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The Agricultural Landscape for Recreation

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1. Introduction

Food production is not the only use of our agricultural landscape. The landscape also fulfils basic human needs for recreation outside the urban fringe. This chapter describes a study of how certain qualities in the rural and semi-urban landscape correspond to well-being. The study covers Skåne, the southernmost region in Sweden as well as the most productive agricultural region. Large datasets on the environment – land use, land cover, environmental qualities, impacts, etc. – were associated with results from a major public health survey. The results were published in the Journal of Epidemiology and Community Health (Björk et al., 2008). The chapter explains in more detail the method used to assess environmental qualities using Geographical Information System (GIS), and the relevance of these qualities for well-being and health promotion.

2. Background

A number of interview studies conducted between 1995 and 2005 in landscape architecture/environmental psychology (Grahn, Stigsdotter and Berggren-Bärring, 2005) have revealed eight characteristics of the outdoor environment (Serene, Wild, Lush, Spacious, the Common, the Pleasure garden, Festive/centre and Culture) that correspond to basic human needs. The line of research in which the eight characteristics were discovered has existed for decades. Already in 1989, Kaplan and Kaplan pointed out that sounds of nature can reduce stress and improve well-being. Several investigations have shown that people are often afflicted by illnesses related to stress (Grahn and Stigsdotter, 2003; Ottosson and Grahn, 2005a; Ottosson and Grahn, 2005b; Ottosson and Grahn P. 2008).

Many studies have shown a relationship between urban green areas and health (Hartig et al., 1996; Ottosson and Grahn, 1998). When walking in a natural environment, people's blood pressure drops already after a few minutes (Hartig, 1993). Certain biotopes and habitats seem to have been of great importance during human evolution (Coss, 1991; Ulrich, 1993). When people are stressed or ailing and in pressed situations, the availability of such environments seems to be even more important. If people can visit environments with

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certain characteristics, their blood pressure, pulse, etc., can return to normal more quickly (Ottosson and Grahn, 1998).

That the landscape promotes well-being is a common feeling among most people, but more specific knowledge about different landscape qualities has been lacking, as have evidence from epidemiological research and hard facts that can be used in social economic calculations.

An epidemiological study was enabled by merging data from a large regional public health survey with regional GIS data on landscape, land-use, nature and cultural preservation, etc.

3. Materials and methods

3.1 Public health survey

The public health survey was distributed in 2004 as a postal questionnaire in Skåne, the southernmost region of Sweden as well as the most productive agricultural region. The study population consisted of a total of 855,599 individuals. The population was stratified by gender and geographical area. Samples were randomly selected from the population registry. In total 50,000 questionnaires were sent out to individuals 18-80 years of age who had geocoded residential addresses. The participation rate was 59%. Survey questions posed to respondents included topics such as neighbourhood satisfaction, time spent on moderate physical activity per week, body mass index (BMI), self-rated physical and psychological health at present, and a 36-item short-form health survey item called "vitality". Neighbourhood satisfaction was measured in the survey by the question 'How much do you like the environment you live in?' Participants scored their level of satisfaction on a four-point ordinal scale with an additional 'don't know' option. For individuals using that answer, neighbourhood satisfaction was unknown and was therefore excluded in the analyses that use neighbourhood satisfaction as outcome variable. Blank answers to this question, or to any of the other questions that represent outcome variables (i.e. physical activity, length and weight used to calculate BMI and self-rated health), were also excluded in corresponding analyses and for the same reason (Björk et al., 2008).

The questionnaire was not pretested for clarity, but parts of the survey had been used in the year 2000 in the same region. A steering committee, with representatives from the county, municipalities and the research community, drafted the survey questions carefully before launching the questionnaire. Validated questions were used when available.

3.2 Environmental qualities for well-being

A number of studies in the fields of environmental psychology and landscape architecture at SLU, the Swedish University of Agricultural Sciences, have resulted in new assessment criteria for recreational values. This research revealed eight characteristics of outdoor recreation values that correspond to basic human needs: Wild, Lush, Spacious, the Common, the Pleasure garden, Festive/centre and Culture/History (see Table 1). Thus far, these values have mainly been studied on a local scale, in parks, gardens, and small forests, but also at the neighbourhood and urban fringe level. In the present study, the characteristics are applied at the regional level.

1. Serene	A place of peace, silence and care. Sounds of wind, water, birds and insects. No rubbish, no weeds, no disturbing people.
2. Wild	A place of fascination with wild nature. Plants seem self-sown. Lichen and moss-grown rocks, old paths.
3. Lush	A place rich in species. A room offering a variety of wild species of animals and plants.
4. Spacious	A room offering a restful feeling of “entering another world”, a coherent whole, like a beech forest.
5. The Common	A green open place allowing vistas and stays.
6. The Pleasure garden	A place of imagination. An enclosed, safe and secluded place where you can relax and be yourself, let your children play freely.
7. Festive/centre	A meeting place for festivity and pleasure.
8. Culture	The essence of human culture: A historical place offering fascination with the course of time.

Table 1. Eight characteristics that meet recreational needs (from Grahn, Stigsdotter and Berggren-Bärring, 2005).

3.3 Assessing characteristics for well-being on a regional scale using GIS

GIS data from the county administration were used to elaborate characteristics. Corine land cover data play a vital role in this classification, as do other data of relevance, such as topography, environmental protection, noise disturbance, etc. CORINE (Coordination of Information on the Environment) is a programme initiated by the European Commission in 1985 to compile information on the environment with regard to certain topics and to ensure that information is consistent and that data are compatible across member states. One main part of the programme is the Corine land cover project covering 12 countries with a working scale of 1:100,000, and the smallest mapping unit 25 hectares. Sweden, however, has used a more detailed working scale with 5 hectares as the smallest mapping unit (Lantmäteriverket, 2003). Since the inventory of Corine land cover data is a European project, data corresponding to the present data should be available for most European countries.

Other data sources for this project are administrated at the County Administration level and deal with, e.g., natural and cultural protection areas, key biotopes, a pasture land inventory, Nature 2000, a beach zone protection plan and a regional inventory of “silent areas” (a large-scale noise impact calculation). In addition to this topographic evaluation, data from the land survey administration were used.

Of significance in assessing characteristics for recreation on a large regional scale is that only existing data sources can be used for evaluation. In the present study, no resources, neither time nor money, have been available for a detailed systematic process of ground truth validation of different classification methods. However, the studied region is well known to

members of the research group, which facilitated preliminary and overall checks of the produced classification maps.

After testing different alternatives for identification of the characteristics, including revisions, we ended up with the classification in Table 2. The final maps are presented at the end of the chapter

Serene	Wild	Lush	Space	Culture
Broad-leaved forest (3.1.1) Mixed forest (3.1.3) Pastures (2.3.1) Marshes, mires (4.1.1, 4.2.1) Water courses, Lakes and ponds (5.1)	Forest (3.1) Thickets (3.2.4.1) Bare rock (3.3.2) Inland marshes, mires (4.1.1) Water courses, Lakes and ponds (5.1) each >15 ha, or if <1 km from city	Mixed forest (3.1.3) Open space with little or no vegetation (3.3) (Beaches, dunes, and sand plains 3.3.1) Bare rock) Wetlands (4)	Forest >25 ha (3.1) Natural grassland (3.2.1) Heath land (3.2.2) Open space with little or no vegetation (3.3) Open wetland (4)	Non-urban parks (1.4.2.5)
	Slopes > 10 °	All registered “key biotopes”	Slopes > 10 °	
		Pasture land of regional interest	Farmland pointed out in a preservation plan	Farmland pointed out in a preservation plan
		Biodiversity areas, Bird biotopes ref. Nature 2000		National interests of cultural preservation Ancient remains
		National park	Coastal zone preservation	Nature reservation areas
Excluded areas				
Noise > 30 dB(A) No artillery range	Noise > 40 dB(A) < 800 m distance to wind power aggregates		Noise > 40 dB(A)	

Table 2. Criteria for assessment of the five characteristics, final version. Figures in brackets refer to the land cover nomenclature (<http://www.eea.europa.eu/publications/COR0-landcover/page001.html>).

In the present regional study, we have limited our investigation to the five characteristics Serene, Wild, Lush, Spacious and Culture, as the three characteristics the Common, the Pleasure garden and Festive/centre require local data from the municipalities not available at the time of the study.

Also we have excluded the four largest cities in Skåne (Malmö, Lund, Helsingborg and Kristianstad) but kept smaller towns and villages. In cities, large parks and other inner city green areas are a main recreational resource for residents. GIS data to elaborate characteristics of these areas are not available on a regional level. Therefore, the present study is limited to the rural and semi-urban areas of Skåne.

3.4 Statistical analysis

This study included 24,819 respondents located using their residential coordinates. Using GIS, the presence/absence of each of the five characteristics within 300 m from each respondent was defined based on the criteria in Table 2. The working process for the assessment of the characteristics is described in *Results* below. Table 3 shows the percentage of the population living close (300 m or 100 m) to the different characteristics. Spearman’s rank correlation coefficient, appropriate for investigating associations between ordinal scales, was used to test associations statistically between the number of characteristics (0-5) present within 300 m or 100 m of the respondent’s residence and ordered answers to the survey questions. P-values below 0.05, and equivalently 95% confidence intervals for odds ratios excluding unity in ordinal regression analyses with adjustments for a broad list of individual determinants of health, were regarded as statistically significant (Björk et al. 2008).

Characteristics	% of population	
	< 300 m	< 100 m
within		
Serene	6	4
Wild	3	1
Lush	24	7
Spacious	10	5
The common	(not in the study)	
The pleasure garden	(not in the study)	
Festive, centre	(not in the study)	
Culture	24	15

Table 3. Percentage of the population that has the different characteristics within 300 and 100 meters, respectively, distance from their residence (Björk et al. 2008). Note that all individuals that have a certain characteristics within 100 meters also have it within 300 meters distance from their residence.

Each respondent’s coordinates are defined as the centre point of the complex in which he/she lives. That centre point can be quite far from the position of the person’s home, making the 100 m distance incorrect. 300 meters is a fairly normal distance to walk to get to a nature area or a park.

One outcome of the study is that the objectively GIS-assessed availability of the five characteristics near one’s residence (< 300 m) is positively associated with neighbourhood satisfaction (Figure 1), moderate physical activity (Figure 2) and, among tenants, low BMI. Thus, figure 2 suggests that individuals spend more time on average on moderately demanding physical activities the more characteristics they have within 300 m from home. This association remained after adjustment for individual (socioeconomic) factors.

The impact of the number of characteristics on BMI was less clear. After adjustment for individual factors associated with BMI, the beneficial effect of the characteristics was present among tenants but not among house-owners. The proportion of obese (BMI > 30 kg/m2) individuals among tenants was 17% in residences with zero characteristics within 300 metres compared with 13% in residences with at least one characteristics present (Björk et al 2008). No clear association between the number of characteristics and self-rated general health was detected after adjustment for individual factors.

The result for neighbourhood satisfaction among people living in flats is remarkable. If all five characteristics exist within 300 m, 70% of the tenants are satisfied with their neighbourhood, whereas a maximum of 50% are satisfied if only one or no characteristics are present. The corresponding figures for house owners are 83 % and 74 %. Consequently, house owners seem to be rather satisfied with having their own garden, while tenants’ well-being is highly dependent on having good natural environments or parks within 300 m from home. This provides important input to the current debate on global warming and densification in urban planning. We are supposed to live more densely in cities to minimize commuting to our workplaces, but on the other hand, if we do not have sufficient nature and park qualities close to our homes in the cities, we will need to commute into the rural landscape for recreation, and that also has an impact on the climate effect.

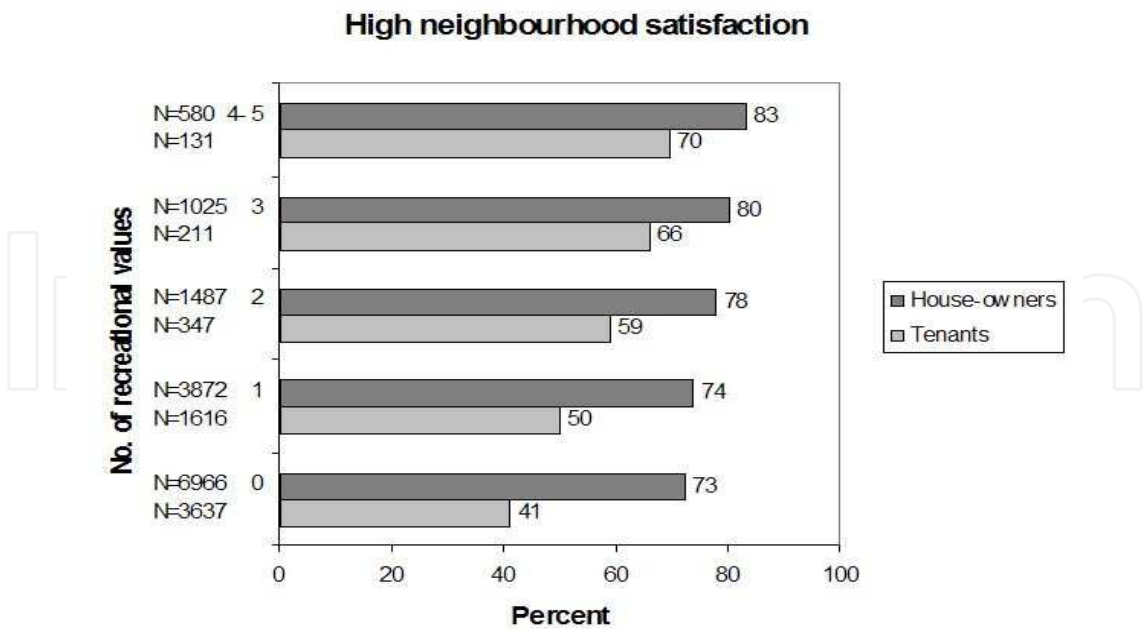


Fig. 1. The relation between the number of recreational values (0-5) of the natural environment within 300 metres distance from the residence and the percentage reporting high neighbourhood satisfaction among house-owners (N = 13,930 answers) and tenants (N = 5,942 answers) (from Björk et al.2008).

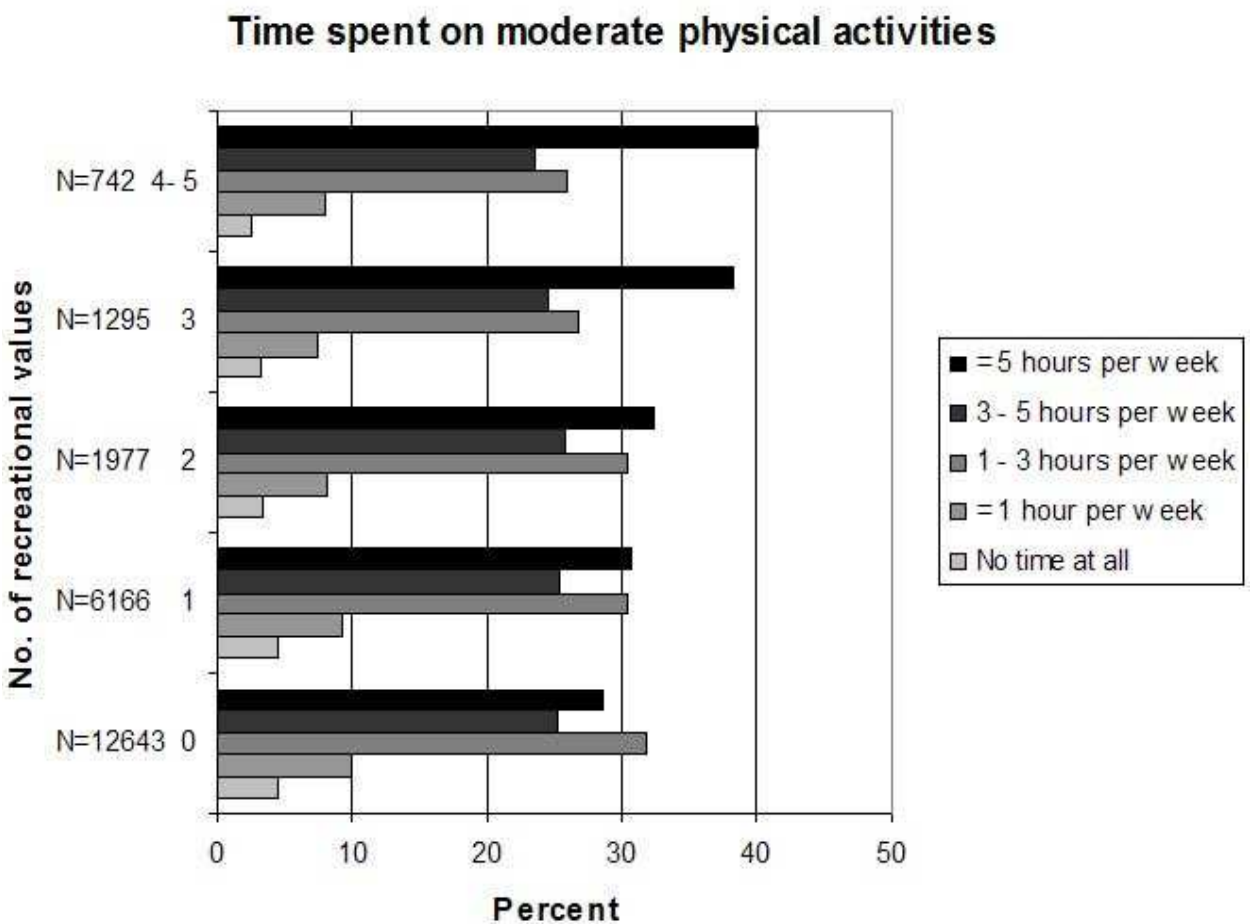


Fig. 2. Time spent on moderate physical activities in relation to the number of recreational values (0-5) of the natural environment within 300 metres distance from the residence (from Björk et al. 2008).

3.5 Results – Working process for the assessment of characteristics

The choice of criteria for elaborating each characteristic using GIS was in some cases a long process in which different combinations of classes of parameters for accessing each characteristic were elaborated successively. These trials generally started with a discussion among the research group members to develop a first set of criteria for identification. The first attempt at classification aimed at achieving an appropriate number of areas for the concerned characteristic, not too many and not too few.

As seen in Table 3, the scope of characteristics close to respondents on average differs substantially. Culture and Lush are most common. Wild and serene are most rare.

The resulting maps were examined by the project staff and compared to their own experiences of certain areas in the studied region. After critical studies of the resulting maps, other classification criteria were tested in a second attempt, and so on in further attempts until the final classification versions were established – those found in Table 2. At the end of the paper, you can see the five maps of the final classification.

3.5.1 Serene

The effort to develop the classification model can be illustrated to some extent by looking at the work with the characteristic Serene. For Serene, we first used a minimum size criterion: Areas should have a minimum size of 20 hectares to be classified as Serene. The reason for this was that an area must be relatively large to be perceived as Serene. From the beginning, we also claimed that the average noise level should not exceed 40 dB(A)_{24 h}, and that a 250 m buffer along roads and dwellings was required. Moreover, we required a buffer of 800 m around large wind power generators and shooting ranges.

Later on, the area size criterion for Serene proved to be useless, as a single large forest often consists of several serene land use areas grouped together, each of which is smaller than 20 hectares. Therefore we rejected that size criterion. We also rejected the minimum distance criterion to roads and wind power generators. The noise criterion, however, was sharpened to 30 dB(A)_{24h}. This is perhaps the reason for the relatively rare presence (Table 3) of Serene near the residents.

3.5.2 Wild

Forests, thickets, bare rock, mires and wetlands, lakes and rivers – all larger than 15 ha, if not closer than 1 kilometre from villages and towns. If closer, there is no minimum size for the area, because children seem to sense the Wild characteristic even in very small areas. Also areas steeper than 10° are classified as Wild.

Excluded are areas with a noise level over 40 dB(A), and areas with wind generators within 800 m.

In our first attempts, we set the minimum size of areas to 30 ha and to 5 ha within 1 km from villages and towns. But that reduced the amount of Wild too drastically.

3.5.3 Lush

Mixed forest, marshes and mires, beaches, dunes, sand plains and bare rock. Plus all registered “key biotopes”, certain inventories of pasture land, biodiversity areas, bird biotopes of regional interest, also Nature 2000 objects and national parks.

Many of the mixed forests are very small areas, down to 25 x 25 m integrated in the open agricultural landscape, and these are of great importance to biodiversity from an ecological as well as recreational point of view. At our first attempt we included a buffer zone of 100 m. The reason was that fringe zones between different biotopes are very species rich, and we wanted to capture that by including a buffer zone in the biotope area concerned. However, this resulted in areas that were far too large to make the classification useful. One hundred meters is an overestimate of species rich fringe zones, they are narrower than this.

The best areas cannot be drowned in an overly generous classification, which is a general problem in most landscape analysis. Therefore, this buffer zone was rejected from our classification. Despite this rejection, Lush was classified close to a large percentage of the population.

3.5.4 Space

Beaches, dunes, and sand plains, bare rock, sparsely vegetated areas, burnt areas, natural grassland, moors and heath land, all forests larger than 25 ha. Plus slopes more than 10 degrees (creating viewpoints), farmland pointed out in a preservation plan and coastal zone preservation in a national plan.

Excluded are areas with a noise level over 40 dB(A).

In our first attempt, we used minimum size criteria: Forest 100 ha; natural grassland 20 ha; heath 50 ha. This resulted in very few areas. One observation was that many open space areas are small, but together form large open spaces. Therefore the size criteria for grassland and heath were rejected in our classification. Moreover, forests of different categories are in reality rather small, but together form large forest areas, giving the impression of “entering another world”. To address this, we reduced the size criterion for forest to 25 ha.

In our first attempt, we also used noise level criteria for roads 250 m from the residence, but rejected these as being too high in many cases. At first we also used 800 m minimum distance to wind power aggregates as a criterion for obstructing a feeling restfulness, but later rejected this as well.

3.5.5 Culture

Non-urban parks, farmland pointed out in a preservation plan, areas of national interest in cultural preservation, nature reservation areas.

In our first attempt, we also included national interests in recreation. Such areas often overlap national interests in cultural preservation, and are in these cases included anyway. However, they also include large areas for recreation without meeting criteria for the Culture characteristic, but instead for some of the other characteristics, so that dataset was rejected from Culture. Culture was classified as being close to a relatively large percentage of the population (see Table 3).

4. Discussion

When conducting a regional analysis of environmental perception, there are a great many pitfalls to consider. Regional studies require existing datasets mainly produced to show objective data, but perception is a subjective interpretation of the real environment. People's perceptions also differ from individual to individual due to their previous experiences. This, however, is a general issue independent of the scale of the study. For these kinds of studies, the elaboration of classification criteria always has to be done by representatives of the local community.

The present epidemiological study aimed at finding general associations between well-being and proximity to nature for the population in Skåne. Epidemiological studies provide overall patterns of associations and variations. These kinds of studies do not necessarily give a “correct” picture of individual cases.

One pitfall of using objective data such as forest types, topography, etc., is the issue of interpreting and combining the data so they correspond to common perceptions of nature characteristics. That is what the present paper tries to describe. It is the first study of its kind, and there is a great deal more research to be done to improve the methods. One issue, for example, is that Corine land cover data are derived from an analysis of satellite data, and this is associated with a relatively large percentage of misinterpretation, for some land use types around 30% (Rost & Ahlcrona, 2005).

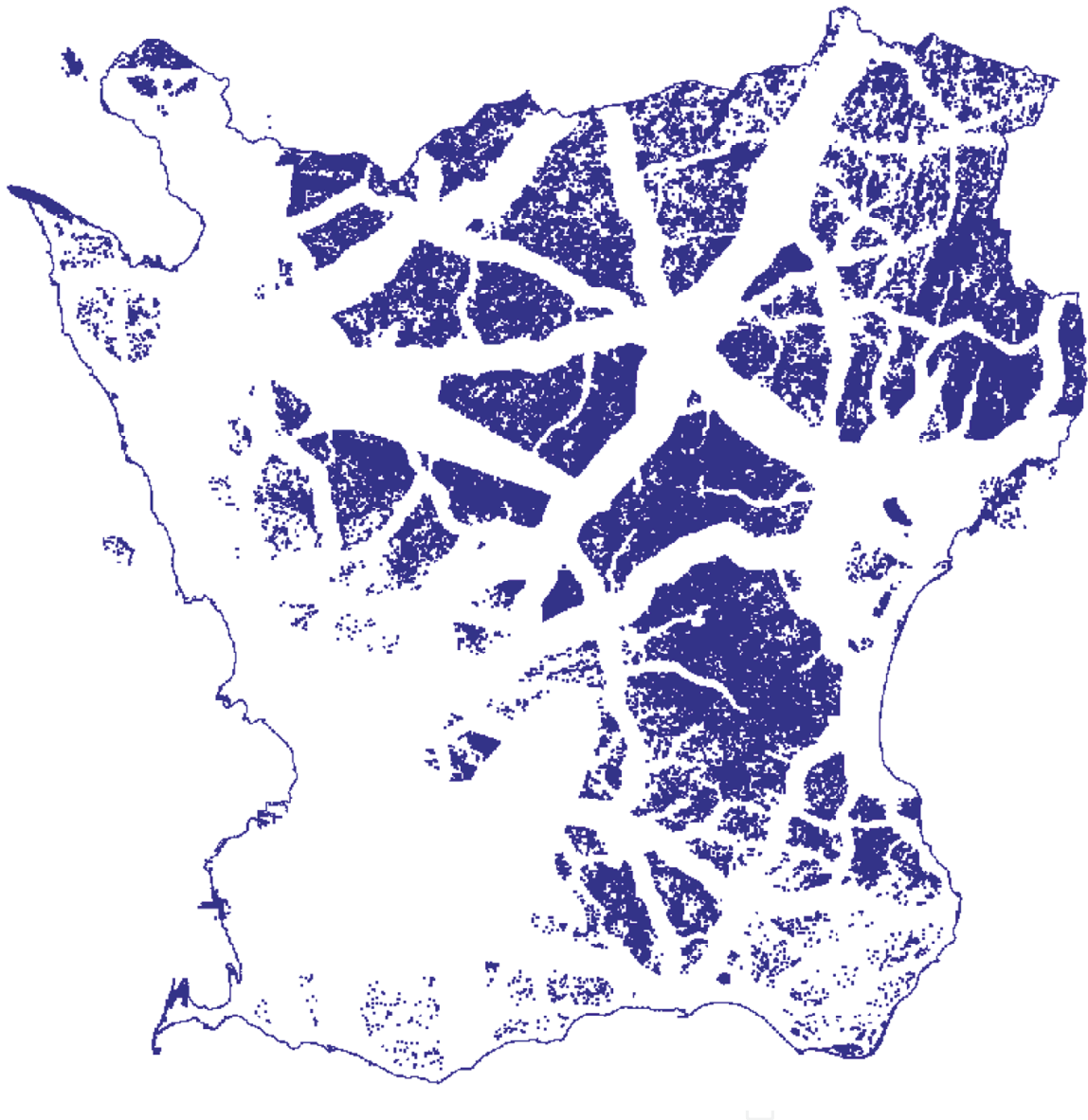
Because the book focuses on agriculture, we would like to comment additionally on the agricultural landscape. Skåne is in the southwestern half of the region dominated by agriculture. The soil is fertile. Avenues and other landscape elements are impressive. A rather flat zone 30 kilometres wide and following the southern and western coast is the most productive part (the Baltic moraine clay), and is at the same time the most urbanized area, with many roads and railroads creating noise. To some extent this zone is spacious and includes long views, but it is not particularly accessible for walking, and walking promotes a feeling of restfulness. More accessible is the diagonal zone of Skåne from southeast to northwest. This zone has more hills and small scale farmland and is more accessible and silent, offering a restful feeling of “entering another world”, a coherent whole. Both zones are rich in impressive visible cultural history, as can be seen in the last map.

There is a need for validation of this kind of analysis. High correlations between the prevalence of GIS-evaluated characteristics and people’s responses concerning health and well-being indicate that development of parameters for GIS evaluation is on the right path. Overall, we found a high correlation between people’s perception of a cosy atmosphere and the prevalence of the characteristics. The Skåne study shows that the rural landscape, both arable land and forests, plays an important role in health promotion.

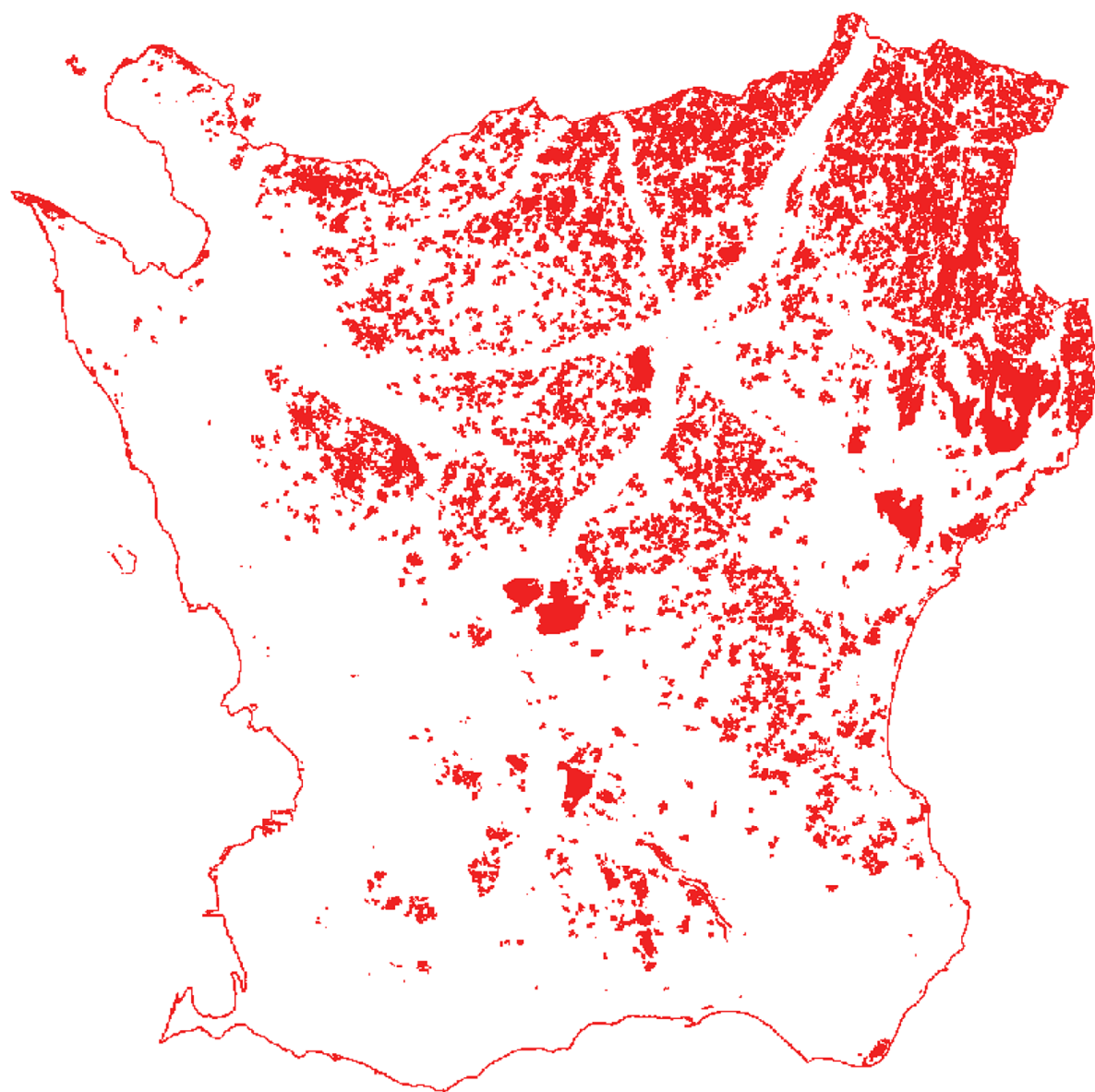
The Swedish National Institute of Public Health now recommends these characteristics as a checklist for green planning (FHI, 2009). The eight characteristics have been implemented in a number of planning projects for housing and infrastructure in Sweden (Skärbäck, 2007).

5. Conclusion

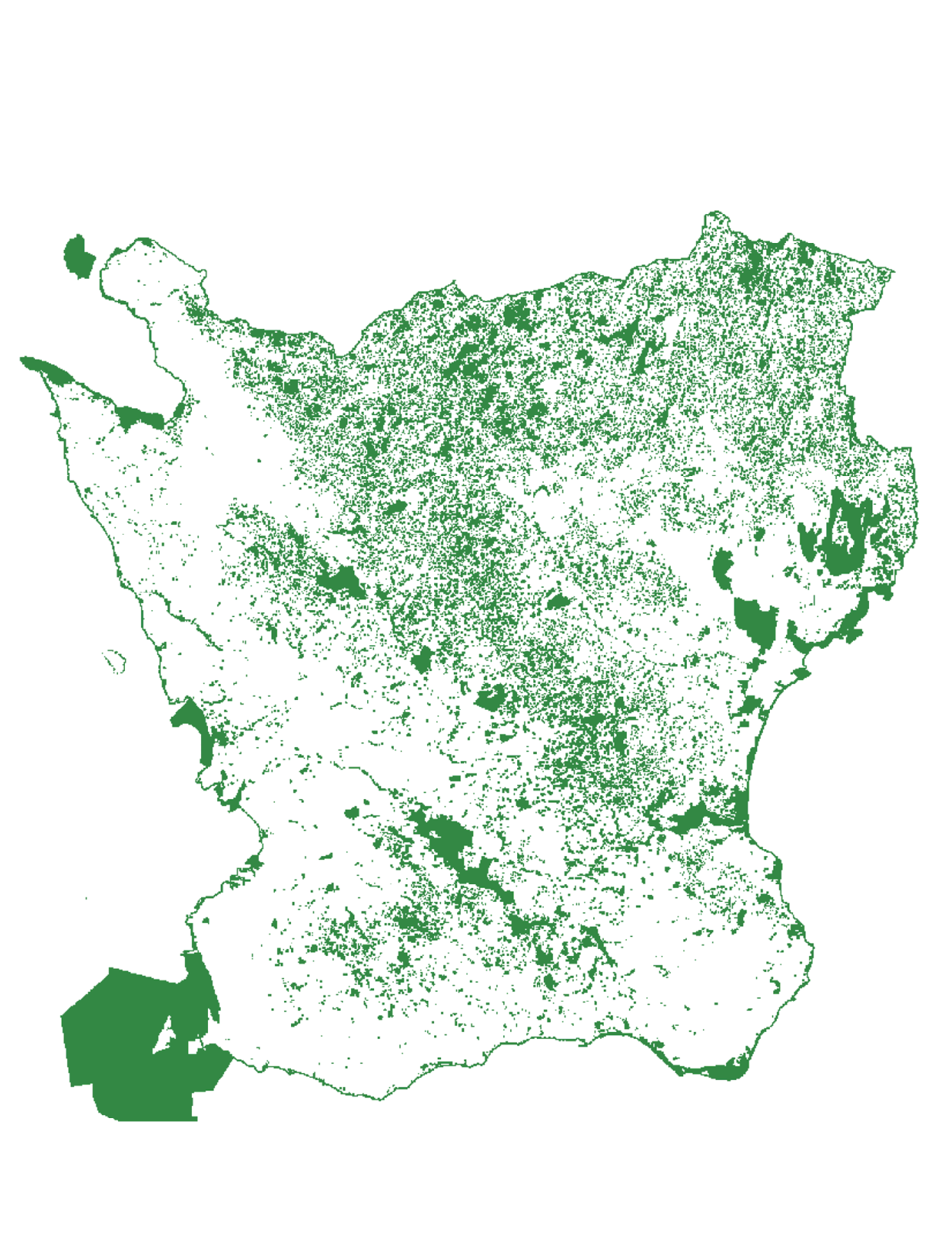
In the study by Björk et al. (2008) green characteristics of the nearby natural environment was shown to be positively associated with neighbourhood satisfaction and physical activity. The association with neighbourhood satisfaction was especially marked among tenants, and a beneficial effect on BMI was also noted in this group. No evident effect of the green characteristics on self-rated health was detectable. The cross-sectional design limits definite conclusions regarding cause-effects. A further limitation is that the study was restricted to rural and semi-urban areas and the generalizability of the results to inner-city areas is therefore uncertain.



Map 1. Serene. The western part of Skåne Region consists mainly of arable land and cities. Silent (<30 dB(A)) nature areas accessible for recreation are rare in that urbanized area. The eastern part has much more assessable nature land, however partly penetrated by road noise, which reduces the serenity.



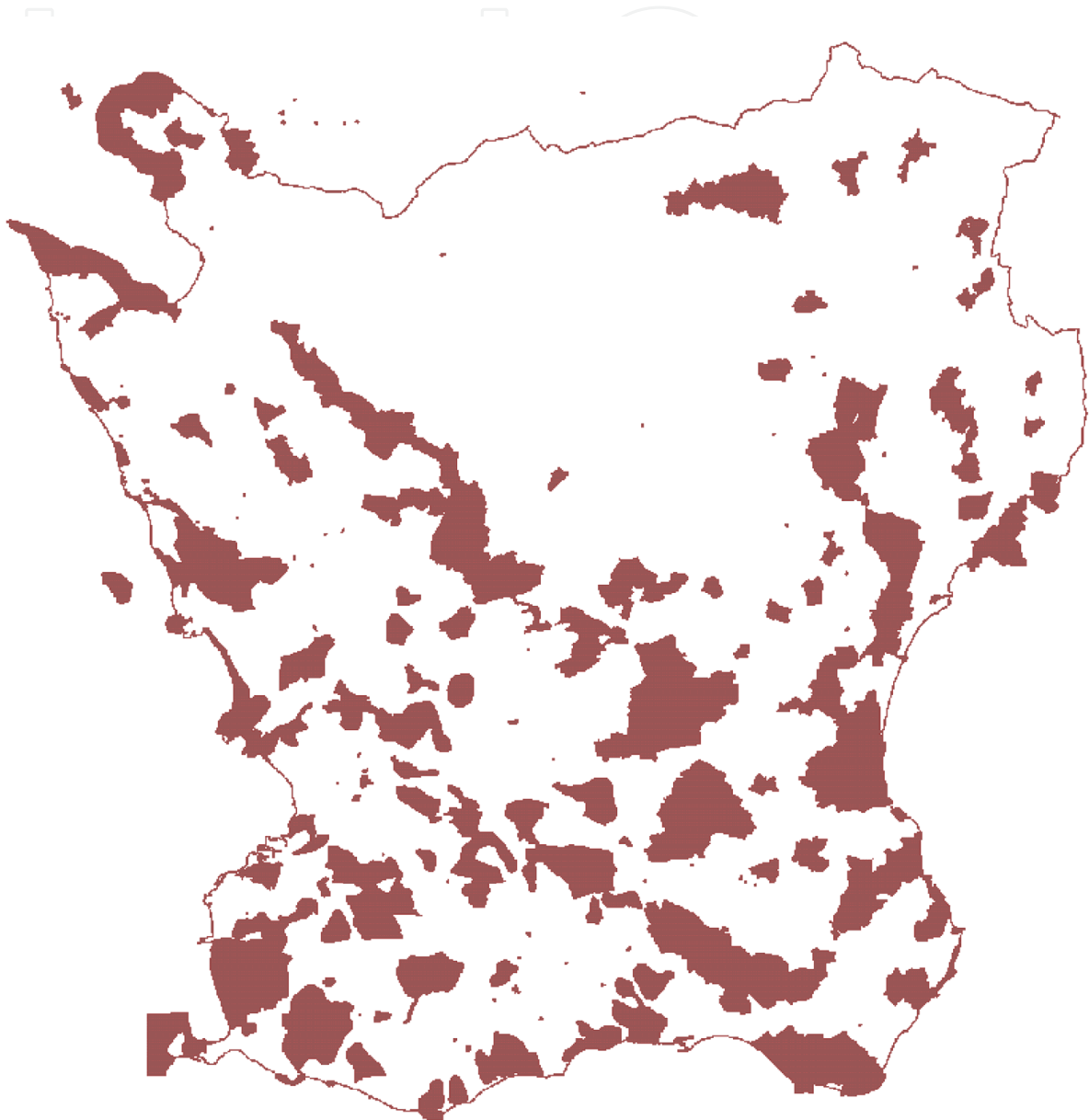
Map 2. Wild. The criteria for silence (<40 dB(A)) is not as heavy as for Serene. Some open land use categories from Serene are left out here.



Map 3. Lush, rich in species. Small parts of nature. And some large nature reservation areas. No reduction of noise.



Map 4. Space. Mainly open and half open accessible land, e.g. classified in a national plan for preservation of farmland.



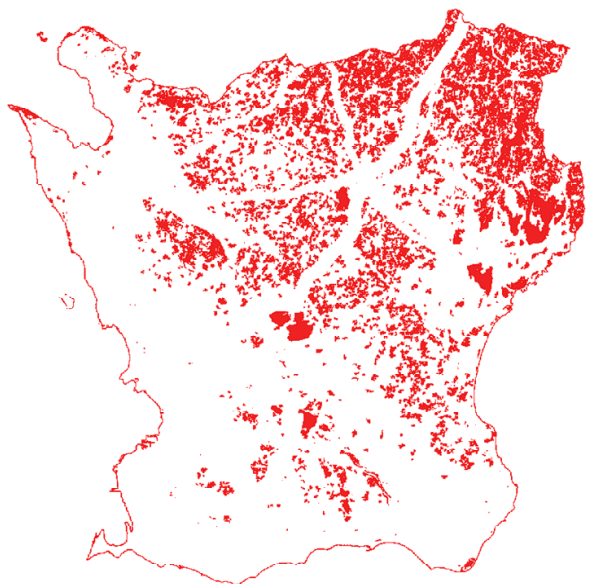
Map 5. Culture. Mainly identified from national and regional plans for preservation.



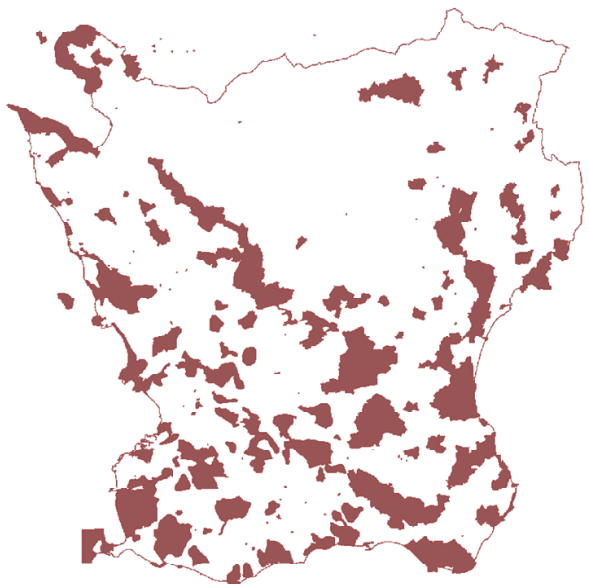
Serene



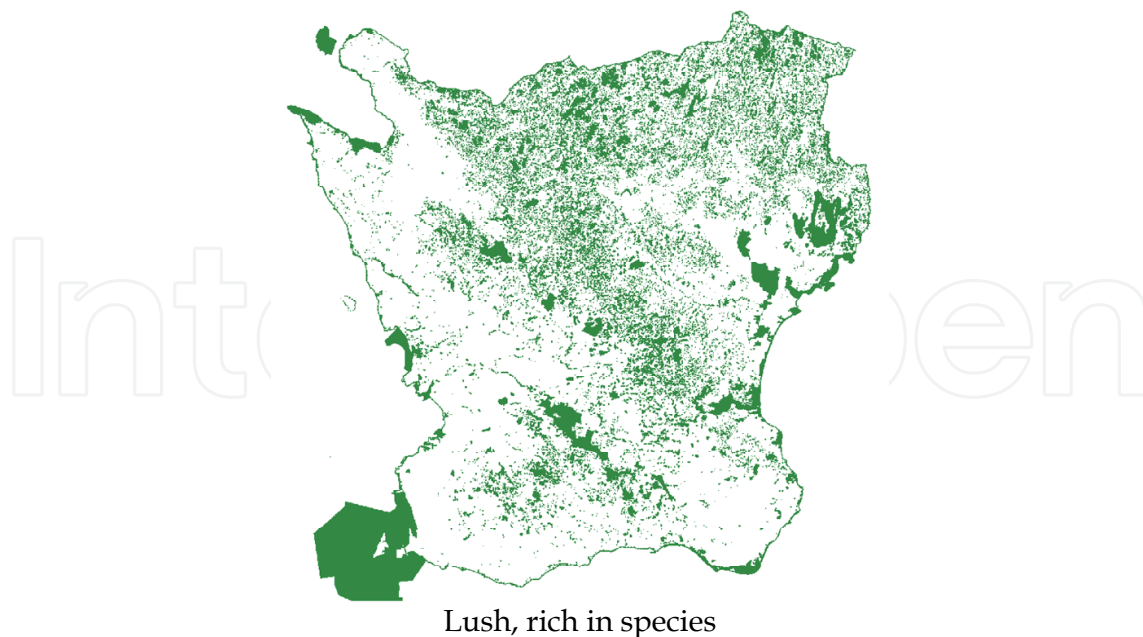
Space



Wild



Culture

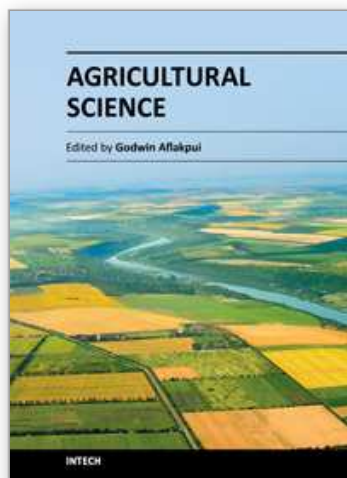


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This book covers key areas in agricultural science, namely crop improvement, production, response to water, nutrients, and temperature, crop protection, agriculture and human health, and animal nutrition. The contributions by the authors include manipulation of the variables and genetic resources of inheritance of quantitative genes, crop rotation, soil water and nitrogen, and effect of temperature on flowering. The rest are protecting crops against insect pests and diseases, linking agriculture landscape to recreation by humans, and small ruminant nutrition. This book is a valuable addition to the existing knowledge and is especially intended for university students and all professionals in the field of agriculture.

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