The Norwegian landscape reference system

- use of different sources as a base to describe landscape regions.

Oskar Puschmann.

Cover photographs: Oskar Puschmann.

Foreword

Interest in the visual qualities of the landscape has greatly increased over the last few years. This is apparent in the media and government reports, where attention is drawn to the different changes effecting the landscape with their various impacts throughout Norway. To meet these processes of change through sound management, more systematic knowledge is needed about the structure, resources, character and endurability of the landscape. In addition, more knowledge is needed about the processes of landscape change occurring over time due to different human activities.

With this as a starting point, the Norwegian Institute of Land Inventory (NIJOS) is now building up a 'National landscape reference systems' where one of the objectives is to meet the increasing demand from public administration to consider the landscape as a resource in its own right. The project is financed with external project funds from, amongst others, the Ministry of Agriculture, the Ministry of the Environment and the Ministry of Trade and Industry. The aim is to complete the work of describing all 444 subregions of the country by the end of 2002. By 01.07.1998 a draft proposal describing approx. 60 subregions was completed, these being mainly central landscape regions in the east, plus all subregions in landscape region 31 'Lofoten and Vesterålen.

This report shows how NIJOS's 'National landscape reference systems' is built up; both the baseline data being used to describe the landscape and the methodology used to describe the individual landscape regions and subregions. The report is written by project manager Oskar Puschmann, while all map illustrations are made by geographer Roar Lågbu. The English translation is by Inger Marie Larsen and Isobel Harrison.

Ås, 18th August 1998.

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Director.

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Project manager

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1 Introduction

The landscape mapping conducted by the Norwegian Institute of Land Inventory (NIJOS), is based on a method developed by the US Forestry Service, adapted to Norwegian conditions by Prof. Magne Bruun at the Institute of Landscape Architecture at the Norwegian Agricultural University (NLH), and presented in the project 'Countryside Management and Planning' (Nordic Ministers Council, 1987). Since then NIJOS, in consultation with Prof. Magne Bruun, has further developed the method into a national landscape reference system, dividing the landscape into three different geographical levels, *landscape region, subregion* and *landscape area*. Of central importance are the *three-dimensional contents* of the landscape, and the interaction between the natural and cultural factors, which shape and comprise the visual impression of the landscape.

The three-dimensional classification of the landscape is based more on a multidisciplinary understanding and holistic evaluation, than on traditional science and cartography. Studying the six main components of the landscape is important in three-dimensional landscape mapping, while the relative importance of individual components varies between the different landscape regions.

In 1997 the landscape section at NIJOS, started a project aimed describing all 444 subregions of the country as part of the process of establishing a national landscape reference system. The use for such a reference system was especially apparent when the Ministry of Environment decided to establish a national area-documentation-programme called 'AREALIS'. This programme wanted to also focus on landscape as a thematic theme among others and the Ministry chose to use the hierarchical approach for landscape classification.

As a baseline to describe the subregions in the national landscape reference system, NIJOS has chosen to use many different national or regional thematic maps and data bases which can give relevant information about the landscape character of the subregions. The purpose of using these sources is to make sure that each subregion within the same landscape region is interpreted and described using the same approach and the same base data.

This means that analysis of, for instance the landscape component *agricultural land,* to a much greater extent than before, can be linked to data from *Agricultural cadastral*-register and the *Application for agricultural support*-register. This report illustrates the methodological processes involved in this

Illustration: In many places, agricultural land in interplay with the major landform and the natural vegetation of the landscape is crucial for the visual impression of the area. In addition, the different forms of agriculture play a major role in giving the landscape its character. In the national landscape reference system developed by NIJOS, these factors are taken into consideration when describing subregions. The photos show how both different landforms and agricultural production can create different landscapes. On the left: cereal production, Stange Vestbygd (Hedmark county); on the right: grass production, Liagardane in Ål (Buskerud county).

2 Division into landscape regions and subregions

The classification of landscape regions used by NIJOS is based on the project 'Countryside Management and Planning' (Nordic Ministers Council, 1987). In this project Norway was divided into 30 landscape regions. This was increased to 43 regions after 1990 when NIJOS took over the development of the national regional division (Scale 1:1 000 000.).

In 1993, NIJOS started dividing the landscape regions into subregions. This was done in meetings with representatives from all the County agricultural- and nature conservation departments and County cultural heritage departments. At these meetings, the borders of the subregions were adjusted on maps of scale 1: 250 000. The number of landscape regions was increased to 45 and divided into 444 subregions. The final map was presented in 1997, and revised in 1998.
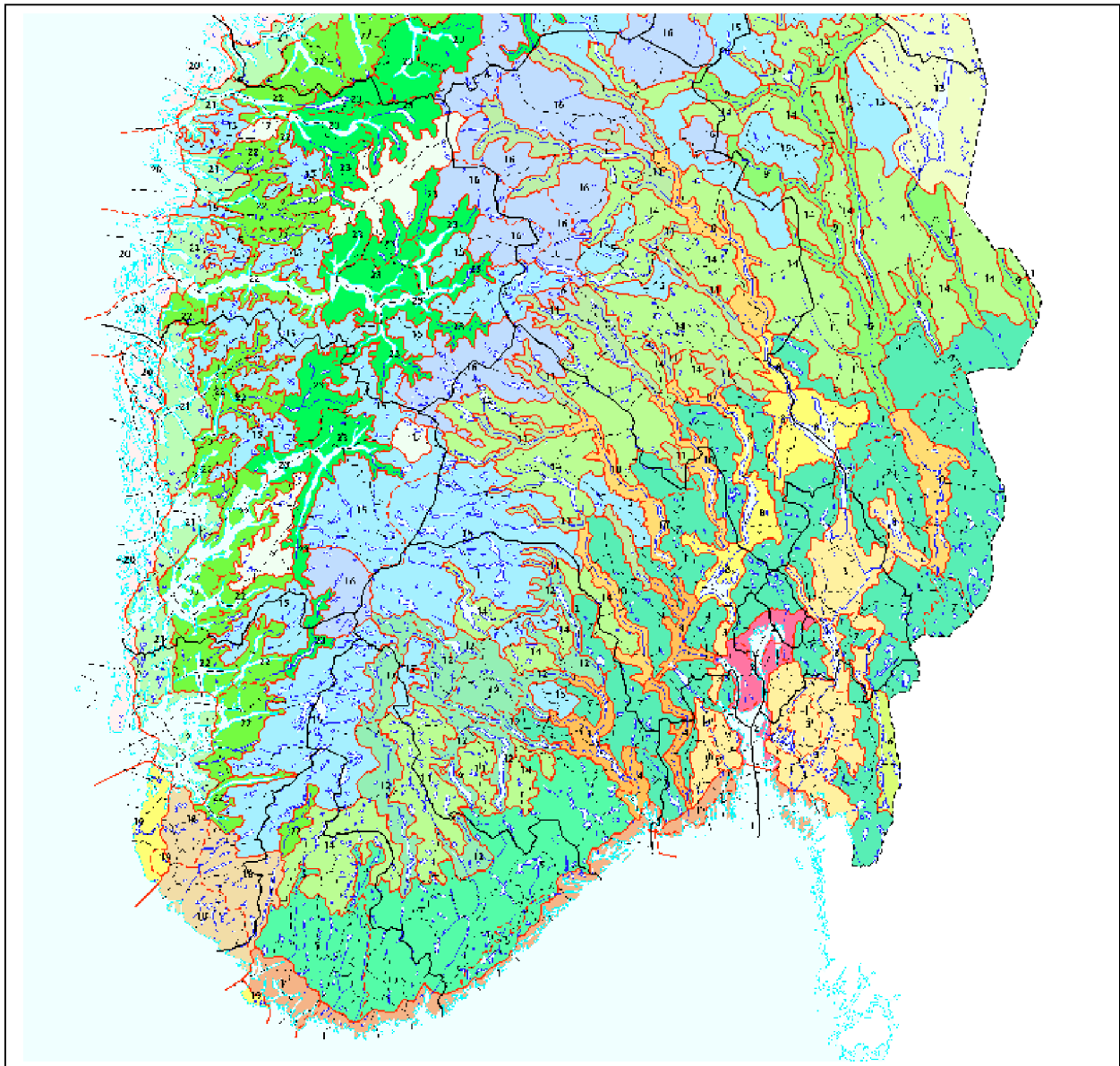

Figure 1. Section from map 'Landscape regions in Norway, with subregional division' (Elgersma 1996).

2.1. Hierarchical structure

Figure 2 illustrates the hierarchical structure of the landscape classification developed by NIJOS. The landscape regions form the foundations of the national landscape reference system, and are the basis for the classification of subregions at regional and county level. The subregions then form the basis for the division into landscape-areas at municipality level. This approach will increase the local awareness of whether different landscape qualities are common or rare at county level or in a national context. This hierarchical structure developed by NIJOS, is part of the Department of the Environment's project 'Area Documentation Programme using the Vestfold Model', which has been repeated in several counties.

Figure 2 uses Vestvågøy municipality as an example to illustrate the hierarchical classification structure. Vestvågøy lies entirely is within landscape region *31 Lofoten and Vesterålen*, which consists of nine subregions. The municipality is covered by four subregions; *31.05 East Lofoten, 31.04 Agrarian settlements of Vestvågøy and Gimsøy, 31.07 Outer side of West-Lofoten* and *31.08 Inner side of West-Lofoten*. What makes Vestvågøy different from other municipalities in region 31 is the presence of large agricultural areas in the centre and at the fringe of the island.
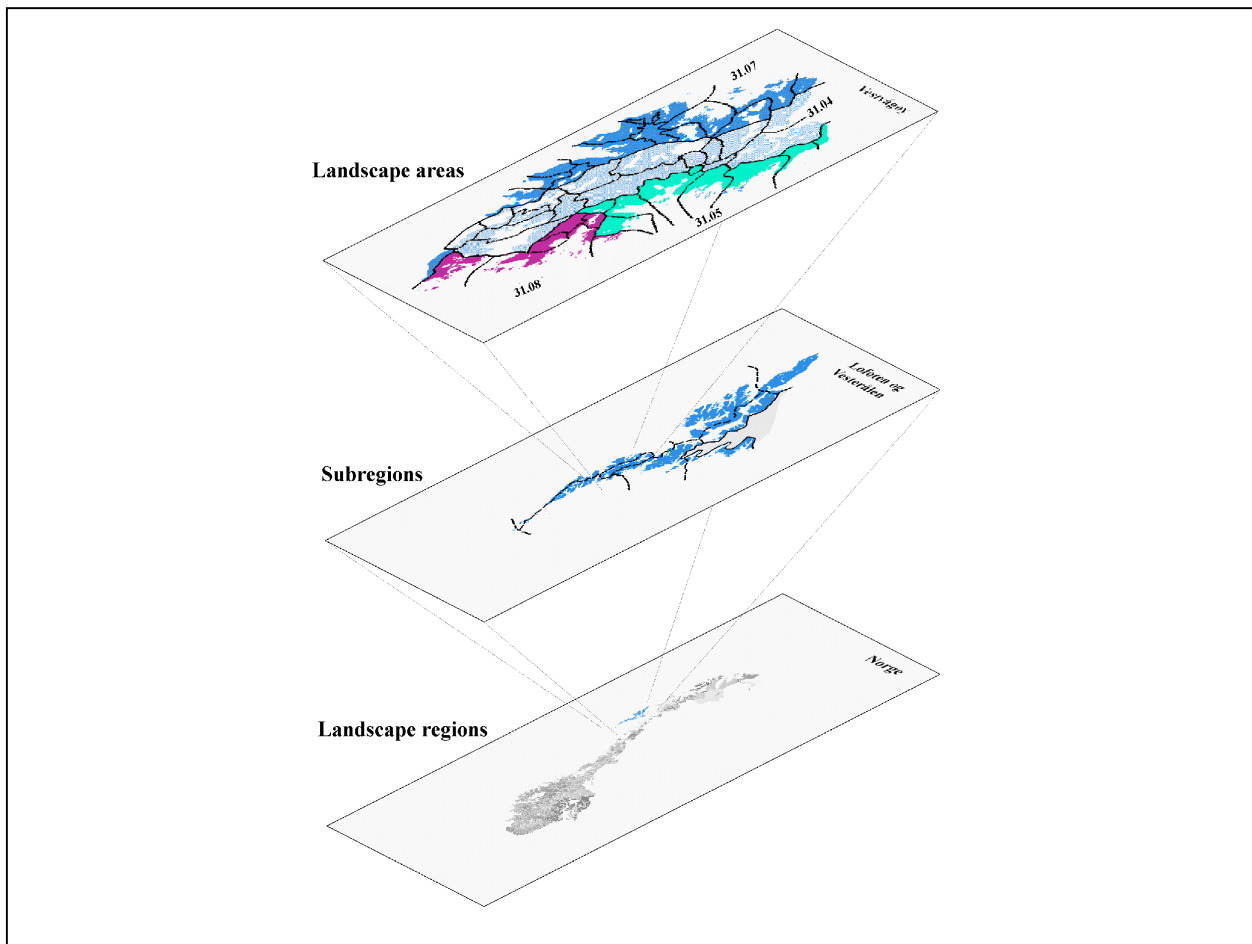

Figure 2 illustrates how NIJOS's hierarchical reference system for landscapes will be built up. At the national level, Norway is divided into 45 landscape regions, which again are divided into 444 subregions at the regional/county level. At municipality level, the subregions can form a basis for division into landscape areas.

2.2 Landscape components

The 'building bricks' for all three levels of division (landscape region, subregion and landscape-area) are six landscape components which together describes the landscape-character. These components are *1) the major landform, 2) geological composition, 3) water and waterways, 4) vegetation, 5) agricultural land use*, and *6) buildings and technical installations*. When describing the subregions, each landscape component is described by analysing the most recent thematic maps and/or data registers. All the maps/ registers used have to be national or regional to be able to compare different subregions within the same landscape region. As an example different national or regional quaternary and geological maps are used to describe the landscape component *geological composition* and the N 50 series to describe *the major landform* and *water and waterways*. To describe *agricultural land* the N50 map series is used, together with a series of maps called 'The Agricultural Production Basis' (scale 1:250 000); in addition, various thematic maps are derived by using map co-ordinates to link the *Agricultural cadastral register* and the *'Application for agricultural support*-register. To describe the distribution of *buildings and technical installations,* the building register *Norwegian Properties*, regional road maps and the N50 series are used.
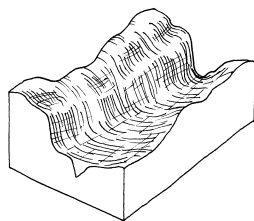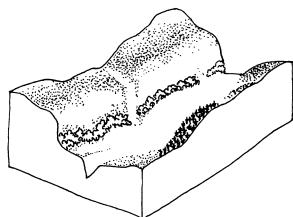
Major landform
The dominant form of
the landscape
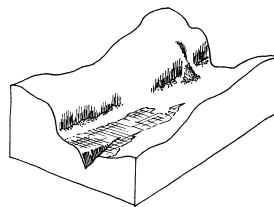
Geological composition
Bedrock and deposits,
Adding geological details to
the major landform.
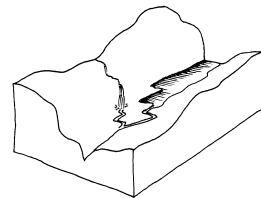
Water and waterways
Lakes, fjords and sea.
Streams, rivers and waterfalls.
Water surface and coastline.

Vegetation patterns
Natural, semi-natural and
managed vegetation.
Structures and mosaics.
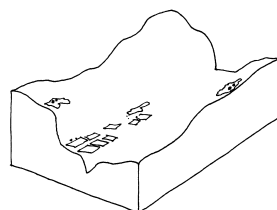
Agricultural areas
Land suitability for agricultural
and land use. Meadows, fields
and pastures. Outlying fields.
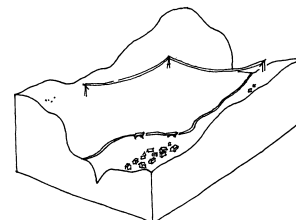
Buildings and technical installations
Towns and villages, scattered settle-
ments and industry. Linear structures
and road networks.

Landscape character
Together these landscape
components comprise a complete
picture of the landscape.
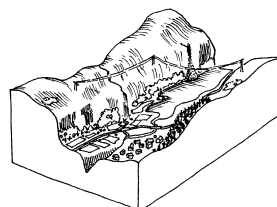
(Ill: Gaute Sønstebø, NIJOS 1993)

Figure 3. When describing the subregions, each landscape component is described by analysing the most recent thematic maps and/or data registers.

3 The use of national thematic maps to describe the natural bases

The following pages provide examples of how NIJOS uses different national thematic maps and data registers to give a comprehensive, analytical description of the subregions of the country. All the maps used are from Mjøsa-Randsfjorden: an area with two large lakes, in the central, eastern part of the country.

3.1. Description of the components 1) major landform and 2) geological composition.

Figure 4 shows a simplified geological map, which is used to describe the component *major landform*. In this context it is not only the types of rock that are important, but also their visual appearance in the landscape. The way they form the landscape will depend on hardness, fault lines etc. To be able to connect this information to the description of vegetation and agricultural land, it is also important to separate areas with nutrient-rich bedrock from nutrient-poor areas. Quaternary maps are used in a similar way to describe *geological composition*.

Boundary of regional landscape
Boundary of subregional landscape
County boundary
Municipality boundary

Datakilde: Berggrunnskart over Norge,
Landskapsregioner med underegioninndeling, oktober-97

7. Forest districts of East Norway
8. Lake and Silurian districts of East Norway
10. Lower valleys of East Norway
11. Upper valley and highland settlements in Oppland and Buskerud
14. Northern boreal forests in South Norway

Granite - basement rocks
Gneiss - basement rocks
Quartz sandstone, eocambrian
Dolorites, caledonian
Arckose, cambro-silurian
Mudstone, cambro-silurian
Shales, cambro-silurian
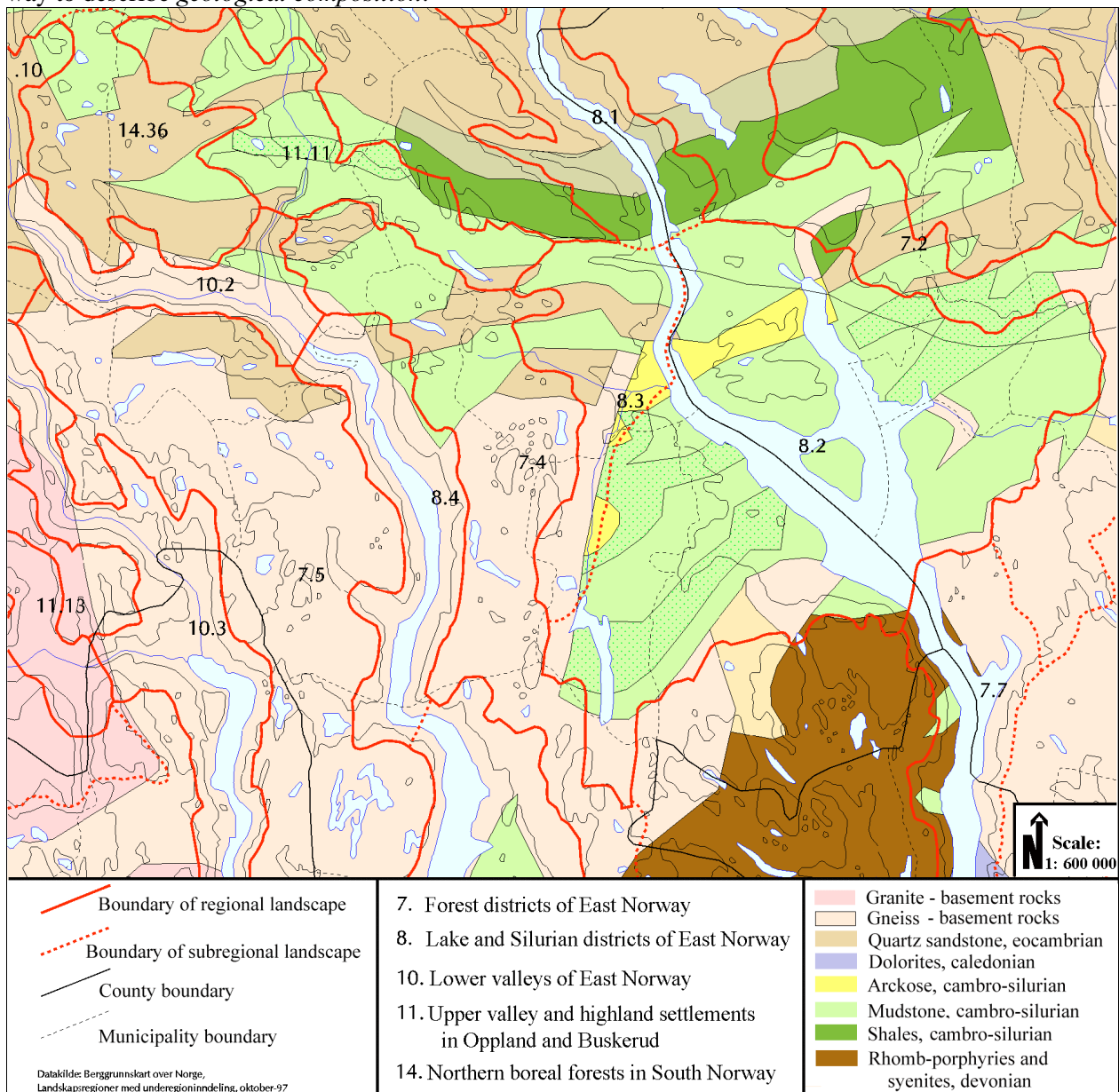Rhomb-porphyries and syenites, devonian

Scale:
1: 600 000

Figure 4. Landscape regions and subregions, overlaying a simplified geological map.

3.2 Description of the components 3) water and waterways and 4) vegetation.

Since the subregion is quite a 'coarse' geographical unit (presented on maps scale 1: 250 000) NIJOS use mainly the N50 series of maps to describe the landscape component *water and waterways*. This series of maps has sufficient level of detail to give an overview of the size of tarns and lakes, and the drainage areas of streams and rivers.

It is more difficult to describe the landscape component *vegetation* for a geographical area as large as the subregions, since there are no national maps covering this theme. Therefore, as a basis for interpretation of the vegetation in each subregion, *'Vegetation regions in Norway'* (Dahl, et al. 1986) and the map series *'The Agricultural Production Basis 1:250 000'* (NIJOS) are used. Additionally, the map series N50 is used to aid the interpretation, with contour lines and aspect providing good indicators of the local vegetation. The N50 series also shows boggy land.
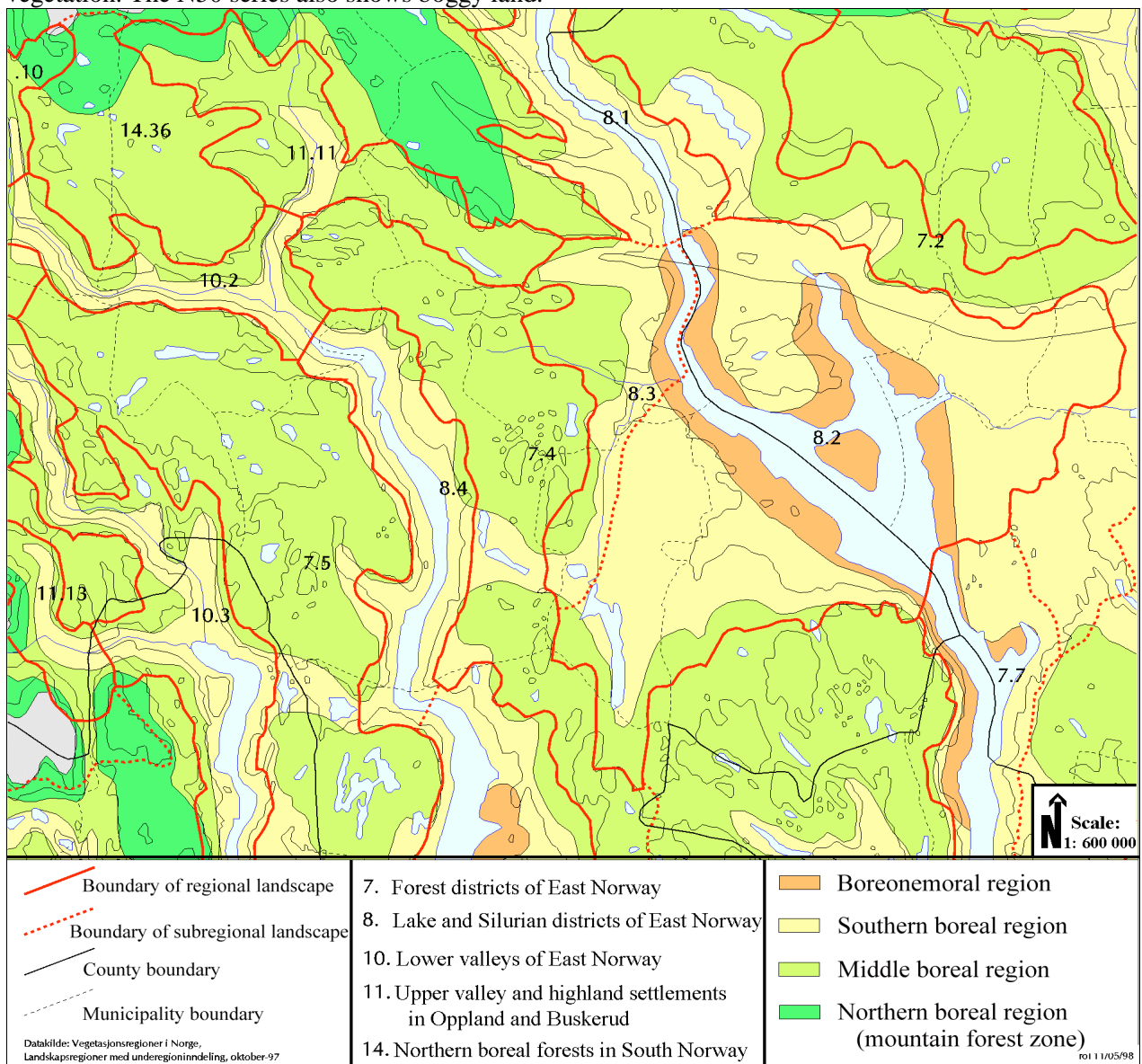

Figure 5. Map section showing landscape regions and subregions, overlying vegetation regions (Dahl, et al. 1986).

4 Use of the production subsidy register to describe *agricultural land*

Agricultural land is a component that greatly contributes to increased variety and contrast in the landscape. Since agricultural land is distributed very unevenly in Norway, a landscape reference system should show where and how the agricultural land is important for a region. To illustrate this NIJOS has developed thematic maps based on connecting the *Agricultural cadastral*-register and the Norwegian National Grain Administration's *Application for agricultural support*-register.

4.1 Agricultural land as percentage of the total area in subregions

Even though only approx. 3 % of Norway's total land area is agricultural land, there are great regional differences. To describe the distribution of agricultural land, a thematic map has been drawn showing agricultural land as a percentage of the total area in each subregion. This also indicates whether a landscape region should be considered as an agricultural region or not.
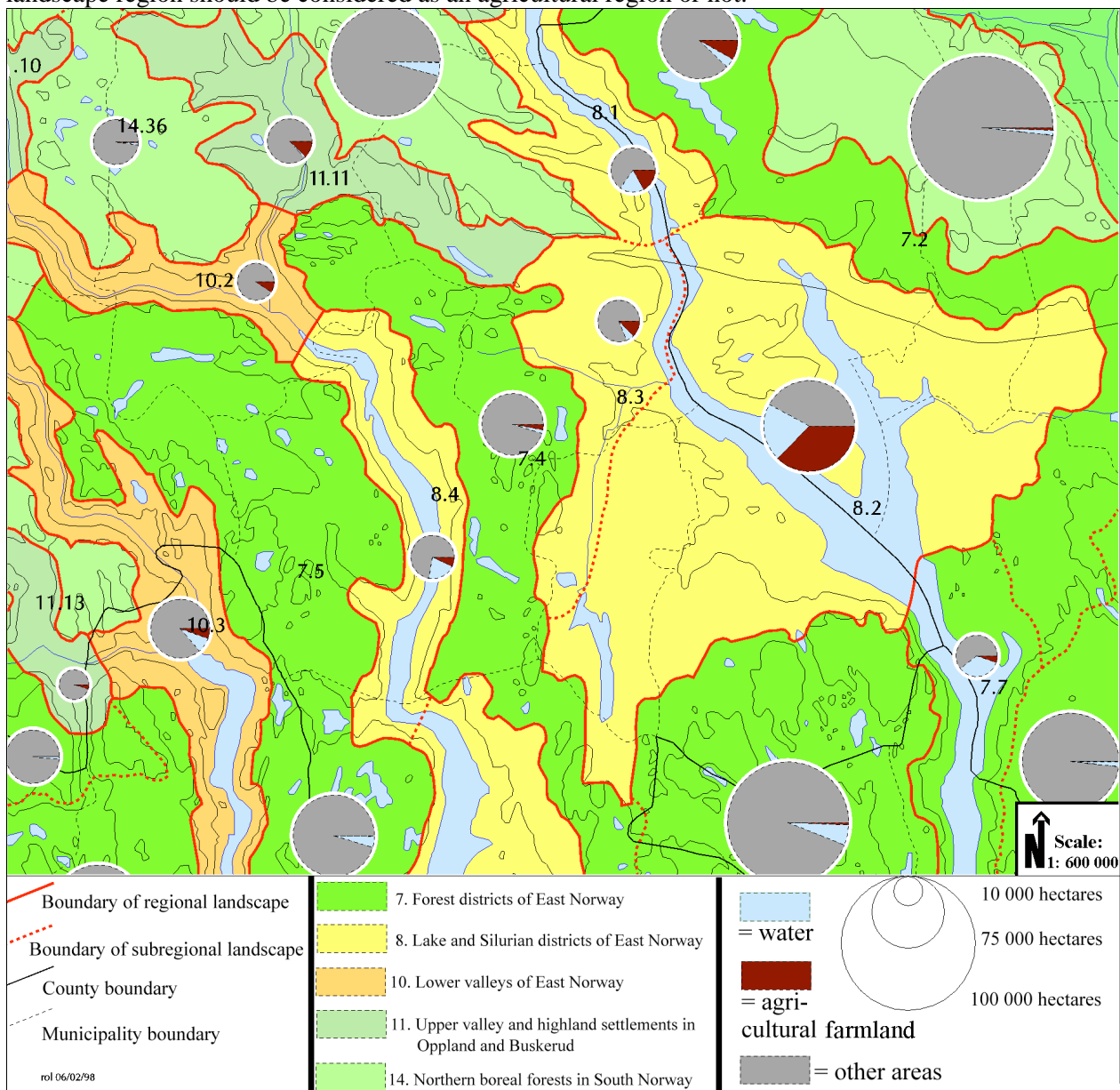

Figure 6. Agricultural land as a percentage of the total area in each subregion. All the thematic maps are prepared by connecting the *Agricultural cadastral*-register and the *Application for agricultural support*-register (from 31.07.96).

4.2 Distribution of different crop types per subregion

In addition to information outlined in section 4.1, it is also important to visualise the type of agricultural production dominant in each subregion. Different forms of agricultural production like animal husbandry, fruit or cereal production will influence the landscape in very different ways.

Figure 7 shows the distribution of different crop types per subregion. Using information from the register *Application for agricultural support*, area for agricultural land has been divided into seven crop types: cereals, grass, oil seeds, fruit/berries, vegetables, potatoes and 'others'. The size of each circle is proportio-nal to the area of agricultural land in the subregion. The map shows subregional differences in agricultural produce within the same landscape region (e.g. in region 8), but also clearly illustrates the difference be-tween landscape regions (e.g. between region 8 and 11). At a national level, this kind of produce-map can give information about which subregions are, for instance the main areas for fruit and berries production.
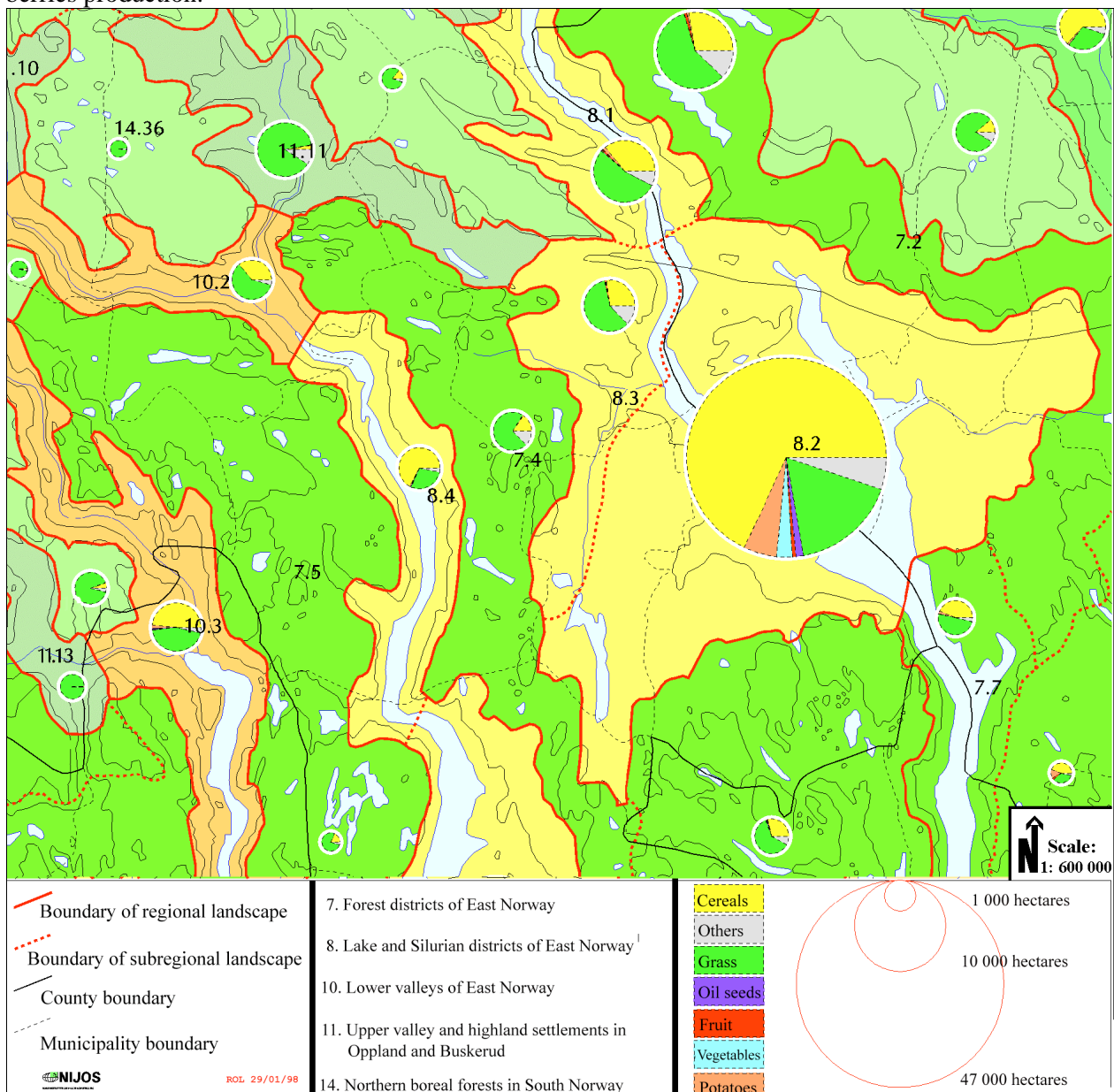

Figure 7. Distribution and area of different produce per subregion.

4.3 Cereal production per farm.

Figure 8 shows how data from the *Applications for agricultural support* register can be used to illustrate the importance of different produce for the local landscape character in each subregion. Each circle represents one farm, and the map shows the geographical distribution of the cereal farms in the subregions, and the area of arable land for each farm. The map also shows how the farms with cereal production in landscape region *8, Lake and Silurian districts of East Norway* (in yellow) are concentrated in subregion *8.2, Agrarian settlements in Toten and Hedemarken*, while more dispersed in the other subregions of the same landscape region.

The map also shows contrasts with other landscape regions like *11, Upper valley and highland settlements in Oppland and Buskerud* (light green) where there is hardly any cereal production. This underlines the major difference in landscape character between the two regions.
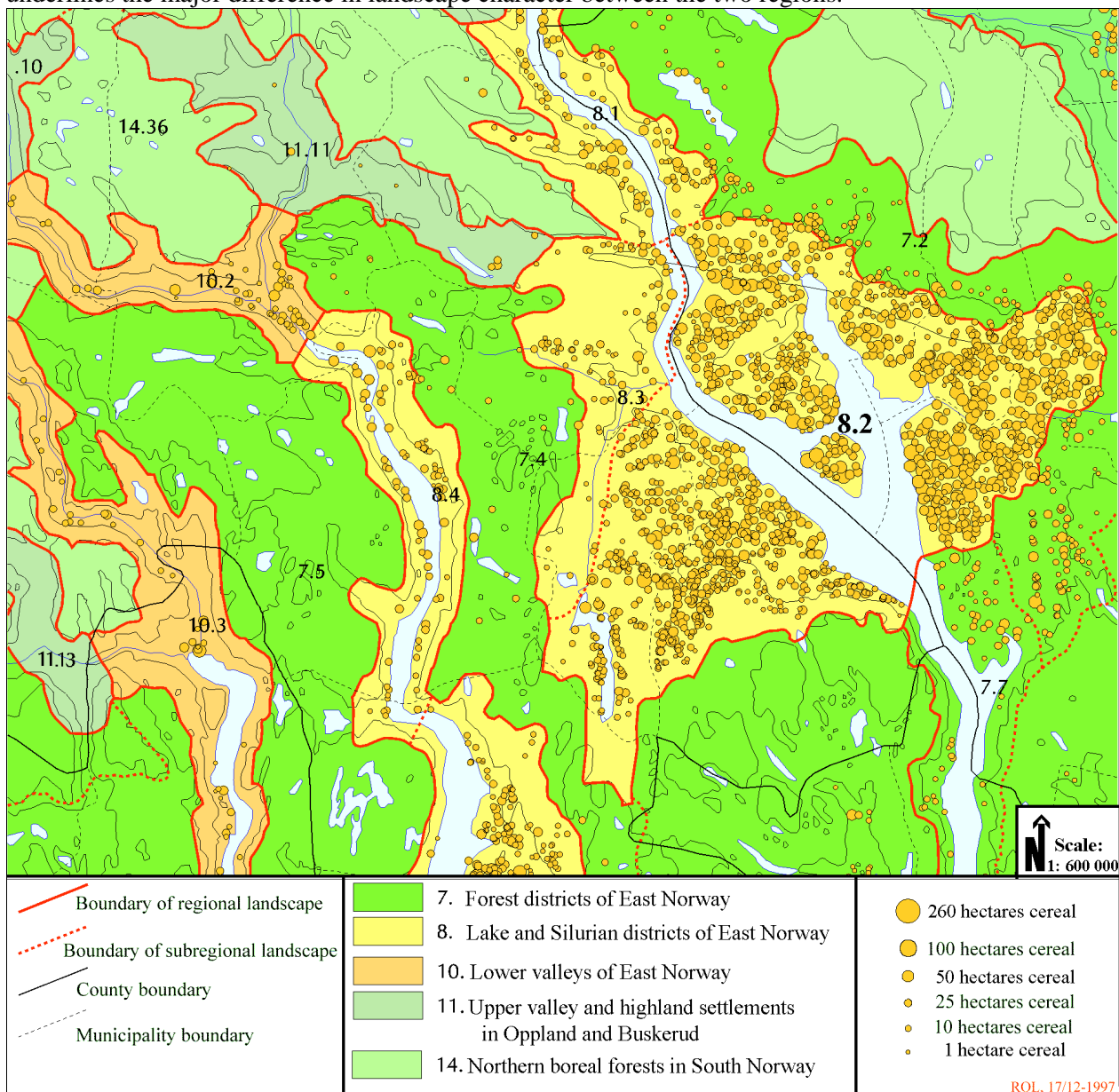

Figure 8. Cereal production per farm, compiled by combining farm-co-ordinates in the *Agricultural cadastral*-register with data from the *Application for agricultural support*- register (31.07.1996).

4.4 Grass production for cutting and pasture per farm.

The map section below illustrates a form of agricultural production which creates a different landscape character from that shown in figure 8: grass production for cutting and pasture. Cereal production is often more area intensive, while grass production is more extensive, less dependent on climatic conditions and often has a higher biological diversity. The map shows that grass production is evenly distributed in landscape region 8 (yellow), but not as common and widespread as cereal production.

More interesting is the dominance of grass production in some of the surrounding landscape regions, like for example region *7 Forest districts of east Norway* (dark green). These are the subregions with a higher degree of small-scale forestry (e.g. *7.2 Hill tracts of Hedemarken*) and not the subregions in region 7 with a more 'untouched' character (e.g. *7.5. Veståsen*). Another prominent feature is the dominance and density of grassland in region *11 Upper valley and highland settlements in Oppland and Buskerud* (light green). As figure 7 showed, grass is the main produce in these subregions, due to climatic conditions.
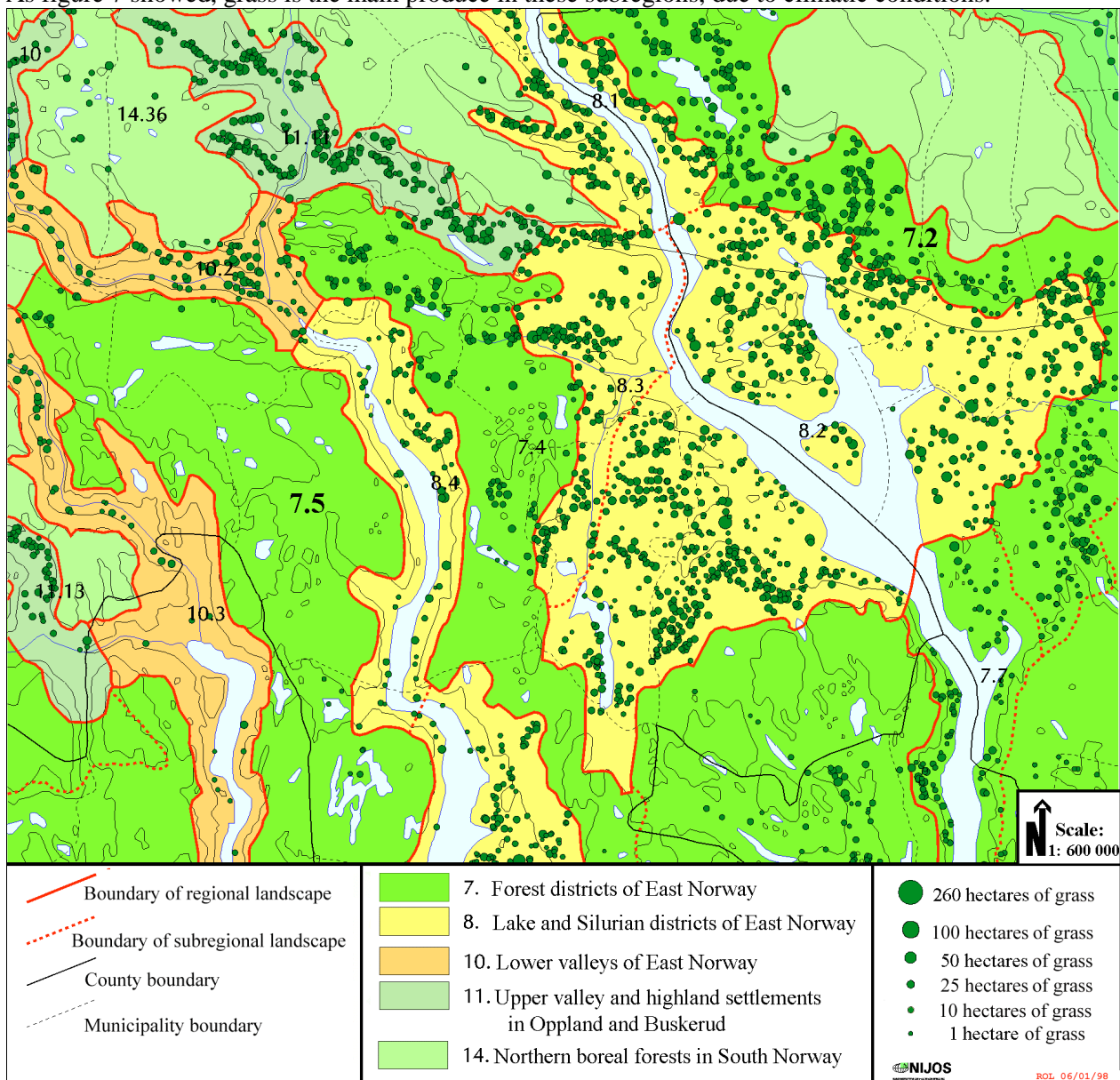

Figure 9. Distribution of farms with grass production for cutting and pasture.

4.5 Potato production per farm

Description of the landscape component *agricultural land* requires careful consideration of which crop types are of most significance. For example in subregion *8.2 Agrarian settlements of Toten and Hedemarken* potato production covers only 5% of the total agricultural land area. Is this then important to emphasise in the description? To answer this, NIJOS has also compiled several national maps of agricultural production by linking the *Agriculture cadastral-register* and the *Agricultural support-register*.

The national production map shows the geographical distribution of different types of agricultural production. By comparing this with the regional produce maps (figure 7) it is possible to assess the relative importance of for example potato production compared with other produce. The national map will tell that subregion *8.2 Agrarian settlements of Toten and Hedemarken* is one of the country's five main areas for potato production, which makes this significant information for the description. It is also important to illustrate the distribution of the 'potato farms'. Similarly the production of vegetables, oil seeds, and fruits and berries are analysed.
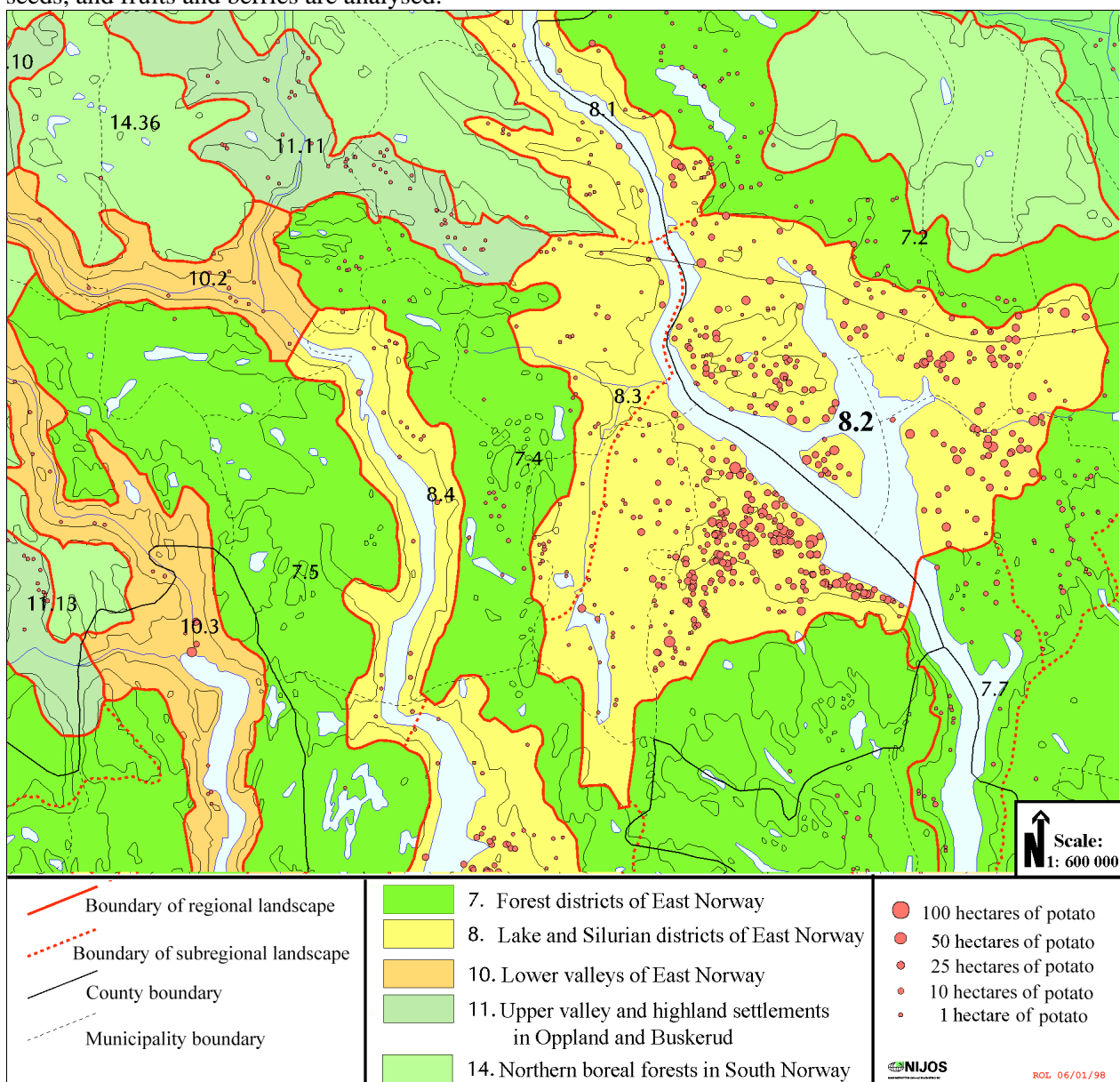

Figure 10. Potato production per farm.

4.6 Farm size assessed as agricultural area per farm

To assess the actual size of a farm using terms such as 'småbruk' (smallholding) and 'storgårder' (large farms) is difficult because the terms are used differently in different parts of the country. Figure 11 is a simplification showing farm size assessed as agricultural land per farm (including own fields + land rented from other farms).

As an overview, the map is a good indicator of what can be considered a large farm in different landscape regions, and it also shows subregional differences within the region. The map shows how subregion 8.2, the rich eastern side of the lake Mjøsa, has many large farms, such that a farm with 10-20 hectares of land is considered to be relatively small. However, a farm this size would be about average in subregion *8.4 Randsfjorden* and even relatively large in landscape region *11 Upper valley and highland settlements in Oppland and Buskerud*.
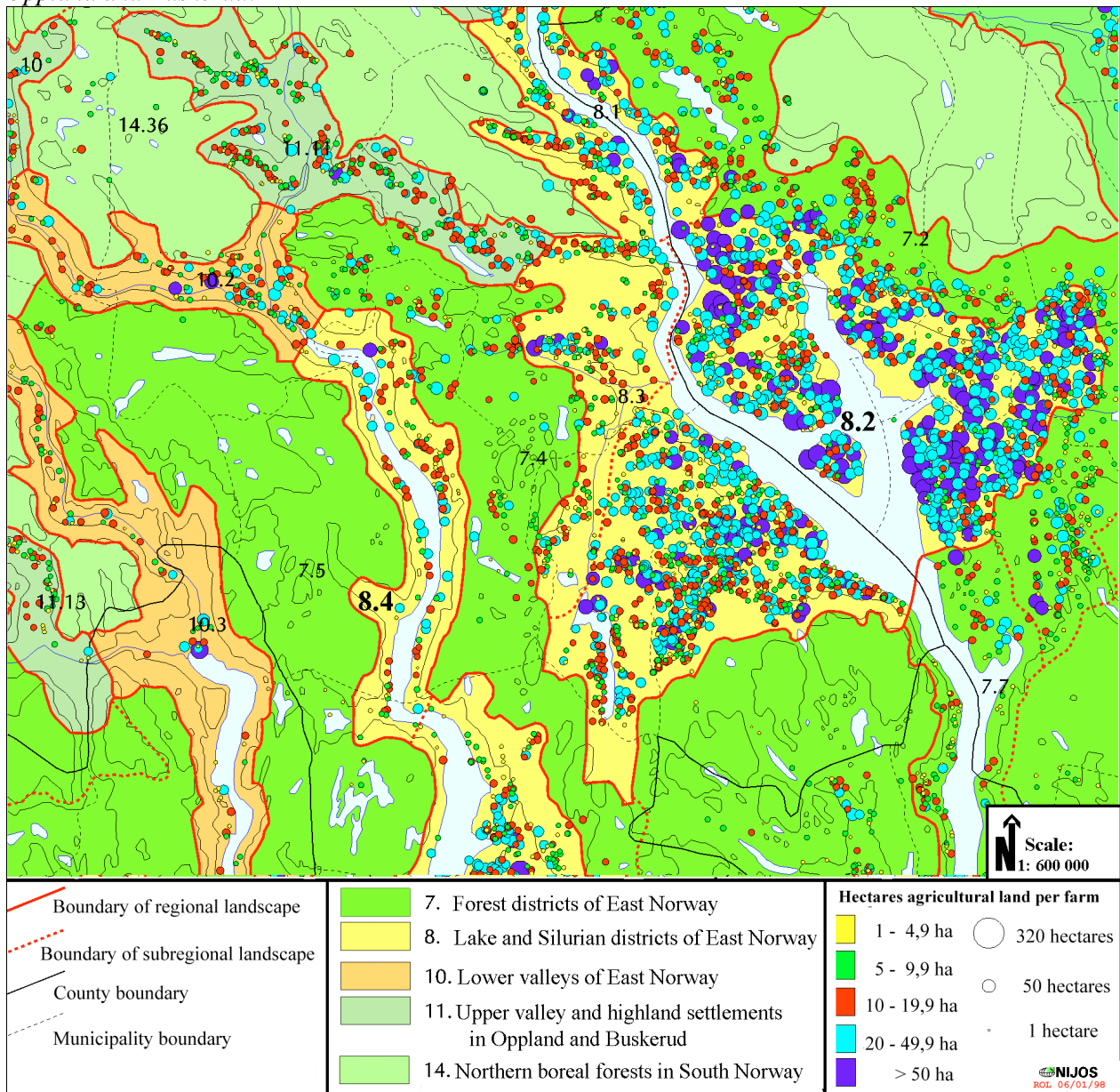

Figure 11. Farm size assessed as area of agricultural land per production unit.

4.7. Number and distribution of grazing animals per subregion

In addition to agricultural land used for meadows and fields, it is also relevant to consider animal husbandry in the subregions. To some extent this information is available from the *Application for agricultural support*-register. It is, however, difficult to differentiate between cultivated pastures and areas less intensively used as grazing land. This distinction is important since intensive and extensive use has different impacts on the landscape.

To give an indication of potential grazing pressure and thus the potential impact of grazing, NIJOS has compiled a map showing the distribution of grazing animals per subregion. Grazing animals are defined as all domestic animals which 'normally' graze, i.e. sheep, goats, cattle and horses. The fact that some farms practice 'zero grazing', because the grazing has not been taken into account, because also the grazing *potential* in the sub-region is emphasised in the description. Each animal is counted as one grazing animal, independent of kind. As figure 12 shows, sheep are most common in all subregions, while subregion 8.2 and 8.3 also have a considerable proportion of cattle.
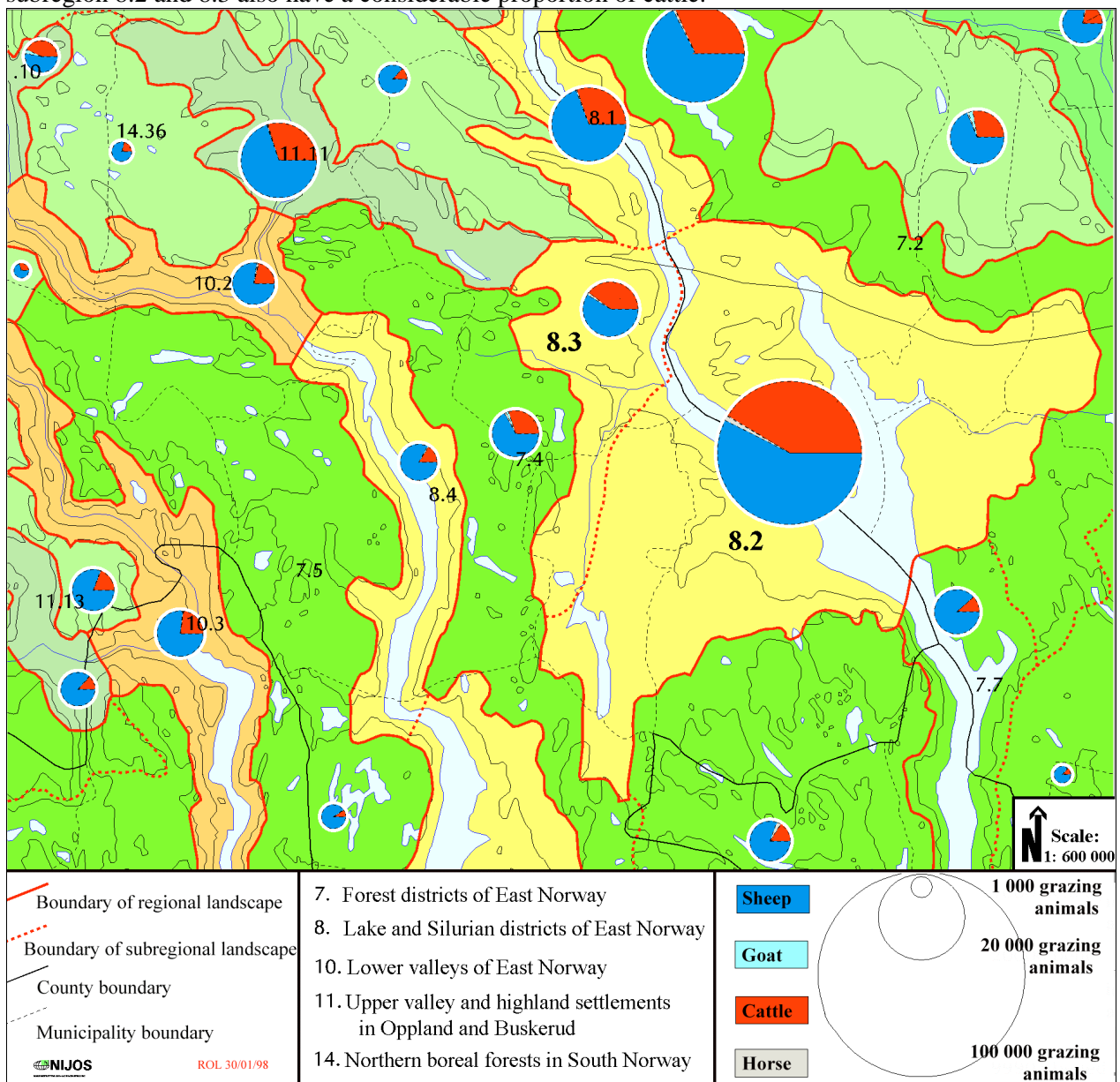

Figure 12. Number and distribution of grazing animals per subregion

4.8 Number and distribution of cattle per farm

In the same way as figures 8-10 show different crop types, figure 13 shows the geographical distribution of farms with cattle production. Using data from the *Application for agricultural support*-register, cattle here includes all nursing cows, milking cows, bulls, heifers and calves. In a landscape management context, it is important to show the potential for grazing, because the distinctive grazing landscape is disappearing in much landscape regions due to a decline in grazing. This may change by taking areas previously used for grazing back into use to meet the requirements of new legislation stating that all cattle are to have a minimum of eight weeks of grazing per year.

Figure 13 shows that many of the forested areas in region 7 have a high number of farms with cattle, but also the cereal dominated landscape region *8, Lake and Silurian districts of East Norway,* has many "cattle" farms. In this region, cattle could be used in an active management to maintain traditional cultural landscapes of grazing land.
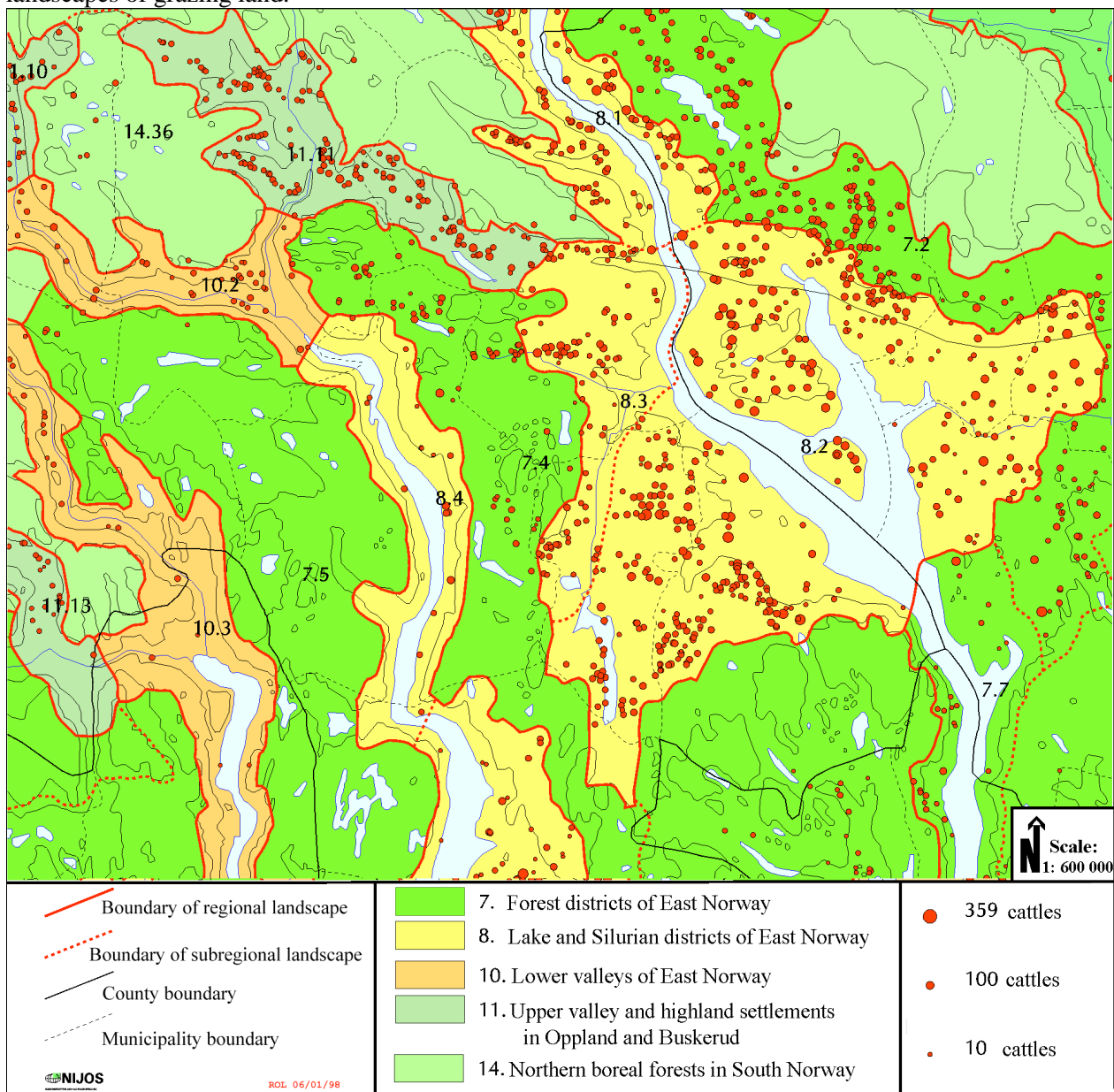

Figure 13. Number and distribution of cattle per farm.

4.9 Number and distribution of sheep per farm

On maps showing location of farms using size-proportional circles, the farm co-ordinates are usually located to the farmhouse. This is sufficient for most of the maps derived from the *Application for agriculture support* register, but not for maps showing the distribution of sheep in a landscape context. Sheep are often sent to outlying fields (away from the farm), which means that a 'sheep map' does not necessarily indicate the grazing effect in an area, even if the number of sheep in that area is high.

To overcome this, the 'sheep maps' can be connected to a national *Information System for the Use of Outlying Fields for Grazing* which is currently being developed by NIJOS. This system is based on data from *Organised Use of Grazing*, and integrates different sources of information about grazing in outlying fields. Based on this information, it is possible to make a map showing where in each subregion sheep actually graze, in addition to where the sheep belong, as illustrated on the map below.
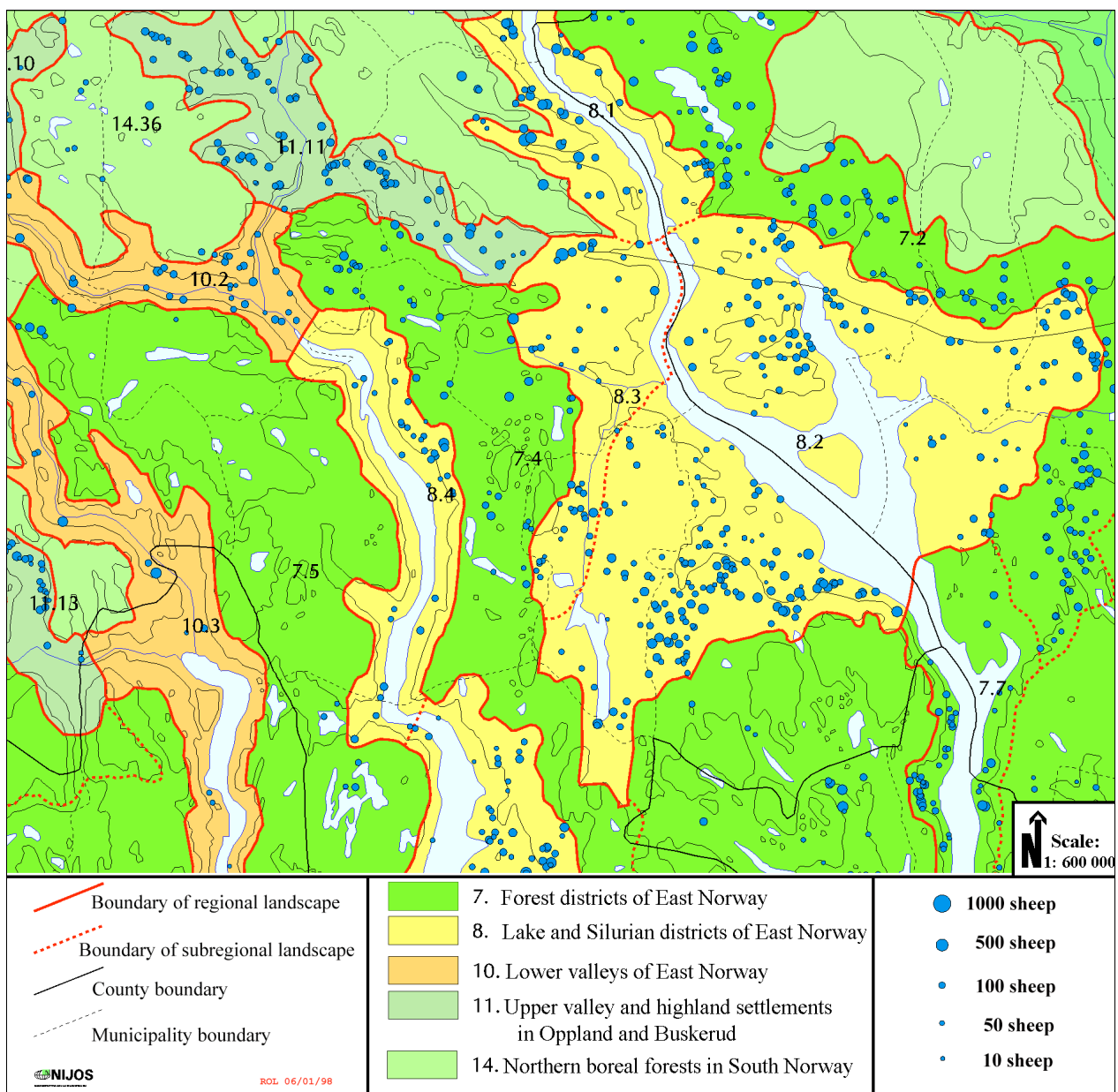

Figure 14. Number of sheep owned per farm

5 Use of the property register to describe the distribution of buildings

In a similar way to the compilation of theme maps for agricultural production (figure 6-14), different maps can be created by using other data registers connected to a digital co-ordinate system. Norwegian Mapping Authoritie's *Property Register* provides such a possibility, and NIJOS use data from this source to make *internal* work-maps as a basis for describing the landscape component: *distribution of buildings and technical installations*.

At present, the *Property Register* is almost complete (approx. 3 million buildings). All buildings with foundations more than 15 m^2 are registered with x and y co-ordinates, farm number, leasehold number and the type /function of the building. The *Property Register* organises the buildings into 99 groups, while NIJOS has chosen to use only eight main groups.

By using such a register as the basis for the description, one can also focus on what types of buildings are dominant in a landscape region and what might cause conflict, like farm buildings vs. holiday homes in coastal and mountain areas.
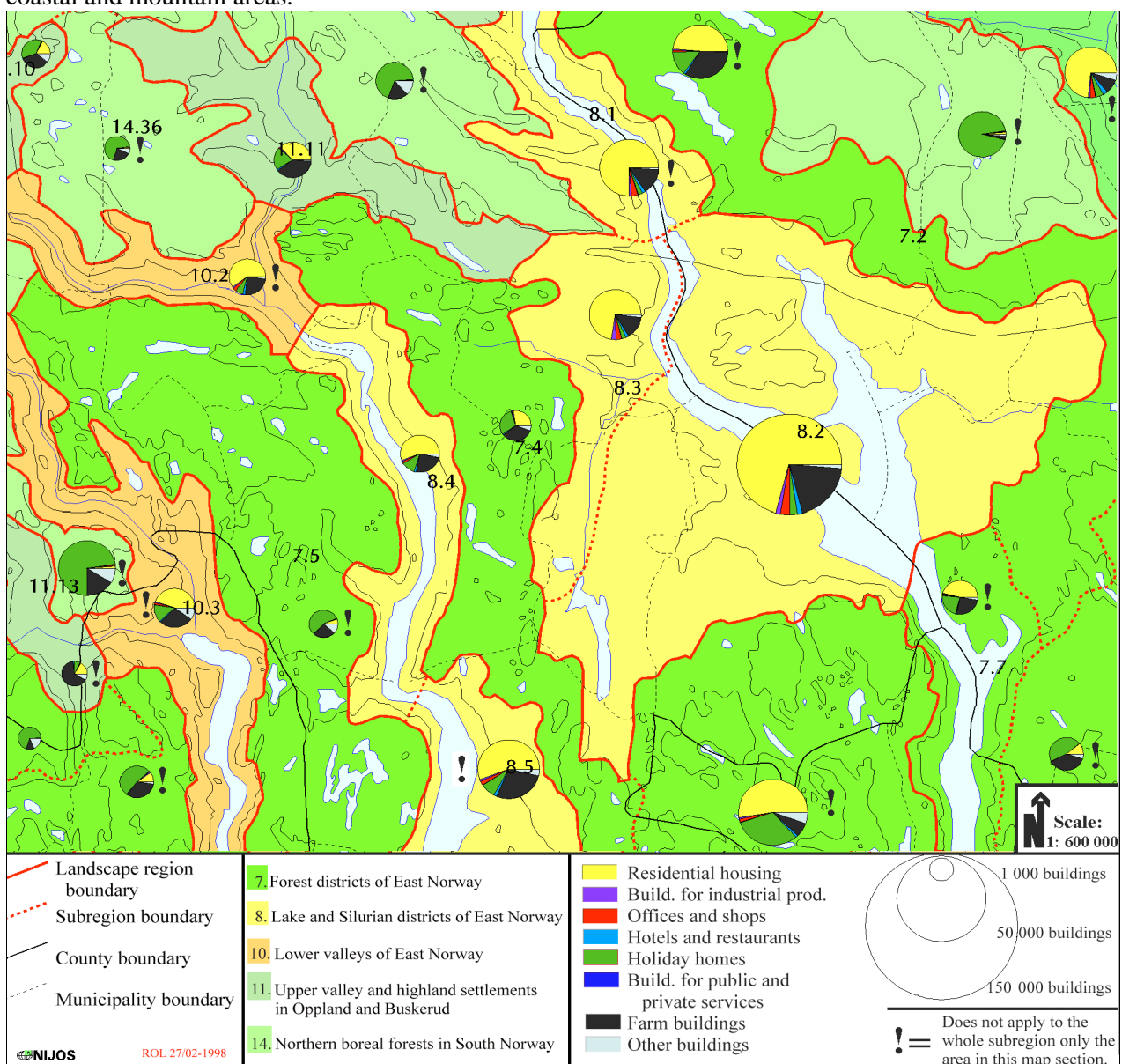

Figure 15. Distribution of buildings per subregion, grouped according to the function of the buildings.

5.1. Occurrence and distribution of single buildings.

It is possible to compile maps showing the actual geographical distribution of buildings, since all buildings in the *Property Register* have co-ordinates. As work-maps to use when describing the distribution of buildings this is important as it also indicates where and in what way the different types of buildings might influence the landscape in a subregion. Figure 15 showed that subregion *8.2 Agrarian settlements of Toten and Hedemarken* have approx. 10 000 buildings of which approx. 70 percent are residential houses. Nevertheless, the landscape of the subregion is dominated by the 20 percent of farm buildings; they are evenly distributed and are highly visible due to the open character of the farmland, while the residential housing is concentrated in towns and villages.

In addition to the *Property Register*, NIJOS uses *County Road Maps* (1:250 000) and the N50 map series to describe the road structure of a subregion. In the longer term, it is desirable to compile similar maps from both the Historic Building Database (SEFRAK) and the *Cultural Monument Register* (Fornminne-registeret), and possibly use this data in the subregional descriptions.
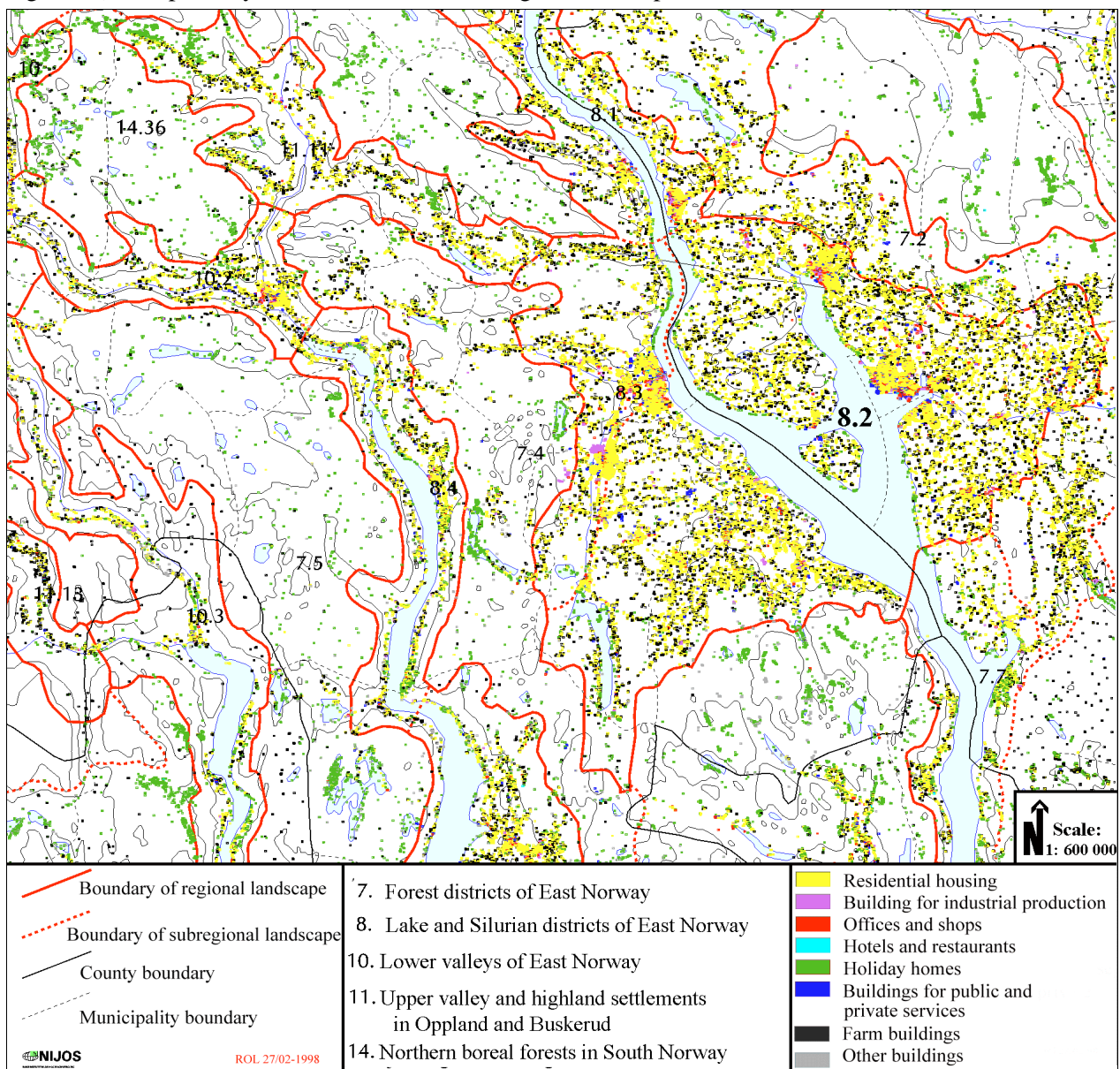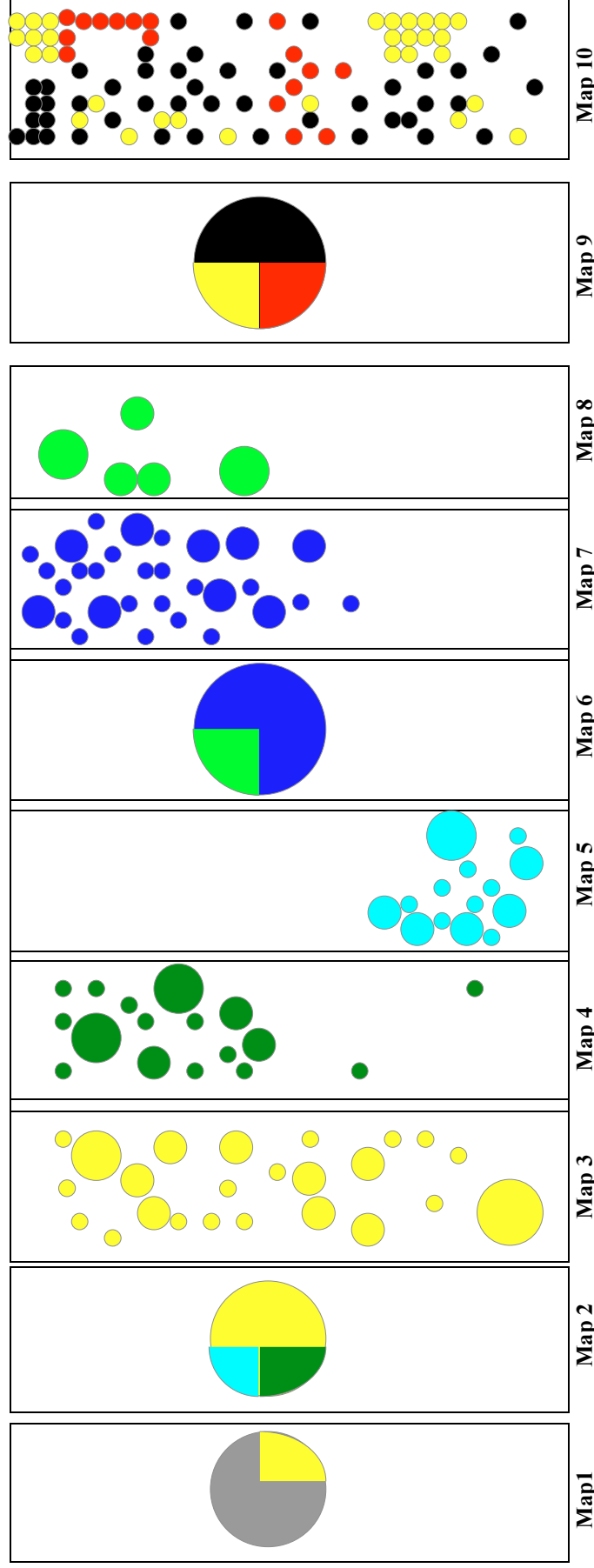

Figure 16. Geographical distribution of individual buildings, classified according to the building's function.

6 Analysis of work maps and the description procedure

| Map1 | Map 2 | Map 3 | Map 4 | Map 5 | Map 6 | Map 7 | Map 8 | Map 9 | Map 10 |

The figure illustrates different maps derived from the *Applications for agricultural support* register and the *Property Register*. Each column represents the same sub-region. The text explains how the maps are used to describe the influence of agriculture (1-8) and the distribution of buildings (9-10) in the subregion.

Agricultural land (1) covers 25 % (2 980 ha.) of the subregion's total area. (**2**) Cereals are the most common produce, covering 50 % of the agricultural land. In addition 25 % is used for grass production and 25 % for vegetable production. (**3**) Cereal production is evenly distributed, while (**5**) vegetable production occurs mainly in the south. (**4**) Grass production is concentrated in the ravine areas in the northern and central parts of the subregion. (**6**) In a regional context, there is a high number of domestic "grazing" animals (3400), mainly cattle (75 %) and sheep (25 %) (**7** and **8**). Animal husbandry is concentrated in the northern and central parts, in association with grass production areas. Cattle are distributed among many farms, while a few farms have a high number of sheep. The most distinctive effects of grazing are seen in ravine pastures in the central part of the subregion. In this intensive area, production occurs on flat terraces in steps down towards the bottom of the valley, whilst grazing land is often on steep valley sides.

Buildings and technical installations: (9) The subregion is a well populated agricultural valley (1400 buildings, with farm houses (●) dominating (50 %). (**10**) The farms are evenly distributed at the edge of the ravine valley bottom and on flat areas at the side of the valley. (**9**) 25 % of the buildings are residential houses (●), (**10**) mainly concentrated in two areas: "Bølling" in the north and "Reistad" in the south. A few residential houses are also scattered between the farms. (**9**) 25 % of the buildings are holiday homes (●), (**10**) located either at the forested "Havsåsen" in the middle of the valley or along the eastern side of the "Storsjøen" a large lake in the north. (NB! The locations of technical structures, roads, railways, gravel pits, etc. are also taken into account in the final description.

7 Compiling a reference framework for textual landscape description

In the same way as the *classification* in the inventory method is hierarchical, NIJOS wanted to develop a 'hierarchical' references framework for *textual* landscape description. Figure 18 illustrates how this is done. The red 'text' in the lower drawing, *the landscape region*, explains what is similar for the different landscape components within a region. The orange 'text' describe some central features which only occur in some of the subregions, for example 'rivers' in some subregions of landscape region "*8*".

The red 'text' on the next drawing, *the subregion* tells us that this subregion has several characteristics described at landscape region level. The orange 'text' tell us that this subregion also has the central features described at region level. The green 'text' describes in more detail the variations within the specific subregion.

The upper drawing, *the landscape area*, has 'text-colours' from both the subregion and the landscape region description. This shows that the area has characteristics from both the landscape region and the subregion and is therefore 'representative' for the landscape region. The new 'text-colours' in the description explain in more detail the local features.

The purpose of this textual reference system is to show regional and national landscape qualities within the local landscape, and from this assess important landscape criteria like rarity and representativity.
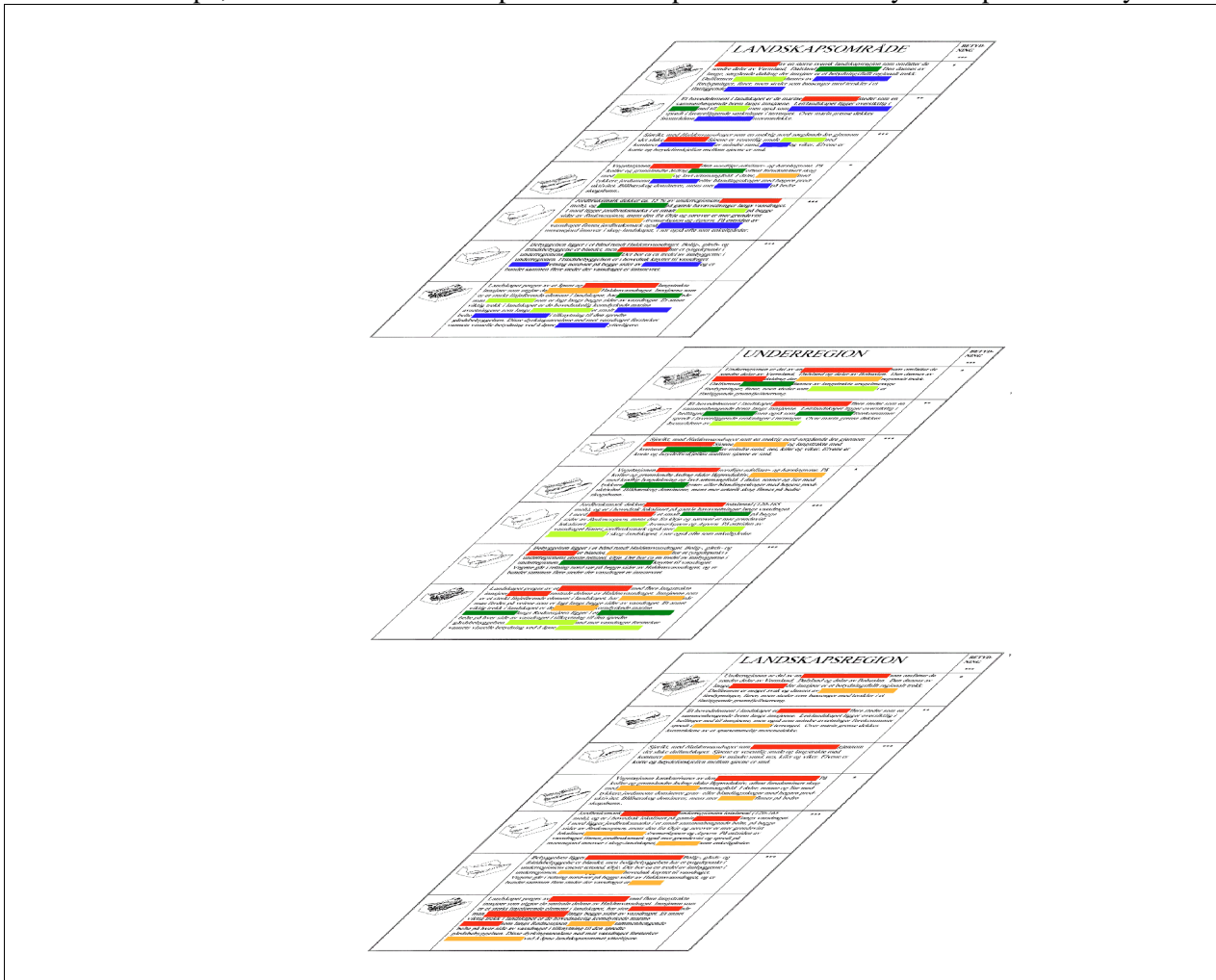

Figure 18. The principles underlie a reference framework for textual landscape description.

7.1 Using the hierarchical reference system for landscape data

As more and more knowledge accumulate about each landscape region and subregion in the national reference system for landscape, it will be possible to use each region (or subregion) as an independent geographical unit of analysis. This would reveal and visualise specific development trends, environmental problems and planning strategies effecting the landscape in each landscape region. As an example, figure 19 illustrates environmental problems in region *3, Clay soil districts of East Norway*.

One of the reference system's main objectives is to obtain a clear indication of the geographical extent of specific environmental problems. Later this can serve as a planning tool, showing how and where to use available resources and initiatives to solve existing management problems related to the landscape.

Geographical position of landscape region 3:

Clay soil districts of East Norway

- illustrating environmental problems typical for the region

- OSP 98.

Landscape areas influenced by large-scale mineral extraction in the many glacial deposits characteristic of the region.

Landscape areas with environmental problems related to autumn ploughing.

Agricultural land subject to pressure from urban development.

Nationally important cultural landscapes including pastures in ravines.

Landscapes with environmental problems following misplaced landscape grading operations.

Establishment of field margins as a landscape improvement measure in open landscapes.
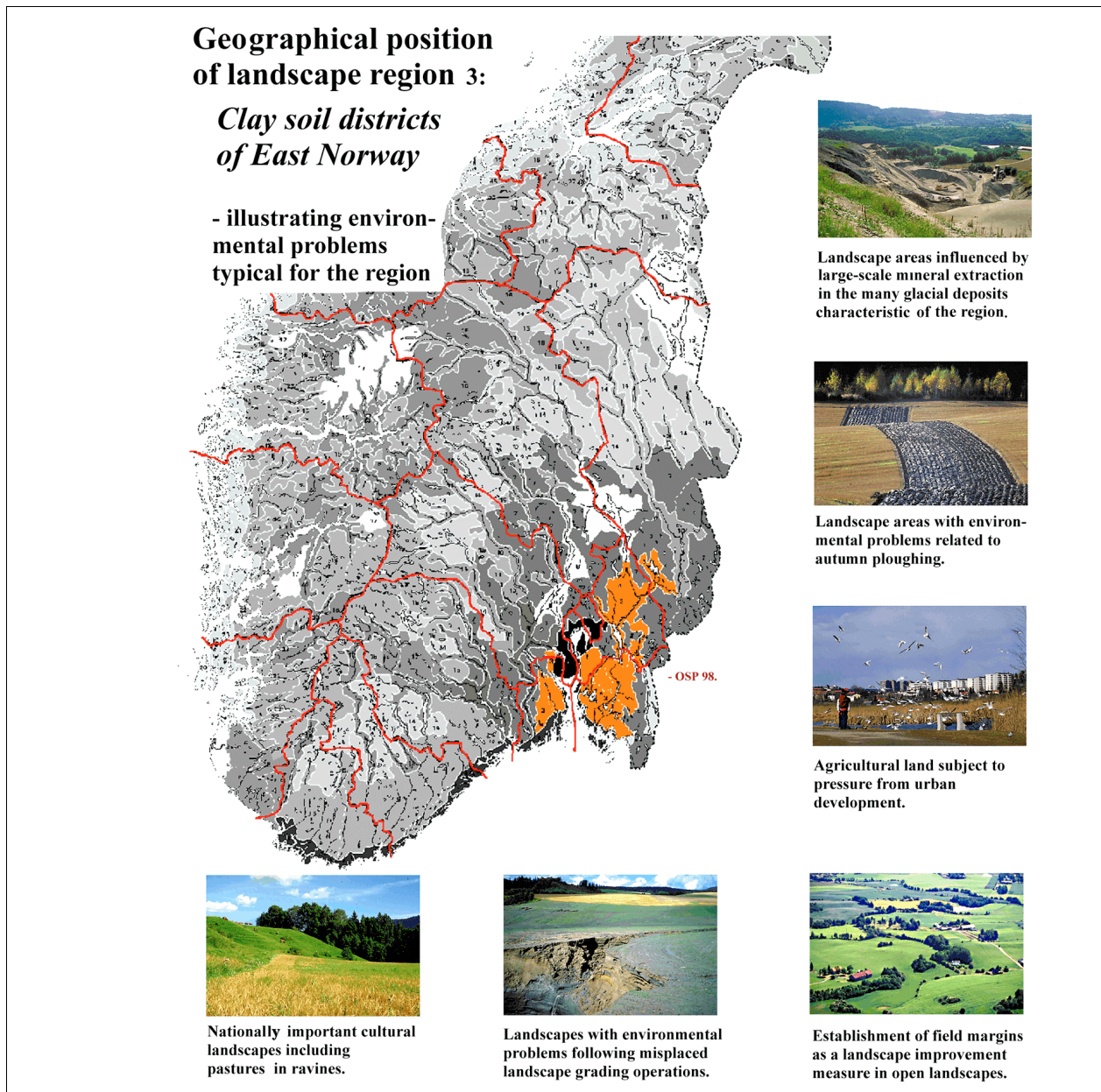
Figure 19. One of the future objectives of a national reference system for landscape is to operationalise each landscape region to become a geographical unit of analysis on it's own with specific problem areas.
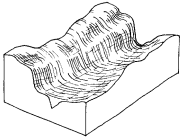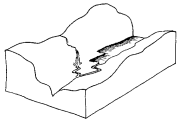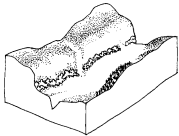
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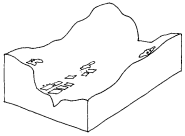
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	LANDSCAPE REGION: 08 Lake and silurian districts of East Norway - **SUBREGION: 02** Agrarian settlements in *Toten and Hedemarken*	**IMPOR- TANCE** ***
MAJOR LANDFORM	The landform is created by recessed areas, following the distribution of limestone, clay- and alum slate. The distribution of these sedimentary rocks is wing-shaped, crossing lake Mjøsa in the middle at the widest part, and stopping abruptly against the bedrock in the south. To the north, the rocks alternate between sandstone and basaltic rock. This results in a more broken landscape with river and stream valleys cutting deeply into the softer rock, while the harder rock is left as strong ridges. Deposits are important in shaping the landscape in the subregion, with the rock almost completely covered by a thick, continuous moraine. Exposed rock and hills occur sporadically, usually in connection with stretches of calcareous rock. The moraine gives a rounded landscape against the surrounding hills. The central parts of Hedemark are characterized by a gently undulating terrain. Toten has a stronger relief, especially along lake Mjøsa, while the hills in the middle and western parts of the sub-region are accentuated by the weak valley and trough formations along the water systems.	***
GEOLOGICAL COMPOSITION	Locally the moraine creates important formations in the landscape. Oblong ridges with a characteristic keel shape can be found many places, for instance around Ingvaldstad. In other places, irregular ridges and hills cut the long lines of the basal moraine. This terrain is more common in Toten. In areas where the moraine cover is thinner, the ridges of calcareous sedimentary rock protrude, as at Ottestad. Glacial river deposits with a terraced landscape and slopes, can be found many places, for example by Ilseng along the river Fura and along the river Flagstadelva. Also in the deeper river-cut valleys further north, deposits can be found as benches and terraces. The moraine hillside above Totenvika is deeply cut by river valleys. These formations are also found in other places in the subregion. Along several water systems, the soft contours of the basal moraine are a clear contrast to the narrow plains along the rivers.	*
WATER AND WATERWAYS	The widest, middle part of lake Mjøsa divides the subregion into two. The lake seems enormous and gives a strong feeling of space. It dominates the overall impression of the landscape from the surrounding hillsides and beaches. Helgøya island is located in the middle of the lake and reduces the vast sea impression to some extent. Furnesfjorden stretches north and forms the peninsula Neshalvøya. The narrow Åkersvika, an important marshland area, cut distinctively towards Hamar. Lake Eina in the southwest is mostly surrounded by fields in a low relief landscape. On the Toten side, the river Lena twists through a heavily cultivated landscape towards Skreia. Brumunda, a more torrential V-shaped valley river, flows through the center of the Brumundal before ending up in Mjøsa. Flakstadelva is also a V-valley river, twisting before the mouth. The much calmer and strongly winding river Svartely from lake Rokko, and the joining river Fura, both end in Åkersvika. These rivers flow mostly through fields, partly bordered by woodlands and trees.	***
VEGETATION	The main impression is of fragmented areas of conifer forest, mostly spruce, in a predominantly agricultural landscape. The vegetation is mainly rich. The calcareous rock gives considerably lush coniferous forest areas with many herbaceous plants, best developed on the south facing slopes and on land with trickling water (low herb- and tall herb woodland). Deciduous or mixed stand forests are common between fields and along rivers as woodlots or edge stands. These are often cultivated, and old 'birch gardens' are a feature many places. Conifer woodlands with a more limited number of herbaceous plants (bilberry and small-fern woodland), dominate the vegetation on some smaller hills and ridges. Pine forests can be found on coarser and poorer deposits, mainly as heather pine forest mixed with deciduous stands. Small lime pine forests can be found on some well-weathered calcareous ridges. Thermophilous deciduous woodland can also be found but is not very widespread. Varied marsh vegetation occurs, partly rich in the agricultural landscape, but often poor in the southern hill areas.	**
AGRICULTURAL AREAS	Agricultural land covers 38% (43 900 ha) of the total land area, which makes it the country's third largest cultivated subregion. A common feature is the large fields in the gently undulating and sloped terrain down towards lake Mjøsa, especially on the east side with predominantly larger farms. Towards the hills this large scale image decreases, and the landscape becomes a more fragmented rural district. Here medium sized farms dominate, with land of moderate suitability for arable farming. The western side of the lake has a small-farm image, especially towards the edges of the agricultural land. In the southwest, the fields are more west facing down towards the recessed Raufoss-lake Eina area. There is a belt of fields along lake Eina, bounded by moderate slopes. The cereal (68%) and grass (17%) production is evenly distributed, while the	***

	potato (5%) production is concentrated in the areas in Toten facing Mjøsa. Regionally, the number of domestic animals is slightly less than the average for the region (51 700 grazing animals). The sheep (57% of all grazing animals) are concentrated to the eastern side of Neshalvøya and the southern areas of Toten. The cattle production (42%) is more evenly distributed in the subregion, but still within quite dense concentrations.	
BUILDINGS AND TECHNICAL INSTALLATIONS	The largest towns Hamar and Brumundal are situated on the eastern side of Mjøsa, along the Dovrebanen railway and the E6 motor way. Hamar is an important junction where the Rørosbanen railway heads east towards Østerdalen. Many villages are situated along these two main lines. Other villages are scattered in the subregion, many in connection with the closed-down Skreiabanen railway at the western side of Mjøsa. Most of the towns and villages are surrounded by fields. The farmyards are evenly distributed in most of the wide agricultural landscape. Only 20% of the total number of buildings are farmhouses, but they still dominate the landscape visually. There are large farms with prominent farmyards in the open, continuous fields on both sides of Mjøsa. Adjacent to the forested areas, the farms make less of a visual impact and the farmyards are closer together. Buildings related to industry are mostly assosi-ated with villages and town, with the bulk around Hamar and Brumundal. Some scattered holiday homes are located along the beaches around Mjøsa and lake Eina. The E6 motorway runs parallel with Dovrebanen railroad. The subregion has a dense network of roads, especially on the eastern side of Mjøsa.	***
LANDSCAPE CHARACTER	A wide and moderately recessed lake reservoir surrounded by low hills. Rich limestone, clay and alum slate characterize the subregion and are the base for some of the country's best agricultural land. The mere size of Mjøsa gives a strong feeling of space, and where visible, it s beaches and surface are the most eye-catching features of the landscape. The surrounding terrain has quite a low profile with long, gentle undulations and moderate slopes. The ridges are mostly low, rounded and weathered, with one exception, the Solbergås at Nes, a projecting ridge of hard bedrock. A thick, rich moraine cover provides the basis for the large-scale agriculture in the area. In addition, the moraine smoothes the contours of the underlying rock, and exposed rock is rare, but can be found for example in the east-west calcareous ridge. A characteristic feature of the landscape is the large fields creating a large-scale image, especially around Mjøsa. The large farms on the eastern side of Mjøsa are a characteristic of part of the subregion. More remote, up towards the hillsides, are indi-vidual and small clusters of farms. Cereal production predominates, but in some areas there is also a fair amount of animal husbandry. Spruce dominates the larger forested areas, and elements of lush vegetation are common on calcareous ground. Both lime-pine forest and thermophilous deciduous woodland can be found. Lake Eina in the southwest is surrounded by fields in a slightly sloping, marsh and conifer covered moraine landscape. There are a few smaller rivers; some twisting close to Mjøsa, others are torrential rivers cut deep into the sloping moraine. The area has a good network of roads. Hamar and Brumundal are the largest urban areas, but there are also several smaller villages.	

Large fields around Lake Mjøsa characterize the agriculture in subregion *08.02 Agrarian settlements in Toten and Hedemarken*. The photo is from the island Helgøya, which is one of the most open and large-scale agricultural landscapes in Norway.