Landscape Impact Analysis: a systematic approach to landscape impacts of policy

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ABSTRACT *A method for analysis of landscape impacts and for presentation in visual terms was developed by the author and has been applied in Sweden and Norway to policy analysis. The method has successively been developed into a generalized method of landscape impact analysis of policies, programmes and plans—Landscape Impact Analysis (LIA). This deals with the interaction of human and natural systems and the resulting landscape. The method uses scenario techniques as a way of solving the problems of lack of specificity of policy, a problem which seems underestimated in the development of strategic environmental assessment. The paper describes the main steps of the method and shows examples of the application of the method to changes in Norwegian agricultural policy.*

KEY WORDS: scenario techniques, strategic environmental assessment, policy analysis, landscape impacts, visual impact analysis

The Need to Consider 'Landscape Futures'

The ways in which landscapes will change in response to future fluxes in global environmental conditions, and to revisions of national policies for agriculture, forestry and energy or of local plans for development is of considerable public and political interest (Emmelin, 1983). The future landscapes which are inherent in plans and policies for conservation, development, forestry, agriculture, etc. need to be examined before large-scale programmes are implemented (Vedung, 1991). Methods of communicating complex scientific information concerning landscape impacts are needed if the public is to understand and participate in policy making (Clark, 1989).

At present, policy analysis deals mainly with the aggregate effects of policy at national level and is primarily concerned with economic and social systems (Premfors, 1989). Conventional methods of environmental impact assessment tend to focus on the effects which well-defined projects will have on ecological, economic and social systems. Methods of assessing policies, programmes and plans for environmental effects are much less well developed and there is very little experience of their use (Lee & Walsh, 1992; Therivel *et al.*, 1992). The spatial

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aspects of impacts of policies, programmes and plans have received far less attention, usually confined either to regional policy issues or to detailed visual impacts of large projects. Conventional visual impact assessment of projects has dealt mainly with the aesthetic impact of proposed installations on an existing landscape (Bramsnæs, 1993).

Current methods of analysis deal mainly with the impacts of projects on environmental systems rather than on localized landscapes. In order to envision 'landscape futures', we need to be able to transform knowledge from a systems perspective to a spatial or 'arena' perspective. This requires a method which disaggregates a policy into its local effects, and describes and analyses these in concrete and spatial terms.

A method for analysing the landscape impacts of policy scenarios, and for presenting them in visual terms—Visual Impact Analysis (VIA)—was developed by the author and has been applied in Sweden and Norway to policy analysis during the last decade (Emmelin, 1982; Emmelin & Brusewitz, 1985; Emmelin *et al.*, 1990). Interest in this method has led to, and been paralleled by, applications both in the Nordic countries and elsewhere (e.g. O'Riordan *et al.*, 1993). The approach used by the author has successively been developed into a generalized method of landscape impact analysis of policies, programmes and plans—Landscape Impact Analysis (LIA). This deals with the interaction of human and natural systems and the resulting landscape.

This paper describes and discusses a method of strategic environmental impact analysis at the landscape level. The use of the results of such analysis in a planning process or in policy making is not considered. The primary aim of LIA is not to produce policy recommendations but rather to understand policy processes and the ways in which they impact on the landscape. Such understanding is necessary for informed policy making. The method is based on scenario construction from policies. The role of scenarios is to provide consistent and concrete descriptions of a landscape undergoing a particular form of development under explicit policy and contextual influences. The main components of the method are shown in Figure 1.

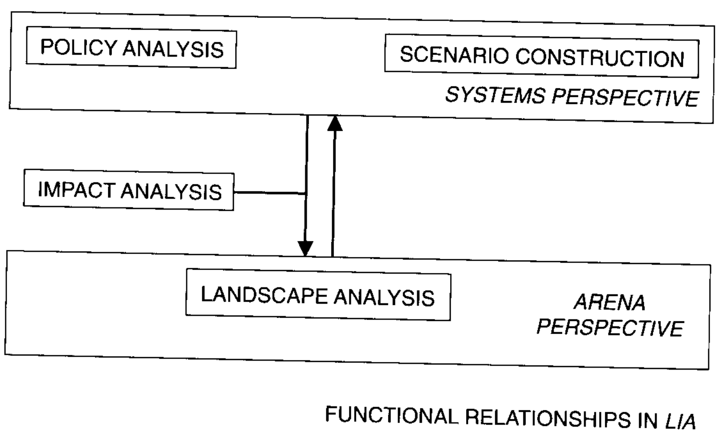

Figure 1. Main elements of the Landscape Impact Analysis (LIA) method.

'Ecological Modernization': a methodological challenge

The challenge of environmental politics is to find socially acceptable ways of dealing with environmental problems. Hajer (1992) proposes two normative conditions to be met in the process of ecological modernization. First, any method must promote a change from reactive to anticipatory policies, and towards structurally different modes of production. Second, ecological modernization should, if possible, not interfere with the social imperatives of emancipation, self-determination and equal opportunity (cf. Næss, 1974).

Methods that attempt to produce one-dimensional solutions, based on a narrow interpretation of rationality in economics or ecology, will come into conflict with the second criterion and will constitute steps in the further 'rationalization' of society (Habermas, 1989). As Hajer (1992) also points out, the environmental discourse has been highly rationalized by scientification, including the use of complex mathematical models. The management culture of environmental management seems particularly predisposed towards scientification, due to a strong component of natural science-based expertise (Emmelin, 1993). The methods used in both conventional environmental impact analysis (EIA) and the emerging branch of strategic environmental impact analysis (SEA) run the risk of falling into this category. O'Riordan (1992) has pointed out the need for very radical change in attitudes and the consequences for science and methodology if public participation in environmental decision-making is to become a reality.

Modernization entails the process of penetration of 'systems' of the state and the market into social life, the 'colonization of the life world' (Habermas, 1989). This process can be observed in modern landscape change. The local arena is colonized by processes, structures and artefacts planned and managed by absent and abstract organizations, such as power lines, groups of wind generators and new roads. It is also affected more subtly by the changes which result from agricultural policy, taxation, etc., whose origins may be national but where the actual agents of change are local. The syndrome called by planners 'NIMBY' (*n*ot *i*n *m*y *b*ack *y*ard), which is often described as an expression of local selfishness, can be understood in Habermas's terms as the dissent against the colonization of the life world, or local arena.

Precisely what methodological conclusions should be drawn from the call for emancipatory techniques and planning practices is arguable. However, as a minimum requirement, it seems that methods which make the underlying processes transparent and understandable are needed. The object of disaggregating national policy or programmes into their effects on the local level is to make these policies transparent, which they are manifestly not in their aggregate form (Lykke, 1992). The promotion of fundamental change must entail the generation of a wide range of alternatives for discussion and analysis rather than predictions based on 'business as usual'. Alternatives must challenge conventional wisdom and promote a readiness to cope with unanticipated (hereafter referred to as 'surprising') developments. Planning as a means of coping with uncertainty, as distinct from attempts to design a single future, must be promoted.

Some Conceptual and Methodological Considerations

The LIA approach is based on some simple concepts and methodologies which will be briefly discussed before the method is outlined and an example of its application given.

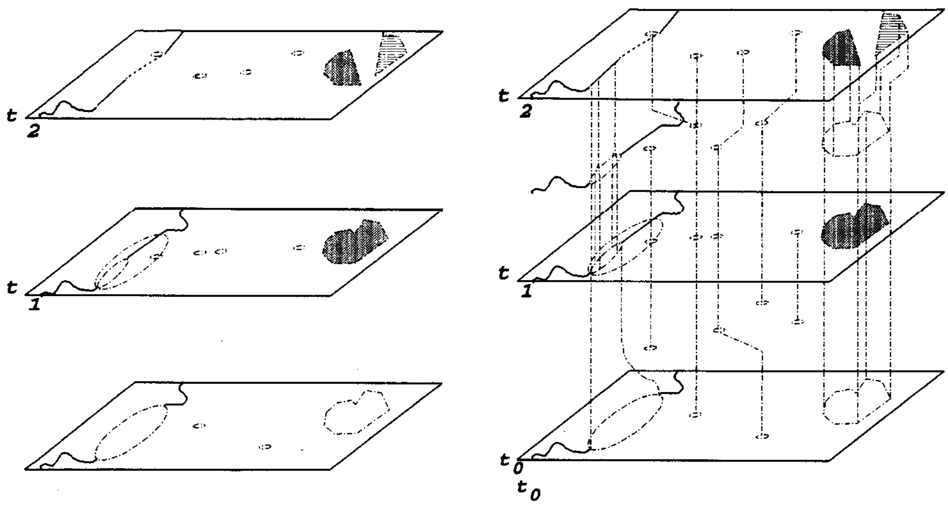

Figure 2. Landscapes in space and time. The three sections in time on the left illustrate the fragmented understanding of landscape that result from discontinuous, cartographic representation at three points in time. The series on the right illustrates Hägerstrand's concept of 'the landscape of process and continuity'.

The Concept of Landscape

The concept of landscape is neither simple nor unambiguous. The term has geographic, cultural, historic, aesthetic and other connotations. Jones (1988, 1993) has discussed the term 'cultural landscape', with particular reference to its use in the Scandinavian languages. LIA deals explicitly with the 'cultural landscape', i.e. a landscape modified or influenced by human activity. The *term* 'landscape' is here used to denote the *visual expression of the sum of objects and processes in a given locality at a given time.* The *landscape concept* in LIA is closely related to Hägerstrand's (1992) 'landscape of process and continuity'. Not only the landscape concept, but many of the central ideas in the development of LIA, are inspired by the 'time-space' geography of Hägerstrand.[1] The emphasis on continuity and interconnectedness of objects and processes in time and space is a central idea. Individual objects of a landscape thus exhibit trajectories in space/time and this provides an approach that ties in well with methods of scenario construction (Asplund, 1978; Schwarz *et al.*, 1982). In LIA, the idea of individual landscapes as sections in a flow of time rather than as discrete and separate pictures is important (Figure 2).

Thinking about the Future Landscape—a simple model

Figure 3 illustrates a simple model around which we can organize our ideas about landscape change from the past, through the present, to the future. It has served as the simple conceptual model behind the development of LIA.

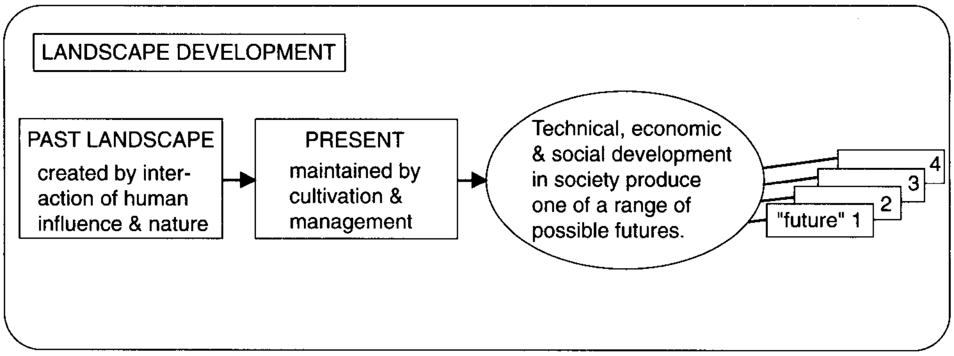

Figure 3. A conceptual model for landscape change from past to future (*Source:* Emmelin, 1982).

The model underlines some essential aspects of landscape development in relation to planning and forecasting. It should be noted that the model views landscape from the point of view of planning and landscape conservation.

The present landscape is the *product of a combination of natural attributes and the historical heritage.* The landscape of the future will be the product of the *interaction* of nature, the historical heritage, and future technical, economic and social conditions. This interaction will comprise forces of inertia and change. Because of the importance of past and present landscapes in shaping the future, the *future landscapes are to some degree immanent in the present.* This is the idea behind de Jouvenel's (1967) 'futuribles' and Asplund's (1978) use of the term 'a fan of futures'.

The landscape of the future is not one, single landscape which can be predicted. It is rather *many potential landscapes,* dependent on differing sets of assumptions or influences: the landscape futures are best described as a *fan of potential landscapes.* A limited and partial determinism is a condition of the analysis, but not necessarily of the landscape. The number of potential landscapes will be endless, given the range of combinations of landscape processes and elements which could exist at any one point in space and time: thus, the analytical solutions will always have to be arbitrary to some degree. Though the analysis may contain elements of prediction concerning individual components, any one landscape as a whole will be a construct whose overall appearance cannot be predicted. In other words, a landscape of the scale discussed here cannot, in most cases, be reduced to the outward manifestation of a very small number of predictable factors. This is a major reason for arguing for scenario construction as a basis for yielding a 'fan' of landscape futures.

The model presented here underlines the transient nature of the present cultural landscape: future ecosystems will be different from past systems. For the planner this aspect of the model underlines the fact that the present is in present is in dynamic rather than static equilibrium and that managed change rather than preservation is the essential challenge.[2]

Planning and landscape conservation measures will merely be elements in the interplay of forces creating a future landscape. Their effect will be variable, modified or obscured by other forces, so that they may *influence but rarely shape the landscape* outside parks and nature reserves. The indirect influence—by changing aggregate societal impacts—may be profound, as when legislation changes the context for economic impacts or influences development of new technology. From the empirical point of view it must be remembered that, in market economies, physical planning may make very little attempt to shape or influence landscape processes, especially those which influence agriculture and forestry (Emmelin, 1983; Skage, 1984).

Landscape planning is, in effect, conditioned by planners' anticipation of *virtual landscapes* which they perceive to be desirable, and which they try to bring about. There are many virtual landscapes—for example the landscapes which are assumed to follow from changes in agricultural policy, or from energy generation and distribution—which form fragments of landscapes rather than a consistent whole. Planners tend to react to these fragments. Also, there are 'immanent' landscapes, which lie in existing landscapes, with their inherent tendency for change. In principle, virtual landscapes of this kind can be analysed and visualized in a similar manner to future landscapes which are 'immanent' in present ones. Picturing them, so that they can be analysed and discussed, is one of the functions of LIA.

Critical analysis of various images of the future including ideals, theories and perceived threats, as well as the internal consistency or desirability of scenarios, is an important task of policy and impact analysis. If presented in visual form, the virtual landscapes embedded in ideals and theories can be analysed in a manner analogous to conventional landscape assessment. The methods of scenario analysis dealing with 'anticipatory scenarios', also termed back-casting, explicitly deal with such images of the future.

The Arena Perspective on Policy Impacts

It is when policy finally results in changes at the local level—the transformation from a systems perspective to an arena perspective—that we can rightly talk of an impact. The rationality which exists in national policies on an aggregate basis will be interpreted by individual decision-makers at the local level who act according to their own 'rationality'. In the transformation from the general to the particular, 'arena' factors such as local ecological conditions, historical heritage and the inertia of various local systems will prevail. The arena is thus where impacts become manifest, where we live our daily lives, and where we identify with a landscape. A major object of LIA is to *co-ordinate these two perspectives* by breaking down the aggregate 'systems world' into impacts and interactions in the 'arena world'. LIA should be seen both as an exercise in impact analysis or participatory policy-making, and as a contribution to holistic approaches to landscape-society interactions.

Going from Policy to Landscape—three modes of analysis

In moving from the policy scale to the individual landscape scale, several complementary types of analysis become necessary. Jones (1979) has described

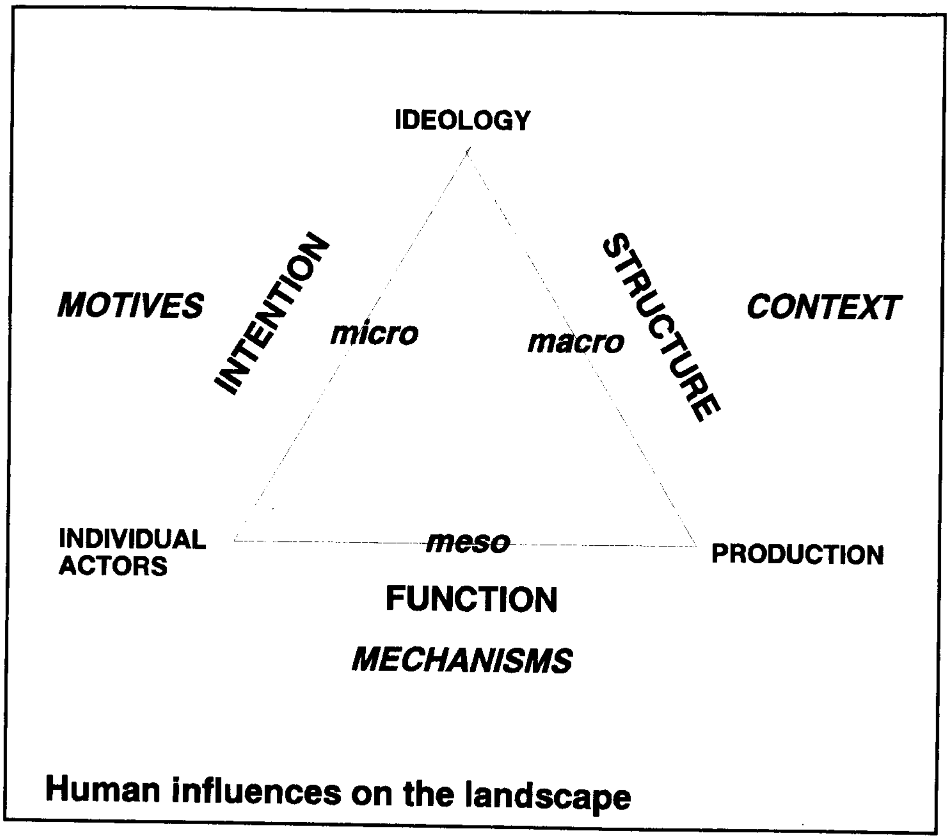

Figure 4. Three modes of analysis for the interaction of humans with landscape, corresponding to three geographic levels of landscape (*Source:* Jones, 1979).

a model corresponding to three different geographic levels (macro, meso and microscale), to three modes of analysis, and possibly three different modes of explanation (Figure 4). In essence, the transformation from system to arena is an attempt to move between different modes of understanding landscape change.

At the macro scale or policy level, the analysis is concerned with socio-economic structures and related ideologies as well as techno-economic systems. At a meso (regional) scale, analysis is concerned with how the elements of the landscape function in relation to one another. The question asked is primarily 'how does the landscape function?'. Observations of regularities makes this mode of analysis and explanation more general, and this quality has formed the basis of landscape ecology. At this scale, economic rationality often forms a useful organizing framework for a functional analysis, though alternative modes of explanation also need to be explored.

On a micro scale, what Jones (1993) calls 'the chronological-biographical method' can be used to organize disparate information concerning particular landscape features and the actions of individuals and groups. The chronologicalbiographic method is suited for reconstructing the detailed historical geography of individual landscape features. By analogy it is thus also suited for constructing futures at the local, arena level. The method corresponds to the time-space model of Hägerstrand and the idea of a local landscape as a section in time. Jones also notes that it is 'broadly humanistic' and based in hermeneutical method: hence, the contention here that landscape futures on the local, arena level are hermeneutical discourses, basically interpreting landscape structures and functions over time and interacting with larger systems.

In practice, much of landscape ecology tends to work on this level and the attempt to find generic systems of description is an attempt to break out of the local and idiographic. However it has limited applicability here, since it operates within an ecological paradigm, which is itself controversial. Also, since LIA is not concerned with prescription or design, the approaches of landscape analysis are of limited use. They tend to focus on form rather than function and the aggregations used will tend to group together elements with widely different generic background. Such analysis and classification may, however, be useful in characterizing the resulting landscapes.

Thus, the 'landscape futures paradigm' of LIA provides a framework for the discussion and analysis of future landscapes. This is a less ambitious claim than historical landscape analysis or landscape ecology, which attempt to *explain* processes of landscape change or landscape dynamics. The 'landscape futures paradigm' is composed of elements common to many types of futures studies, but it also includes elements and perspectives from studies of landscape processes and change; it can also make explicit any new or controversial assumptions and concepts necessary in studies of future landscapes.

Briefly, the elements of the 'landscape futures paradigm' consist of:

- a planning concept and a planning ideology;
- a concept of landscape;
- the meta-methodological ideas and concepts culled from the fields of futures studies, policy analysis, impact analysis and other disciplines concerned with landscape studies (most notably, landscape ecology);
- a perspective on knowledge concerning both the future and the past and on processes of landscape change in space and time.

The following discussion concentrates on the landscape aspects, in particular the problems associated with the transformation from systems to arena perspective.

Determinism and Prediction

Any attempt at landscape impact analysis, or the construction of a logical chain of reasoning concerning landscape futures, risks courting accusations of determinism. Whilst more or less random, causative events may in themselves be reasonably predictable—as, for example, the instigation and dynamics of secondary succession—the intrinsic variability of their outcomes is a key argument for developing scenario techniques. However, techniques such as scenario-building and impact analysis assume that, for well-defined systems or subsystems, there are logical chains of events that can be 'preconstructed'.[3] The consequences of these for the 'landscape futures paradigm' can be summed up in two points. First, 'large scale determinism' and, by implication, attempts at 'grand theory' are likely to be interesting for generation of policy alternatives or scenarios but of limited use for impact analysis in specific landscape settings. Second, according to Urban *et al.*'s (1987) hierarchy paradigm, it is likely that large-scale determinism will not have any clear and singular expression at lower levels of a time/space hierarchy. Thus, the search for determinants of landscape processes must be made at the appropriate level, which for LIA is the level of the arena or local landscape.

In particular, it seems that when the study is concerned with systems where an important component or subsystem is natural, such as in most landscapes, a certain cautious 'historicism' may be permissible. It is important to stress that this is an intellectual device to make reasoning possible, not a claim for explanation.

Strategic Environmental Impact Assessment (SEA)

The central problem, both practically and theoretically, in impact analysis of policies, programmes and plans is making statements about them simultaneously concrete and consistent. Very simply, the basic difference between an impact analysis of a project and the analysis of landscape impacts of policy is the concrete nature of a project. Whereas a single project is concrete, specific and localized, policy is essentially none of these, and its indirect consequences may be conditional, ambiguous and not necessarily clearly located in space.

The Role of Scenarios in SEA

Policy proposals lack the specificity and local focus of a project application. Whilst a policy may have reasonably clear aggregate results at the national level, given certain assumptions concerning the future context in which the policy is to operate, these results are composed of a bewildering array of local responses. To discover the unwanted side-effects of a policy also requires the examination of its operation under varying conditions. Impact analysis may be part of the formulation of a policy, in which case a most important issue is that of testing the policy alternatives.

The role of scenario techniques is to allow such testing under specified but variable conditions. Thus, the different landscapes which are immanent in the combination of a present landscape and a policy instrument is brought out as a set of scenarios. The 'fan of possibilities' is displayed in Figure 3.

Outline of the LIA-method. The method is presented in a series of figures for completeness and economy of space. Figure 1 presents a broad outline of the general method. It illustrates a basic idea in LIA, which is to separate the main operations into a number of discrete steps possessing different methods and analytical principles. The figure underlines the central role of the 'matching' process, namely, the way in which a transition is achieved from the systems perspective to the arena perspective.

Figure 5 shows the steps in more detail. This figure underlines a number of important stages:

(1) The role of synopsis as a preliminary step in scenario construction: this corresponds to the first step in impact analysis, 'scoping';

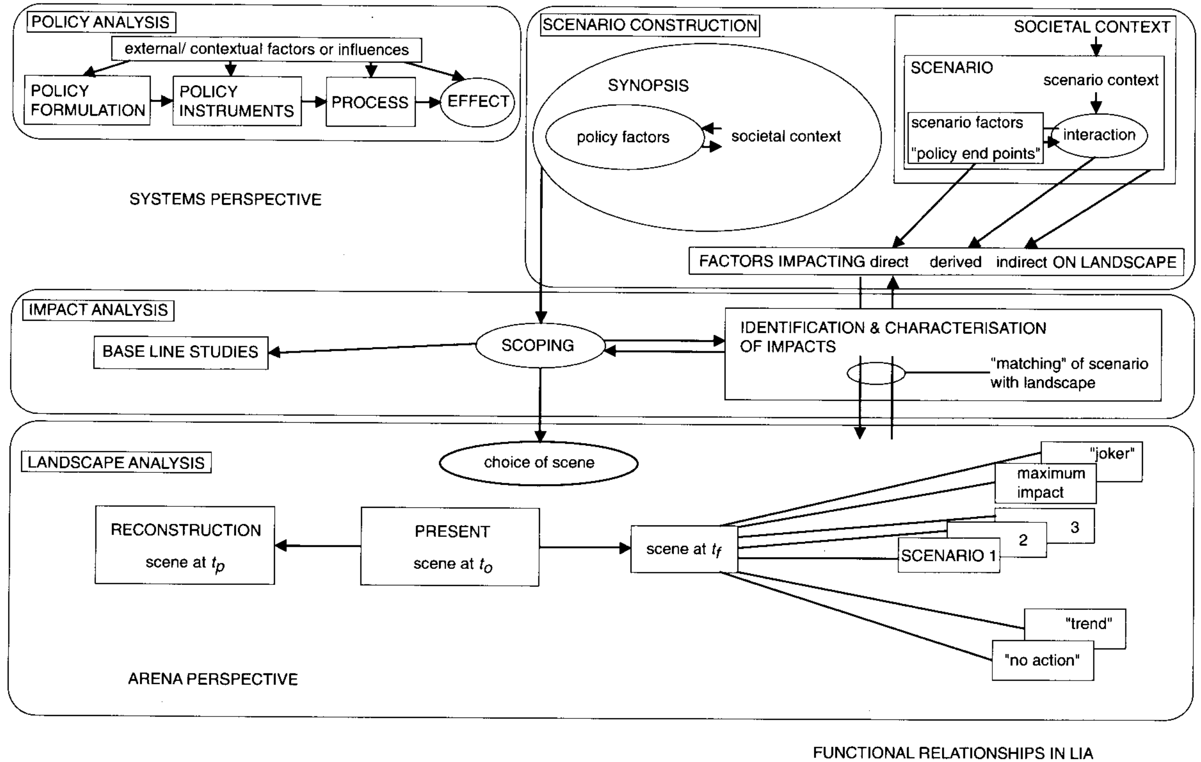

Figure 5. Components of the LIA-method and their internal relationships. The figure indicates the simplification of policy analysis into a linear chain of reasoning, which leads to a specification of policy factors and a scenario context. Scenario construction is divided into a preliminary synopsis and the more complex final scenario which produces the 'factors impacting on landscape'. The impact analysis ties the scenario with the landscape in the step called 'matching'. As a first step in impact analysis 'scoping' is used to guide the choice of landscape to be used, 'the scene', and to specify the need for baseline study.

(2) The 'impact analysis' stage, entailing reconstruction and visualization: this is analogous to the 'baseline studies' of impact analysis;
(3) The 'landscape analysis' step, introducing the temporal aspect and the idea that there is a range of futures immanent in a present landscape (this links the steps to the conceptual model in Figure 3);
(4) The construction of the 'scene' as a surprise free trend extrapolation and a direct physical extrapolation of the landscape, as opposed to extrapolation of the societal factors determining a landscape;
(5) The idea that the 'fan of futures' immanent in any given landscape should lead to the exploration of a range of alternatives, including a set of standard alternatives.

Figure 6 deals with the policy analysis component of VIA, and shows the main steps from policy to project actions and environmental effects. It emphasizes that the chain from original policy to landscape impact is an 'information chain' (Hallden, 1980). Information and signals are likely to get lost or be distorted by noise along the chain. This increases the problems of finding any direct and simple relationship between policy and effect or impact. The progression from broad policy and its signals to actors in the form of rules and economic instruments on the one hand, and the concrete and specific actions of the actors in the landscape on the other, are complex components of the chain. In particular, the LIA method focuses on the problems of the translation of systems effects into actions, effects and impacts on the arena. This step is critical in the environmental assessment of policies and programmes because it contains a translation into actions which can then be handled with much the same methods as those developed for project-EIA. There is no simple relationship between policy and environmental effects. Policy instruments combine in different ways for particular geographical areas and for different societal segments. The landscape is shaped by a multitude of influences and decision-makers who pursue their own interests according to their own rationales.

Matching of Scenario with Scene

Interpreting the effects of a policy-generated scenario on a local landscape involves a process of matching the scenario with a specific scene. Once the factors which produce the scenario have been defined, the scenario must also be provided with a set of contextual factors. These relate to the general state of the economy, local labour markets and various policy effects. Out of a large number of important future influences, a manageable set must be identified and specified for each scenario. Two types of factors will thus act on the landscape: first, the direct scenario factors, and, second, the indirect contextual factors which interact with the landscape.

The impact analysis of the future outcomes of policies cannot, of course, be projected onto the present landscape. The scenario can only interact with a hypothetical future landscape, which will change in the course of time. Ecological processes such as erosion and succession will act on the landscape. This is why a 'no action' alternative should be among the scenarios produced. It serves as a reminder that landscapes are dynamic and would change irrespective of any particular policy under analysis. A landscape may be 'drifting' towards a future state that could be significantly different from the scene constructed for the

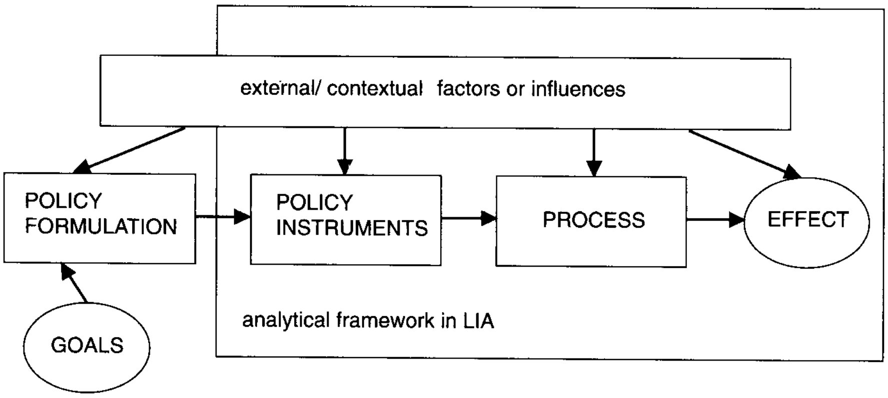

Figure 6. Simplified model of the policy process used in LIA and the delimitation of the analytical framework of the method.

analysis. The 'no action' alternative is also a reminder to consider the robustness of the assumptions that go into the analysis.

Unit-by-Unit Analysis

A major reason for the discrepancy between land use (e.g. agricultural, forestry) policies and the resulting landscape is the number of decision-makers who convert government policy into day-to-day actions in an actual landscape. The alternative options for adapting to a policy instrument which are open to an individual landowner tend to depend on a complex mix of economic and social factors, values and intentions. Thus, it is hardly realistic to superimpose a particular policy in a generalized way onto any given, existing landscape. A more sensitive approach is necessary, and this has entailed a 'tree analysis' for simulating changes in individual landscape elements which are associated with individual decision-makers. A 'unit-by-unit' analysis is used as part of the matching process whereby instruments from the systems level are analysed for their influence on decisions at the arena level.

In cultural landscape studies, one special case of such 'unit-by-unit analysis' is the simulation of decisions taken at the farm level, which are further broken down into an analysis of the impact on each individual field ('field-by-field analysis'). The reason for this is that the scale used for 'field-by-field' analysis most closely approximates to individual farmers' decision-making. This is also the only method of combining scenario or policy factors with historical and ecological landscape factors, and with those technical and socio-economic factors which influence decisions. The method is the 'idealist' approach advocated by Guelke (1982): intentional reasoning based on an understanding of factors that the individual uses as inputs to decisions, but constrained by an assumption of rational decision-making. The unit-by-unit analysis makes it possible to move from a discussion of macro-scale effects, via the analysis of mechanisms of change, to an intentional interpretation of the effects at the local, arena level.

An example of the application of LIA: agricultural policy impacts on Jæren in western Norway[4] Norwegian agricultural policy has been geared to self-sufficiency and the main instruments have been protectionism and heavy subsidies. There have been strong ties between agricultural policy and regional policy. Not letting the best agricultural regions outcompete the mountainous and subarctic parts of the country has been an overriding consideration. The subsidies have therefore been geared to enhancing the natural comparative advantages of different regions in the country. Broadly, one can say that animal production has been favoured in the west and north and grain production in the south-east. This policy has led to both overproduction and environmental problems. In the districts where animal production predominates, fertilizer runoff to inland and coastal waters has become a serious problem. The object of the LIA exercise was to explore the landscape effects of policy measures geared to solving this problem. The example shown here is from the west of Norway, in a district close to the city of Stavanger, dominated by animal production.

The first picture (Figure 7a) shows the landscape in 1966 when mixed farming was still widespread. Animal production was characterized by grazing on semi-natural grasslands and winter fodder was mainly produced as hay. Field boundaries were marked in a characteristic pattern of stone walls built mainly during the last century. In the 1988 picture (Figure 7b)—which is the starting-point for the series of futures—rationalization had resulted in a landscape dominated by grass production on ploughed and fertilized fields. Stone walls had been removed, wetlands drained and grassland cleared of stones for cultivation. Biodiversity and landscape diversity had diminished considerably from the 1966 situation.

Figure 7c is an extrapolation of the landscape trend from 1966 to 1988. This picture serves as one possible 'no action' alternative. All too often future landscapes are compared to present-day landscapes as if changes would not occur even if no changes were made in policy or land use. The trend alternative is simply a mechanical extrapolation of what the landscape would look like around the year 2000 if agriculture had continued as it had in the period 1966 to 1988. The main agent of landscape change is assumed to be continued subsidies for clearing and cultivation and a continued lack of specific pollution control measures.

Even the mechanical extrapolation of a landscape trend is not without problems. The strength of a trend may depend greatly on the choice of points in time used for the extrapolation. The years immediately preceding 1988 saw a decline in the extent of conversion of land to arable land, drainage and landfill. The reasons are related to a certain saturation in some areas, changes in values, and a withdrawal of State subsidies (Sødal, 1990). In another series of pictures we explored two different 'trend' alternatives using different points in time. The reason for insisting on at least one 'no action' alternative is not to deny the possibility of a static situation, an unchanged baseline in time, but to force a conscious decision on the issue and an examination of the mechanisms that would lead to change irrespective of changes in policy or other external influences. In the case illustrated here, the trend extrapolation cannot serve as the base for the scene on which future policy or other action can impact. Some of the contextual factors, notably subsidies, cannot be extrapolated into the future.[5]

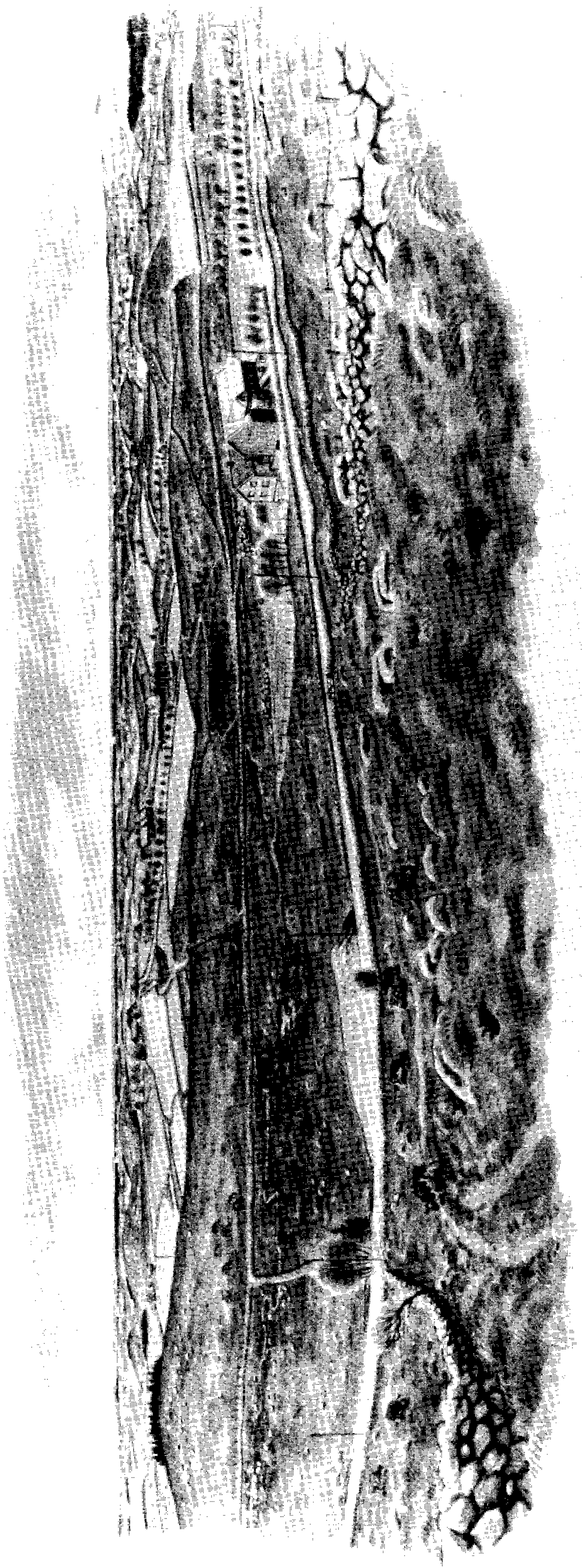

Figure 7a. A landscape on Jæren in western Norway as it appeared in 1966. Reconstructed from detailed maps, aerial photos and pictures.

Figure 7b. The point of departure for the futures: the landscape as it appeared in May 1988.

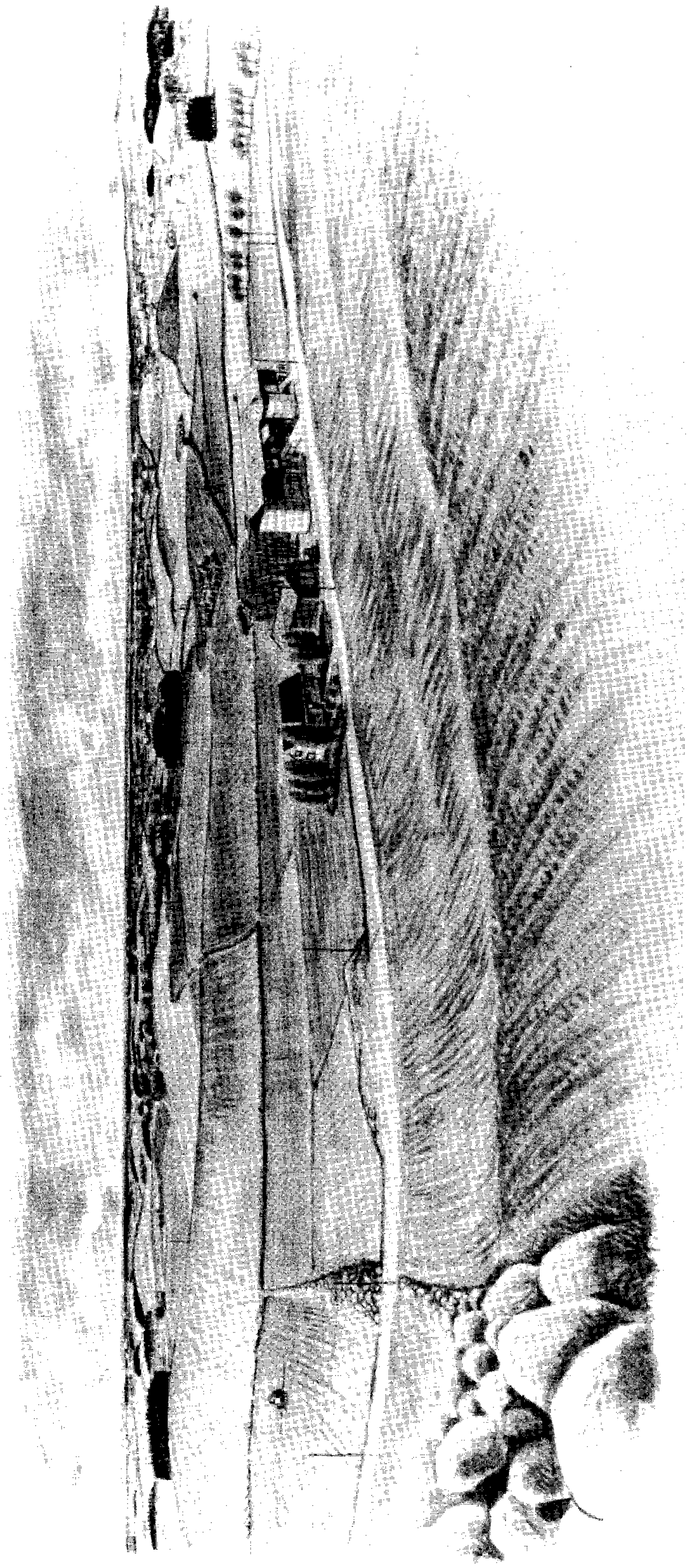

Figure 7c. A 'trend alternative for the year 2000': the mechanical extrapolation of the trends from 1966 to 1988 into the future.

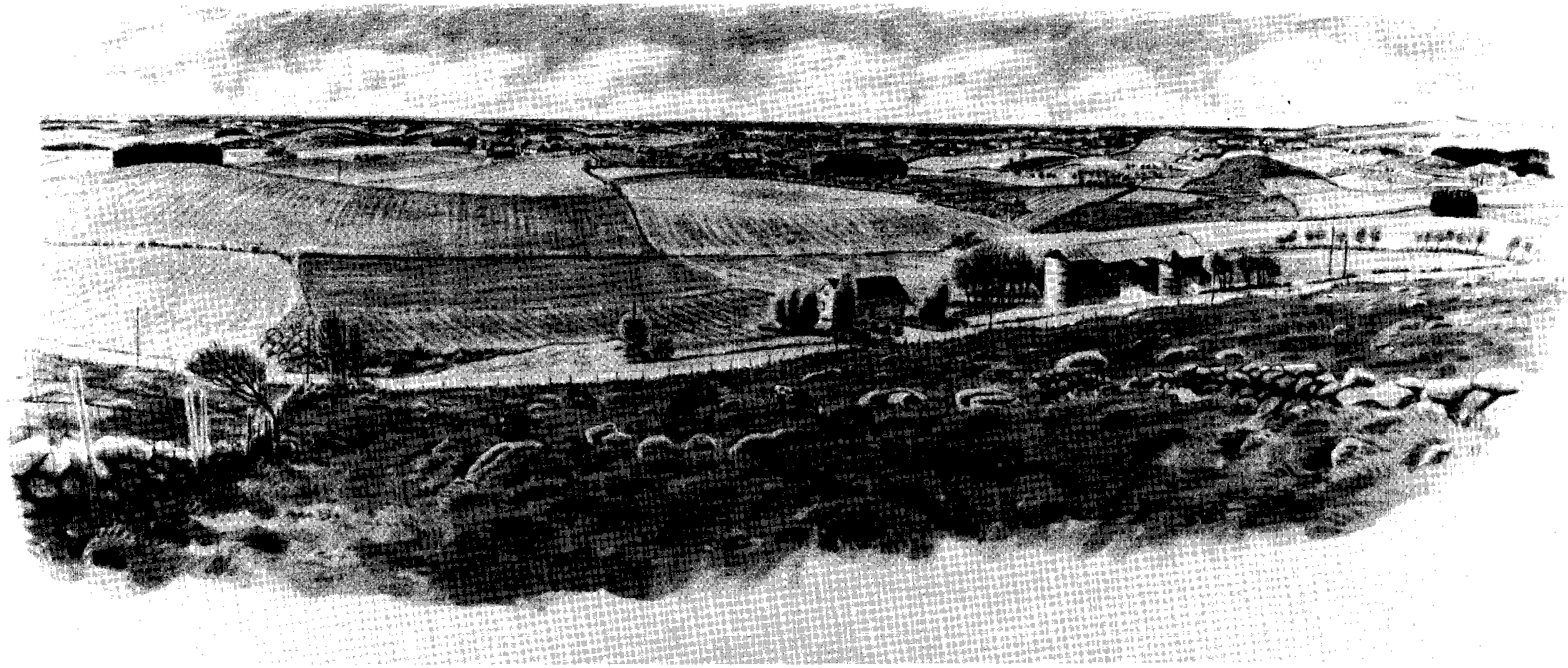

Figure 7d. The introduction of a requirement for an ecologically sufficient spread area for manure on each farm: the 0.4 hectare spread area requirement (see text).

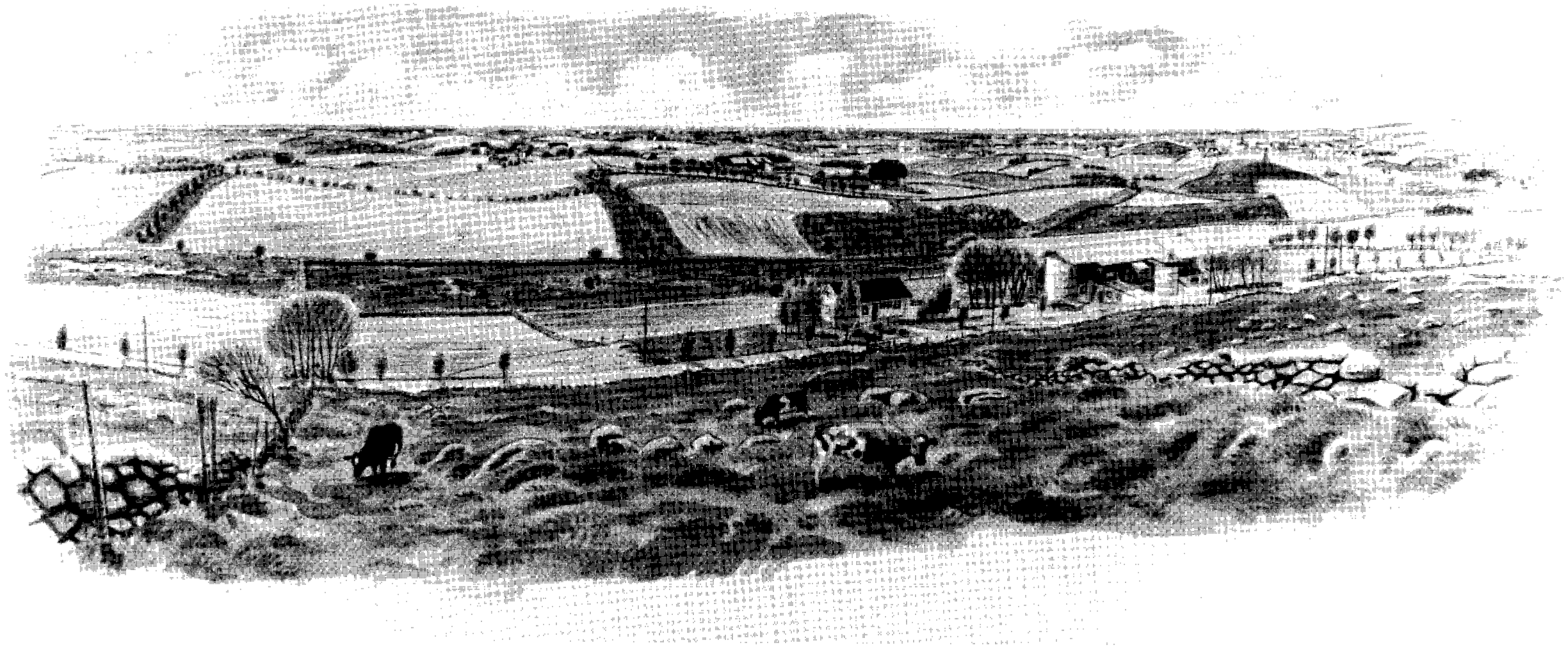

Figure 7e. One possible way of translating the environmental rhetoric of Norwegian agricultural policy into concrete action at the landscape level, with respect for the history and tradition of that landscape.

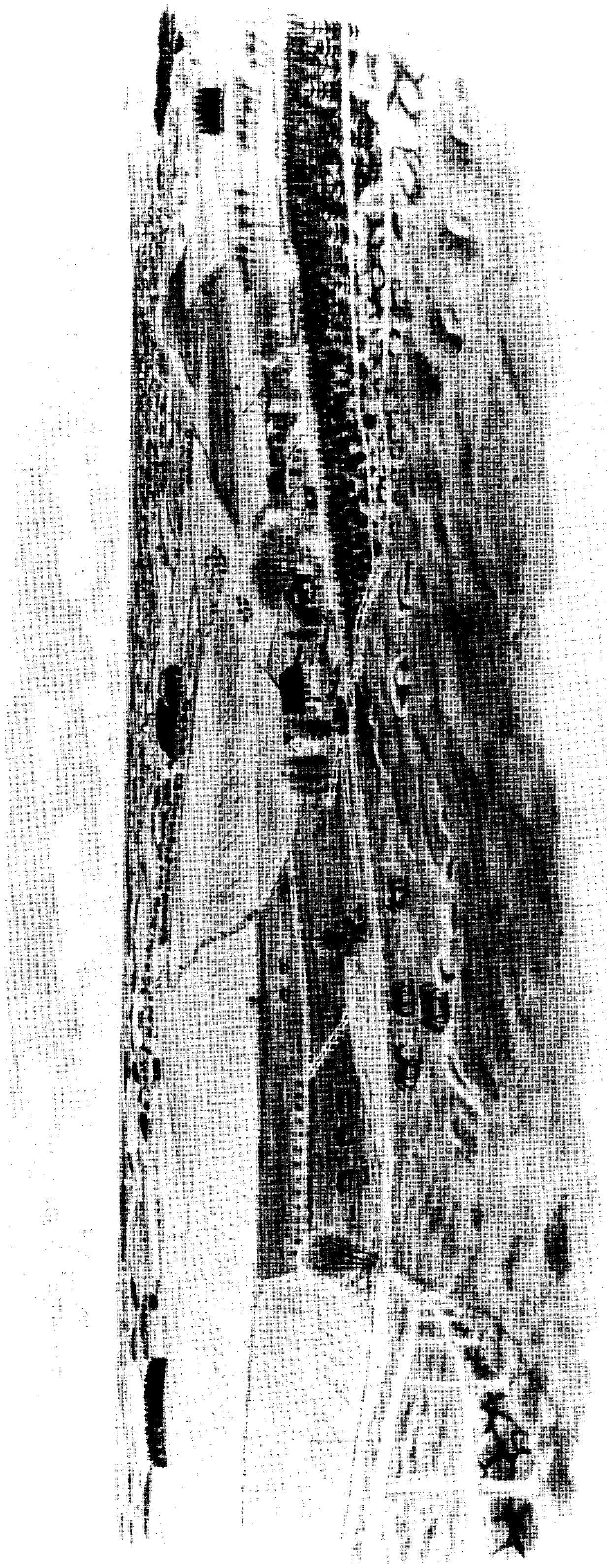

Figure 7f. A surprising future: market response to stimuli outside the conventional agricultural sector.

Figure 7d shows the effect of introducing a policy instrument aimed at securing a better balance between animal and vegetal production. A 'manure spread area' requirement was introduced in the late 1980s. For every animal on a farm the farmer had to have an area of 0.4 hectares of field on which manure could be spread. Initial resistance to this was at first great, as it was felt that it could increase dramatically the pressure to cultivate remaining grasslands. In fact, the picture painted by opponents was something like the 'trend alternative' of Figure 7c. However, the combination of the 0.4 hectare spread area requirement and discontinued subsidies for cultivation can be shown to produce a less rationalized landscape. Subsidies had, as noted above, already largely been discontinued.[6] The basis for Figure 7d is a farm-by-farm analysis of individual farmers' decision-making using socio-economic variables such as farm size, investments in different types of equipment and buildings, composition of livestock, etc. This analysis is then broken down to decisions concerning the future use of each individual field. The assumptions behind the picture are not solely economic rationality but also views derived from individual farmers and more general knowledge of patterns of adaptation by farmers, such as the wish to remain in farming and the reluctance of dairy farmers to give up milk production.

Figure 7e shows an example of implementing a combination of the general environmental policy goals now contained in Norwegian agricultural policy. Many of the resource and environment goals—with the exception of the spread area requirement—have never been implemented with specific policy instruments or changes in the subsidy structure. Here, we have shown what might arise if the two main goals were to be taken seriously. First, the total area under cultivation has been reduced to limit over-production, and the land set aside from production has been arranged so as to enhance landscape diversity and connectivity. Second, water pollution problems have been tackled by re-creating wetlands and open watercourses so as to slow down water flows and increase biological activity. Trees have been planted along roads and boundaries to increase diversity and reduce the effects of wind. Thus, sustainability and biodiversity have been given concrete expression in a manner compatible with traditional local landscape management.

The final picture (Figure 7f) is one which illustrates an important point in LIA. In studying the landscape effects of a particular sectoral policy we may become blind to the fact that other influences might come to dominate over the ones under scrutiny. Thus, it has been recommended here that we should always produce a 'surprising future'. In this case we have taken two lines of development common in other parts of Scandinavia, but which are alien to the mentality of Norwegian farmers. Around urban centres, particularly expanding and dynamic centres, there is a market for horse riding. Here a small 'riding centre' has been established on the farm in the foreground, as a response to less favourable conditions for agriculture and to capture a market segment. The second market response in the picture is cultivation of Christmas trees. Urban areas such as Oslo import a significant number of Christmas trees from Denmark: rather paradoxical if one remembers that the English name of the Christmas tree is Norway spruce! Thus the picture is 'surprising' only to those who think of the future in conventional terms and in terms of sectoral trends.

Conclusions

The series of pictures shown here illustrates a number of significant points about the LIA method. First, there should be an historical background to the present, in order to emphasize that change is the norm for most cultural landscapes. Second, the 'trend alternative' is important as a baseline for other futures. Utopian or undesirable or possible futures should be compared to what would have transpired in the absence of policy measures, not to some nostalgic interpretation of the past. Third, alternative futures should be shown to emphasize that there is no single, ineluctable future. Fourth, the method can be used both for examining the consequences of proposed policy-impact analysis—and for constructing scenarios used for back-casting. Fifth, it is important to remind both the team doing the analysis and the user of the analysis that there may be surprising futures in store for us.

In the example of the application of LIA shown here the policy instruments analysed were those under discussion in the official policy process. Local officials and landowners were used as informants in the production of the scenarios. The LIA-method is here seen as a development of the policy making process, part of the responsibility of concerned authorities to make the impacts of proposed policies explicit. However, the policy instruments tested could just as well come from a wide variety of sources. In particular the normative scenarios could be generated by non-governmental organizations or other interest groups. Local farmers' associations, environmental groups or agricultural economists could equally well produce other scenarios from the same loosely-formulated goals.

It could be argued that future studies are a futile pursuit, when we consider how unpredictable the future is. Despite this, there exists a wide variety of activities which have the explicit objective of influencing or forming this uncertain future. LIA provides a way of making the abstract objectives and general measures of alternative policies visible in a concrete landscape. It seems to me that a landscape futures discourse goes a long way towards what O'Riordan (1992) termed 'a vernacular or user-friendly, interdisciplinary science' as part of the prerequisites for 'ecological modernization'. It does so in accordance with the planning philosophy that can be derived from Habermas (1981, 1989) and is advocated by Etzioni (1968).

The claim that LIA would contribute to a more open and democratic decision-making process thus rests on its emphasis on production of alternatives and on the transparency and accountability inherent in its analysis. It would seem that making the local and concrete impacts of aggregate and abstract policy understandable and available to public scrutiny is an urgent task of 'ecological modernization'.

Notes

1. The Swedish term coined by Hägerstrand—*förloppslandskap*—does not translate into a single English term. A suitable paraphrase is *the landscape of process and continuity*.
2. For example, a perfectly natural wilderness preserved as a national park or reserve will undergo changes caused by fire, windfall, flood, grazing, trampling by visitors, etc. Whether any of these need any form of management will be a matter of the goals formulated for management of the park and of contextual factors and conflicting interests outside the park.
3. The term 'preconstructed' may seem an unnecessary terminological innovation. It is used here for the type of construction of chains of events based on an analogy of 'reconstruction' used in the

historical reconstructions in visual impact assessment. There is an averred component of historicism implicit in the method.

4. The sequence of pictures shown here as an example of the use of landscape impact assessment are from a project dealing with agricultural policy and the environment. It should be noted that the original illustrations are watercolours, which give a greater sense of realism. These are published in Emmelin *et al.*, 1990, and will soon be available in an English language publication from the Department of Geography, University of Trondheim.
5. There is a particular didactic value to this picture. Critics of the 'spread area requirement' claimed that this would lead to intensification. Ironically, careful examination of this policy instrument (see Figure 7d) shows this not to be the case, whereas continuing with a high level of subsidies would have produced a landscape of intense cultivation.
6. At the particular locality shown here, however, the local municipality had continued to give subsidies, an interesting example of an attempt by a farming community to run counter to national policy (see Emmelin *et al.*, 1990).

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