LAND-USE PATTERNS IN SOUTHWESTERN
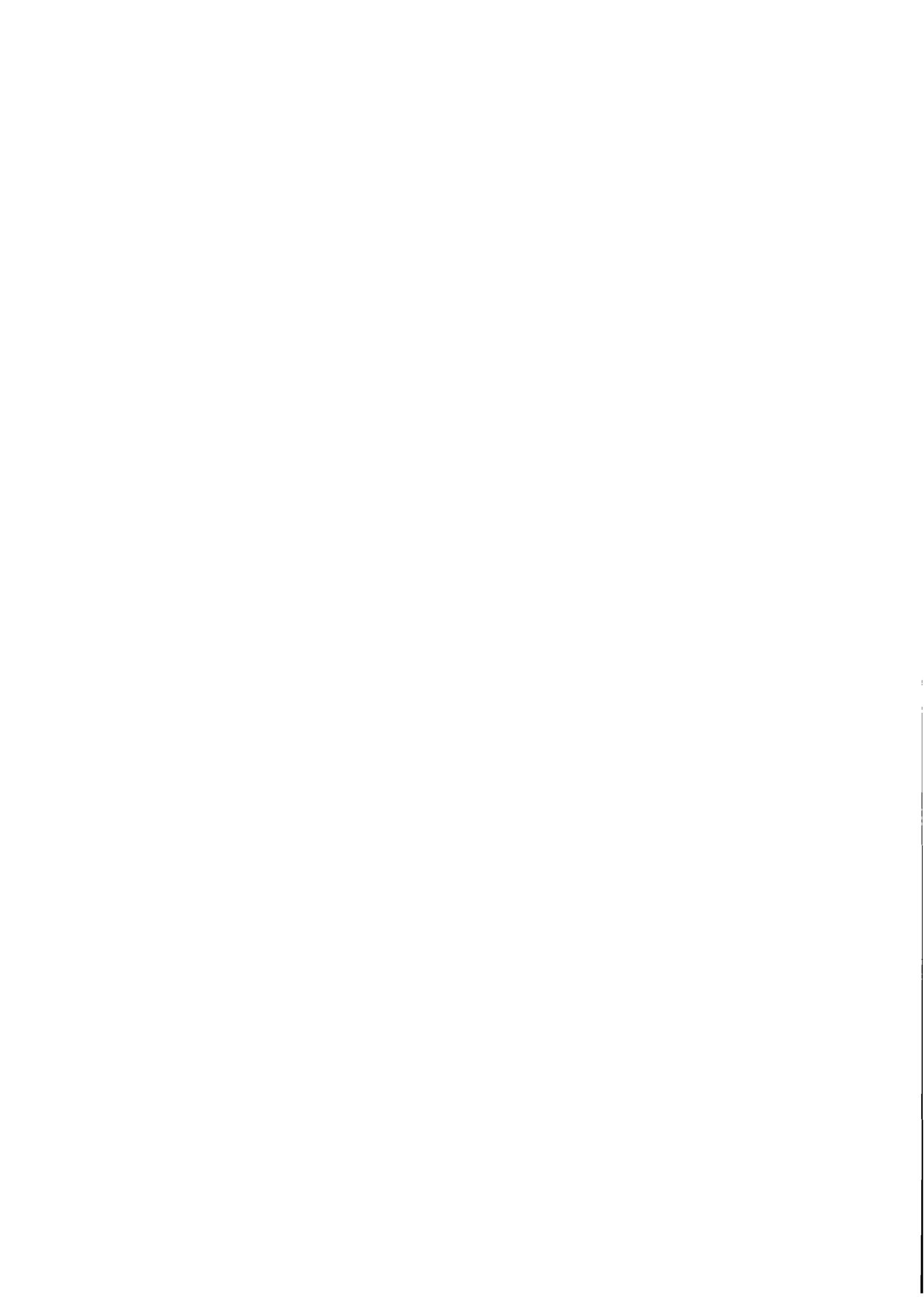SKÅNE, SWEDEN: A NOTE ON A
STATISTICAL METHOD AND SOME
PRELIMINARY RESULTS

Jörgen Schultz*

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*Intermunicipal Association of
 Southwestern Skåne (SSK)
 Box 2500
 S-20012 Malmö - Sweden

PREFACE

Since 1979, the Regional Development Group at IIASA has
been engaged in a case study of economic and demographic develop-
ment, land-use and related problems in the region of southwestern
Skåne in Sweden. The case study is the third in a series of at-
tempts made by the Regional Development Group to apply systems
analytic methods to regional planning problems in regions with
different economic structures, resource endowments and organiza-
tional settings.

The research in the Swedish case study has been done in colla-
boration with the Intermunicipal Association of Southwest Skåne (SSK),
as a part of their ongoing work in physical and public transport
planning for the metropolitan region of Malmö, and its neighbo-
ring municipalities. The research has been partly sponsored by
the Swedish Council for Building Research.

In the case study an integrated systems analytic package
of models is used which has been developed within the Regional
Development Group in cooperation with a group of Swedish resear-
chers and planners. In that package, separate models have been
developed for interregional economic and demographic problems,
and for intraregional land-use problems.

This paper focuses on the point of departure for the Skåne analysis — compilation of detailed information on existing land-use patterns. Because available official information was seriously incomplete, the researchers had to devise strategies for extracting data from other sources. By taking advantage of existing real estate tax information and conducting a survey of major public properties, they were able to account for nearly all land-use in the SSK region. The paper thus illustrates a creative solution to data problems that often hinder research at a subnational level.

Boris Issaev
Leader
Regional Development
 Group

Laxenburg, August 1982

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SWEDEN: A NOTE ON A STATISTICAL METHOD
AND SOME PRELIMINARY RESULTS

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1. INTRODUCTION

During the period 1979-1981 the International Institute for
Applied Systems Analysis (IIASA) in Laxenburg, Austria and the
Intermunicipal Association of Southwestern Skåne (SSK), Sweden
collaborated on a research study covering economic and demo-
graphic development, land-use planning, and related problems
in the metropolitan region of Malmö in southern Sweden. This
was the third case study undertaken by IIASA's Regional Deve-
lopment Group that applied systems analytic methods to regional
planning problems. To the SSK - a joint planning board[*] repre-
senting nine municipalities with a total population of 450,000 -
the study constituted an application of new methods for land-use,
housing, and public transport planning. The research was spon-
sored in part by the Swedish Council for Building Research. The
research project is being documented in a series of reports and
working papers published in English by IIASA and in Swedish by
the SSK. Selected papers are listed in the Appendix at the con-
clusion of this report.

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[*]An information booklet on the SSK's organization and acti-
vities, including its 1979 Structure Plan, is available in English
and German from the SSK.

2. THE NEED FOR LAND-USE DATA

The IIASA - SSK study developed and tested an integrated package of systems analytic models. In some cases, such as the model for demographic analysis and projections, it proved easy to compile necessary data from official records. For the economic models, however, data needs were harder to satisfy, since statistics on production, investment, and economic activity are often unavailable on a sufficiently disaggregated, regional level. Here estimation procedures had to be used to supply the information required to run the models.

Inadequate knowledge of existing land-use patterns thus initially hampered implementation of the project's integrated economic - physical methods in Skåne. The information ordinarily used by planners in the region was not sufficiently disaggregated by economic sector and activities.

There are no official land-use statistics covering all of Sweden's territory. The total urban area is calculated every five years as a part of the Census, but land-use patterns within cities are not surveyed. In contrast, statistics on agriculture are exceedingly detailed, including large quantities of data on farmland, crops, livestock, and yields. (Comparison with the modest statistics on manufacturing suggests that Sweden is primarily an agrarian country.) As a consequence, responsible local planning authorities undertake independent investigations of local urban and rural land-use patterns. Unfortunately, because of the variation in methods and data sources, their findings often cannot be compared.

During the past five years the Swedish National Central Bureau of Statistics (SCB) has investigated ways of generating official land-use information, but has not yet recommended a specific solution. Attempts to use aerial photography were not successful; the classification produced using photos taken from airplanes was only 67 percent accurate, while that produced using satellite photos was just 55% accurate. The use of large-scale maps furnished somewhat better results, but large variations in

scales, contents, and age of existing maps make it impractical
to apply this method to the country as a whole. In a vast,
sparsely populated country such as Sweden, it is not possible
to update official large-scale maps very often.

In our view, the SCB's most interesting approach was to
use existing administrative and statistical records, particu-
larly the real estate register. This register is kept by tax
authorities in each county to aid in calculating and levying
local property taxes. It contains valuable information on
ownership, acreage, type of use, and value of land and build-
ings. Unfortunately, it does not contain information on tax-
exempt public properties, such as schools, hospitals, parks,
streets, railways, harbors, and airports. Because public
properties comprise a substantial portion of urban areas, the
SCB could not classify all urban land. In fact, some 40 percent
of the land remained unclassified in the major town of the test
area. This finding, together with some other methodological
shortcomings, led the SCB to abandon, at least temporarily, the
use of register data to compile land-use statistics.

3. THE REAL ESTATE TAX REGISTER AS A SOURCE OF LAND-USE DATA

For several reasons we found the possibility of using the
real estate tax register more promising than the SCB did. First,
we needed the figures urgently and were inclined to accept some
errors rather than having nothing at all to work with. (Produ-
cers of statistics tend to demand higher quality than consumers/
planners can afford to do.) Second, we thought the register
could be improved by adding information from other sources.

The crucial information gap concerned tax-exempt proper-
ties. Initially, the sheer number of such properties (10,000
in the Skåne region) made the task of filling the gap seem
infeasible. A listing showed, however, that many are too small
to significantly effect total land-use patterns. Even if 8000
properties were left unclassified, we would lack information
on only a small percentage of the urban land area. For this
reason, we decided to concentrate on the 2000 largest properties,

all at least 5000 m^2 (approximately 1 acre). Each of these
properties was identified on large-scale maps and then classi-
fied according to use.[*]

On the basis of the official real estate tax register and
our own classification of the 2000 public properties, we then
created a data base. It contains approximately 80,000 proper-
ties classified by 35 different types of land use. The data
base accounts for almost 99 percent of the total area of
southwestern Skåne. Nearly all land in rural areas and approx-
imately 95 percent of land in urban areas has been classified.

Thus far the data base has been used to produce statistics
on four different levels of aggregation: the 122 parishes
in the region; the 24 planning areas used in the IIASA - SSK
study (all consisting of one or more parishes); the 9 local
authorities (kommuner); and, finally, the entire region.
Presently we are trying to produce statistics on a micro
level, namely for 100 smaller areas within the city of Malmö.

Because the method still has a number of weak points, the
statistics produced so far must be regarded as preliminary.
Several possible sources of error are summarized below:

o All information about the properties liable to taxa-
   tion (i.e., area and type of use) was collected in the
   1975 general assessment and the 1976-1980 special
   assessments. The assessment procedure calls for the
   active participation of the owner, the tax authority,
   and an elected assessment committee; although this
   should guarantee fairly accurate data, no formal
   evaluation has been performed.

o Although a property may be used for several purposes,
   just the major use was considered in the official
   assessment and in our classification. Only in the
   case of farms is the total area broken down by use
   (i.e., arable land, meadow, forest, farmyard, and other).

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[*] We benefited from the assistance of the County Surveyor
Department and several town planning departments in carrying out
this time-consuming work. Their knowledge of the locality aided
us greatly.

This simplification may cause unacceptable errors in the case of large properties with a complicated pattern of land use.

o Some types of land uses are systematically underestimated. This occurs, for instance, in the case of enterprises too small to dominate a property and also in the case of roads in the countryside, which normally are not independent properties. When a road is to be built on a farm, the land is usually not partitioned, but rather guaranteed through easement, i.e., a special agreement between the State and the landowner.

4. SAMPLE STATISTICS

Some examples of statistics produced thus far are presented in this section - namely, land-use patterns in the region as a whole and in a town parish, and the results of a special study of development densities in residential areas.

The SSK region has almost 500,000 inhabitants, distributed over an area of only 1600km^2. The overall population density is 280 persons/km^2, i.e., slightly lower than the average for England and Wales, the Netherlands, and Belgium, but 15 times higher than the Swedish average. About 10 percent of the SSK region consists of urban areas and small settlements. Housing and various commercial premises in apartment buildings account for 6 percent, industrial premises for 2 percent, and publicly owned urban land (including land for transportation, recreation, and reserves) for 9 percent. Most of the rural area is intensively farmed: 62 percent is arable land, while only 6 percent is meadows, and 7.5 percent is forests. Land-use data for the SSK region is presented in absolute terms in Table 1 and in relative terms in Table 2. The breakdown is shown graphically in Figure 1.

This land-use pattern is not typical of Sweden. Urban land accounts for only 1 percent, arable land for 7 percent, and forests for 55 percent of the nation as a whole. While 80 percent of the SSK region is urban or used for agriculture, only 8 percent

Table 1. Land use, by category, in the SSK region as a
whole and in the Lund Cathedral Parish, 1980 (ha).

Land-use Category	Area	
	SSK Region	Lund Cathedral Parish
FARMING AND FORESTRY		
Arable land	99,194	63
Pasture, meadows	9,115	4
Forests	12,118	-
Farms, etc.	2,299	2
Other	5,812	-
Total	128,538	69
DWELLINGS AND COMMERCIAL PREMISES		
Houses for seasonal uses	1,173	-
One-family housing units	6,915	54
Apartment buildings, primarily dwellings	1,186	64
Apartment buildings, dwellings and commercial premises	192	9
Apartment buildings, primarily commercial premises	206	14
Total	9,672	141
INDUSTRIAL USES		
Manufacturing industries	1,139	23
Mining quarries	416	-
Energy, water/sewage, waste	444	2
Petrol stations, repair workshops, garages	128	7
Stores	743	8
Greenhouses	236	-
Other	261	-
Total	3,367	40
PUBLIC URBAN LAND		
Public Administration facilities	43	1
Education facilities	477	18
Child day care centers	87	1
Medical facilities, hospitals	270	54
Churches, cemeteries	344	2
Airports	1,354	-
Harbors	171	-
Railway, post, telecommunication facilities	217	-
Roads, streets, parking facilities	2,448	105
Sport facilities, recreational areas	2,738	53
Sports grounds	470	45
Landscaped parks	1,152	4
Natural Parks	762	-
Other recreational areas	354	-
Other	4,648	8
Total	12,797	242
LAND TO BE DEVELOPED		
Sites for houses for seasonal uses	335	-
Sites for one-family housing units	380	1
Sites for apartment buildings	76	7
Sites for industrial uses	676	4
Other	882	7
Total	2,349	19
NOT CLASSIFIED	1,963	30
TOTAL AREA	158,686	541

Table 2. Land use, by category, in the SSK region as a whole
         and in the Lund Cathedral Parish, 1980 (%).

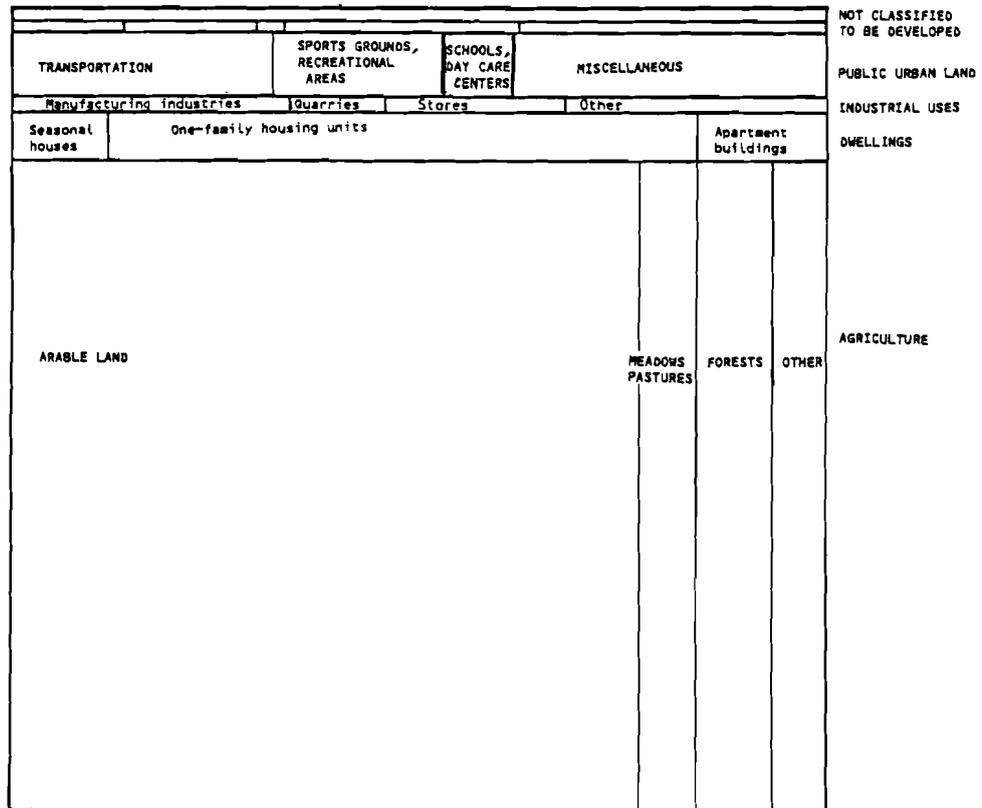| Land-use Category	Area	
	The SSK Region	Lund Cathedral Parish
Farming and forestry	81	13
Arable land	63	12
Pasture, meadows	6	1
Forests	8	-
Other	5	-
Dwellings and commercial premises	6	26
Industrial uses	2	7
Public urban land, transportation	8	45
Land to be developed	1	3
Not classified	1	6
Total	100	100

Figure 1. Land use in the SSK region, by category,
          1980. The portion of the figure allo-
          cated to a given category indicates its
          relative size.

of total Swedish territory falls into these land-use categories.
Thus, SSK planners face a dilemma unique in Sweden - namely,
resolving the conflict between urban growth and agriculture.

Land-use patterns are more distinctive in small areas,
as demonstrated by the Cathedral Parish in the medieval town
of Lund. This parish covers 550 ha and consists of a town
center, a medieval cathedral, some university buildings, a
hospital, residential areas containing housing for 14,000
persons, extensive parks and sportgrounds, and two of Sweden's
largest packaging industries. At its southernmost boundary,
the Malmö - Lund motorway crosses a small river valley and
ploughed fields. The statistics presented in Tables 1 and 2
and Figure 2 show that almost half of the parish's area is
used for public purposes and another quarter for housing.
The comparatively high proportion of unclassified land, 5 per-
cent, is explained by the presence of many small tax-exempt
properties. In fact, half the parish area is exempt from real
estate taxes.

Because the real estate tax register contains infor-
mation on age, type, and size of buildings, ownership, and
market values of land and buildings, in addition to acreage,
many possibilities for further analysis exist. A special
study on densities in residential areas demonstrates this
potential. The 55,000 single- and two-family housing units
within the SSK region, i.e., the entire housing stock other
than apartment buildings and farmhouses, constituted the
statistical base for the study. Disaggregation of plot size
by geographical location, year of development, and type of
house provided a good picture of how development densities in
residential areas have changed in different parts of the region
during the twentieth century.

Study results showed that densities in residential areas
are higher in the SSK region than in the rest of Sweden. The
average plot size in the SSK is 1100 m^2, compared to 2500 m^2
for the country as a whole. Within the region there is some
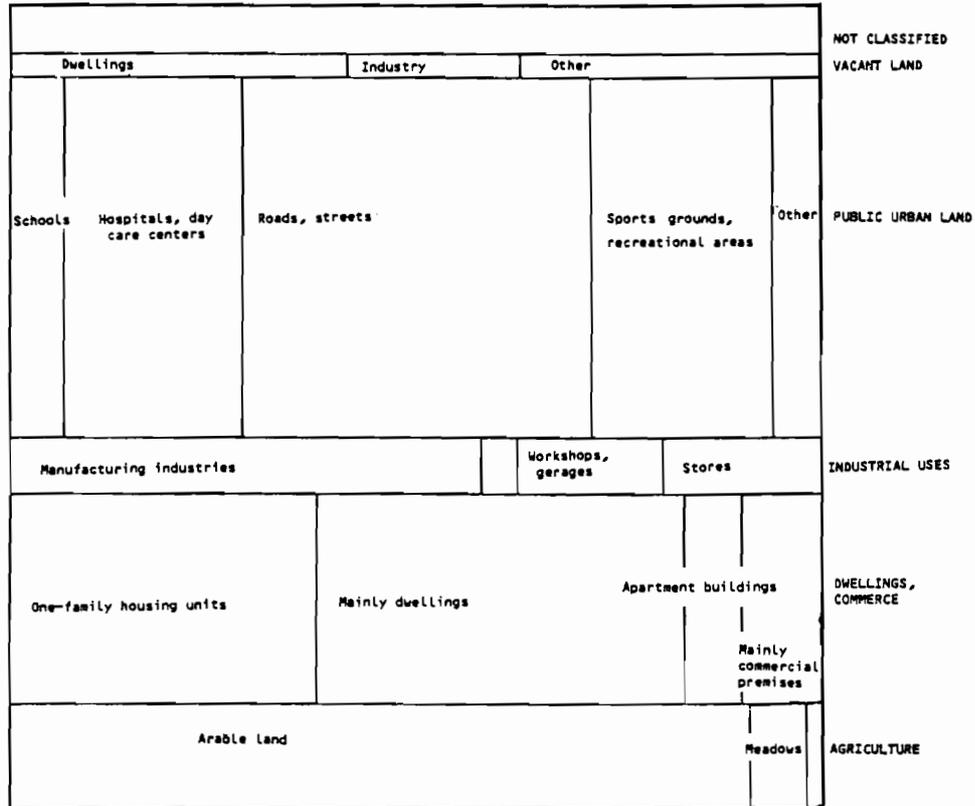variation at the local authority (kommuner) level, but even

Figure 2. Land use in the Lund Cathedral Parish, by category, 1980. The portion of the figure allocated to a given category indicates its relative size.

greater variation at the settlement level (see Figure 3). In part, this can be related to differences in age structure; as shown in Figure 4, the average plot size has decreased from 1800 m^2 in areas developed before 1930 to 680 m^2 in areas developed most recently.

There are clear intraregional differences in land-use planning traditions. For instance, in the city of Malmö, land use always has been intensive; in a settlement like Bjärred, land use was extensive in the beginning of the century, when the village was predominantly a vacation resort. As Bjärred's population started to grow and it was transformed into a suburb of Malmö, plot sizes decreased markedly. This temporal change in average plot size is shown in Figure 5. Still, old low-density residential areas, characterized by one-family houses on large plots, do exist; as shown in Figure 6, the SSK region contains some 13,000 plots larger than 1000 m^2. In general, however, local differences in planning seem to be rapidly disappearing, resulting in a more uniform residential structure within the region.
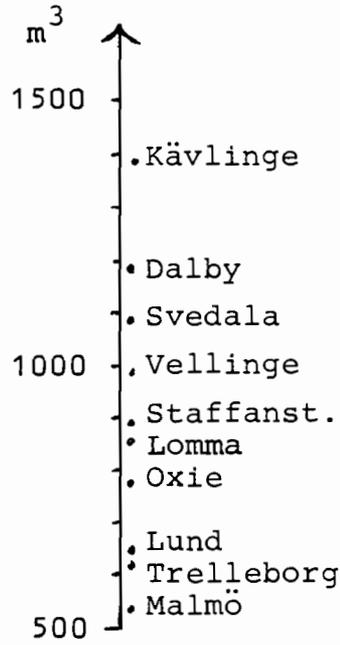
m^3

1500

.Kävlinge

. Dalby
. Svedala
1000 . Vellinge
. Staffanst.
. Lomma
. Oxie

. Lund
. Trelleborg
. Malmö
500

Figure 3. Average plot size for one- and two-family housing
units in selected settlements, SSK region, 1980.

2070
2000
1800
Detached houses

m^2

1500

TOTAL

1000

750
680

500 350 Attached row houses
310

1920 1930 1940 1950 1960 1970 1980
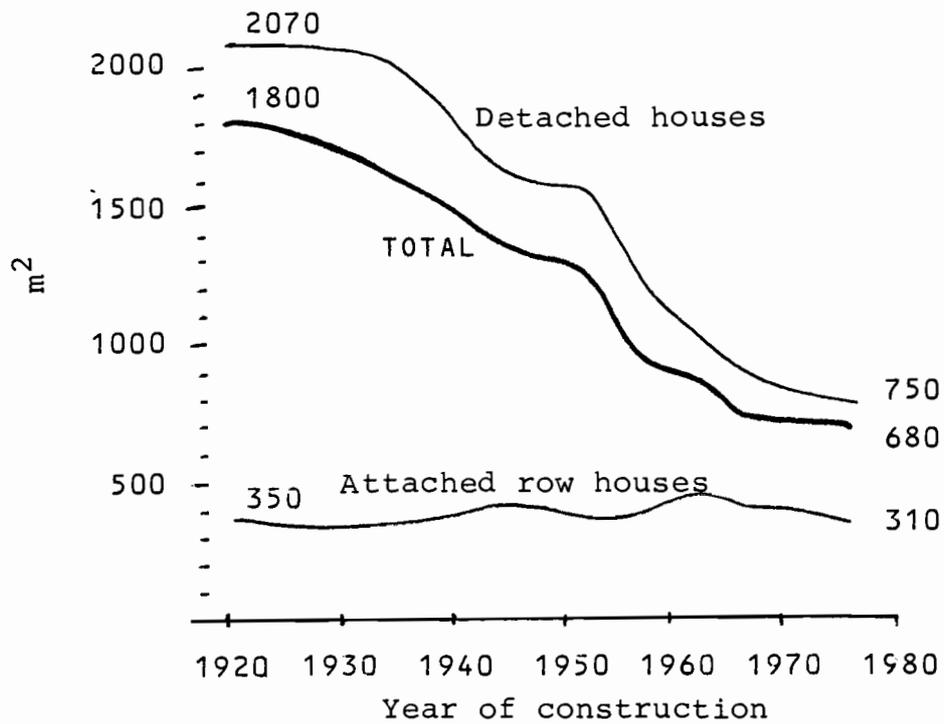Year of construction

Figure 4. Average plot size for detached houses and attached
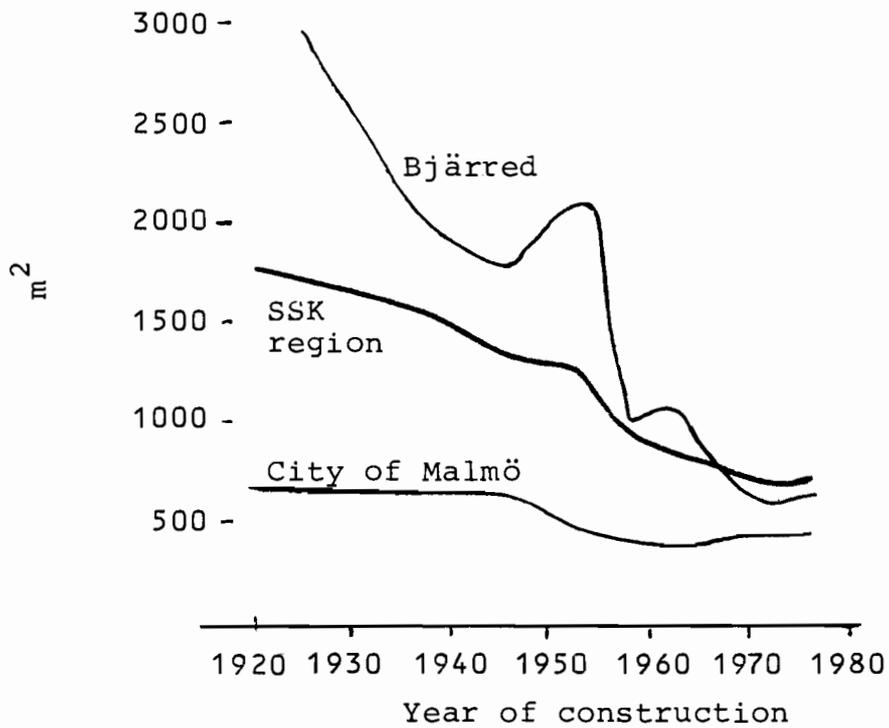row houses on the SSK region, by year of construc-
tion.

Figure 5. Average plot size for one- and two-family housing units in Bjärred, the City of Malmö, and the SSK · region as a whole, by year of construction.
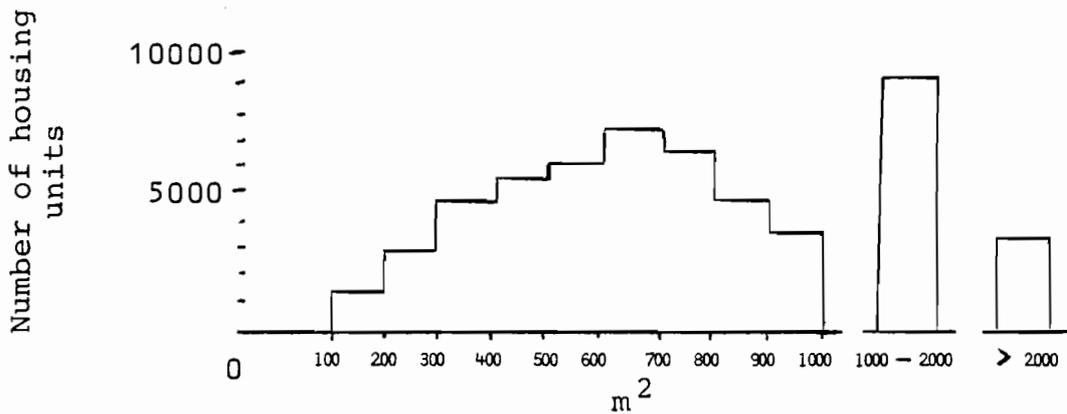

Figure 6. Number of one-family housing units by plot size, SSK region, 1980.

APPENDIX: Selected Reports on the Southwestern Skåne Case Study

Andersson, Å.E.   1980a.   The Swedish Case Study--A Progress
       Report. WP-80-74. Laxenburg, Austria: International
       Institute for Applied Systems Analysis.

Andersson, Å.E.   1980b.   Regional Systems Analysis--From Theory
       to Application. WP-80-136. Laxenburg, Austria: Interna-
       tional Institute for Applied Systems Analysis.

Andersson, Å.E., P. Hjorth, L. de Maré, A.L. Thelander.   1979.
       Water Resources Planning and Management in Advanced Econo-
       mies: The Case Study of Western Skåne, Sweden-- A Back-
       ground Report. WP-79-23. Laxenburg, Austria: Interna-
       tional Institute for Applied Systems Analysis.

Andersson, Å.E., I. Holmberg, J. Schultz, F. Snickars.   1981.
       Regional Demographic Development in Southwest Skåne.
       CP-81-33. Laxenburg, Austria: International Institute
       for Applied Systems Analysis.

Andersson, Å.E., and M. Kallio.   1982.   A mathematical pro-
       gramming approach to land allocation in regional planning.
       In: Regional Development Modeling--Theory and Practice,
       edited by M. Albegov, Å.E. Andersson, and F. Snickars.
       Amsterdam: North-Holland. In press.

Anderson, R.J. 1981.   An Economic Analysis of Supplementary
       Irrigation in Skåne. RR-81-33. Laxenburg, Austria:
       International Institute for Applied Systems Analysis.

Ohlsson, L.   1982.   Industrial Structure and Possible Industrial
       Futures of the Malmöhus County. CP-82-19. Laxenburg,
       Austria: International Institute for Applied Systems
       Analysis.

Roy, G.G.   1981.   An Interactive Computer Model for Land Allo-
       cation in Regional Planning. Part II: System Design and
       User Manual. WP-81-47. Laxenburg, Austria: International
       Institute for Applied Systems Analysis.

Roy, G.G. and F. Snickars.   1982.   An Interactive Computer Model
       for Land Allocation in Regional Planning. Part I: Theore-
       tical Foundations and Operational Principles. Laxenburg,
       Austria: International Institute for Applied Systems
       Analysis. Forthcoming Working Paper.

Roy, G.G., and F. Snickars.   1982.   An Introduction to the ISP
       System for Land-Use Planning. Laxenburg, Austria: Inter-
       national Institute for Applied Systems Analysis. Forth-
       coming Working Paper.

Snickars, F.   1981.   Comparative Studies of Regional Planning
       Models--with Special Emphasis on a Case Study in South-
       western Skåne. WP-81-49. Laxenburg, Austria: Interna-
       tional Institute for Applied Systems Analysis.

Snickars, F., Å.E. Andersson, I. Holmberg, B. Marksjö, G.G. Roy, J. Schultz, U. Strömkvist. 1982. Economic Development and Land Use in Southwest Skåne. A Case Study of Regional Systems Analysis for Physical Planning. Laxenburg, Austria: International Institute for Applied Systems Analysis. Forthcoming Collaborative Paper.

Snickars, F., and A. Granholm. 1981. A Multiregional Planning and Forecasting Model with Special Regard to the Public Sector. Regional Science and Urban Economics 11(3): 377-404.

Strömkvist, U. 1982. An Economic Analysis of Agriculture and Industry in the Skåne Region. Laxenburg, Austria: International Institute for Applied Systems Analysis. Forthcoming Collaborative Paper.

Strezpek, K., and J. Kindler. 1982. Integrated Water Demand/ Supply Management in Southwestern Skåne: A Preliminary Analysis. WP-82-22. Laxenburg, Austria: International Institute for Applied Systems Analysis.