surveys within local areas
To enhance the development and application of skills relevant to employment in way which is accessible to all, and which links local / employee skills requirements with training opportunities	% of employees undertaking work related training in last 13 weeks	Department for Education and Employment	Training and Enterprise Councils (TECs) in England and Wales; Local Enterprise Companies (LECs) in Scotland, Training and Employment Agencies (Northern Ireland) Regional Development Agencies	Training and Enterprise Councils (TECs) in England and Wales; Local Enterprise Companies (LECs) in Scotland, Training and Employment Agencies (Northern Ireland)
	% of employers with hard to fill vacancies	Department for Education and Employment		
	Number of organisations recognised as Investors in People	Department for Education and Employment	Regional Development Agencies	
	% of 19 year olds with level 2 qualifications and adults with level 3 qualifications	Department for Education and Employment	Regional Development Agencies	
To further economic development and regeneration	Existing GDP per head	National Statistics Office / Department of Trade and Industry – economy reviews	Regional Development Agencies	
To promote business efficiency, stability investment and competitiveness	Number of business start-ups and survival rates	Department of Trade and Industry – Business Start-ups and Closures, Statistical News Release	DTI – Regional Business Resources e.g. The North East Chamber of Commerce / Regional Development Agencies	
To promote employment	Employment and unemployment rates, including levels of long term unemployment	National Statistics Office Department of Trade and Industry – Employment Market Analysis / Department for Education and Employment	Regional Economic Strategies	
To contribute to sustainable development through targeting brownfield land for development	Area of vacant brownfield land	DETR Land Use Change Statistics Bulletin. Scottish Executive Derelict and Vacant Land Surveys National Land Use Database	Regional Planning Guidance	Local Plans – land analysis and development allocations
Increased domestic and international market share for specified technologies and products	Current level of domestic sales and exports of specified technologies and products.	Industry reviews and news eg. By British Wind Energy Association etc. Annual Energy Reports (DTI)	Regional Development Agencies	Views of local companies involved in renewables technologies and related products
Reduce energy costs to industry	Existing energy costs for industry	Digest of United Kingdom energy Statistics (DTI) / UK Energy Sector Indicators (DTI)	Regional energy suppliers	