Including landscape in long-term spatial planning

A pilot study of Västra Götaland
Including landscape in long-term spatial planning – Foreword

A publication from the Research and Innovation project "Landskap i långsiktig planering" (Including landscape in long-term spatial planning).

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Foreword

Sweden’s transport policy targets and Sweden’s signing of the European Landscape Convention are important starting points for the work of the Swedish Transport Administration. This means that our activities must contribute to the furthering of Sweden’s environmental quality targets and to the maintenance of attractive landscapes and the facilitation of their development.

Realizing this target requires a comprehensive understanding of the landscape, that is to say, a collective view of its natural, cultural, formal and functional features. Landscapes are not static. Knowledge of ongoing transformation processes in a landscape, its sensitivity to change and potential for development, is crucial. Equally important is an understanding of the impact of infrastructures on, and their interaction with, the landscape wherein they lie. And, of course, the ability to translate that understanding into action when planning, maintaining and developing new infrastructures.

A dilemma faced by today’s sectored planning with its segregated expert analyses, legislation and organization is that it rarely allows for such a holistic approach. The purpose of the Research and Innovation project “Including landscape in long-term spatial planning” (Landskap i långsiktig planering) is to find, develop and test methods for a holistic awareness that can be employed in the work of the Swedish Transport Administration. The project belongs within the R&I portfolio “More benefit for money” (Mer nytta för pengarna).

This publication has been produced by the project “Including landscape in long-term spatial planning” and is in two parts. The first is a description of the methodology worked out by the project and the second is an account of a pilot study carried out in the county of Västra Götaland, which served as a testing arena for method development. The investigative work was conducted by an expert team of consultants led by Bengt Schibbye in intimate and constructive dialogue with the County Administrative Board of Västra Götaland, the Swedish National Heritage Board and the planners and environmental specialists at the Swedish Transport Administration.

Future work in the project “Including landscape in long-term spatial planning” aims to verify and refine this method and test its viability in different planning situations. We look forward to continued stimulating and fruitful collaboration across administrative, organizational and sectoral boundaries. A vital part of our work for long-term sustainable development and an attractive landscape.

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Appendix 1: Checklist

Instructions to the reader

This report consists of two parts. Chapters 1–3 describe the background to this project and the methods developed to carry it out. Chapters 4–8 present the application of these methods to a pilot study in the county of Västra Götaland. A checklist is given in an Appendix at the end of the report. This has been developed as an aid to characterization assessments, for use during group landscape observation (befaring) and other analytical work.

Background documents

The report is supplemented by two background documents, each with their own publication number.

Workshop i ekosystemtjänstanalys, underlagsrapport till “Landskap i långsiktig planering” 2011:122 (Publication no. 2012:139)
This publication is the report of a workshop on ecosystem assessment – an additional useful method when it comes to working on sustainability issues in an overall perspective. The workshop was held within the framework of this project, but the method has not been applied to the project.

Metodevurdering, underlagsrapport till “Landskap i långsiktig planering” 2011:122 (Publication no. 2012:140)
This publication is a scholarly survey of the methodology developed within the project “Including landscape in long-term spatial planning”. The survey is written by Morten Clemetsen, Aurland Naturverkstad AS, and is based on a preliminary version of the report presented here. Note that some parts have been revised since this survey was written.
1. Introduction

Environmental assessment of the Swedish Transport Administration’s national plan for 2010–2021 was found to be extremely difficult, especially when assessing its effect on the landscape as a whole, considering nature, culture and outdoor activities on an aggregated level. It became clear when reviewing the environmental impact assessments of the infrastructure plans on a county-by-county basis, that background descriptions of landscape values and features were missing or were restricted to designated areas; with the result being that it was very difficult to make an overall assessment. Nor could the positive benefits be identified. It should be possible to remedy this perceived deficiency by a different kind of knowledge- and assessment base; one that used a holistic understanding of the landscape where one could suggest measures at the planning stage. This led to the development of the R&I project “Including landscape in long-term spatial planning”.

Using an existing national infrastructure plan – the regional plan for Västra Göta-land – and the county as a study area, we have searched for an approach that would allow a holistic assessment of the entire landscape. This work was undertaken by a team of consultants in close cooperation with Swedish Transport Administration. Continuous dialogue and working meetings have been held with Region Västra Götaland, the County Administrative Board of Västra Götaland and the Swedish National Heritage Board.

This publication is an interim report of this R&I project, and consists of two parts. The section on method (Chapter 3) presents a way of working that aims to facilitate planning on the basis of a holistic view of the landscape. The technique is suitable for long-term planning and is applicable to environmental assessments of long-term plans. During 2012 and 2013 the method will be further evaluated and developed. The second part (Chapters 4–8) comprises the report of a pilot study, a first test, carried out in Västra Götaland. In practice, both pilot study and method development have progressed hand in hand.

The target audience for this report is all who work with such planning: The Swedish Transport Administration’s planners and specialists, regional and county administrative board administrators concerned with infrastructure issues and those dealing with long-term planning at central level. It can also be seen as a source of inspiration for all who work with landscape analyses in various contexts; we hope it can stimulate further development of methods for a holistic approach to landscape planning.

The increased knowledge of a landscape and overview offered by that a regional assessment such as this offers can obviously serve as a comprehensive knowledge base to be further developed in other planning contexts within the Swedish Transport Administration. Examples might include its use in the planning and designing of measures for different projects and as a basis for improved efficiency in operation and maintenance of road and railway-line peripheries.
The management, maintenance and construction of transport infrastructure affects the landscape. But how do we establish to what degree these measures influence the greater picture? It has proved difficult to find an answer to these queries in the environmental assessment of the national and regional infrastructure plans. This was the main objective to launch the Research and Innovation project "Including landscape in long-term spatial planning"
2. **Aim and approach**

2.1 **Project description, background and aim**

The project “Including landscape in long-term spatial planning” is an R&I project that aims to develop methods for strategic environmental assessment and create a knowledge base for decisions in cross-sector planning. In this way, a clearer understanding of the landscape can be obtained which can serve as a starting point in long-term infrastructure planning. The project has been carried out as a pilot study in the county of Västra Götaland. The methodology and type of basic data must be applicable to other geographic regions and counties. The pilot study has been included as one of the bases for the government’s mandate to further develop methods for environmental assessment of long-term traffic planning.

The Swedish Transport Administration must also work for the implementation of the Landscape Convention and is now involved in considerations of how the Convention might be implemented in practice. This study can be seen as one of the starting points for that work.

2.2 **Why integrated landscape character assessment?**

All measures taken, and all changes made, affect and are affected by the surrounding landscape. The possibility of creating satisfactory solutions increases if we can gain knowledge of an affected area at an early stage. Key issues become identifiable sooner, which is vital for continued planning.

The method proposed here – integrated landscape character analysis (ILCA) – aims to provide an overall picture of the main features of the landscape, its character, idiosyncrasies and assets. It allows for the analysis of functional, visual and meaningful elements along with ecological and historical descriptions of the area. A prerequisite for integrated landscape character assessment should be that it is composed of contributions from many different types of expertise. Planners, project managers, natural and cultural heritage specialists, landscape architects, geotechnical engineers and many more, come together to create a shared picture of the conditions, opportunities and complications that the landscape offers.

It is at the earliest stages in the planning process that the greatest chances occur for influencing choices, location and the form of the different measures – but this is when knowledge of the landscape is at its weakest. Integrated landscape character assessment is an effective way of increasing knowledge and awareness at an early stage.
2.3 From limited designated areas to a holistic perspective

Environmental assessments were conducted in accordance with the Environmental Code and the EC directive on plans and programs, when establishing the national and regional action plans for transport infrastructure in 2010–2021. Environmental assessments must describe the impact of a proposed plan and influence the outcome so that sustainable development can be promoted and environmental quality targets reached. It proved however to be extremely difficult to demonstrate what the national plan’s 417 billion SEK for investments and maintenance actually means on a cumulative level, on the basis of current methods and sector-by-sector planning bases. It simply was not possible to obtain an overall picture of how transport systems interact with and affects the Swedish landscape, nature and cultural heritage in the long term; nor how constructive action, proactive planning, could have positive effects on environmental target attainment and sustainable development of the landscape.

With existing methods, our knowledge of the landscape has most often been limited to designated areas of natural and cultural heritage management, etc., as illustrated in the figure below. In such situations, it is impossible to comment on the impact and consequences for the landscape, other than on a “hit and miss” basis. Absolutely nothing is said about how the landscape's functional capabilities, character and future development possibilities are affected.

Traditional relationship between transport-system plans on a national and regional level and their influence on the landscape.
Today we know that the sustainable development of designated areas does not happen in isolation but is dependent on what happens in the surrounding landscape. In addition, the everyday landscapes that are not designated areas also require status of their own.

A new kind of knowledge base of analytical material is required which relies on an overall understanding of the landscape. We can obtain this by implementing integrated landscape character assessment – which is a form of landscape assessment. The results offer an overall understanding of content, context and ongoing processes in the landscape, so that descriptions integrate information from the three different aspects of natural and cultural heritage and the form of the landscape. This provides a common understanding of the landscape as an arena – the place and the context where everything happens or will happen.

The ILCA (Integrated landscape character assessment) method is described in Chapter 3. There you will also find a description of how measures for the national and regional action plans can be sorted, in order to better facilitate environmental assessment.

What is required is a shift in thought patterns, from a focus on limited designated areas to holistic reasoning. The figure on the next page attempts to illustrate this changed view.
Landscape issues have long been treated as a matter of the protection and conservation of particularly valuable areas. Change has been regarded as an infringement. This view is not adequate when working to achieve sustainable development. By focusing on the whole landscape, it becomes possible to collaborate with other actors to find solutions that can significantly improve the situation, instead of the earlier focus of planners on avoiding tangible damage in specific areas. In the case of e.g. cultural heritage management, this means that “the history of the landscape” becomes an important contribution for understanding the processes of change, and thus plays a role in creating future habitats. The European Landscape Convention has contributed to this change in our thinking.
3. Method

In this chapter we present the method that has been developed. The method is called Integrated landscape character assessment (ILCA), and it is based on creating a description of the landscape’s character that is then used for evaluating the landscape’s sensitivity, potential and development trends. It is essential that this can be related to the measures being proposed in national and regional planning. To achieve this, the potential effect of these measures on the landscape must be assessed.

The results can be applied both to environmental assessments – reactively, in the case of proposed measures – and to proactive planning when suggesting or steering measures.

The methodology presented here is based on an interdisciplinary approach. This means that the various actors in this process – the different landscape specialists, traffic specialists of various kinds, and those involved from other state agencies, etc. – must share their knowledge and discuss and develop a shared understanding of the landscape to be analysed. In practice this means that a representative mix of actors with different expertise should take part in a series of field trips and workshops, as the work progresses. This results in a cross-sector assessment of the character of the landscape, its development trends, sensitivity and potential – a shared description that all parties can support.

The methodology used is based on – but does not copy – the English method of Landscape Character Assessment (LCA). The strength of this method is that it views the landscape as a whole: how it is perceived today and how it has evolved, i.e. why it appears and functions as it does.

The method is applicable at various scales. The study presented here has been carried out on a regional scale. Classification, description and evaluation can be refined within the same methodological framework on a more detailed scale.

The method is transparent and repeatable in that it separates the different aspects of the landscape: character, development trends, sensitivity and potential. Through a system of checklists, anyone with a specific interest can trace the underlying basis for the various definitions, descriptions and evaluations.

3.1 Usefulness

Integrated landscape character assessment (ILCA) (sometimes here abbreviated to “character assessment”) is primarily intended as a tool to be used during the earliest planning stages in long-term planning, by the Swedish Transport Administration and regional actors involved in infrastructure planning. The figure on the next page shows the phases in the Swedish Transport Administration's long-term planning, and subsequent project planning, where character analysis can be useful. This is not a chronologically fixed planning process, rather, the figure describes important stages when long-term plans are formed.
Planning guides that:
› place sustainable development in focus (from significant harm to significant improvement)
› give a geographical dimension to “environmental aspects”
› cover different ground than other planning guides (hanging gutter as opposed to downpipe)
› are in accordance with the European Landscape Convention (ELC)

Landscape Strategies
› landscape considered early in the process
› landscape as a functional goal
› landscape as a preliminary consideration before measures are chosen
› adds “potential” to a description of problems and requirements
› better assessment of effects (environment and landscape)
› guide to evaluation of “environmental aspects” (in preparation for ecosystem service analysis, for example)

› early guide for sustainability analysis (from multiple collective effect assessments)
› provide alternatives for comparison
› higher quality in impact assessments (sustainability appraisal – Environmental Impact Assessment, EIA)

› Strategic quality measures

› Improved internal project orders
› Starting point for design programming, etc.
› Base of knowledge for project EIAs (big picture and context)
› Strategic quality measures

› Better quality in ordering management and maintenance services

Usefulness of regional Integrated Landscape Character Assessment for the work of the Swedish Transport Administration. It is one of the many bases of information available (highest in the “funnel”), and can be applied in many ways to the different planning stages, including environmental assessment, which permeates the whole spatial planning process.
The figure on this page opens with an example of the multitude of tasks – surveys, reports, research, needs evaluations, gap analyses, programs, strategies, etc., covering scenarios and needs for the future. Here, character assessment can create a platform from which to form landscape strategies together with other actors. Such strategies are needed to coordinate the various efforts to achieve the established target – the desired development of the landscape.

**Application in long-term planning**

Initially, the different needs and claims, etc., on the infrastructure are weighed up (B in the figure). Integrated landscape character assessment becomes a basis for the identification and prioritization of the needs for landscape quality values – concerning nature, culture, scenery – that the plans must meet and deal with. Character assessment can be used as a prerequisite for specifying targets and describing landscape features as a complement to other functions described by techniques such as systems analysis, rolling action planning, concept studies, structure studies and other analyses that are used as a basis for deciding the measures to be included in national and regional planning.

For those measures that end up at national and regional level (C in the figure), character assessment can for example be used as a basis for the non-monetary part of collective effect assessment. Collective effect assessment provides a basis for evaluating the measures that meet the transport policy objectives, and which therefore “belong” in a plan. This analysis can also be used to evaluate the attainment of goals and to identify significant environmental impact.

Infrastructure plans must be accompanied by an assessment of their environmental impact. Here, character assessment is used to evaluate the basic evidence. It must of course be supplemented by other data for the assessment to be comprehensive. Thus the developmental trends described for character areas can be helpful when describing the current situation in planning for environmental impact assessments, and for satisfying the zero alternative under the Environmental Code.

In operational planning (D in the figure) integrated landscape character assessment can be used when budgeting for different “pots”, etc., depending on the potentials / risks identified in the assessment. Operational planning is a budget for the plans for 1 to 3 years.

**Application to the planning and maintenance stages**

Integrated landscape character assessment plays a significant role as an organizational tool when ordering the implementation of the various measures in a plan. At the Swedish Transport Administration this has enabled the swift transference of orders through the various internal administrative divisions of the organization.

It is important to emphasize that the regional character assessment does not replace the need for more detailed information which is required in the various planning stages at project level. Rather, it complements the evidence by explaining the detailed information with a holistic understanding of the parent context. Character assessment can be used as a knowledge base for all work dealing with location, design and environmental description as undertaken for the planning of projects, where a deeper knowledge will be added later on.

The maintenance performed on our roads and railways can in many ways help to achieve the targets that are desirable in different landscapes, and assist in implementing development strategies. In such cases, integrated landscape character assessment functions as one of the bases for ordering maintenance work, by offering a nuanced picture of the management of different landscapes and strengthening biodiversity and cultural characteristics.
3.2 Definitions

The concept “landscape”
During the 1960s and 70s the perceived notion of the term “landscape” (in planning contexts) was linked to particularly valuable natural, cultural and visual landscapes. It became a sector interest in environmental management and environmental policy. One task in planning at that time was thus to delineate areas with particularly valuable natural and cultural landscapes – often those which were also visually appealing.

Over time, the term broadened in scope, and embraced agricultural and forestry production areas. The understanding gradually took hold that active farming could help preserve the traditional cultural landscape and develop new attractive landscapes. This was also reinforced during the 1980s and 90s by new rules on subsidies to agriculture which also gave a value to environmental measures and the “production” of public values such as experiences of nature, recreation and accessibility.

The European Landscape Convention
When the Council of Europe approved the European Landscape Convention (ELC) in 2000, the concept of landscape became elevated to include the entire environment, including living landscapes. At the same time, emphasis was placed on the multidimensional aspects of the landscape such as the stories it could tell, its identity, etc.

The opening paragraph of the Convention defines a landscape as “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors”. The entire first article is shown in the box below.

The Landscape Convention was ratified by Sweden in the spring of 2011. The Swedish National Heritage Board has received a special directive from the government to ensure that Swedish authorities work together to implement the Convention.

Article 1 – Definitions
For the purposes of the Convention:

a “Landscape” means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors;

b “Landscape policy” means an expression by the competent public authorities of general principles, strategies and guidelines that permit the taking of specific measures aimed at the protection, management and planning of landscapes;

c “Landscape quality objective” means, for a specific landscape, the formulation by the competent public authorities of the aspirations of the public with regard to the landscape features of their surroundings;

d “Landscape protection” means actions to conserve and maintain the significant or characteristic features of a landscape, justified by its heritage value derived from its natural configuration and/or from human activity;

e “Landscape management” means action, from a perspective of sustainable development, to ensure the regular upkeep of a landscape, so as to guide and harmonise changes which are brought about by social, economic and environmental processes;

f “Landscape planning” means strong forward-looking action to enhance, restore or create landscapes.

The Landscape Convention, first article.
The Swedish Transport Administration sees this as an important challenge and applies the Convention's new approach to the landscape. It is obvious that this approach demands a new knowledge base. This pilot project can contribute to the Convention's implementation in long-term spatial planning through increased understanding and acceptance of planning from a holistic landscape perspective, instead of planning only from a purely sectoral perspective. The latter is currently the most common approach today.

**The Convention on Biological Diversity**

Integrated landscape character assessment is also aligned with the Convention on Biological Diversity (CBD), which has three main objectives. Two of these are treated here:

- The preservation of biodiversity. This includes the whole concept of biodiversity, i.e. variability at the genetic, species and ecosystem level, as well as the structure and function of ecosystems. The latter is a broadening of the concept of biodiversity as more consistent with the Convention on Biological Diversity (Jong 2004).

- Sustainable utilization of biodiversity. This alludes to the human need for a an enduring functioning ecosystem that can produce the ecosystem services that we need. In practice this means that we must take into account all of the ecosystem services produced by biodiversity.

**Landscape character and Integrated landscape character assessment**

Central to this method is the concept of landscape character. It has been defined as:

> “Landscape character is a concentrated expression of the interaction between an area’s natural conditions, land use, historical and cultural content, as well as spatial and other perceivable conditions that characterize an area and set it apart from the surrounding landscape.” (Landskapsanalyse – framgangsmåte for vurdering av landskapskarakter og landskapsverdi, 2010; freely translated)

Integrated landscape character assessment (ILCA) is the composite assessment of the landscape character of an area, based on group landscape observation (befaring), thematic studies, etc.; see further in Section 3.5

**Character areas**

To be able to use the landscape character's qualitative content in planning and management, it must be linked to geographically limited areas – character areas. Each character area is unique, it only exists in one place and it differs from adjacent areas. Identification and delimitation of character areas require an understanding of landscape processes, and are based on judgements that are partially subjective. The landscape is of course characterized by its context and successive transitions from one character to another – it is not always possible to perceive clear boundaries. Therefore, delimitation is based on the context in hand. What is the purpose of this analysis? What scale are we working in? There are no set answers, even if the work is methodical.

> “The boundary between two character areas is placed where it is least clear which character dominates” (Stahlschmidt 2003; freely translated)

> “The delimitation of character areas is therefore a matter both of identifying salient characteristics and of distinguishing transition zones from surrounding areas.” (Clemetsen 2011; freely translated)
Character types
Different character areas have nearly always certain features in common. This can lead to the character areas being categorized according to character types, for example, plains or rift valleys. Character types can occur in several places, for example, both of the character areas “Dalbo Plain” and “Skara Vara Plain” belong to the character type of “plains landscapes”. In this methodology, the division into regional character types is important to the descriptions. It makes it possible to compare different character areas that contain similar structures, for example, various rift valleys.

Scale
Character types and character areas can be used at different scales. The example in the figure below, is taken from Västra Götaland. At the regional level, there are several character areas of “the plains” type, including the Skara Vara and Dalbo Plains. On the next level we can see, for example, that the Skara Plain is in turn composed of parts of one or more character types on a local scale. In this way, the regional analyses can be deepened at a future stage, without losing any information.

3.3 Actors
Holistic thinking is the mainstay of the European Landscape Convention. Interpretation of the landscape is fundamentally an interdisciplinary task. The combination of competence and fruitful working methods is a vital. Sharing experiences of the landscape on field trips is central, as also is the repeated interchange of different views of the landscape and its development, after thematic and more in-depth studies.

Relationship between landscape type and character area. A landscape type, e.g. plains landscape, can occur in many places but a character area occurs only in one – it is unique. Character areas and landscape types occur on all different levels, which is an important point in the process – it can be added to at later stages after more detailed studies. The English example on the right shows how this can be applied in a planning situation. From the handbook for Landscape Character Assessment (The Countryside Agency, 2002).
Generally speaking, there are four types of actors involved in this process: the organizer (the Swedish Transport Administration region which needs the basic information), the executors (the team operating the analysis), the external knowledge sources (others; often specialists on the county administration boards, etc.) and the “users”, the people who live in and utilize the landscape. All are important to the results; see Participation, below.

### 3.4 Implementation

The work involved in characterizing the landscape is not a linear process. Field visits – group landscape observation (befaring) – are combined with research studies, meetings (workshops) with the participation and exchange of ideas from different directions and at various intervals. In this way, knowledge builds up and assessments get constantly reconciled. The workshops and group landscape observation (befaring) often need to be carried out several times before classifications, descriptions and assessments are agreed upon and finalized. The figure at the bottom of the page – the “spiral” – describes how work is carried out in practice.

**Delimitation**

The methodology is developed for the long-term planning of infrastructures at a regional level. This means that the assessments are basically geared for use in infrastructure planning. In addition, the assessments need to be delimited geographically (which region is being studied?), and thematically (what aspects of the landscape are important?). In the pilot study, Västra Götaland comprises the geographical extent and the themes studied are nature, culture and form. But infrastructure planning measures are affected by many factors outside of a region’s boundaries. Ecological, cultural-historical and perceptional contexts rarely pay any regard to regional or provincial boundaries, and studies may need both national and sometimes international perspectives in order to explain a landscape’s structure and function.
Scanning and desktop studies
At the preparatory stage, relevant maps and literature are gathered. Suitable sources include the National Atlas of Sweden, orthophotos, ordnance survey maps at different scales and basic information from the county administrative boards in the form of GIS data, etc. It is helpful to make a rough classification of character types based on this general evidence before going out on a group landscape observation (befaring).

Group landscape observation (befaring)
Once the relevant basic documentation is gathered, an “a group landscape observation (befaring)” is conducted. This is a multidisciplinary field trip through the relevant landscape. The term has been borrowed from Norway. Since our work is on a regional level, large areas need to be covered in a short time. The idea is to offer everyone a common base to stand on while sharing experiences and knowledge of the landscape. These field trips concern how things look and how the landscape works. It is very important to share one’s perception of the landscape during these field trips; to enrich and be enriched by impressions. A checklist exists as a tool for use in the field, see Appendix 1. A preliminary classification of character types should also be done before a group landscape observation (befaring). Questions that may be important for future studies need to be discussed in the field. What do we not know and therefore cannot explain? Why do things look and work the way they do? What processes are in action? How is the landscape changed by natural processes? Is the land utilization stable or does it seem to be in a state of fluctuation?

Subdivision into character areas
There is no given correct way to delineate different character areas – where one character shifts into another. Sometimes the border is clear, sometimes it is floating. In such cases, the border gets placed where it seems least clear which character dominates. As a result, transition zones need sometimes to be identified.

Participation
Participation is a positively loaded term, which is about the democratization of social planning. It is a matter of facilitating public participation as well as of broadening the scope of expertise drawn on in the thematic studies; contributing with their knowledge and taking part in the planning and development processes. There are many who have different sorts of knowledge that can be important when characterizing the landscape as a whole. The Swedish Transport Administration and regional planning bodies have much internal expertise but also draws from the county administrative boards, municipal associations, municipalities, etc. There is no general answer to the question of “appropriate” participation. This must be evaluated from project to project.
Integrated landscape character assessment is carried out on a regional level. As regards the participation of the public, the users, this is easiest for issues that directly affect their immediate environment. The regional scale has extensive subdivision into areas where the public is involved in a somewhat different way, see figure on right. But people still have opinions on identity, the value of the landscape, etc., for different geographical areas. Public participation was not a feature of the pilot study of Västra Götaland county.

**Thematic studies and working meetings**
The results are discussed at repeated working meetings attended primarily by the executors. For anchorage and consensus, working meetings and workshops that include a wider group of participants are also important. The participants bring their thematic “sectoral knowledge” to these workshops – explanations of why the landscape looks and works as it does from a variety of environmental perspectives. This often leads to adjustments of character areas and character types. The collective and the thematic studies that are carried out afterwards, both aim to answer the question why the landscape looks / works as it does. Character descriptions as well as assessments of the landscape’s development trends, sensitivity and potential are discussed by the work groups, the project executors. The checklist is used as a platform for this and filled out as required. Page two of the checklist deals with the effects that are important in determining sensitivity.

**Description and evaluation**
Integrated landscape character assessment provides a common description, based on observations and thematic studies. At this stage, an evaluation is also made of the development trends in the character area, of sensitivity to changes in the existing character and of the potential for actions that strengthen the important features of the landscape.

### 3.5 Integrated landscape character assessment (ILCA)

The methodology for integrated landscape character assessment described here is based on, but does not copy, the English method of Landscape Character Assessment (LCA). The strength of this method is that it views the landscape as a whole: how it is perceived today and how it has evolved, i.e. why it appears and functions as it does. Some basic concepts have been defined earlier in this chapter. In this section the method and its concepts are explained in more detail.

Integrated landscape character assessment comprises:

- character description
- thematic studies
- evaluation of development trends, sensitivity and potential.

The different sections of Integrated Landscape Character Assessment.
Choice of scale
Deciding the scale or “viewing altitude” from which to evaluate the landscape is fundamental to this method. It fixes the level of focus of the assessment and the level of detail. The pilot study of Västra Götaland was intended to be useful at the regional level. That scale was considered suitable for an assessment of infrastructure measures in the planning context, for both national and regional plans. The question is whether an analysis at this level says enough about the landscape to be of use to long-term planning. The response from the planners and specialists who participated in seminars and workshops has been positive; both scale and focus were felt to be appropriate.

Choice of scale is important. Should the scale or viewing altitude be too great, the regional characteristics do not show up, should it be too detailed the regional characteristics get overwritten by those that are more local. In Västra Götaland 1:250,000 was chosen as the main scale, which led to a division into 12 character types and 26 regional character areas. However, different scales, from 1:50,000 to 1:500,000, were tested during the process. A suitable scale for an analysis is 1:100,000, since the Ordnance Survey maps in this scale are of an appropriate format for in-depth analyses at a regional scale.

Character description
Landscape character is created by the conditions that determine the (general) perception of an area and what sets it apart from surrounding landscapes. Its description is based on information and evaluations that are not purely objective or quantifiable. For transparency and to facilitate re-examination of the evaluation process, it is important to describe a landscape’s character in a methodical way.
Character description is based on a compilation of information that can be understood and documented, and is expressed as the collective character of a particular area. A character description should be written in everyday language. While in fact independent of the aim of the work, this part is affected by it – it focuses on the use to which it will be put: – the infrastructure measures here determine choice of focus.

A character description describes the character of the landscape – how it looks and why it functions the way it does. For aspects of content, context, and ongoing processes, see the checklist in Appendix 1. The description is based on a compilation of information from literature and desktop studies, experiences from group landscape observation (befaring) as documented in the checklists, notes and photographs, but is also based on the thematic studies. For topographical conditions, spatial structure, etc., a special map, called a “Teddy Map”, is produced (see map extract on the previous page).

The description of the landscape is constructed continuously during the work process but crystallizes during group landscape observation (befaring). A journey through different types of landscapes leaves many impressions. This creates the need to be able to take structured notes, best achieved using the checklist while on group landscape observation (befaring). The list for each character area takes up landscape content, fundamentals such as landforms, types of nature and settlement character, but also contextual knowledge-based aspects such as time depth and ecological relationships and patterns. An important function of the checklist is therefore to document the participants’ varied conversations about the landscape. The checklist can be filled in after a group landscape observation (befaring), and acts as a fact sheet for the relevant character area. The checklist is attached to the report as Appendix 1. Detailed headings are shown in the figure below.

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Main points of the check list. It helps to make a description clearer, more transparent and comparable across different areas. The checklist is reproduced in Appendix 1.

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<table>
<thead>
<tr>
<th>CONTENT</th>
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<tbody>
<tr>
<td>Land form / topography, watercourses, geological direction, bedrock and soil types</td>
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<tr>
<td>Scale</td>
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<tr>
<td>Relief, height variation</td>
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<td>Land use</td>
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<td>Vegetation / vegetation structure</td>
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<td>Nature</td>
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<td>Biotopes</td>
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<td>Communications</td>
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<tr>
<td>Settlement (character, age, structure, function)</td>
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<tr>
<td>“Cultural references” (famous places, local sites, meeting places...)</td>
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<tr>
<td>Key elements, further defined where necessary</td>
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<table>
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<tr>
<th>CONTEXT</th>
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<td>Spatial context (boundaries, patterns, structures, movement, landmarks...)</td>
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<td>Functional context</td>
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<td>Ecological context</td>
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<td>Historical context</td>
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<th>ONGOING PROCESSES</th>
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<tr>
<td>Natural</td>
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<tr>
<td>Agriculture / Forestry</td>
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<tr>
<td>Developments in society / building enterprises</td>
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Thematic studies

Answering the question of why the landscape works and looks like it does at regional level requires a synthesis of a range of expertise. Often deeper studies in relevant subjects are needed concerning matters such as landscape form (here a combination of physical geography/geology and visual parameters), ecological context and functions (here analysed as a biological infrastructure) and the landscape’s cultural historical development (time depth and utilization). The methods developed for assessments on a regional scale for the three themes are each dealt with separately on the following pages.

Thematic studies influence both the descriptions and the classifications of character areas and character types. They also have an intrinsic value. Information on, for example, ecological functionality is important to record because it often turns out that biodiversity is greatest in the border between two character types, which is important to understand and point out.

One example of a development tendency in the Bohus coast is that new buildings and new roads are built in unconventional locations. Photo Johannes Kruusi.

Another development trend is the closing down of some railways. Here is the railway at Karlsborg. Photo Tobias Noborn.
The full integrated landscape character assessment thus results in several maps: one group concentrating on subdivision according to character types and character areas, and another group consisting of thematic maps describing important relationships in the landscape.

**Development trends**
Development trends are worked out from a qualified evaluation of what is visible or interpretable today. This is not a judgement of whether the development is good or bad. To judge developments would require the presence of formulated objectives for comparison. For example, is continued overgrowth good or bad? Is the continued conversion of coastal fishing sites into tourist villages good or bad? The analyses merely state what is happening.

When these questions begin to be discussed, the strengths of this chosen method become clear. Integrated landscape characterization establishes a common understanding of the landscape and its diversity in the region – as a prerequisite for development. This also brings to a head the need for a common strategy for different landscape sections.

**Sensitivity**
Evaluation of sensitivity concerns the susceptibility of the character area to the negative effects of change. The character-bearing features of a character area are generally also those features that are most sensitive to change in that specific character. For example, if an area is characterized by its small-scale structure, it will be sensitive to large-scale change.

Sensitivity is not described in general terms, but is directed at the measures at issue in the infrastructural planning. The various aspects of sensitivity are cited in the checklist on page 2, see Appendix 1. The concepts of impact and effect most commonly used in sectoral assessment have been adopted for sensitivity evaluations, but they are reclassified to suit the approach of this methodology. Both figure and text on page 40 describe the relationships between these concepts.
Potential

The European Landscape Convention states that the landscape is a common arena and framework for community development and the management of environmentally important issues. Traditionally, thoughts leap to mitigation measures to ensure that exploitation projects become more environmentally acceptable. But with the knowledge of the landscape gathered through integrated landscape character assessment, firmer qualities of the landscape and environment can be integrated into planned development of infrastructures: the landscape has a potential which must be made use of. This requires a particular focus at a strategic level.

Assessment of a landscape’s potential becomes based on what can be read in the landscape. For example, character descriptions and thematic analyses can identify the landscape’s development potential for enhancing ecological functions, can make its cultural history, etc., more readable. Analysis of potential can form a basis for discussions on common targets and landscape strategies, where decisions can be made about the nature and development of the character area’s potential.
3.6 Thematic study: The landscape’s form

A study of landscape form, aims to summarily describe the factors that influenced and influence the landscape from a spatial perspective, that which is the basis of the landscape that we see and experience today. This study is central to the description of character types and to some extent also character areas.

The basic form of the landscape is provided by the geological forces that have affected the land surface over millions of years. Special interest is paid to the processes that explain today’s surface shapes and land use. The scale of analysis shifts between national (and sometimes international) and local level. National and regional descriptions such as the National Atlas of Sweden and the former Atlas över Sverige are used as a base.

Land use and vegetation types also affect the landscape from a spatial perspective, and here desktop studies are not enough. In order to capture the spatial relationships of the landscape one needs to see and experience it in the field. This takes place primarily during the group landscape observation (befaring) but may need to be supplemented through additional field studies.

Landscape structure and direction

The main features of the landscape, its direction and structure, can be largely explained by the surface shape of the bedrock. Are we in mountainous terrain, hilly plains or rift valleys? Are there faults and fissure systems that shape the direction of the landscape? The landscape’ has been developing over millions and billions of years. The compilations and bedrock maps in the National Atlas offer excellent information at the regional level.

Landscape relief or relative differences in altitude are an important parameter, especially for the infrastructure. Roads and railways are geometrically rigid elements that can be difficult to adapt to certain types of landscapes without making major changes (cuttings and embankments, tunnels and bridges). Therefore it is important to account for “wavelength” and “amplitude” in the terrain. By wavelength we mean slope and distance of heights between peaks and valleys. Amplitude refers to the relative height difference between valley bottoms and mountain peaks. In the pilot study a specific map has been produced to show this, the so-called “Teddy Map”. It is based on readings of elevation data where the colour scale varies depending on height above sea level. There is also shading to better bring out relief.

Deglaciation and land uplift

Many landforms and the distribution of soil types originated in quaternary processes. The moraine and glaciofluvial sediments that cover our land have given rise to the more subdued forms in the landscape. These are partly documented in the “Teddy Map”, but because soil type distribution steers land use, it is important to also document this. A map of soil types provides an overview, but it may need to be enhanced with information on specific surface forms such as drumlins, eskers, glacial deltas, end moraines, etc.

When the inland ice melted, the whole bedrock plate rose. This uplift has affected soil distribution and landforms to a very great extent, which in turn has affected the way people used the landscape. There is, for example, a great difference in the distribution of soil type above and below the highest coastline. The same is true in those parts of Sweden where large glacial lakes once existed, such as Småland and Jämtland.

On a regional scale it can be sufficient to record the data available in national and regional overviews of bedrock and soil types, as well as any specific surface shapes that exist within the study area.
Lakes and watercourses
All thematic analyses describe lakes and watercourses, but from different perspectives. Here it is the forming force of the water that is under analysis. Watercourses create patterns in valley bottoms and plains, which are of importance to their character. They are also of importance for structuring land use and can explain the localization of roads and settlements. Lake size, direction and character also partly control the scale in which the landscape is perceived.

Land use and spatial context
In this context, it is land use patterns and structures that are described. Man’s way of cultivating the land greatly affects the relationship between open and closed landscapes, and thus ways of perceiving the landscape; its scale and infrastructure and settlement location and structure. This description is linked to the description of character types.

Scale
The concept of scale is essential when analysing the relationship between infrastructures and the landscape. New infrastructures increasingly tend to be more large-scale – such as motorways, new railways, airports and ports. The relationship between the scale of these structures and the landscape is an essential parameter. Group landscape observation (befaring) is the main source for these analyses, in addition to topographical maps (such as the “Teddy Map”) and general maps.
3.7 Thematic study: The ecology of the landscape

This is a description of the thematic analyses that concern the natural environment. Besides analyses, an integrated study of the group landscape observation (befaring) and landscape character assessment described elsewhere in this report, should be done. Thematic analyses of the natural environment aim to produce an overall picture of the landscape's ecological relationships that may be relevant to the early stages of infrastructure planning.

The method is based on the following premises:

- the analyses of landscape ecology follow the Convention on Biological Diversity, i.e. consideration is given to species, ecosystems and processes that are relevant at the landscape level
- special attention is directed to high concentrations of biodiversity
- focus is also placed on lack of biodiversity and the ecological functions that are at risk of disturbance
- landscape scale varies within different subsidiary analyses, from national (sometimes international) to local (county or municipal)
- national sources for data are used in the first place, comprehensive regional sources in the second place
- standard methods for landscape ecological analyses are used in the first place.

The analyses are not intended to give a comprehensive and complete picture of biodiversity at landscape level, Such is not possible from existing survey results and our current state of knowledge. Furthermore, these are a matter of targeted analyses, concerning the biodiversity that is likely to be affected by the Swedish Transport Administration's operations and investments.

Biological infrastructure

The methods used here are gathered under the one name, “biological infrastructure”. This is a concept born out of previous research and work within the former administrative agencies for roads (Vägverket) and railways (Banverket). At the European level, and in a project run by the Swedish Environmental Protection Agency, the concept “green infrastructure” is used for interrelationships in landscape ecology. Creation of the term “biological infrastructure” prevents confusion between the two concepts.

The name is a play on the fact that biodiversity is dependent on an infrastructure to function. The word infrastructure accommodates the notion of interconnections – the distribution patterns and movement patterns that must be present for biodiversity not to be depleted. Use of the word infrastructure also has a pedagogical aim to increase understanding of the landscape's ecological interrelationships with technology.

Most of the analyses are GIS-based but in some cases are compilations of existing information. The method for biological infrastructure has been divided into 12 stages:

**Step 1 Characterization of a natural geographic region / biome**

The first step concerns being aware of the wider perspective, which is easy to forget. It is important to identify one's global position and the most important nature types, their fundamental properties and how they have been affected in terms of fragmentation by human activity (extinction debt). This gives the analyses a holistic perspective where larger themes can be related to the region. No separate assessment technique is needed, since this is a matter of compiling information from general reference books such as *The National Atlas of Sweden*. 
Step 2 Identifying large-scale corridors
This step considers how species spread and move over large distances. It concerns large mammals (especially large carnivores), birds, and in some respects, fish. Assessments are often difficult to carry out due to weaknesses in the basic data, so this mainly involves a compilation of existing knowledge and specialist interviews.

Step 3 Assessment of high-value tracts
This involves a GIS analysis of the habitat types that predominate in the analysis area. It shows concentrations of biodiversity for coniferous forests, deciduous forests, noble broad-leaf forests, bogs and meadowland. The assessment does not indicate functional relationships, but offer a good overview of the landscape “topography” in terms of biodiversity.

Step 4 Assessment of mosaic regions
The basic idea of this analysis is to highlight areas that have a rich variety of habitats. In many cases, the total biodiversity is higher when there is rich agricultural landscape and rich woodland together. The method is similar to the above but differs in that the results of the high-value tract analyses are superimposed and weighted. Weighting is carried out on high-value tracts that overlap one another. Primarily, superimposition is carried out on forest habitats, cultivated landscapes (pastures) and bogs.

Step 5 Assessment of host systems
This analysis aims at deepening the high-value tract assessment to display functional relationships. Some habitats occur fragmented in their natural state and that is where this analysis can be most useful. An example is the analysis of pasture systems. Data is collected from national databases such as “TUVA” (the Department of Agriculture’s database), “Skogens pärlor” (the Forest Agency database) and “VMI” (The Wetland Inventory). The assessment consists of a cluster analysis where the input consists of habitat requirements and ecological threshold values for areal requirements (at different scales if necessary) and dispersion distances.

Step 6 Degree of fragmentation
This concerns fragmentation analyses that take into account existing infrastructure and human settlements. It provides information on how the fragmentation appears and complements assessments of both high-value tracts and mosaic regions by showing up the gaps. It should be superimposed on the former in order to “prune” both value system and region assessments as well as to obtain a measure of the importance of each “patch” (fragment) for biodiversity (quality). Input data is retrieved from databases for infrastructure (e.g. the roadway database) and traffic.

Step 7 Identifying major areas
This is partly a product of fragmentation assessment where focus lies on the large unfragmented areas. Assessment can indicate large areas that are without major roads and railways, but also areas that have low noise levels.

Step 8 Sensitive watershed regions
This is primarily a compilation of the state of our knowledge and consists of mapping watershed regions with good ecological status in combination with information on infrastructure-sensitive species like trout, freshwater mussels and otter. Where there are regionally designated waters these are also included. Documented as watershed areas or sub-watershed areas.

Step 9 Gap analyses
This employs the analyses that are already completed or in progress within the Swedish Transport Administration, currently for wildlife and natural environments that are disturbed by noise. In the future, other types of gap analyses can be
employed, e.g., historical analyses of how much wetland has disappeared and migration obstacles caused by infrastructures (the latter can be compiled regionally). Work is ongoing within the Swedish Transport Administration to collect this type of environmental data.

**Step 10 Targeted species analyses and biotope analyses**
This is not a mandatory step, but is performed if it is relevant to the landscape scale. These analyses aim to record the rarer biotopes and species that have high relevance for the infrastructure but are easily missed in more generalized analyses. Examples include species-rich verges, sandy railway environments, lined avenues, ponds and wetlands. Assessments can be performed if comprehensive regional data bases exist.

**Step 11 Targeted assessments in urban environments**
In metropolitan areas, and in some other built-up areas the pressure for change in the landscape is so strong that in-depth analyses are needed. These may even need to be done at regional level. The assessment needs to take into account the combination of physical planning and infrastructure planning. In biologically impoverished environments, ecosystem services may need to be analysed separately. The focus of these assessments is on ecological relationships and barriers.

**Step 12 Protected areas**
This is not an analysis in itself, but a compilation of the legally protected items contained within the study area. This is especially important in environmental assessment for e.g. intrusions but also represents an important basis for evaluation of analyses and conclusions.

**Data sources**
The data sources used must be widely available, either as national databases such as “TUVA” (Department of Agriculture), “Skogens pärlor” (Forestry Board) and “VMI” (County Administrative Boards) or regional databases such as the deciduous inventory in Västra Götaland and the inventory of large trees. It will be possible to use the Swedish Transport Administration’s own databases to a greater extent when the information on lined avenues, culverts and species-rich verges is collected. Until then, the data is accessible from the Swedish Transport Administration regionally.

### 3.8 Thematic study: Historical time depth in the landscape

What follows is a description of the thematic assessments that concern the cultural environment. These assessments can be divided into two parts: a compendium and an analysis and verification of the historical time depth in the landscape, in addition to the integrated processes described earlier. These two parts interact with one another.

All cultural environment assessments in this report are based on an epoch method similar to DIVE (Describe, Interpret, Valuate, Enable). This is a method for examining the cultural environmental values in the landscape developed by the Directorate for Cultural Heritage in Norway (Riksantikvaren) in an international collaboration also participated in by the Swedish National Heritage Board.

An important concept that runs throughout the cultural-environmental process is “Then-Now-In Future” – bringing history into the present and then taking it forward into the future.

**Compendium**
The basis of the epoch method is a compendium that aims to summarize the factors that influenced and influence the landscape from a historical perspective. Both
the summary and its production are termed the compendium which provides the historical framework for the landscape that we can see and experience today. It is therefore important that the compendium makes a connection between history and today's landscape with the physical remains of the historical phenomena that it holds.

Choice of historical features to be highlighted is controlled by several factors, including:

- **Scale**, which is selected to suit the purpose of the relevant study. Differences in scale, from national to local, can range from overviews and analyses of the broader contexts, patterns, structures and frequently occurring fundamental features, to the local scale of where these fundamentals are described in detail and the broader picture often less so. The boundaries between the different scales are fluid and regardless of level, different information needs to be retrieved from other levels in order to complete the description.

- **Application of the integrated landscape character assessment method in long-term infrastructure planning.**

- **This work draws on existing and available information (the knowledge base).** No new inventories are undertaken. Existing knowledge bases are brought together to the same scale.

- **Since integrated landscape character assessment surveys today's landscape, man's physical footprint in today's landscape is one of the factors to be included when deciding on the content of the compendium. Some examples follow of the interplay that occurs between the different parts of cultural management work.**

The compendium does not purport to be all-inclusive; that would be neither possible nor appropriate in this kind of work. Discussion and concordance regarding content should be carried out with the cultural representative of the current landscape area, e.g. the county administrative boards.

A compendium can be structured thematically or chronologically; the unique features of each area influence the choice of approach. The following elements should be included in the compendium: Common to all aspects is that essential themes be brought to light, as well as major changes such as relevant focal points that have shifted through time. The headings on the next page provide examples of aspects to include.

**Role throughout history**
The role and function of the area throughout history in an international, national or regional perspective.

**Human settlement**
This concerns how and when man became established in the area, and in its various parts. Known ancient monuments for each time zone are one source. Together with shoreline displacement information this material receives an added dimension by contributing to our understanding of where to expect ancient monuments and increases our understanding of the processes involved in human settlement in the area and the recorded archaeological sites.

**Governance**
This concerns previous boundaries, “power relations”, politics and administrative governance, etc. Examples include national or provincial boundaries, the establishment of the church, towns and places of administration (district courts, residences, important trading centres, etc.), important military affairs and places, land ownership, administrative structures, such as district, parish and municipal boundaries.
Subsistence
This concerns subsistence systems on different scales. Land use, land type, soil type, natural geographic conditions and commercial development are examples of what should be checked. Principal and also ancillary industries are included.

Settlements / dwelling patterns
This includes types of settlement, building structures, density, etc., during different epochs. It is important to include the location of settlements / buildings in relation to surrounding land, and how this relates to subsistence systems, communications and social administration. Moving between several different scales to verify information is often necessary.

Communications
This concerns the historical foundation and development of communication patterns. Waterways, roads, railways, other terrestrial communications and hubs are examples of what can be mentioned. The connection between the infrastructure and landscape development, such as boundaries, major centres, trade and industry, etc., is of importance. Here too it is important to move between the different levels of scale.

Analysis and verification of the historical time depth in the landscape
This involves a general analysis of the historical time depth of today's landscape. It offers cultural environmental dimensioning to the landscape character assessment. Assessments at this stage are relatively cumbersome because of the character of the knowledge base. Digital base data is often lacking on an overall scale. It would be ideal if the knowledge base covered both the occurrence of physical features and their condition. For several of the important features both of these dimensions are missing, e.g. for the majority of the settlements. Assessment is instead made from the historical synopsis in the compendium, satellite images and aerial photographs, the accepted views of specialists, interviews and other sources and one's own arguments.

Examples of assessments include: Dominant epochs compared to unique items; what stands out? Relationships between nodes and peripheries areas, over time. Identification of the persistent “red threads” through time. Changes versus continuity and their causes. Analyses of designated areas can also be made, as also gap analyses concerning the representativeness of high-value tracts in relation to historical events and different time depths.

These assessments offer a picture of the collective cultural landscape today, on a general landscape level, and include cultural heritage dimensions such as:

- land use
- settlements / buildings
- communications
- context, etc.

It is only when in the field that chronological schemes and physical remains can be evaluated and quality, clarity and condition be verified or rejected. Thus field observations have great weight. They can be carried out during the group landscape observation (befaring) but may need to be supplemented with additional field trips.

Sources useful in preparing the compendium and time depth assessment
Contemporary and historical maps, satellite images and aerial photographs, historical sources, natural geographical source material, the different actors’ cultural heritage assessment material including databases, registers of ancient monuments and sites, land records, etc.
3.9 Strategies for landscape development and landscape quality targets

The relevant knowledge of different areas gained through integrated landscape character assessment, can now be linked to the different targets for landscape quality. Having this foundation, different strategies and planned actions can be evaluated – and managed – in the actual landscape. Goals for landscape quality are as yet lacking so this evaluation cannot be exhaustive.

In order to assess if the changes that occur now or in the future, are desirable, it is necessary to formulate a strategy for the character area. What future character is desirable? This can be formulated according to the scale:

Preserve – Maintain/Manage – Develop – Create

Here the Swedish Transport Administration is dependent on targets formulated by several other actors in society, including political targets. A compilation of the targets for landscape development that already exist is a good start. These can include, for example:

- targets for regional development
- targets for tourism development, efforts to exploit landscape resources to develop industry
- targets in municipal master plans
- the agricultural sector’s different targets and intentions, expressed e.g. in society’s support for different measures for maintenance of the cultural landscape
- the targets of the Forestry Agency
- national and regional environmental targets – with regard to landscape development.

The Swedish Transport Administration has its own targets for landscape development, but they were drafted within the former organization of Vägverket and are not updated within the new administration. Present work within natural and cultural heritage management on targets can be updated and tested.

This can also be linked to a stronger implementation of the European Landscape Convention. It is important that landscape targets be developed in dialogue with different user groups in order to get a properly anchored strategy for how to plan and implement the management and development of the landscape. The European Landscape Convention, particularly stresses this, but it is a challenge to do so on the regional scale, where the individual item does not have the same local connection to landscape strategies as on more detailed scales.

The Swedish Transport Administration has developed methods for working with project targets. It might be interesting to see how this methodology can be employed or improved on for the early stages.
3.10 Environmental assessment of infrastructure planning

As mentioned earlier, it has been difficult to environmentally assess infrastructure plans (national and regional) partly because of the lack of a planning underlay aggregated to an appropriate scale and partly because planned measures often lack “geography” – are not specifically anchored in the landscape.

The argument for an improvement in the situation that has been worked out during the present project is as follows:

- that the regional level is feasible and appropriate for obtaining an aggregated knowledge base
- that environmental assessments need to be done at the level of landscape character area in order to link them to the landscape
- that environmental assessment is facilitated if the measures proposed in spatial development plans are categorized according to the extent to which they affect the landscape.

These assumptions are not fully tested but have been tried out in the Västra Götaland region. By developing corresponding information bases for other regions, a comprehensive knowledge base can be developed for environmental assessment on both national and regional levels. When working with the national plan, such regional planning bases have to be consulted collectively. A base generalized to a higher scale would probably say too little about the landscape to be effective.

It should be pointed out that a landscape character assessment is one of several sources of collected information needed to conduct a full environmental assessment.

The concept is summarised in the figure below. Through regional landscape character assessment (lower half) an aggregated regional information base is generated. Planning measures are categorized by their impact on the landscape (upper half). Estimates of sensitivity and potential in the respective character areas are evaluated according to sensitivity to new construction work, reconstruction, operation, and changes in traffic. In this way, one is prepared for the environmental assessment of the overall environmental impact of spatial development plans.

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*By regrouping the planned measures in the national and regional development plans according to the blue headings, it becomes easier to understand the various impacts on the landscape. Environmental assessment within a character area can be made in association with evaluations of sensitivity and potential as recorded by Integrated Landscape Character Assessment.*
The pilot test to environmentally assess the national and regional development plan for Västra Götaland Region covered two of 26 identified character areas. The assessments are described in Chapter 5. There the importance of common landscape strategies is stressed and also the need to formulate targets for the development of the landscape.

Proposed measures in long-term spatial planning
In order to judge the impact of the various measures in national and regional development plans, they are sorted into four categories, depending on the extent to which the landscape is affected. Are we dealing with completely new areas? or the local environment around an existing infrastructure? Or with maintenance/operation of infrastructures and their peripheries? Or changes to traffic patterns? These four categories are presented in the illustration on the previous page. The following section describes how the different measures in the long-term plan are grouped under the four categories. Grouping the measures in this way facilitates an understanding of the impact of the various activities on the landscape.

The national and regional plan for transportation systems, transport measures are called and sorted primarily on the type of financing that is relevant, and after the authority responsible for the measures. The measures in the regional plan for Västra Götaland were divided into the following categories:

- **Specified operations** (for roads, railways and public transport)
- **Co-financed operations** (with the national plan)
- **Carrying capacity operations** (measures to improve roads and railways to withstand heavy traffic)
- **Railway operations** (new construction and reconstruction of railway, systems and stations)
- **Designated pots** (covers a broad mix of measures)
- **Other pots** (e.g. pedestrian and cycling paths, targeted road safety measures, bus stops and commuter parking and a “pot for minor operations”)
- **Pots co-financed by the state** (e.g. disability adaptation of public transport, quaysides as well as road safety and environment)
Example of rebuilding – an extended pedestrian and cycle path. Dalarna. Photo Bengt Schibbye.


Example of altered traffic – a more heavily used road (Viska Valley). Photo Bengt Schibbye.
Measures in the national plan sorted on how they affect the landscape

New constructions – measures that are not directly connected to the existing road/rail network

- New roads
- New rail tracks, new rail yards
- New pedestrian and cycle paths
- Central barriers where dual carriageways are required
- New travel centres
- New routes – major refurbishment

Rebuilding – measures in the vicinity of existing road and railway systems

- New junctions in existing road networks
- Rebuilding of existing roads – bearing capacity projects, e.g. adjustment of inclination, new embankments / rock cuts
- Widening / meeting point separation where the road position and inclination are changed, i.e. adjustments in plan and profile
- Central barriers not entailing measures other than a mid rail
- Traffic safety measures / new geometries (curve straightening, etc.)
- Speed reduction measures with obstacles in or beside the road
- Road safety measures in built-up areas, e.g. refurbishing of intersections, lighting
- Noise protection measures
- Transfer points (bus stops, commuter parking, etc.)
- Rebuilding of travel centres
- Pedestrian and bicycle paths along existing roads
- Widening – road widening / dual lanes
- Upgrading bridges (for smaller projects can also be sorted under operation)
- Wildlife passages, tunnels or ecoducts
- Storm water facilities
- Resting places
- Erosion protection includes embankments that spread into additional land
- Side tilt
- Traffic safety measures in side regions (clearance, blasting for improved vision, etc.)

Operation and maintenance

- Ditches
- Wildlife fences
- Operational measures – smoothing, salting, etc.
- Lighting
- Paving
- Clearing of permanent obstacles affecting the infrastructure
Altered traffic routes
This last is not really a measure in itself, but rather a consequence of some of the other. But several of the different components of planning aim at reduced or increased traffic on different roads and railways, and these changes also affect the landscape, for example by a change in the noise situation, with implications for how the landscape is experienced. Increased traffic means greater barrier effect and risk of greater frequency of wildlife accidents.
Effect assessment
The current model for assessing effect does not include knowledge of the landscape as a whole (see figure on page 10). What is assessed is the impact on protected and valued areas (intrusion). Impact on natural and cultural heritage interests should be handled in the overall effect assessment. However, integrated landscape character assessment offers the opportunity to assess the impact on the landscape as a whole. One difficulty is that the planned measures in these early stages often “lack geography”, i.e. it is not known exactly where they will happen, nor sometimes what they entail.

On an overarching strategic level the concept of effect holds similar meaning and content to that of sensitivity. Using the knowledge of the landscape that is made available through integrated landscape character assessment and the assessments of the different character areas, the effects of the planned measures – sorted as above – can be evaluated.

Concepts of “effect”
Today the assessment of impact and effect is usually carried out by each sector on its own. This means that each sector, mainly representing natural and cultural heritage management, has developed its own concepts of the effects that various infrastructure projects can have. In addition, the impact on the visual landscape is often described.

Common concepts:

**CULTURAL ENVIRONMENT**
eradication
neglect/good maintenance
changed character
changed context
structural alteration
habitat loss

**FORM (IMAGE OF THE LANDSCAPE)**
alterations of scale
disturbances of structure
altered visual character

**NATURAL ENVIRONMENT**
disturbance
mortality
habitat loss
barrier effects
invasive species
corridor effects

Common concepts in effect-assessment of infrastructure measures.
The proposed methodology uses the three categories of landscape content, context and ongoing processes. The concepts of effect that are normally used can be sorted under these three headings to allow for assessments in relation to the landscape as a whole.

Content
This refers to the physical geography: what actually exists. Actions that primarily affect the content of the landscape and can lead to eradication, altered visual character, disturbances of scale or structure, habitat loss and risk of the spreading of invasive species.

Relation
This concerns how different patterns and movements in the landscape are affected, how spatial, ecological and cultural relationships are strengthened or broken. Relationships of a social nature in the landscape can also be attributed to this category. These include effect, changed character and relation, barrier effects, corridor effects and mortality.

Ongoing processes
The landscape is in constant change, and a character description of the landscape resembles a photo of the landscape right now. Some of the processes are natural given, such as land uplift, erosion and sedimentation, but today, most are a result of human activity. Important effects include changes in land use in the form of, for example, overgrowth and decay, or the opposite, exploitation and intensive cultivation. Structural change and disturbance also fall into this category.
4. Regional integrated landscape character assessment - Västra Götaland

In this chapter the results of the pilot study are presented: 12 character types and 26 character areas of which five are described in detail. A complete character assessment was not possible within the time allowed for the pilot study. After an initial preliminary division into regional character types and character areas, field-study trips/group landscape observation (befaring), thematic analyses and integrated deliberations during several two-day work meetings resulted in revised borders, descriptions and assessments.

4.1 Regional character types

The landscape has been shaped and developed by natural and man-made processes. Västra Götaland offers a rich variety of character types each with unique characteristics. The integrated landscape character assessment presented here is based on a subdivision into regional character types (12) and regional character areas (26).

In the map overleaf the topographical information has been streamlined in order to clearly show the different regional characteristics of Västra Götaland. In the Northwest the great plains and plateau mountains dominate in a region that has been the centre of Götaland's development since the Stone Age. Against Tiveden's and Hökensås' sandy soils and large forests lie fertile calcareous soils that were most suitable for cultivation - as still today. The volcanic diabase on the top of the plateau mountains, covered the looser bedrock and protected it from erosion. These mountains are ever present as one moves in the open plains towards the flat beaches of Lake Vänern.

On the west side of Lake Vänern a completely different landscape takes over. This is part of the rift valley that lies like a wreath between the plains of Skaraborg and the coast. In Dalsland it is large-scale, forested and rich in lakes, shrinking in scale towards the border with Bohuslän. The whole landscape has a “combed” character. In the valley floors lie the arable land, lakes and streams, and most of the settlements.

South of the plain the ground rises and forms a gently undulating mosaic of forests, wetlands and cultivated land before the rift valley terrain takes over again. Much of this is above the highest coastline, where land use is differently structured; it is on the higher parts of the rounded ridges (the drumlins) that the best arable land lies, and therefore where we find settlements, arable land and most roads. The numerous bogs and the large-scale undulating topography characterize the borderlands with Småland. Several of West Sweden's important smaller rivers – the Viskan, Åtran and Nissan – flow through this area.

The fringed effect of the Bohus coast is a result of the same bedrock history as the rift-valley landscape – but here the hills are not so high, and the valley floors filled with clay, giving them a relatively flat surface. Towards the coast the mountains become barer and the rocky archipelago takes over. The settlement pattern and infrastructure interact with the large-scale topography, which adds additional structure and spatiality. Västra Götaland's topography is dramatic, rolling, hilly and scenic, making it Sweden's most varied region.
The so-called “Teddy Map”. This is a contour map coloured from light to dark brown in accordance with height over sea level (the darker the higher). Additional shading is applied to produce three-dimensional emphasis. The map thus offers considerable information concerning the structure of the landscape.
General characterization into regional character type and regional character areas marked on the Teddy Map.
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1. Coastal and archipelago landscape (Kust- och skärgårdslandskap)
The coast is a small-scale rift-valley landscape with distinct valleys in south-westerly – north-easterly direction. The rugged outer archipelago is characterized by bays and islets that rise 25–50 meters above sea level. The inner archipelago has a similar dramatic character with a small-scale agricultural landscape where flat clay valleys meet steep mountains. This is an area where the moraine is thinly draped over the rocks in the inner archipelago with thicker layers of peripheral forest of oak at the cliff foot. The outer archipelago almost totally lacks moraine. The forest grows on the hills and along the mountain sides. Orust is an exception to this character with cohesive mud flats and patches of coniferous forests. The sea is ever present in the outer archipelago, but the coastal landscape is otherwise rather poor in water sources. The road network is small, the roads wind along the valleys, often bordering the mountains. In the outer archipelago the roads run along the mountains and crevices and are generally very small-scale. One exception is the E6, which runs across the valleys in a north-south direction. Urban communities are located mostly in the bays and the river estuaries. The fishing villages have dense clusters of buildings, while the agricultural settlements are scattered in the valleys.

The coastal landscape contains many small sub-populations of plants and animals linked to the well-defined heights. There is an interesting east-west zoning associated with proximity to the sea and high altitude. Near the coast there is a zone of ocean-favoured plant and animal species, then the different zones follow one another up towards “the mountains” in the east. The new north-south route of the E6 often runs in the boundary between two of these zones.

Human activity is focused on the coast and the area was settled at an early stage. Today ancient monuments link up with currently or previously navigable waters, as do recent defence structures. Human traces such as rock art, district (härads) subdivision and road systems all indicate subsistence landscape dependent on the sea. Important industries such as the fishing industry, stone industry, as well as bathing resorts and holiday homes combine with cultivation to create a “coastal and lake landscape character”. The coast outside Göteborg and in the municipalities of Sotenäs and Lysekil is highly exploited by residential dwellings. Industrialized coast land is to be found close to the towns especially at Göteborg, Lysekil and Stenungsund.

Important characteristics include the dramatic play between bare rock and blue / green valleys, the small-scale networks of roads with their stone guards (guardrails on stone pillars) as well as the densely clustered fishing villages in the bays. Equally characteristic are the leafy fringes of forest between the mountains and the valley floors and the open heather moorlands leading down to the sea. The area is one of Sweden’s most popular recreational landscapes and is reached through winding roads or by cruising between the islets of the archipelago. It is a richly varied and small-scale landscape. The irregular farmed countryside is also an important characteristic. Our image of the west coast has been immortalized by the poet Evert Taube who describes the coastal landscape in general and Bohuslän in particular.

One character area: The Bohus coast
2. Lake landscape (Sjölandskap)

The lake landscape is influenced by proximity to the great lakes with panoramic views. The shore zones can vary considerably, but with the exception of the few areas that are still grazed a border of deciduous trees lies closest to the water, often enclosing pockets of cultivated land. The lake landscape has occasional expanses of reed beds and is lined with screens of e.g. alder and birch, which separate the shore zone from the neighbouring coastal landscape. Road systems usually run at right angles to the water, leading to the villages and farms further inland, where those who fished and utilized the lakes had additional means of livelihood. Along the beaches there are boathouses and nowadays the occasional holiday cottage. Where the rivers empty into the lakes, the situation is quite different: with the development of good communications, large communities and towns have emerged, such as Trollhattan, Lidköping, Mariestad and Karlsborg.

The two lake landscapes in Västra Götaland – Vänern and Vättern – have very different characters. Flat areas surround Lake Vänern, apart from Kållandsö where a small-scale rift-valley landscape rises out of an inland sea, and continues as a ridge to the southwest and separates the Västergötland plains of Grästorp and Vara. The reeds and trees screen the lake, making it difficult to see, though one is very aware of its presence. In Dalsland the lake landscape meets the large-scale rift-valley landscape that created the rocky and indented coast towards the border with Värmland. The Vättern-basin beaches instead rise in sloping terraces, formed by the faults that create the overall topography of the lake. The southern part is more open and cultivated, while Tiveden’s coniferous forests dominate the north.

Two character areas: Vättern basin and Vänern shores
3. River valley landscape (Älvdalslandskap)
The river valley landscape is composed of broad valleys flanking large and small rivers. The scale ranges from vast beach terraces to contracted slopes where the valleys get narrow. The valleys follow a clear line and forested steep mountains distinctly delimit them. In the valley floors the terrain is flat to undulating, rising to a height difference of between 50–150 m. The valleys widen at the river tributaries into a flat undulating mosaic-like landscape. The open countryside in the valley floors has been cultivated and settlements lie like a meandering string of beads along the tributaries. Roads cross the rivers at the towns. The Göta Älv estuary encloses Trollhättan in the north and an expanding Göteborg in the south, located at the confluence of several valleys. The infrastructure of road, rail and waterways follows the valley, and sometimes the road runs along both sides of the river. The strong direction of the river valleys also means that they constitute a barrier to flight and wildlife paths across the valley. While the infrastructure that crosses over the river valleys creates breaks in the elongated lines they are historically important nodes.

The Göta Älv river has been an important route throughout history for the movement of both land and aquatic organisms, but urbanization, power plants and the expanded infrastructures have limited its function. Yet Göta Älv is one of the most important salmon rivers in the country. For terrestrial animals the valley sides and surrounding woodlands are more significant. The Göta Älv river is still very important for birds. The shore and strand meadows are important resting places. Their flight paths often follow the valleys.

The Göta Älv river bears witness to the importance of communications for man ever since the area was settled. Many hill forts watch over the river valley. The area has always had a strategic position and once formed the border between Denmark/Norway and Sweden. In the Middle Ages Lödöse was one of Sweden’s most important harbour and trading cities and competed with the Norwegian fortress of Bohus in present Kungälv over the inlet of Göta Älv. In the 17th century, Göteborg was founded and Bohuslän became Swedish. The exploitation of the river continued. The construction of Trollhätte Canal, the locks in Trollhättan, Dalslands and Göta Canal developed the ability to transport goods on the river. The falls at Lilla Edet and Trollhättan were converted into locks. The ironworks in Dalsland grew and took on industrial status and manufacturing industries became an important sector linked to Göta Älv. This river valley has thus always been an important source of livelihood and a communication route that continues to be urbanized with an expanding infrastructure, growing population and industrial exploitation. West of the river, between northern Göteborg and Trollhättan the land still retains its farming village character in flat cultivated valley floor where scattered buildings follow the roads.

One character area: Göta Älv river valley

The flat river-valley of Göta Älv is delimited by steep mountain slopes. The infrastructure closely follows along the valley floor. West bank of Göta Älv. Photo Bengt Schibbye.
4. Large-scale rift-valley landscape (Storskaligt sprickdalslandskap)
The rift-valley (also termed joint-valley) landscape is characterized by having at least one distinct direction. Ridges and valleys follow one or sometimes several lines, caused by weak zones in the bedrock. Rift valleys may vary in size, but give the impression that the entire landscape is “combed”. The cultivated land, buildings and roads lie were possible in the valleys. The rift-valley landscapes are generally rich in sources of water. Large parts of Västra Götaland consist of rift valleys – almost the entire zone between the coastal landscape and plains landscape between the lakes.

The large-scale rift-valley landscape is characterized by larger rifts in clearly dominant north-south fissures, with smaller valleys in the east-west direction. The relative height differences are large, between 150–300 metres. This is one of the highest parts of the region, much of it above the highest coastline. The east part of southern Sweden's moraine region also contains a drumlin landscape with characteristic whaleback form. The character type is predominately forested, deciduous in the southwest but otherwise dominated by conifers. Rift-valley landscape is water rich with lakes and rivers, which follow the undulating and sometimes hilly valleys. In the large-scale rift-valley landscape sometimes large-scale valleys break in as a local character type. The valleys played a key role in man's establishing him/herself in Västra Götaland and Sweden, and the ancient monuments show a great time depth. The road systems and settlements follow the valley and are often associated with the waterways. Between the valleys these areas are sparsely populated. In areas over the highest coastline, settlements and farmland lie on the heights.

Three character areas: Bullarebygden–Kynnefjäll, Bottnaryd area and regions around Borås–Ulricehamn.
5. Lesser rift-valley landscape (Småbrutet sprickdalslandskap)

This character type has a varied, rolling terrain, often with a height difference of over 100 m. The mountain backs of gneiss, diabase and granite are forested and delineated by dramatic fault escarpments. The lush, often cultivated valleys and gorges contrast strongly with the mountains. This character type often offers limited views, and the landscape is experienced as small scale. Extensive views are however offered around the larger lakes Ante and Mjörn, and along the major valleys that traverse the area. The forest areas with elements of wetlands have an important function as natural holding tanks before the water penetrates the river valleys. Cultivated land, roads and buildings lie traditionally along the valleys and around the lakes. The valleys with fine sediments and widely meandering rivers have typically flat to undulating countryside that is cultivated, with grazing lands placed near the watercourses. The relationship of open to closed landscape varies, but generally the valleys have an open mosaic-like structure.

The rift valleys radiating from the Göta Älv estuary form a distinct “finger-like” structure for the greater Göteborg, where buildings and infrastructure have expanded. The landscape continues to be urbanized along these valleys, and in the vicinity of Göteborg buildings spread even up onto the surrounding hills, which increases the need for transverse infrastructures. This character type also contains inaccessible, sparsely populated forest areas between the valleys that give great areas of silent forests offering rich recreational experiences, such as Svartedalen. The large height difference means that larger construction sites have required large quarrying, bridges or piling.

Two character areas: Göteborgs hinterland, Bredfjället–Svartedal area
6. Forest and lake-dominated rift-valley landscape (Skogs- och sjödominerat sprickdalslandskap)

The forest and lake-dominated rift-valley landscape is characterized mainly by vast forests and elongated lake systems. This character type shows large contrasts with height differences of between 75–200 metres. Orientation on the larger scale is north-south, but is interrupted by smaller valleys in different directions. The only horizontal surfaces available are the elongated lakes, and it is around watercourses that most of the buildings, roads and industries lie. The proportion of cultivated land is small, and agriculture is mostly small scale. Forestry dominates the land use and the forest and hydro power have been the bases for industries in the area, such as iron foundries, sawmills and paper mills.

One character area: Dalsland lake system
7. Mosaic Landscape (Mosaiklandskap)

As the name suggests, this is a mixture of different character types, a composite landscape of varied scale and openness. The area has a flat undulating terrain with few relative height differences. It is the lack of clear and dominant directions which mainly distinguish mosaic landscape from rift-valley landscape. The proportion of wetlands due to the topography and often dense soils is also higher than in other character types. Coniferous forests dominate height parties while the valleys and depressions have varying degrees of cultivated land. The road network is dense in the cultivated parts and sparse in the forest-dominated areas, and does not follow the same clear pattern as in rift-valley landscape. The area alternates in character but has an even distribution of open and closed.

Parts of the mosaic landscape comprise easily cultivated sedimentary soils, and these have been used for a very long time – in some areas since the Early Bronze Age. These parts are dominated by deciduous woodland, and the proportion of arable land is greater than in the moraine and peat-rich parts of the mosaic landscape.

The landscape north of Hornborga Lake (Valle district) is a water-rich camel landscape (rolling and lime-rich) created during deglaciation when the water swirled away fine sediments around the ice blocks which later became hills and valleys. There are botanical remains from the time where southern species migrated across land bridge to the north (mammoth steppe with e.g. “ponytail” grass). This creates a visually and botanically fascinating Tolkienesque landscape (The Hobbit, Lord of the Rings). The camel landscape extends north along Billingen’s western edge where the rich lake systems are surrounded by both pickled oak pastures and manor landscapes with structured lined avenues and large estates and church settings such as Axvall and Varnhem.

Subdivision into character areas is not fully completed. At the southern tip of Lake Vänern forms a cultivated undulating mosaic landscape around Hästefjord. Centrally in Västra Götaland you find a varied mosaic landscape that functions as a transitional settlement district between the rural plains in the north and the rift-valley landscape in the south.

Two character areas: Hästefjord, Kedum mountain–Herrljunga–Slättsjöarna.
8. Plains landscape (Slättlandskap)

Plains landscapes are, flat to rolling, mostly cultivated areas. The structure spans the vast openness such as Vara plain to a mosaic-like structure such as Kåkind plain. Clay soil – in Västergötland, often calcareous – dominates, forming the basis for large/scale agriculture. The plateau mountains Kinnekulle, Billingen, Halle and Hunneberg paint dramatic silhouettes visible from afar Occasional low wooded hills rise over parts of the plains. Otherwise, there are trees all around the farms and houses as lined avenues or windbreaks, and at the border with the surrounding mosaic landscape.

Biologically a plains landscape is poor, but where pastures and old trees occur there can be great biological richness locally. The plain can be characterized as a gap landscape where there is a historic debt from the drainage of wetlands, cultivation of forage lands and cutting down of deciduous forests.

Medieval structures have placed their stamp on the Västra Götaland plains. Church spires still form important landmarks. There are smaller communities and parish villages linked by the finely branched roadway networks. Agricultural settlements lie scattered as isolated farms since the 19th century land reform when villages were divided up. The earliest roads probably stem from the Iron Age and the follow the water systems. The plain became densely populated at an early stage and the road network expanded: between church villages and towns in the Middle Ages, and later with direct transit roads out to the dispersed farms. With industrialization came railways and the “station communities” and embankments that still produce clear structures in the landscape.

Major rivers meander, cut into the mud, and rivers such as Nossan, Lidan and Tidan drain the plains towards Vänern. These are highly important as dispersal corridors. The plains landscape changed dramatically with the large-scale agricultural reforms during the 18th century and 19th century when the distribution of farms and new rational, increasingly large-scale operations created today’s rational farming. In the intensely cultivated countryside, rationalization continues. This has also led to lowering of the lakes and digging ditches throughout most of the plains landscape but along the valley of the Tidan many wetlands and deciduous-dominated sections still survive.

Four character areas: Dalbo Plain, Vadsbo–Kåkind Plain, Grästorp Plain and Skara–Vara Plain

The main characteristic of the plains is the extensive open, cultivated landscape with scattered farm settlements, along a fine network of roads. Photo Bengt Schibbye.
9. Hill landscape (Backlandskap)

Hill landscape differs from mosaic landscape primarily in having larger relative height differences and greater cultivation. The land-form consists of rolling hills with a height difference of between 10–50 metres. The whole area has a high situation and the surrounding plateau mountains tower up to 150 metres higher than the surrounding area. A hill landscape has no clear direction but a strong sense of space, both in the large-scale context where the plateau mountains form the backdrop on the horizon and on the smaller scale between fields with stone walls and screens of broad-leaves. Land use is dominated by farming and grazing and there is rich abundance of valuable pastures, tree-lined avenues and deciduous trees. The few contiguous woodlands consists mainly of coniferous forest. Character area Falbygden is a Cambro-Silurian plain, a plateau covered with chalky moraine and glacial sediment that fold into ridges and hills. The hill landscape has few watercourses in comparison to the water-rich mosaic landscape close by it but has great water resources in the extensive glacial deposits.

This calcareous rich and easily cultivated hilly landscape has been settled by man at an early stage. It is one of the richest areas of ancient monuments in Sweden. Passage graves and cists from the Stone Age are a witness to this and are important character elements even in today’s landscape. The road network runs meandering between several thousand-year-old settlement sites, farms and villages. Church density in the area is high. The main roads lead to Falköping which is the only town in the character of the area of Falbygden. Falköping was an important trading centre during pagan times, mentioned as such in the Västgötalaga (Västgötalagen) from the 13th century, and has continued to be the marketplace for agricultural and livestock production in the area. In the 19th century the city was connected to the railway from Göteborg to Stockholm.

Two character areas: Falbygden, Färgelanda region
10. Ridge landscape (Åslandskap)

The direction of this character type follows the ridge back, a huge bedrock ridge that reaches a height of 300 metres in the south. The ridge formation is probably a horst that was raised at the same time as the neighbouring depression of Lake Vättern was formed. Parts of the area lie above the highest coastline and belong to the central Swedish ice margin zone where the ice expanded and melted in periods. The bedrock is gently undulating and has the character of Norrland. Glaciofluvial deposits have created a small-scale landscape with a height difference of 50–150 metres. The area is mainly dominated by pine forest and contains lots of dune formations. The eastern part is lower and has a high abundance of small lakes, fens and bogs. Open parts appear on the often small, sparsely lying farms and villages. “Horse farms” are becoming all the more common – perhaps a result of their proximity to major cities such as Jönköping. The road network is sparse and follows the direction of the ridge with intersecting routes between Vättern and the plains landscape in the west.

The ridge landscape is often elongated and may therefore be important for the spread of particular forest-dwelling species. The sandy environments give rise to very distinctive moorlike forest types where pine is most dominant. They are by nature very poor in nutrients.

One character area: Hökensås
11. Large-scale rolling / undulating countryside (Storskaligt böljande landskap)

The landscape has a rolling topography with no clear direction, with large upland areas above the highest coastline. Differences in level are often large with a height difference of 75–200 metres. Buildings, roads and cultivation follow two distinct patterns. On the one hand, they form larger river valleys with obvious corridors of communication and settlement – these valleys contain sites of major prehistoric colonization and prehistoric trade routes. On the other hand, there are scattered highland settlements, linked to the easily cultivated soils on the moraine hills above the highest coastline. Between these cultural landscapes spread large very sparsely populated forest and moss-dominated areas.

The undulating landscape has become easily tilled with modern forestry methods which have converted a large part of the forest to pure forestry production. The proportion of key biotopes is therefore generally low. Instead, a large part of the biodiversity is associated with the large bogs which have their largest concentration here. These bogs are also important bird habitats.

Two character areas: South Swedish plateau and Southern Tiveden.
12. Plateau mountains (Platåberg)
Plateau mountains are typical of Västra Götaland and form clear blue silhouettes in the open countryside. Each plateau mountain is a landmark with its own character: Billingen is a ridge, Kinnekulle a cone, Mösseberg and Ällebergs hills and Halle and Hunneberg steeply faced sheer plateaux. The mountains rise as layered cliffs 90–335 meters above their surroundings and provide panoramic views. These plateau mountains were formed 300–500 million years ago when the ancient bedrock was a seabed and was overlain by sediments, plants and animals that fossilized. Volcanic eruption led to parts of these sediment areas becoming covered by lava that solidified to a hard, impervious rock (diabase/stair). As the land rose the easily weathered rocks were flushed away and these encapsulated plateaux remained. Their great mineral deposits have for centuries laid the foundation for industrial activities such as lime kilns, the cement industry and quarrying. Billingen also has a large uranium deposit. The road network is sparsely distributed where there are settlements. There is only one major road, Road 49, crossing Billingen between Varnhem and Skövde.

The geology of plateaux mountains provides a rich and varied flora and use of the land. The diabase plates are barren and covered by coniferous forest with some bogs unlike the calcareous deciduous forests on the scree-lined slopes. Smaller lakes have formed in the old quarries. Streams and waterfalls run down the slopes.

The plateau mountains are largely unpopulated, apart from Kinnekulle with its several large farms to the north and villages and medieval churches to the south. Husaby on Kinnekulle holds the grave of Olof Skötkonung, the first king of Sweden to adopt Christianity through baptism. The towns of Skövde, Falköping and Trollhättan lie directly adjacent to the plateau mountain. Through their large-scale iconic forms in the landscape, their incredibly diverse nature and accessible history the plateau mountains are the clearest characteristic of Västra Götaland.

Five character areas: Halleberg and Hunneberg, Kinnekulle, Billingen, Mösséberg, Gerumsberg.

The plateau mountains raise their characteristic silhouettes over the plains of Västra Götaland, a unique characteristic of this county. Photo Bengt Schibbye.
Quick sketches made during group landscape observation (befaring) trips to capture the most distinguishing features of the landscape.

Drawings Emily Wade
The Bohus coast character area with its large contrasts between the protruding mountains and valleys and the bays. Painting Emily Wade.
4.2 The Bohus coast

The outer archipelago consists of fjords and skerries in southwest-northeast direction with sheer cliffs and open flat valleys (clay). Height difference is usually 25–50 metres, in places up to 100 metres. The rocky outer archipelago with bare rocks and salt drenched exposed pasture-land and salt marshes form important biotopes and is emblematic of Sweden’s west coast. Here settlement is collected into clustered fishing villages. Fishing, along with agriculture and the stone cutting industry, has provided a livelihood for the people here.

The inner archipelago has a small-scale cultivated landscape running along valleys with settlements and broad-leaf screens and roads linked to the valley sides. The whole area is characterized by the high consumption level of the small-scale agricultural landscape, where every cultivable surface or pasture has been put to use. Agricultural land has been a necessity for survival in this barren landscape. It is still forms an important part of its character, but is threatened by increasing overgrowth. Arable land is small and irregular. Where the valley continues to the sea, the cultivated landscape extends right down to the water. Often you will find salt marshes or wet pastures along the beaches which are important biotopes. The entire Bohus coast is a high-value tract for biodiversity associated with the cultivated landscape (see map on page 111). Typical features are the salt-marshes and the heather moorland. Ancient monuments can be found on the hills: coastal cairns, recent fortifications, tombs, rock art, some traces of older farming and croft sites.

The larger settlements are located predominantly at the river and estuaries. The whole area is a small-scale network, originally coastally oriented (in the direction of the valleys, from the coast inland). The large-scale E6 crosses in a north-south direction. The Bohusbanan railway line also runs north-south. The classic road runs along the edge of the forests between cultivated land and the steep mountain sides, weaving up and around the hilltops offering diverse panoramas. The use of stone in road building is very common and has been a special feature of the region throughout the history of the stone industry. Characteristics include stone cobbled, stone walls and the “stone guards” (railings with stone pillars). The broad-leaf screens and rake forests along the mountain sides are important habitats for biodiversity. Particularly distinctive are the oceanic deadwood forests with their rich lichen flora favoured by the high humidity that proximity to the coast provides.
This character area is poor in lakes but not in water. There are many small streams, several of which are trout waters. The mountain landscape contains small bogs and wetlands are a common feature.

Nature exhibits great variety in a small area because of the extensive differences in topography, soil type, solar radiation, land use, etc. This means that many species live in small sub-populations defined by the valleys’ fields. Dissemination is most likely predominantly along valleys. There is an interesting east-west zoning associated with proximity to the sea and the altitude. The more extreme marine species are to be found close to the coast and then different zones follow one after up the “mountains” in the east. This east-west zoning lacks spatial expression – except for the modern north-south communications, where the new E6 often lies on the boundary between two of these zones.

**Development Trends**

The Bohus coast is an attractive recreational landscape with great emphasis on construction of weekend/summer homes, mainly in the vicinity of existing communities. The buildings climb up the mountains to get the best view, disrupting the previous settlement pattern and creating a new character. This can affect and threaten the relics from past eras (in the mountains) and valuable deciduous biotopes. It can also lead to further changes, such as resulting exploitation.

The road network is considered deficient when tourist traffic thickens, and the safety of vulnerable road users is low. Roads are an important part of the character of the landscape, which also changes when you make small adaptations such as straightening curves, road widening of paths for pedestrians and cyclists, removal of steep road crests, etc. The rebuilt roads often take on a different scale than the rest of the landscape.

Even the fishing villages develop because of the changing economic structure. The central sections are converted into restaurants, shops and tourist accommodation, while many year-round residents move out to these newly built areas.

Shore meadows, islands and valleys are dependent on grazing and/or grass cutting and cultivation in order to preserve their openness, at the same time that these small pieces of land are not profitable to farm any more. Landowners and farmers receive various forms of support to preserve local traditions. Large areas are still left in disuse and this overgrowth is a serious problem.
The limits of the character area on a map showing national planning measures.
Sensitivity

- The outer sections are highly sensitive to alterations that break the scale and context of the roads with the surrounding landscape. Material and alignment is an important part of the character of the landscape. Sensitive to rebuilding enterprises in open valleys.

- The landscape is sensitive to new infrastructures that do not follow the clear pattern of the landscape, and e.g. cut across valleys or create barriers and break lines of sight in the open valleys. Need for new infrastructure occurs when, for example, new buildings are placed in unusual or non-traditional locations.

- The whole character of the landscape is sensitive to overgrowth that may reduce grazing and to actions that impede land use – it is the grazing animals that keep even the smaller areas open today. Prospects along the valleys are vulnerable to overgrowth encroachment and to visual barriers that can be created e.g. by new land use such as commuter parking out on the cultivated areas.

- The salt-marsh bird life is sensitive to noise disturbance.

- New buildings and new infrastructures present the risk of habitat loss and increased barrier effects. It is important to preserve ecological relations in the rich biodiversity of Bohuslän.

- Watercourses are sensitive to clogging since the soil is often composed of thick clays that create dense clouds for long periods.

- Geotechnically the Bohus coast is a problematic landscape and when actions are taken more areas are frequently affected than in geotechnically simple landscapes.

- Raked oak forests and similar environments with species that thrive on humidity are susceptible to dehydration that can occur from the systematic felling of trees in the vicinity.

- Geotechnology results in projects being more expensive on the Bohus coast, also larger areas are either taken into use by infrastructure facilities or disturbed by them. This is just what the landscape is most sensitive to.
Potential

• The stone building tradition is one of Bohuslän’s potentials as can be seen in road fixtures and details of the roadway environment such as stone guards, bridges and bridge abutments, etc. These are emblematic for Bohuslän and clearly visible to tourists. It might be possible to restore these typical characteristics and develop the Bohuslän stone building tradition for the environment surrounding roads. Road safety issues need to be particularly addressed.

• Bohus coast is one of the biologically richest landscapes in Västra Götaland. This means that there is great potential to eliminate barriers and obstacles to migration. The mosaic of habitats makes circulation critical for many populations such as sand lizards and other reptiles, amphibians and some insects.

• Roadside maintenance has a potential for aiding biodiversity, by improving the habitats of animals and plants that belong to the open countryside.

• The archetypical view of Bohuslän lays to a great extent in the way the roads and settlements follow the landscape. This means that individual projects may need to pay more attention to the landscape than to achieve mass balance. Generally, it is better to go around hilltops than through, under and over them.
The Göteborg hinterland character area. Small-scale rift-valley landscape where the valleys provide a strong sense of direction. The area includes large lakes such as the Mjörn and rich river valleys as that of the Lärje. Painting Emily Wade.
4.3 Göteborg’s hinterland

It is very clear that this is a rift–valley landscape and that it is small in scale compared to the surrounding character areas. The small-scale fissures, mainly in north-south orientation, are broken by four large rifts / valleys in east-west direction. These are from the north: The rivers Lärje, Säve (and Aspen), Malmö (with Lake Landvetter) and Lindome (with east and west Ingsjö islands). The bedrock is gneiss and height difference is extreme – up to 100 metres. The main road and rail networks and settlements mainly follow the line of these larger valleys.

There is a range of very different characteristics within the character area. The mountains and forests share one character, while the four valleys show great variation. Forest areas, which in many places lie close to built-up areas, are protected to a relatively high degree for nature conservation, outdoor activities and recreation.

The Lärje river valley has an open, wide cultivated landscape that meets the fringes of greater Göteborg with small-scale housing within the Million Program on and at the edge of the surrounding heights, and industrial areas on flatter arable land. The landscape is still protected not just by agricultural farming, but also by “horse farms” and through golf courses. Some supplementary building has occurred in the villages. The residential area south of the valley has grown and now reaches the forest, but much of its older structure is still readable. This applies to the village structure (large villages affected by land reform), farm locations at the forest edge or on high points down in the valley, and churches at regular distances centrally within the valley.

The Säve river valley is multifaceted. A considerable time depth is perceivable here – manors, industries using water as the traditional power source, settlement communities and large-scale communication networks. The Säve Valley contains a cohesive urban development west of the character area – in the river valley landscape. East of Jonsered built-up areas lie in a string one after another until Alingsås, with some gaps where the natural environment is given play. Along with the infrastructure the valley is otherwise greatly exploited.

Malmö river valley is, like Säve river’s, largely exploited by urban areas with homes and industries, roads and rail. However, the built-up areas are fewer and more discrete.

The Lindome river valley is less exploited and less cultivated, though not as wide and large as the Lärje Valley. The village structure with traditional location still survives in addition to scattered settlements. The village structure with traditional location still survives in addition to scattered settlements.

Spatial, functional, historical and ecological contexts closely follow each other and are linked to the four major rift valleys. Consequently, communication paths and roads follow the larger valleys, especially those of the Säve and Malmö rivers.

An important structure is the green wedges of forest running towards Göteborg between the valleys. These have most certainly had great significance both for ecological relationships and for recreation. Also notable are the wildlife routes and dispersion routes which run in a north-south direction, broken by the valleys with their infrastructures. This is particularly clear for the Säve river valley where there is a huge shortage of wildlife passages from Lerum up to Alingsås (see map on page 118).

The valleys were important for food production for the residents of Göteborg. Extensive cultivation occurred from the 1850s, and peaked in the 1950s. The Lärje river stands out as a particularly broad valley and is dominated by open farmland in
The limits of the character area marked on a map showing national planning measures.
The "Teddy Map" displays the clearly small-scale landscape of the Gothenburg area, with its main geological structures running north-south, broken at right angles by four larger rift valleys of varying character.
The Lärje, which is a Nature 2000 area, meanders deep down in a ravine which is extensively grazed.

The sheer topography and narrow valleys have made it difficult to build modern infrastructures without major changes. Road 40 and the E20 are raised up in the terrain by excavating through the rock. The railways run partly through tunnels and the coastal line (Kust till kustbanan) along Mölndal river meanders where the new rail tunnel is planned underneath Landvetter Airport. The surrounding forest areas contain only a sparse network of forestry equipment roads and roads leading to crofts and holiday houses. Very few roads traverse the area. Lateral connections between the major main roads are therefore very few. The valleys show long continuity as communication routes: First for waterways and then for road and rail. The waterways served also for floating timber from the forests down to Göteborg. No cultural road inventory exists for the area. In 1972 Landvetter airport brought air transport to the area.

Settlements with large-scale commercial activities and larger residential areas are linked to the two major river valleys: the Säve (Lerum, Stenkullen, Floda, Ingared, Bodarna, Alingsås) and the Mölndal (Mölndycke, Landvetter, Hårryda, Hindås). The former is laid out in a string along the western main line commuter train route (Västra stambanan). Towns have also been established along the disused rail service, Västgötabanan, in the Lärje Valley and along Lake Mjörn (Olofstorp, Gråbo, Björboholm, Sjövik, Grafsnäs). The origin for the sites along the lakes can be traced to the summer villas built by wealthy Göteborgers in the late 19th century and the early 20th century. During the post-war period, places outside Göteborg grew and now function as commuter towns.

A great time depth can be read in the landscape, from the early manors (säterier) and subsequent industrial and railroad eras, until today. The time depth varies depending on the area. Most building blocks, most diversity seems to be along the Säve mainly because of the long industrial era, but in the agrarian valleys the time depth can go back to prehistoric times depending on the extent to which the ancient monuments create character. In the valleys and around the lakes (especially around Mjörn and south of it) numerous fossil fields beside prehistoric cemeteries indicate a long continuity in farming.
The landforms make the character area rich in large and small lakes, especially between the valleys of the Säve and Mölndal rivers. The two large Lakes Mjörn and Anten also lie within the character area. Around Mjörn, Anten, Aspen and around other smaller lakes there are older holiday houses and summer villas.

The lakes are often poor in nutrients with relatively clear water reflecting the stability of the gneiss bedrock and thin moraine layer on the higher land. This, together with air pollution fallout has given rise to acidification problems in the lakes that still remain severe. In the valleys the problem is instead eutrophication. Despite eutrophication and acidification many of the water systems are biologically rich, have high purity and good water quality (Good Ecological Status). Among lakes the Mjörn stands out and among water systems particular mention should be made of the rivers Rolf, Lärje and Grönan (see map on page 115).

Forestry dominates on the hills. For both natural geographic and cultural-historical reasons, the area is rich in deciduous forests of different types, especially along the valleys and the larger lakes, especially Mjörn. A characteristic feature is the number of oak forests that occur both as oak pastures and so-called raked oak forests on cliffs and slopes. The proximity to the sea and the generally higher humidity gives this region particularly rich forests in terms of oceanic lichens, many of which are endangered (red-listed) in this country. The area has several high-value tracts that are important both regionally and nationally. These are in particular the noble broadleaf forests around Lake Sävelången (Nääs), north-east of Floda, and Lake Aspen at Lerum as well as the coniferous forest areas in Risveden (see map on page 108).

Along the main roads (40 and E20) and the westward-running commuter railway line, Västra stambanan, the natural environments are contaminated by noise. This includes many of the valuable broad-leaf forests in the high-value tracts in the Säve river valley (see map on page 110).

There is a long continuity of man's control over forest areas near Göteborg precisely because of the city's needs. Many forests, such as Vättlefjäll, Alefjäll and Risveden were deposed as crown commons/royal parks to e.g. secure access to timber for the city's needs. Today, many of these are protected for recreational needs and nature conservation. There are a wide range of recreational environments from sporting facilities and walks (e.g. the Delsjö area) to forests wilderness (Vättlefjäll, Alefjäll, Risveden, etc.). In addition to outdoor activities in the forest areas, the valleys are also used for golfing, hiking, etc.

Crofts established on arable land were once common in the forests. A peak was reached during the rapid population growth in the 19th century. Forests have also been used for charcoal burning and other forestry activities and for grazing. Overuse turned these into heather heaths during the 18th–19th centuries. Forest plantations have occurred since the 19th century.

Forestry has shifted from traditional management to modern, efficient, forest clearance. The forests in built-up areas are used somewhat differently, depending on the municipality, and are often protected by law.

Previous pastures and infields that became overgrown over longer periods have converted from heathland to woodland, often mixed deciduous.

Agriculture is suppressed in some parts of the expanding urban areas. Agriculture in a slightly larger scale is conducted only in the Lärje Valley and the Lundome's western, wider, valley. The exploitation of building land is under pressure from an expanding greater Göteborg. The lightly populated land in the two highly developed valleys is largely used up. Only small open areas remain.
Development Trends
In the planned structural development for the Göteborg region particular focus is placed on development along the major communication routes with their built-up areas.

There is a lot of pressure for housing in the area closest to Göteborg. Concentration of villages occurs and new housing is built in earlier agrarian areas, such as around the Lärje. Settlements are spreading out even in locations that are difficult to build on, such as mountain tops and in forests. Here it is difficult to clear roads, partly because of the gradient, partly because of earlier communication and settlement patterns which would be dramatically altered. These locations are difficult to provide with public transport and an urban structure becomes less tenable.

Crofts and other buildings often become second or permanent homes. Vacation areas are becoming converted into areas for permanent residence. These often lie reasonably close to good road links to Göteborg, but only rarely with public transport.

Significant for the suburban areas around Göteborg are that land requiring care and maintenance become overgrown. Or are designated nature reserves, whereby they receive better management than previously. This results in an “either/or” situation in ecological terms. If, in addition, the reserves lie too far apart both the changed management and the new buildings and infrastructure increase fragmentation. This emphasises the necessity of planning green structures within a regional context.

Agricultural land is used increasingly for horse management. Horse owners are generally not traditional farmers and have a different approach to the land. There is a great difference between a traditional farm and a “horse farm”. Horse husbandry helps to keep the land open and increases the chances that the older farm buildings will be used.
Sensitivity

- The inherent small scale of the rift-valley landscape is its speciality. Infrastructure measures can easily give rise to breaks in scale and structure. The small-scale rift-valley landscape is so diversified and varied on all levels that modern infrastructures require major measures. Sensitivity varies from place to place, depending on direction, rifts, complexity and visual exposure.

- Barrier, character and context effects can easily become great when narrow valleys are intruded upon by large-scale linear structures.

- On a larger scale, the area is vulnerable to further ecological barriers in north-south direction since infrastructures and new buildings cut through the major wildlife routes between the elevated forested areas.

- High sensitivity to further fragmentation offered by new infrastructures in combination with settlements. Ecologically the area is most likely near or below the threshold for further extinction of species.

- Biologically rich noble broad-leaf environments lie largely in the valley border zones where the infrastructure is being extended and traffic is increasing.

- Despite the proximity to Göteborg, there are several sensitive watershed regions. Eutrophication and acidification problems enhance sensitivity. Watercourses are sensitive to new migration obstacles and increased pressure from surface water.

- Sensitive to further depletion of ecosystem services, especially the water-retaining capacity of wetlands and nitrogen reduction.

- Restructuring is under way to more closely link up the metropolitan area. There is diversity in all sub-areas, but with variation in content, epochs and character. Considering the pressures in the area, both new infrastructure measures and small changes in existing infrastructures can stimulate further contributions and improvements. An example would be consequential establishment in the valley outskirts or in the “green wedges”. Awareness of this as a driving mechanism in ongoing restructuring is therefore important. It also leads to dispersion in the region, which can increase transport needs.

Larger infrastructures (Road 40) through small-scale, dense, areas often result in major impacts such as rock excavation. However, the density of the landscape prevents the impact from being predominantly visible from afar. Photo Tobias Noborn.
Potential

• **Joint planning** The area contains many actors who are planning operations in the landscape. Consensus and cooperation in structural planning at various levels and between various actors at the same level can lead to satisfactory overall solutions. The planning of infrastructures and settlements should be integrated in order not to complicate structural transitions.

• **Diversity** The area is varied. The nature of diversity can be protected even in the future. This is a character trait that should be bolstered to maintain each peculiarity and blend of diversity.

• **Dispersal functions** across the major rift valleys in north-south direction are important for the conifer-dominated hills, providing opportunities for wildlife to move around. Likewise, dispersal along the high altitude areas in the east-west direction is very important. These higher areas comprise green wedges that extend into Göteborg. There is potential here for securing the green wedges on a long-term basis. Dispersal is also important for the broad-leaf forests in the outer zones of the valleys and along the major rivers, especially the Lärje.

• **Barrier effects** on the natural environment and human mobility can be improved when infrastructure investments are being made.

• **Noise disturbed areas** can be addressed.

• Important **ecosystem services** in the area are water control and nitrogen reduction. Wetlands are important. Water pressure is a critical factor for the greater Göteborg and depends on what measures on takes in the higher areas that surround the city. Potential to increase natural holding tanks and for nitrogen reduction through wetlands, swamp woodland, etc.

• **Fauna passages** can be created during new construction and renovation of infrastructures in small-scale rift-valley landscapes. With regard to the dramatic variations in terrain, tunnels or “wildlife bridges” can be used to lessen barrier effects.
The Dalbo Plain character area. Prospect of the flat cultivated landscape with its many discernible farms against the mountainous silhouette of Kroppefjäll. Painting Emily Wade.
4.4 The Dalbo Plain

The Dalbo Plain extends between the Vänern lake landscape and the rift-valley landscape of Kroppefjäll. The plain lies as a plateau 20–40 metres above Lake Vänern. The area is a wide, open, flat arable countryside on light clays, an intensively cultivated landscape. Evenly scattered farms and minor forested impediments break the visibility and wind turbines now form a significant part of the character of the plain. The Kroppefjäll skyline to the west predominates. In the south there are wetlands, while further north the land has been drained. In the north, the plain is bordered by the large moraine strip which also forms the Hjorten peninsula. Closest to Vänern there is a continuous belt of forest.

The plain is drained by several smaller rivers such as the Frändefors and Dalberg. The meandering course of the small rivers is mostly bordered by lines of vegetation. Other linear elements such as avenues and ditches are relatively sparse in the open country.

The higher vegetation on the plains is influenced by the streams, farms and impediments. The transition zone towards Kroppefjäll in the west has biologically rich forest environments, especially broad-leaf trees. Important water meadows occur around Kolungen in the north and the river Krok, one of the tributaries of the Dalberg. The water meadows at Kolungen suffer from exposure to noise (see map on page 112). Otherwise the Dalbo Plain is depleted of biodiversity through intensive agriculture, drainage of wetlands and previous grazing that has now ceased. This is also clearly visible on the maps where the biological infrastructure has been analysed and which show for example that Dalbo Plain lacks high-value tracts, see further in Chapter 7 on landscape ecology.

The roads and railways provide orientation in a landscape which otherwise lacks visual direction. Two old roads pass through Dalbo Plain, the E45 and a road closer to the Vänern shore which connects the churches in the area. The latter is one of several historical roads in the area. Today, the E45 is the only major road. A small-scale network of straight roads along ownership boundaries connects the farms.

The Norway-Vänern railway (formerly Bergslagsbanan) runs parallel to the E45. The track is a typical flat rail with a totally straight alignment. Four station communities have grown up along the line: Frändefors, Brålanda, Erikstad and Mellerud, where the latter was an important junction town. Alignments of the E45, requirements for grade-separated crossings and other road safety measures have affected the station communities so that their original characteristics are no longer so obvious.

Settlement in the agricultural landscape has the character of isolated farms, often located on land that cannot be tilled (impediments). Farming is actively carried on but does not have an industrial character such as e.g. on the Skara–Vara Plain. The farms are still lived in.

The river Dalberg served as a shipping port for grain. In the vicinity of the outlet lie the ruins of the Dalaborg fort which was one of the medieval defensive castles in the border lands between Denmark, Norway and Sweden.

A dozen churches stand on the Dalbo Plain, which is a low number compared with other plains in Västra Götaland. The church sites are often surrounded by trees and vegetation and only the spires indicate the presence of a church.

The structures important for species movement and dispersal occur along the western and eastern edge of the Dalbo Plain. In the west the rich deciduous forest hab-
The limits of the character area.

This farming landscape is affected by the land reforms even if the settlement structures with isolated farms are in fact much older. The area underwent an explosive expansion in the “oats epoch” when oats were grown for export and an equally dramatic decline in the late 19th century. After this, animal husbandry dominated. Farm buildings and utilities were adapted accordingly. During this time (1870–1940) many houses were built that are still in use as dwellings, complemented by villas in recent decades. From the 1920s to the 1950s many new barns were erected and are still in operation.

In recent decades, the cultivation of cereals has once more become important. The farms have been supplemented with low-rise barns, silos, dryers and machine halls.

In prehistoric times Dalbo Plain held similar potential for cultivation and population growth as the plains south of Lake Vänern, but the huge expansion in the Middle Ages typical of the plains settlements around Skara are barely noticeable here. One explanation could be that the area was affected by war and destruction in the power struggle between the emerging Norway, Sweden and Denmark in the early 1000s. After the establishment of the three kingdoms, Dalsland ended up to the side of the main route between the west coast and the Mälaren Valley. No towns were established unlike south of the Vänern where they created an early and stable market for agricultural products. Later still, conditions were lacking for rapid development and the farms have remained small. The expansive period for Dalbo plain was during the era when oats were the primary crop.
The road network also shows that the area lay off the main routes. The E45 was the only major route to be recognized as a royal road in the 17th century. The other main road connects the churches in the area closer to Lake Vänern.

The railroad had a major impact on transport between Bergslagen and Göteborg, but it had only a limited impact on the development of the Dalbo Plain. Mellerud received merchant town rights in 1908, but never grew in size.

Shipping over the Vänern was important for the transport of agricultural products before the introduction of the railroad with major shipping on the Dalberg river. Today leisure craft dominate the harbour.

The area is agricultural district rich in farmed land. Intensive cultivation and lack of wetlands leads to rapid run-off and continuous nutrient leakage into the Vänern.

Agricultural policy has always shaped the appearance and content of the plain. Farming is currently vigorous and the plain seems to be a stable farming district. But it is also sensitive in that smaller farm units can be more strongly influenced by changes in agricultural policy, the economy, generation shifts, etc. If many farmers have problems at the same time the effects will be strongly felt.

Tourism is highlighted as the future industry in a regional perspective. Increased tourism and ultimately increased traffic off the main E45 route could lead to demands for improvements in the road network on the plain.

**Development Trends**

Wind turbines are becoming more and more established in the area, as on many plain landscapes. The trend is towards larger and higher plants, as elsewhere. A structural change can be observed, leading to turbines dominating the landscape.
Sensitivity

- Dalbo Plain is a rationally farmed landscape and the projecting passages, masts, wind turbines and silos have high visual impact: they change the visual character. The plain is also sensitive to the use of hoardings for signage and road signs as well as for noise barrier measures.

- The landscape is sensitive to mergers into larger farming units if roads and farm settlements are removed. These are important parts of the character of the area; this amounts to a depletion of the visual character and loss of natural and cultural environments.

- The border zone near Kroppefjäll and the small-river environments are sensitive to habitat loss.

- Since the meandering waterways offer the only wide dispersal corridors through the plains, they are vulnerable to barrier effects. Bridges and passages need to be designed for high permeability to both animals and plants.

- Roadsides, railway embankments and groves next to the houses are important minor biotopes and the landscape is sensitive to changes in management measures that might cause overgrowth encroachment, habitat loss, and erasure of natural and cultural environments or disturbances of these.

- The landscape is vulnerable to overgrowth encroachment if traditional ways cease, especially along the roads. The landscape’s character is also sensitive to changes in the crops that are grown. These factors affect its visual character.
Potential

- Maintain and create scenic views. On a flat plain all protruding elements are eye-catching. This can be exploited to strengthen the characters and features of the plain, for example by opening up views towards the lakes, waterways and churches. Views towards Kroppefjäll are also important. Solitary trees or small groves can also create natural focal points where needed – for example, for road safety reasons.

- The traditional alignment and placement of the minor road networks is important for the character of the whole plain. With changes and enhancements, the effects on these qualities of the area as a whole must be considered. Slopes and new overpasses can create impediments that can be used to increase the biodiversity of the plain and the same time – with correct management – preserve the traditional cultural landscape.

- Shelter planting and tree-lined avenues along roads can create corridors that improve ecological connections while reducing mortality and barrier effects. At the same time, new linear features alter historical relationships and character, so it is important where these are placed.

- The area has historically lacked ponds and marl pits, but instead had many bogs which have since been drained. The creation of wetlands may therefore be one way to reduce the run-off of nutrients into the water systems of the plain and into Vänern and also delay heavy flows. It is important to monitor where these are placed and how they are designed to satisfy functional and landscape values.

- Bridges that are to be replaced over the water systems of the Dalberg can be given a reduced barrier effect. Migration obstacles can be eliminated.

- The noise pollution of the salt-marshes at Kolungen could potentially be corrected if work along the existing road becomes necessary.
The Skara–Vara Plain character area. Panorama over the highly cultivated farmland where solitary farmhouses lie sheltered by the only vegetation that remains. Painting Emily Wade.
4.5 The Skara–Vara Plain

The most important characteristic of the Skara Plain is its vast expanse. This is one of the most open plains in the region. Its nickname is “pancake plain”. The flat to undulating land, mainly consisting of clay, is surrounded by moraine hills. The plateau mountains of Kinnekulle and Billingen create dramatic silhouettes from afar.

The Skara–Vara Plain is dominated by intensive large-scale farming of the land. The plain changed significantly during the agrarian reform of the 18th–19th centuries. The resulting relocating of farms, drainage, hay-making and artificial fertilization created opportunities for large-scale exploitation. Continuous rationalization in this intensely cultivated countryside has resulted in today’s industrialized farming.

Since the land reform the settlements are dispersed as single farms. Houses, trees and large outbuildings, e.g. large active stables, crowd onto islands of land in the cultivated landscape. Settlements also occur gathered into large towns such as Vara and Skara or smaller communities, such as railway villages that form a clear silhouette on the plain.

The intensely cultivated district of the Skara–Vara Plain has little enclosing vegetation or open ditches and is thereby highly depleted in biodiversity. The Lida drains the area and with its meandering tributaries forms shallow gently sloped and usually open depressions and valleys in the otherwise almost flat landscape. The small rivers with their surrounding vegetation corridors are one of the few outstretched elements linking the landscape ecologically. The wetlands are over-drained. As a result there is a lack of many natural environments that historically occurred on the plains, such as cultivated wetlands, cultivated meadows and pastures, tree environments, farmsteads, small biotopes, etc. The only small biotopes present in relatively large amounts are avenues and waterways, which have a connecting function for e.g. bats.

The roads are originally as a sparse network from the Iron Age, which was extended during the Middle Ages to run between the churches and later with straight land-reform roads leading to the partitioned farms which are very characteristic of some parts of the area. At an early stage the area had the most roads in the country. The Swedish Transport Administration has designated cultural roads in this character area, although none are land-reform roads.

The area has long historical continuity and a great time depth (traces of Stone Age settlements have been found at the smaller rivers, such as the Lid and Flin). The district has been of great importance from the Iron Age onwards, but the structures that dominate the cultural environment derive from the early Middle Ages when the area became Christian giving rise to a parochial structure and the large parcelled farms as well as the ongoing agricultural expansion. The medieval structures are readable throughout the area thanks to the many churches on medieval church sites. The area’s towns are among the region’s earliest. A rich and densely populated settlement district developed, based on the excellent soils for subsistence; a central district. The high density of roads and churches is a clear result of this. The railway network from the late 19th century was an important component of agricultural development facilitating the transportation of agricultural products for example for export from Göteborg. Associated with the railways, settlements often grew up around the stations and these often became larger than the old parish centres. Part of the character of the area is the abandoned railways with embankments that rise up in the landscape and station settlements that create a distinctive silhouette in the plain.
Every item that protrudes is a landmark on the plain, whether silos or church steeples – both of which are typical features of this agricultural plain – even the overhead telephone wires and road signs.

Agriculture is overpowering large-scale. The peripheral zones of the character area contain smaller-sized units where the plain is of more mosaic type.

The fine mesh of roads makes the vast landscape reachable by car. With its enormous fields and only a few enclosing features this landscapes offers little scope for recreational outdoor activities.
Development Trends
Rationalization of agricultural practices is constantly ongoing; the agricultural land is highly productive and costly. Farming units are merged, some single farms depopulated and abandoned. When buildings are demolished and the land turns into agricultural land, transparency in the landscape increases. This trend was begun in the 20th century and is ongoing. South and east of the E20 motorway, farm units are smaller and the tendency for abandoned farms is clearer. This is a character change from the cultural environment in which the erasure of clear agricultural development occurs.

In the continued development of large-scale agricultural units habitats for fauna and flora are becoming increasingly isolated and impoverished.

The number of grazing animals has decreased and is confined to fewer areas. In areas where agriculture is less profitable, especially at the edge of the plain, open land is converted to forest plantations or becoming overgrown.

The vast horizon of the plains landscape is being gradually changed with wind farms, e.g. in the Skara region.

The plains landscape of the Skara–Vara Plain consists of large flat areas bordered by a raised mosaic landscape.
Sensitivity

- This character area is a rationalized culture landscape; projecting overpasses, masts and wind turbines and high industrial buildings have high visual impact levels. They change the visual character. The plain is also sensitive to the use of hoardings for signage and road signs as well as for noise barrier measures.

- The landscape is sensitive to mergers into larger farming units if roads and farm settlements are removed. These are important parts of the character of the area; this amounts to a depletion of the visual character and loss of natural and cultural environments.

- The landscape is sensitive to overgrowth and regeneration that breaks up the wide vistas, since openness is one of the main characteristics of the area.

- The landscape is largely boundless in terms of visual directions, those limits that exist are caused mainly by soil types and land ownership boundaries. This contributes to a relatively good resistance to measures at ground level or below, even roads and railways. However, they can create barriers.

- The area is sensitive to measures affecting the clear pattern of the smaller road network, such as straightening curves in the land-reform road network or the winding medieval system. The continued rationalization in agriculture involves large machines which can place new demands on the smaller roads.

- The relationship between the railway towns and the road (the station road) is important. Sensitive e.g. to changes at intersections or road patterns.

- The area is vulnerable to further loss of biotopes and therefore to actions and operational measures that affect the meandering waterways, tree lines and vegetation areas, roadsides and railway embankments.

- Since the meandering waterways offer the only wide dispersal corridors in the landscape, they are sensitive to the barrier effects. Bridges and passages need to be designed for high permeability to both animals and plants.

Tall structures such as sign-posts and bridges can become highly visible from afar.
Photo Bengt Schibbye.
Potential

- Look after the extensive openness and emphasize the grandeur it has to offer. On the flat plain, all protruding elements are eye-catching. This can be exploited to clarify the special character of the plain by, for example, creating outlooks to the surrounding mountains, churches, towns and waterways. Solitary trees or small groves can also create natural focal points where needed – for example, for road safety reasons.

- The pattern the smaller roads create is a strong feature of the area – the density of roads, the typical straight land-reform roads and road network between the churches. With changes and enhancements, the effects on these qualities of the area as a whole must be considered.

- In the large-scale highly industrialized agricultural landscape there is a shortage of tree screening, avenues, pools and wetlands that are important both as habitats and as dispersal paths for many plant and animal species, including those that are important to agriculture, such as pollinating insects and sphecid wasps. This offers the potential of linking up several areas with limited populations to thus increase the chances for survival of these species and create sustainable ecosystems. At the same time, new elements can alter the historical connections and the area’s open character. Active action can strengthen the landscape’s biological infrastructure, clarify its cultural features and strengthen the character of the landscape. It is important where these are located and how they are designed to satisfy functional and landscape values.

- The plains landscape is difficult to access for outdoor recreation. Increased planting of tree screens, care of disused railway embankments can increase accessibility. The historic railway lines that run across the plain link the communities in a different direction than the roads. The finely meshed road network has the potential to increase access by bicycle.
The Kåkind Plain character area. The patchwork effect of the mosaic-like plain in the neighbourhood of Töreboda. Lake Östan lies on the left and the curving River Tida crosses the straight line of the railway to Skövde. Painting Emily Wade.
4.6 The Vadsbo–Kåkind Plain

This character area comprises the Vadsbo and Kåkind Plains with the upper Tidan valley and lies between the Hökensås fault, Tiveden forests and Falbygdens hill landscape at 60 to 70 meters above sea level. The plain is surrounded by faults on the east and west that create sharp slopes and escarpments. The basis is almost wholly flat “sub-Cambrian peneplain” that leans slightly to the north. This Archaean rock characterizes all the plains of Västergötland. The Västergötland plateau mountains stand on the surface of this primitive rock, and are all much younger. Billingen is ever present as a background drop to the Kåkind Plain. In the north and south, the peneplain has cracked, creating the mosaic and rift-valley landscapes that surround the character area. Most of the area lies below the highest coastline and is therefore covered by sedimentary soils.

Because of the large terrain formations, most of the plain has a clear north-south direction, where the large, open flatland is interspersed with gently undulating forested sections. To the south, large areas are covered by forest with open bogs and wetlands on the moraine, while other areas are dominated by cultivated sandy and clay soils. North of Tidaholm grazed wetlands are a characteristic of the area, while the rivers Yan, Osan and Tidan meander through the shallow clays. The plain contains even smaller brooks and open ditches. Several large lakes, Ymsen, Östen, and Viken. Göta Canal crosses the northern part between Sjötorp and Karlsborg. Göta Canal is lined with trees, an important key element in the landscape that also creates orientation.

During deglaciation, moraine ridges formed in the east-west direction in the central part of the area, which created a mosaic-like plain. Here the calcareous soils that occur south of the plateau mountains – a result of the ice flow – are missing. The forest area served as a district boundary between Vadsbo and Kåkind during the Middle Ages. Another medieval border region still dominated by forests lies south-east of Skövde, between the districts of Kåkind and Vartofta.

Land-use shows great variation in the character area, a combination of cultivated fields, pastures with animal husbandry and forestry. The arable land on the Vadsbo Plain has increased in size through extensive lowering of lakes and damming measures. The area has many churches mainly concentrated in the central Vadsbo Plain. The area’s historical administrative division into the districts of Vadsbo, Kåkind and Vartofta is still apparent.

Settlement structure is characterized by small- and medium-sized villages, with some larger villages on the ridges. Compact village settings as well as older farm and croft environments from the 19th–20th centuries still survive within the character area. The settlements have a varied character, combining influences from both north and west with many local features. Single farms occur mainly on the outskirts of the plains and in the forest districts. The many manor houses, particularly to the north and the south, have their foundation in the early manorial system. In the late 20th century, the national defence forces claimed large areas of land south-east of Skövde. Many of the earlier agrarian settlements here are now largely obliterated.

The regional road network has an older structure orientated around the major focal points. The most important roads are the E20 passing through the character area north-east of Mariestad and the main roads, 26 and 49. The modern main roads break this pattern, and avoid the populated, open, plains. Therefore from a car the landscape is perceived as more dominated by forest than it really is. The Swedish Transport Administration has identified a number of roads in the character area as cultural roads. Most of these, including the greatest historically variety, lie in the character area’s outskirts. The central plains contain only a few cultural roads.
The north-south forest areas that delimit the character area to the west and east are very important dispersal corridors for wildlife – indeed probably the most important in all of southern Sweden, along with Hökensås since they link together the forestlands of Svealand and those of Götaland. Gap analysis for wildlife show that the barrier effect of the road system is relatively limited (see map on page 118), which means that the wildlife corridor probably has a beneficial function. The wildlife corridor over the Kåkind Plain coincides with the old district boundaries. The Vadsbo–Kåkind Plain differs from the other plain districts in Västra Götaland in that animal husbandry and grazing are common occurrences. On a regional scale, there are two major concentrations of biologically rich cultural landscapes. One is the Bohus coast and the other Falbygden, the Valle district and parts of the Kåkind Plain (see map on page 111). The character area in the north encloses a biologically rich farming countryside around Lake Östen. It includes water meadows and a rich bird population. The area is not disturbed by noise. The high-value tract is related to the Valle district’s unique arable landscape. In the southern part of the Kåkind Plain, from Tibro to Tidaholm there is a corridor of cultivated land with a high concentration of pastures containing high biodiversity. This corridor connects to the Falbygden high-value tract.

The Vadsbo–Kåkind Plain also includes the water systems of the Tidan where the outflow area around Lake Ymsen has been particularly singled out for its biological richness (see map on page 115). These small rivers are a characteristic of the plain and often meander along slowly. In themselves, they form dispersal corridors but unlike other plains, that in Vadsbo–Kåkind contains a greater extent of other major corridors than just along watercourses. North of Tibro there are larger broadleaved forests that together make up a high-value tract. The area’s valuable natural environments such as broad-leaf forests, wetlands and bird lakes are almost totally without noise disturbance from road and rail.

Thanks to the area’s mosaic nature its prehistory appears more clearly in the landscape than on other plains in Västra Götaland. The whole character area contains many fossil field landscapes from prehistoric times and the Middle Ages. Variations in land use and the long continuity of farming have resulted in significant local variation and a diversity of different types of ancient monuments, where a greater proportion of antiquities have survived destruction by cultivation. The Vadsbo Plain has an extensive time depth with several Stone Age settlements and one of Västergötland’s largest Bronze Age cairns. Iron Age remains in the central
have similarities with Svealand with large mounds and cemeteries adjacent to settlements on ridges, for example, the Askeberga ship-setting. The Vadsbo–Kåkind Plain is a significant Iron Age district, while the Tidan Valley has remains from both the Bronze Age and Iron Age. This character area has a tradition of many ancillary livelihoods besides agriculture. As early as the Iron Age iron was produced, as shown by remains from low-tech iron production in the Vadsbo Plain and Kåkind Plain. People eked out incomes by smithing and woodcrafts, forest products, delivery services and milling. Ancillary livelihoods set the conditions for industrial establishments in, for example, Tibro (furniture) Töreboda (wood and mechanical industry) and Tidaholm (furniture and wood).

In the Middle Ages the area functioned as a central district as illustrated by the many churches and the presence of defended homes and large estates, including Ymseborg. Skövde and Mariestad were two important nodes in the area, since their founding in the Middle Ages and again in the 16th century. Tidaholm is a former railway station community that grew into an industrial centre and town in the early 20th century. Töreboda, along the southern main railway line, and Tibro along the line between Skövde and Karlsborg, are two station communities that became towns and are today central places in their respective municipalities. Göta Canal has also had its impact on communications and transport. Architecturally formal landscape elements include such as avenues of trees and building works such as the canal itself with associated buildings designed by Nyström.

**Development Trends**

Industrial agriculture is conducted in the central plains Slight tendency for over-growing of pastures.

The mosaic structure of the plain means that merging into larger operating units does not affect the character area in the same way as Skara–Vara Plain. Possibly shelter-belt planting and open waterways reduces during merges.

**Sensitivity**

- The local differences in the character area are unusually large for a plain. This means that the conditions for different measures vary widely. It is more difficult to develop general guidelines than in more uniform plain landscapes.

- The area consists of a mosaic landscape with a great variety of soils, vegetation and cultivation. This means that the area has a relatively small-scale structure that contains many and varied character elements with significant local differences. Its mosaic nature in itself is has a stabilizing effect. Here it is less profitable to invest in large-scale farming or forestry, and thus totally alter the landscape. For this character is to continue in the future, variations in land use are important.

- There are many landscape features such as moraine hills, rivers and vegetation boundaries that make the area less sensitive to new infrastructure sites that project from the plain. High embankments could cause depletion of characteristic cultural and natural environments.

- For smaller installations such as overpasses, the moraine hills offer a good opportunity to make additions without affecting the character area, unlike other plains that are sensitive to projecting devices.

- The large contiguous forest areas that were previously border areas between districts are sensitive to new infrastructure and exploitation that blur the boundaries.
• National wildlife corridors are sensitive to new barriers to animal movement.

• The character type is a diversified plain with a use that varies from rational agriculture to small-scale forestry. The area is vulnerable to infrastructure that provides barrier effects and habitat loss for species dependent on cultivation. This is of highest relevance to infrastructure that cut through the high-value tract between Tibro–Tidaholm–Falbygden and the district of Östen–Valle.

• Meandering rivers and rapids with waterfalls are important dispersal corridors where relationships can be changed in connection with the carrying capacity measures or upgrading of road and rail.

Potential

• The Vadsbo–Käkind Plain is a mosaic-like flatland both in an “open-closed” relation and since it is crossed by the stretches of moraine. This provides a good opportunity for bridges at overpasses and linear elements to be built adjacent to heights without changing the landscape scenery.

• Construction of natural “holding tanks” for the road's surface water can increase the amount of aquatic habitats thus enhancing the biological infrastructure. Because the area has a mosaic structure the visual character or structure would not change if more wetlands were to be created.

• Maintenance and restoration of tree screens along the open ditches and roads have the potential to increase biological dispersal and enhance the ecological function and cultural dimension of the landscape.

• The high-value tracts associated with cultivated land offers good potential for species-rich roadsides that can increase the connections between pasture environments.
This chapter illustrates how the measures proposed in the latest long-term national and regional plan (2010–2021) can be assessed in relation to the character of the landscape. Environmental assessment is presented for two of the character areas previously described: the Bohus Coast and Skara–Vara Plain. It is shown that an environmental assessment becomes more anchored and useful if an expressed landscape policy exists – if society has formulated landscape development targets.

5. Environmental assessment – Västra Götaland

Section 3.10 explains the methodology of how integrated landscape character analysis can help in assessing environmental impact from infrastructure plans. In this chapter, the method has been tested on two character areas. The environmental assessment presented here is only a part of the overall environmental assessment that needs to be done before deciding to adopt a national or regional infrastructure plan.

5.1 The importance of targets

To assess whether the change proposed in the national and regional level plans is good or bad for the development of the landscape, whether it is a threat or an opportunity, we must know what we (society) want out of the landscape. Here one is dependent on targets formulated by several other actors in society.

This means that the targets for landscape development that exist e.g. for agriculture and forestry in the region, regional development, municipal planning, etc., need to be correlated. In this pilot project targets have been derived from environmental work in county in order to exemplify possible environmental assessments.

For future planning society needs to formulate targets for development within the character area /section of the countryside. These are processes that require the involvement of multiple parties, political support, etc., and have not been tested in this pilot. Targets should be of concern to the businesses and community development being planned for the landscape. Landscape targets are furthermore important to develop in dialogue with different user groups to get an anchored strategy for how to plan and implement the management and development of the landscape. The European Landscape Convention, particularly stresses this, but it is a challenge to do so on the regional scale.

5.2 Environmental assessment of the Bohus Coast character area

Targets for landscape development

Examples have been taken from the environmental target work for Västra Götaland County of general targets that affect the Bohus coast:

- Action programmes for natural and cultural environments adjacent to lakes and watercourses have been/must be established; in 2010 half of the designated environments must have received long-term protection.

- Planning must include cultural historical and aesthetic values. Västra Götaland County is rich in culturally and historically valuable settlement environments. Local building and construction traditions should be developed (Good Built Environment).

- Lakes, shores and watercourses of great value as natural and cultural attractions, as well as bathing and recreational assets, are safeguarded and developed on a careful and long term basis. Action plans for natural and cultural environ-
Including landscape in long-term spatial planning – Chapter 5. Environmental assessment

ments adjacent to lakes and streams have been / will be prepared and by 2010, half of these designated environments must have long-term protection (Living lakes and watercourses).

Examples of a concrete landscape policy target that can be formulated in consultation with users and authorities might be:

- To improve the accessibility of the attractive coastal landscape of Bohuslän / develop its character as Sweden's most attractive recreational landscape. For the infrastructure in the area, this means that new building and renovations must be done with great care of the scale and structure of the landscape, as well as avoiding new visual and functional barrier effects. The historic road network alignment and building elements linked to Bohuslän's stone-working tradition should be maintained.

Current measures in national and regional planning
During the period commuting between larger towns in the coastal belt and the E6 is to be facilitated. Route 5 is an example, leading from Lysekil past Uddevalla and further east to Karlsborg. This includes several specified measures such as road 161 Rotvik–Bäcken and the Torp Bypass. A bypass and various safety and accessibility measures have been suggested for road 168 from Marstrand. The region's large investment in pedestrian and bicycle traffic also means that new pedestrian and cycle paths are desirable along the busy roads out to the attractive fishing villages. Bicycle lanes will primarily be erected probably near built-up areas. The funds for the specific road safety measures and funds for Route 5 comprise relatively large investments that are not accounted for at all geographically on the regional plan. Other measures affecting the landscape may include commuter parking and the construction of roads for new residential or holiday home areas in completely new locations.

Sensitivity of the character area
Sensitivity is described in more detail in the previous chapter. The landscape character of the area in the west coast is particularly vulnerable for:

- breaks in scale in structure on the smaller scale, e.g. reconstructions to increase road safety by straightening curves.
- measures that break the present clear direction along the valleys from inland areas out to the coast, e.g. construction of new roads to settlement areas in new locations
- measures that make it more difficult to keep the land open – e.g. when erecting central rail barriers which impedes the passage of wildlife over the road
- increased barrier effects between subgroups – e.g. maintenance measures that remove dispersal opportunities along or across roads
- increased noise disturbance of shore meadows – e.g. because of traffic changes.

Environmental assessment
Insensitive alterations to the existing road network can change the whole travel experience for the coastal communities. The ability to reach one's goal may be impeded. The question of HOW rebuilding takes place is crucial. By paying attention to landscape scale and direction, to road networks relative to the settlements as well as limiting barrier effects, the risk can be reduced and one's goal can be achieved.

There is a high risk of breaks in scale with new and reconstruction work in the narrow valleys leading towards the outermost coastal band – e.g. the new pedestrian and cycle paths along the road network or road 168 past Tjuvkil. Sensitivity is smaller in the wider valleys in the interior.

Risk of habitat losses with road widening and new constructions – e.g. on Route 161 Rotvik–Bäcken.
New major traffic interchanges and commuter car parks can affect the visual character and cultural character negatively, and break the distinct structure – e.g. the renovation of the bus terminal at the Torp or new travel centre and commuter parking at Kungalv.

Potential to improve access to the attractive recreational landscape.

Potential to carry out road laying, rock blasting, retaining walls and other arrangements to maintain scale and structure.

Risk of hampering cultivation of open land (crops and pasture) when the existing road network changes, leading to changes in character since the high degree of land use is characteristic of the area. When barrier effects increase, transport across the roads is hampered, and thereby opportunities to cultivate small patches of land – e.g. the conversion of road 161 Rotvik–Bäcken to a 2+1 road with a central rail.

Risk of increased barrier effects and increased mortality with road widenings and higher speeds – e.g. the conversion of road 161 Rotvik–Bäcken to a 2+1 road with a central rail. The relationships between the small sub-populations can be broken.

Risk of overgrowing of valleys resulting in reduced views, which gives an altered visual and cultural character significantly reducing a road’s attractiveness.

Risk of eradicating characteristic features – e.g. disappearance of stone guards in connection with improving road safety.

Potential to exploit the local stonemason tradition when remodelling or building new road and rail environments, commuter parking, etc.

Potential for noise protection of valuable shore meadows, hayfields and grazing pastures, as well as broad-leaf forests.

Risk of change of character and broken relief when roads are being built in new locations since the cultural landscape and road pattern bears such clear relationship to the structure of the valleys.

Risk of ancient monuments on higher land disappearing should new buildings and infrastructure lay claim to these “non-traditional” locations.
5.3 Environmental assessment of the Skara–Vara Plain character area

Targets for landscape development
Examples of the general targets relating to the Skara–Vara Plain have been taken from the environmental quality work for Västra Götaland County:

• Planning must include cultural historical and aesthetic values. Västra Götaland County is rich in culturally and historically valuable settlement environments. Local building and construction traditions should be developed (Good Built Environment).

• Lakes, shores and watercourses of great value as natural and cultural attractions, as well as bathing and recreational assets, are safeguarded and developed on a careful and long-term basis. Action programmes for natural and cultural environments adjacent to lakes and watercourses have been/must be established; in 2010 half of the designated environments must have received long-term protection. (Living lakes and watercourses)

Examples of a concrete landscape policy target that can be formulated in consultation with users and authorities might be:

• Care of culturally significant landscape features: The Swedish Transport Administration must continue its work to ensure species diversity in road areas as well as cultural values and cultural elements of roads and railways, especially in plains. Methods should be developed in order to follow the development of natural and cultural values in the arable landscape. (A rich arable landscape)

Current measures in national and regional planning
During the period it is desirable to facilitate commuting between towns. Routes 4 and 5 affect the Skara–Vara Plain. Specific measures include the Lidköping bypass. Measures for pedestrian and bicycle traffic, commuter parking, etc. are under consideration for several places, although they are not yet specified or precisely located. On road 44 conversion to collision-free main roads with central rail, additional noise barriers and bridges are planned.

Sensitivity of the character area
The landscape of the Skara–Vara Plain character area is particularly sensitive to:

• measures that alter the visual character of the wide-scale openness of the landscape such as embankments, noise screens or elevated structures such as overpasses where the intersecting road is high – e.g. on road 44 where upgrading involves noise screens and refurbishment of bridges. Even hoardings for signage and other protruding elements have more impact here than normal.

• The dense road network is sensitive to actions that alter their medieval character (winding between the churches) or land reform features (running straight across the plain).

• The many railway towns are vulnerable to closure/neglect of rail/embankments and changed road systems (station roads) that constitute their characteristic features.

• The natural watercourses with surrounding buffer zones are almost the only corridors that exist for flora and fauna. They are sensitive to actions that alter species distribution and animal migrations.

• Roadsides, railway embankments, groves, tree curtains and small biotopes are important for biodiversity diversity; high sensitivity to habitat loss and disturbance of these – e.g. with changed operational measures that the Swedish Transport Administration control, but also the amalgamation of farms with continued rationalization of farming land.
Environmental assessment

The wide-scale openness of the Skara–Vara Plain makes it resilient to large roads and railways – so long as they are in keeping with the surrounding ground level. The plain, however, is sensitive to vertical elements, which are clearly visible in the flat and open landscape, and to the loss of the relatively few tree curtains, groves and aquatic available.

There is little risk that the measures along Route 5 will affect the landscape character.

There is a risk that actions that break the line of sight, as noise protection measures or tall structures also alter the visual character – e.g. road 44 where upgrading involves noise screens and refurbishment of bridges.

Risk of habitat loss if measures affect small biotopes, groves etc. which can lead to an impoverished flora and fauna – e.g. with changed operational measures that the Swedish Transport Administration control, but also the amalgamation of farms with continued rationalization of farming land.

Risk of erasure of natural and cultural environments – see previous point.

Risk of changed character of the existing road network – e.g. when the fine network is replaced by fewer roads because of rationalization of agriculture and the depopulation or improvement of roads to e.g. increase carrying capacity or accessibility.

Ponds and wetlands can be created to deal with large amounts of precipitation and retard the infiltration into the Vänern. Positioned correctly, they provide greater diversity in the otherwise biologically poor area.

Risk of changed cultural heritage character if shelter planting, avenues, ponds, wetlands are created in the wrong places. Opportunity to strengthen or emphasize the cultural character and context if the right places and designs are chosen.

Maintenance and restoration of tree curtains along open ditches and roads have the potential to increase the biological dispersal and enhance the ecological function of the landscape.

Overpass crossings that break the view over the plains change its visual character. Photo of the plains at Östgötaslätten, Skänninge; Bengt Schibbye.
Risk of increased disturbance of valuable grazing land with altered traffic features and new constructions.

Risk of increased fragmentation by barrier effects in the construction of bridges and culverts, upgrading of bridges and erosion shields

Potential to transform farm environments in an area that is being converted from agriculture to a service society. It would maintain the settlement’s historic location in the landscape, creating greater living qualities, reducing the number of dilapidated houses and provide opportunities to strengthen links between farm communities with the help of e.g. bicycle paths.

Potential to emphasize the open aspect and grandeur through conscious management and design of road and rail environments.

Potential to utilize abandoned / old railway embankments as pedestrian and bicycle paths.