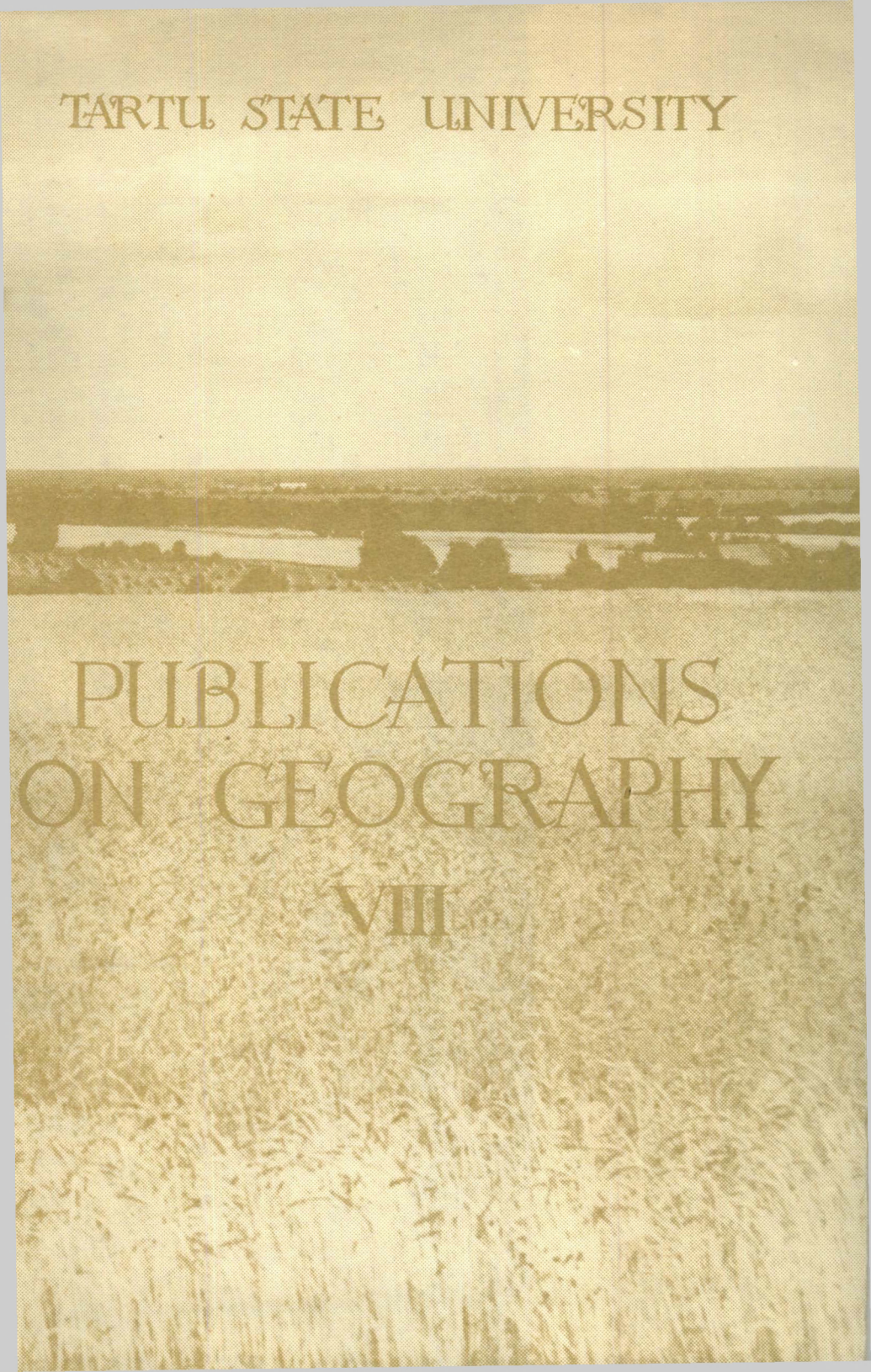


TARTU STATE UNIVERSITY



PUBLICATIONS  
ON GEOGRAPHY

VIII

TARTU RIIKLIKU ÜLIKOOLI TOIMETISED  
УЧЕННЫЕ ЗАПИСКИ  
ТАРТУСКОГО ГОСУДАРСТВЕННОГО УНИВЕРСИТЕТА  
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vihik 282 выпуск

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On the Occasion of the European  
Regional Conference of the IGU

Pühendatud  
Rahvusvahelise Geograafia Uniooni  
Euroopa Regionaalsele Konverentsile

Посвящен  
Европейской региональной  
конференции МГС

TARTU 1971

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## Contribution of Estonian Geographers to Complex Territorial Planning

S. Nõmmik and A. Raik

The Soviet Union was the first country in the world with a planned economy. The forecasting of the basic trends in the development of the national economy in the form of long-term planning and of current planning that relies on the former - this is the road along which Soviet socialist society is moving towards the goals set up before it.

Just as the life of society in general is developing all the time, so does the theory and the practice of the planning of the national economy. Each science has its own social sources. In the last few decades in our country the problem of the rational spatial arrangement of the material-technical basis of our society has risen with all acuteness. In connection with this, the need for the complex territorial planning of productive forces has come to the fore; in the theory of planning, however, a new section is coming into being whose object will be the regularities of a detailed spatial organisation of the national economy.

From the theoretical point of view, socio-economic planning can be divided into three stages: 1) general planning of the branches of the economy, 2) complex territorial planning and 3) territorial designing. Hence complex territorial planning is a connecting link between the general planning of the branches of the national economy on the one hand and territorial designing on the other hand. It must synthesize the data of an analytical plan for the development of the branches of the economy

on a territorial basis. This is a complicated scientific task which presupposes the co-operation of a great number of specialists in different fields among whom a special role falls to the lot of geographers. All three stages of planning the national economy in any form of their expression rely on the knowledge of the characteristics of the natural historical foundation and of the existing spatial regularities of society. From here follows the significance of complex physical-geographical and economic-geographical investigations for socio-economic planning.

The rise of new aspects of socio-economic planning is a law-governed phenomenon conditioned above all by the increasing extent of capital investments, and the ever-growing number of building-sites in both new sparsely inhabited and old, densely populated economic regions. The Baltic Union Republics, including the Estonian S.S.R., belong to the latter category.

The greatest volume of building activity in the Estonian S.S.R. will be carried out in the industrial northern part and it will be concentrated chiefly in towns. Rural building activity will be focussed on the reconstruction of rural settlements since the existing scattered distribution of settlements does not correspond to the needs of socialist large-scale agriculture and will have to be reorganized. Taking into account the large volume of building activity, the complex territorial planning of the productive forces of the Estonian S.S.R. is from an objective point of view absolutely necessary. At the same time the level of development of science in the Republic was so high as to make it possible to tackle such a complicated task. In July 1967 the respective investigations began and this laid a firm basis for the territorial planning of the productive forces of the republic.

The joint efforts of a great many research institutes, design institutes and institutions for the management of the national economy have been con-

centrated on carrying out the above-mentioned investigations. By now the first stage of work has been completed. An extensive amount of information has been collected and elaborated on the natural-historical foundation as well as on the existing situation and the long-term prospects of all the branches of the national economy. At the second stage of complex territorial planning, when a scheme for future development is going to be compiled, this information will have to be synthesized on a regional basis.

There may arise the questions: what contribution did the geographers of the republic make to this complex territorial planning at its first stage and what tasks face the geographers at the next stage of this large-scale undertaking? Below we shall try to answer these questions from the standpoint of physical as well as economic geography.

From the point of view of the utilization of natural historical foundations the tasks of complex territorial planning include the working out of a plan which would ensure a rational and complete exploitation of the natural resources on a level making it possible for the internal balance of nature to be maintained. The latter consideration will guarantee the permanent productive capacity of nature and the preservation of both the natural level of recoverable resources and the maximum healthiness of the natural surroundings as well as their aesthetic beauty. The achievement of this aim presupposes an all-round and detailed characterization and evaluation of both the object of man's labour and the environment of human life and production.

It must be emphasized that complex territorial planning must provide a plan for the utilization of both nature and its various resources. It must also provide a plan for a goal-directed shaping and remaking of nature in which the implementation of the requirements of preserving nature as an environment of man's life must have a prominent place and it must in particular avoid the pollution of nature.

Hence the treatment of natural conditions and resources in complex territorial planning should not remain on the level of providing basic data on complex territorial planning but it must become an independent and equal constituent part of the human environment. The achievement of this aim, however, is hindered by the fact that various pertinent theoretical and methodological problems have not been elaborated as yet.

The tasks facing complex territorial planning will have to be tackled on different levels, which presupposes the consideration of natural conditions in various ways and in a different degree of detail.

The characterization of resources on the level of the Republic taken as an entity provides a foundation for an assessment in general outline of the expediency of assigning the branches of production based on basic natural resources (land resources, fertility of soils, water resources, forests) to this or that category. It must be pointed out that when solving the problems of assignment of a mode of utilization which basically concerns nature and is particularly sensitive to the damage done to nature, research exceeds the amount of detail by one degree, which usually characterizes the level of territorial planning on which the consideration of problems is proceeding. At the same time it is important to bear in mind the circumstance that territories which suit one function may be found only in comparatively limited numbers.

At the present stage of the economic development of the Republic several special problems are worth mentioning in connection with the utilization of territory.

The mining of natural resources in the Republic is expanding, particularly the opencast mining of oilshale, due to which the land involved is made unproductive. The utilization of large quantities of oilshale locally at thermal power-stations and chemical plants results in large amounts of residue the dumping of which causes many worries.

Prospects of treatment at future health resorts demand the reservation of territory. One of the specific natural resources of the Estonian S.S.R. is curative mud which is unique in the European part of the Soviet Union as well as in Northern Europe. In the 1930s Estonian curative-mud health-resorts were visited by Scandinavians in great numbers. Balneological resources were discovered comparatively recently and their utilization is still at the initial stage of development. The combination of mud, balneological and climatic treatment has good prospects, but requires the timely setting-aside of suitable territories for the purpose of establishing health-resorts. In connection with the rise of the living standards and the economic well-being of people and the increase of leisure-time (due to a general transition to a five-day working-week) ever more areas serving the purpose of recreation are thrown open to people as well as institutions, and recreational buildings are put up by the State as well as by private persons.

In connection with the growth of towns and the development of production, the consumption of water has reached a point which requires the control of the run-off of rivers and streams - the erection of water-reservoirs and the establishment of water-conduits between bodies of water, which is again bound up with territorial problems.

The growth of towns and rural settlements renders it necessary to set aside territories where it is most expedient to expand building activity.

Great changes are proceeding in the domain of the most extensive use of territory in the Estonian S.S.R., namely in the use of agricultural land resources. Fifty per cent of our fields and meadows are subject to excessive wetness. Due to this ameliorative work has acquired large dimensions. In some places agricultural land of low fertility is being afforested. This, however, is again associated with the question of an optimum forested area of the republic. The

knowledge of the prospective status of land resources is necessary for taking right decisions on the expedient distribution of central and auxiliary country settlements and large-scale farms. As a result of all this, capital investments in rural building activity show a strong tendency to increase.

All that has been said above testifies convincingly to the need for the complex planning of land utilization. At the same time such planning must embrace the entire territory of the republic taking into consideration all the characteristics of nature as well as all the realizable modes of utilization and the spheres of planning resulting from the former. Only in this way it will be possible to avoid contradictions between different plans for the utilization of nature; for example, where some research workers plan the damming up of a river for the control of the run-off, others on the contrary plan the dredging of the river with the aim of directing drainage water into it. In the framework of complex territorial planning the Geography Department of Tartu State University was given the task to carry out the characterization of natural conditions and resources on the territory of the Estonian S.S.R.. The geographers had to work out research projects, co-ordinate this work and synthesize the data obtained. The supervisor and co-ordinator of this work was Docent A. Raik.

Proceeding from the existing situation, the basic tasks of the total research project were the following:

(1) to collect all the existing natural-scientific information and on its basis to compile a written survey of the needs of planning;

(2) to compile (on the basis of the existing data) a set of maps in which all the maps would be drawn up on a uniform basis whose scale would correspond to the degree of the studies previously carried out (the scale was to be 1:600,000), giving attention to the maps which have a direct bearing on planning and have a predictive value;

(3) to carry out a more detailed study of the land-forms of territory from the viewpoint of relief;

(4) to elaborate the special problems concerning territory and to make definite proposals for the utilization of nature.

Altogether 42 persons from 17 institutions took part in the work of the characterization of the natural conditions of the Republic. Several individual problems were solved directly by persons on the staff of the Chair of Geography. A survey of large inland bodies of water was compiled by L. Kullus, the characterization of rivers was performed by M. Mardiste. The basic work on the compilation of the general-climatic, constructional-climatic and bioclimatic conditions was carried out by A. Raik, L. Palm and M. Mardiste. J. Jagomägi compiled a thorough survey of forest resources. The map drawn up by J. Jagomägi which sums up the assessment of the preconditions for wood production is worth pointing out. This map is based on cartograms of forest increment and total forest yield as well as on cartograms of the yield of maturing, mature and overmature stands.

The assessment of tourist resources is a study essential for planning, which is often omitted. Therefore A. Raik worked out a classification of the objects which are of interest to tourists. E. Jagomägi and Ago Marksoo compiled a map of the places worth seeing, likewise a map of hiking facilities.

E. Varep compiled an extensive survey characterizing the existing types of landscape and the landscape districts; previously there had existed only a very general outline. E. Varep also dealt with the influence of landscape conditions on rural settlement and examined some questions of landscape management and nature conservation.

A survey describing the land resources and discussing the problems of their utilization was compiled by A. Raik.

A valuable part of this collective investigation consists of concrete proposals for the further utilization of nature that have been made by research workers of several institutions. The following deserve special mention: exploitation of land resources (E. Mustjõgi) and of underground waters (E. Cheban), utilization of lakes for the growing of fish, waterfowl and crayfish, and for recreation purposes, establishment of a protective regime for 518 lakes (N. Mikelsaar), preservation and protection of mires in the interests of science, hydrology, tourism and berry-growing (the survey embraces 102 peatland areas and was carried out by V. Masing).

Surveys of the special needs of complex territorial planning have been written by geographers. An extensive work of this kind is the elaboration of a scheme of functional zoning by A. Raik on which we shall dwell below.

Functional zonation is a method for the synthetic characterization of natural conditions which reflects the natural preconditions of a territory for its utilization in different functions. This is particularly important in solving problems of regional planning.

When elaborating a scheme of the functional zonation of the territory of the Estonian S.S.R., the following modes of land use have been distinguished: agriculture, forest management, industry, fishing, recreation and nature conservation. The non-utilization of a territory is considered as one mode of utilization.

According to the role which a mode of utilization plays, we distinguish basic utilization, concomitant utilization and additional utilization.

On the basis of the structural variety of the utilization of territory we differentiate: (1) territorial units with a single predominant mode utilization, (2) territorial units with 2 or 3 equally predominant modes of utilization, and (3) territorial units with several modes of utilization, each having a different importance. The

initial units of zonation are combined into larger units on the basis of the uniformity of the basic mode of utilization.

The scheme of zonation reflects the modes of utilization whose appropriate areas are large enough to ensure expedient utilization for a given purpose.

Functional zonation is characterized by a prognostic property: alongside the established mode of utilization functional zonation points out the potential promising modes of the utilization of a territory which have not yet been carried out. This is especially true of the modes of utilization whose significance will sharply increase along with ever growing urbanization, recreation and nature conservation.

In carrying out the functional zonation of Estonia the characteristics of about 800 territorial units of the State land reserve (farms and forestries) have been analyzed.

Functional zonation is such a mode of analyzing territory which can also be applied for the characterization of water areas.

Taking into account the special significance of territorial planning, work started on the compilation of large-scale practical landscape maps of the surroundings of towns. These maps will serve as a basic material for the enlargement of city territories and for planning a green belt round each city. The principles of compiling such maps were worked out by I. Arold, the principles of composing forest-maps were elaborated by J. Jagomägi. So far practical landscape maps have been compiled by members of the Chair of Physical Geography of Tartu State University on the surroundings of 17 urban settlements, 8 nature reserves and 1 recreational area.

A. Raik and I. Arold compiled a detailed survey of the extent to which the territory of the republic has been studied from the point of view of planning. These authors also formulated the tasks for the study of territory at the next stages of complex territorial planning.

The significance of the economic-geographic study of the location of productive forces in territorial planning results from their spatial complexity. The chief task of economic geography does not lie namely in the study of the location of individual branches of the economy but in research into socio-economic territorial complexes. The analytical trend in the development of science results in the rise of a growing number of new disciplines. At the same time, when carrying out the territorial organization of the national economy, the need for integrated studies is gradually increasing. Economic geography is one of the few sciences which investigates the socio-economic systems (cities, economic regions) that arise in the development of the geographic division of labour and in the process of the spatial concentration of productive forces. The study of their structure and the regularities of their development, the determination of their position in the socio-territorial division of labour is one of the foremost preconditions for the territorial planning of productive forces. The forms of the life of society do not exist in a state of spatial detachment but are associated with one other to a greater or smaller extent, displaying the tendency of territorial convergence on account of these links. At the same time they make use of a common territory which has its natural features and its socio-economic specific characteristics that stem from the amount of invested human activity.

The need for an approach to the study of productive forces from the viewpoint of complexity will be apparent with particular force at the second stage of territorial planning when planning is carried out according to economic-regional units.

The economic geographers of the republic took an active part in the extensive work carried out at the first stage of compiling a scheme of complex territorial plann-

ing. They were joined by architects from several design institutes, economists from research institutes and higher educational establishments, etc. An essential part in the bringing together of geographers, particularly economic geographers working at different establishments, was played by the Estonian Geographical Society. On its initiative and in collaboration with research institutes and higher educational establishments several seminars and discussions were organized on the problems of complex territorial planning, which greatly contributed to the solution of the tasks set up.

Economic-geographic research proceeded chiefly in four principal directions: (1) elaboration of the perspectives and territorial proportions of the development of the branches of the national economy, (2) research into population and labour resources, (3) study of urban and rural settlements and (4) economic and administrative regionalization within the republic. Economic geographic subject matter was researched mainly in the Institute of Economic geographic subject matter was researched mainly in the Institute of Economics of the Academy of Science and in Tartu State University. It was chiefly the Sector of the localisation of productive forces of the Institute of Economics that carried out research into the Republic's distribution of industries (V. Tarmisto), population (K. Laas) and labour resources (V. Kaufman); the research topics of the Institute also comprised the study of urban settlements (H. Paalberg and R. Ehrlich), the location of servicing institutions (H. Aarma), etc.

The Chair of Economic Geography of Tartu State University carried out research into complex territorial planning in several directions. 1) A detailed study of the processes of population migration (A. Marksoo) was carried out which makes it possible substantially to specify predictions concerning the republic's population and labour resources. 2) There was accomplished a research

work into the regional systems of urban (S. Nõmmik) and rural (V. Murel) settlements; on the territory of the republic there was ascertained a settlement system of six functional-hierarchical stages with the capital city of Tallinn at its head. The results obtained are summed up in the typology of the regional functional-hierarchical subsystems of the republic's settlement system. The information collected and elaborated was applied in the compilation of the perspective settlement system of complex territorial planning. 3) The detailed economic (S. Nõmmik) and administrative (O. Kurs) regionalization of the territory of the republic was investigated, a study was conducted of economic links within the republic, and 4) a detailed investigation was carried out of parts (administrative districts and towns) of the republic (E. Tsopp, E. Ladva, etc.). The detailed economic and administrative regionalizing of the territory of the republic proceeded from the peculiarities of economic basis as a whole and from the system of settlement. The existence of five intrarepublican economic regions and eleven administrative-economic regions was determined. As the result of research into the administrative distribution of the republic concrete proposals were made for its reconstruction. Detailed characteristics are given by towns (Viljandi, Tartu, Pärnu) and districts (Viljandi, Pärnu, etc.).

At the second stage of complex territorial planning, regional research will have to be continued and become more detailed. An urgent problem facing the economic geographers is the working out of synthetic research methods. These would raise the scientific level of regional research from traditionally descriptive characterization on to the level of synthetic-mathematical evaluation. The economic geographers of Tartu State University consider this task to be of primary importance for their research. Preliminary results in this field have already been obtained, but the work done in this direction must be substantially extended and stepped up.

**Eesti Geograafide panud komplekssesse  
territoriaalsesse planeerimisse.**

**S. Nõmmik, A. Raik**

**R e s ü m e e**

Artiklis resümeeritakse need probleemid, mille lahendamiseks on vajalikud geograafilised uurimused. Ühtlasi antakse ülevaade Eesti NSV geograafide uurimistulemustest, mis on leidnud rakendamist vabariigi kompleksse territoriaalse planeerimisskeemi koostamisel.

**Вклад эстонских географов  
в комплексное территориальное планирование**

**С. Ныммик, А. Райк**

**Р е з ю м е**

В статье выдвигаются проблемы, которые должны быть изучены географами. При этом дается обзор тех научно-исследовательских работ эстонских географов, которые нашли применение при комплексном территориальном планировании республики.

## Changes in the Natural Environment Caused by Human Agency

(with reference to the Estonian S.S.R.)

E. Varep

The changes that take place in the natural environment as a result of human interference constitute a complicated process, certain aspects of which are still imperfectly understood. Man modifies his natural surroundings most by his economic activity, but we must also take into account all the other forms of human activity that act upon his environment. Here an essential part is played not only by the type of economy and the level of development attained by technology and the general process of production, but also by the structure of social life, specific features of historical evolution, ethnographical relations and various other factors.

Estonia, the northernmost of the Soviet Baltic republics, has an area of only 45,215 sq. km, which constitutes a bare 0.2 % of the entire territory of the U.S.S.R. The country belongs to the northern part of the zone of mixed forests. Nevertheless, the climate of Estonia, due to its situation on the shore of the Baltic Sea, is relatively mild and of maritime character. Its surface structure, mainly of glacial and marine origin, is sufficiently varied. It exhibits a wide diversity of landscapes and as a result the exploitation of the land assumes strikingly different forms, of which the basic features were often determined in the distant past.

North Estonia is for the most part a limestone plateau ending abruptly at the steep edge of the Baltic

Glint. The plateau bears in general appearance a comparatively even, smooth character. This impression is produced by the level stretches of calcareous rock, often intersected by underground streams and other typical Karst phenomena. The carbonate soils distributed over the limestone bedrock of the Estonian Ordovician and Silurian outcrop area are rich in humus and suitable in structure, but frequently desiccated during the dry season. The proportion of cultivated land is small (ca 25 per cent), but the abundance of grasslands has created favourable conditions for the development of dairy farming, which has been further stimulated by the proximity of Tallinn and other industrial centres.

The North-Estonian Plateau was already thickly populated in the distant past. The population of the countryside is still relatively dense, and in addition a large number of urban centres have sprung up during the modern period. In the vicinity of Tallinn there are numerous industrial and residential outgrowths. In the north-east a remarkable group of young urban settlements has come into being in the mining and industrial region of the oil-shale basin, with its centre at Kohtla-Järve. The historical city of Narva has also, notwithstanding its greater age, become integrated into the area.

The moraine plains are the most common landscape type in the interior. In the northern part of the country this type of countryside dominates on the Pandivere Uplands, but it is also characteristic of the Central Estonian Plain. Here we have wide undulating plains, scattered with occasional small knolls and glacial ridges. A fertile calciferous moraine layer is spread over the limestone floor, which crops out on the surface at only a few points. The predominant soils are fertile leached carbonate durns, which rank among the best in Estonia. The vast expanses of level or undulating arable lands create outstandingly favourable conditions for agriculture, and well-nigh half of the surface area is under cultivation. Taken as a whole

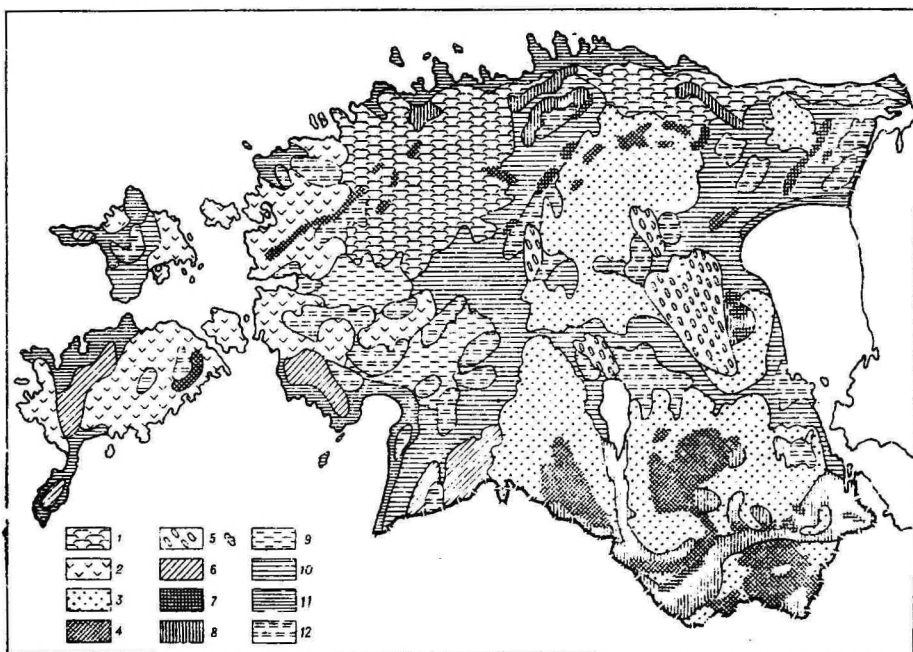


Fig. 1. The landscape types of Estonia.

1. Limestone plateaus; 2. Limestone plains; 3. Moraine plains;  
 4. Moraine downlands; 5. Drumline areas; 6. Wooded elevations;  
 7. Kames areas; 8. Sandy heathlands; 9. Areas of sedimentary  
 clays; 10. Forest covered lowlands, sites of former glacial  
 lakes; 11. Sandy littoral and dune-lands; 12. Bogs and fens.

these areas are the most profitable agricultural districts in Estonia.

In South Estonia the moraine plains are widely distributed in the Sakala Uplands and in South-East Estonia, especially in the vicinity of Tartu and Põlva. In South Estonia the bedrock consists of Devonian sandstone, outcrops of which are to be found at many points along the river valleys and on the banks of lakes. The plains are intersected by deep primeval valleys. In some localities the countryside is dotted with small flattened drumlins running mostly from north to south. Most of these areas are under cultivation and densely populated, especially in the vicinity of the towns of Tartu and Viljandi. For centuries these areas have formed one of the most prosperous districts in Estonia and they still retain their prominent position in agriculture. Urban-type settlements are plentiful; most of them being minor centres of local industrial development.

The drumlin landscapes are especially characteristic of the central part of Estonia. The Vooremaa Area, situated north of Tartu, is one of the most typical drumlin landscapes in the world, with its elongated hills stretching from north-west to south-east. Most of them are from 2 to 5 km long and up to 25 metres high, though individual drumlins may attain a height of 50 metres or even more. They have an argillaceous moraine cover, and the greater part of the surface is cultivated (tilled land ca 40 %). The interstitial troughs contain lakes, swamps and shrubby meadows. A few patches of woodland clinging to the flanks of the hills are all that remains of the one-time extensive forests. Both the network of communications and the settlement of the countryside have been determined mainly by the salient elements of the surface relief. The long, straggling villages are usually situated at the foot of the slopes.

There are other drumlin landscapes in Estonia, e.g.

the Türi Drumlin Area, which are similar in all essential respects to the Vooremaa country, but on a reduced scale, the drumlins being smaller and lower, and there are no lakes.

The hilly moraine landscape dominates on the Otepää, Karula and Haanja Heights in South Estonia. This is the most picturesque part of Estonia, remarkable for its variety. Here the moraine hills with their rounded summits present a surface relief of great natural beauty. In the central part of the Otepää and Haanja uplands the height of the moraine hills attains, and occasionally exceeds, 50 metres. On the outskirts of the heights the hills are smaller, but the relief is no less diverse. The extreme variety of the land forms is enhanced by the unusually broken and chequered character of the glacial deposits and the distribution of the soils. On account of the steep gradients the soils on the flanks of the hills have been to a large extent eroded, and as a result these surfaces are far less fertile. As a general rule the steepest parts of the hillsides are forested, and the problem of their agricultural utilisation is attended by serious difficulties calling for the application of special agrotechnical devices. On the other hand, the intermediate hollows are occupied by numerous lakes and swamps, most of which are relatively small in extent. As a result the cultivable land is parcelled out and dispersed in small units, and the mechanisation of agricultural labour is rendered extremely difficult.

The rural settlements in this type of countryside are very diffuse, and small hamlets and scattered farmsteads were until quite recently the general rule. The main arteries of communication avoid the broken hilly country, with the result that there are no large settlements of an urban type. There are, however, many small local centres which have developed into popular tourist resorts. The exceptionally favourable conditions for winter sports in these localities have attracted constantly growing numbers of enthusiasts over recent years.

The kames landscapes (Kameslandschaften) are characterised by groups of low glacial mounds with sandy surfaces. These localities are mostly covered with forests, but here and there little settlements are found, the inhabitants of which are commonly engaged in forestry. In the past these areas were more densely populated, and in many places we can trace the sites of ancient settlements. The kames areas are sometimes rich in lakes and are of outstanding natural beauty (e.g. the environs of Elva).

The sandur areas of Estonia, originating from the end of the Glacial Period, are mostly represented by the pine-grown sandy heaths, which are common in all parts of the country. One of them stretches for about a score of kilometres to the south of Tallinn, and has become one of the chief residential districts of the capital. Other sandur-type areas of heaths and pinewoods are distributed in the northern part of the Kõrvemaa area and in the district of Alutaguse. Typical sandur areas are also to be found in the Valga Basin and the Väike-Emajõgi Vale, the Hargla Basin and the Vale of Võru, as well as in the Palumaa Area along the northern fringe of the Haanja uplands. In general this type of landscape is unsuitable for cultivation, and therefore sparsely populated. Nevertheless, patches of fertile moraine surface are to be found here and there, with the result that the forested regions alternate with densely populated cultivated areas.

The west-Estonian limestone and moraine plains comprise the lower areas in the western part of the country, including the Western Archipelago. They have been long undated and everywhere we meet the typical surface forms produced by the action of the sea. The numerous coastal barriers, which hinder the outflow of the water, have given rise to large swamplands and saturated areas. On the islands and in the West-Estonian Lowlands we have limestone flats covered with dry meadows, which give place to hay-fields and shrubby grasslands in the moister areas and to

populous farmlands in the more fertile districts. All the surfaces that are in the least tillable have been turned to account and converted into fields, which are surrounded for the most part by long walls of rough, loose stone. There are plentiful examples of alvar-type localities, but also of wooded meadows and deciduous forests, which on account of the calciferous surface are exceptionally rich in plant species and of great interest to the botanist.

The West-Estonian Lowlands and the large island of Saaremaa have been densely populated from early times, in striking contrast to the neighbouring island of Hiiumaa, which was referred to as uninhabited as late as the 13th century. There are few settlements of an urban type in West Estonia, but the villages there have to a certain extent preserved their patriarchal aspect up to the present day.

Plains of varved clays are of particularly frequent occurrence in the Pärnu Lowlands and in the river basin of the Kasari, but they are found also in many other places in the West-Estonian Lowlands, the Western Archipelago and elsewhere. Well-cultivated fields mark the presence of fertile soils on varved-clay surfaces, which yield good crops when properly treated. The main problem here is that of draining the superfluous water. Since this is easier in the immediate vicinity of the rivers, the cultivated fields and the rural population are mainly concentrated along the river banks, while meadows and swamplands stretch away to the rear. The settlement of the Kasari and Pärnu basins did not begin till about the middle of the 13th century, considerably later than in the limestone areas.

The wooded lowlands are common to the Kõrvemaa area and to the district of Alutaguse in North Estonia, but they are characteristic also of large parts of West Estonia and of the basins of Lakes Võrtsjärv and Peipsi. In these districts the land was inundated at the end of the Glacial Period by the water of the melting Continental ice, and the

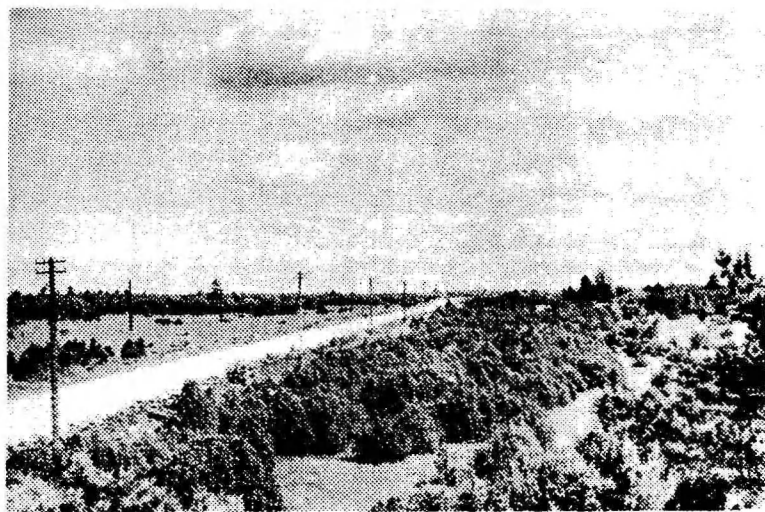
sediments of glacial lakes are distributed widely over the whole area. Here and there occur glacial ridges or äser and rounded hills, which give rise to numerous lakes. Only in a few places does the bedrock rise comparatively closer to the surface, thus producing a somewhat different type of soil and vegetation. These localities are better supplied with arable land and are a little more densely populated. Of all the Estonian landscapes these areas are the richest in forests, some of which have retained their primeval character right up to the present day, sheltering bears, large eagles, and a few other species, which if not absent in other parts of Estonia have at least become extremely rare. Fens and bogs, among them some of the largest in Estonia, occupy a large proportion of these areas.

The wooded elevations of West Estonia can be regarded as a special type of landscape, differing in many respects from the uplands of the inner part of the country. They include the small moraine elevation in the middle of Kõpu headland on Hiiumaa Is., the uplands of West Saaremaa and the small local elevation of Sõrve Peninsula, a few elevations round Tõstamaa and Varbla, and other similar areas. They are composed of fluvio-glacial gravels and extremely stony moraines. In the majority of cases they are forest-grown and are cultivated only in parts. These high areas are encircled by long lines of dunes, often bordered on the far side by swamps and marshes.

The coastal plains are typical of the central part of the North Coast, but also occur in the northern part of the West-Estonian Lowlands, in the neighbourhood of Pärnu and in many places on the islands. They are mostly extensive level tracts which have only recently risen above sea level (as a rule not until after the Littorina stage) as a result of the general uplift of the earth's surface. The ground rock crops out at the surface only in a few places. The surface forms are predominantly of marine origin - terraces, coastal



**Photo 1.** The Juminda Peninsula on the North Coast of Estonia. Photo by E. Linkrus.



**Photo 2.** Alvar area overgrown with juniper bushes in the neighbourhood of Tallinn. Photo by I. Kala.



Photo 3. The primeval valley of the Halliste River in the Sakala Uplands. Photo by I. Kala.



Photo 4. Moraine hills and Lake Kavadi in the Haanja Heights. Photo by I. Kala.



Photo 5. Heaps of stones gathered from the fields of Palmse manor during the Great Famine of 1695-1697. Photo by E. Linkrus.



Photo 6. Land improvement: dredging of the Loobu River, North Estonia. Photo by I. Kala.

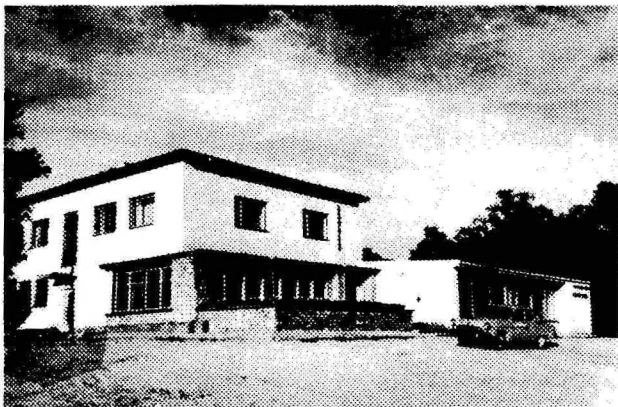


Photo 7. New buildings on the Eduard Vilde  
Collective Farm (Rakvere District).  
Photo by I. Kala.

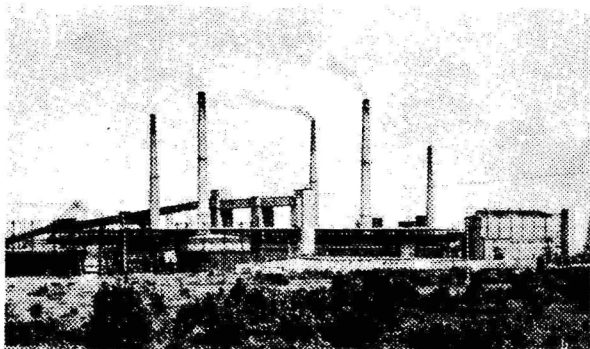


Photo 8. Kohtla-Järve - an industrial town  
in the north-eastern part of Estonia.  
Photo by I. Kala.

barriers and sand dunes. The cover consists for the most part of stony moraine and shingles with marine sands especially at the mouths of the rivers. Stretches of marshland occur here and there, interspersed with coastal lakes. The chief soils are of podsollic type usually with sandy or extremely stony surfaces, and of low agricultural potentiality. The greater part of these areas is overgrown by coniferous forests. Where the surface is moister wooded meadows also occur. Only a tiny percentage of the land is under tillage; but in the vicinity of Tallinn and Pärnu large numbers of market gardens are concentrated along the fine marine sands which constitute suitable beds for the cultivation of vegetables.

The oldest inhabited centres on the coast sprang up on the sites of former landing-places and fortified points. The agricultural settlement of the coastal strip began somewhat later than farther inland, - not until the second half of the 13th century. Most of the settlements along the coast are fishing villages, which in the majority of cases are situated directly on the sea front. The North Coast, but also other parts of the coastal zone are dotted with holiday resorts, which are especially numerous in the vicinity of Tallinn as well as in the north-eastern part of the republic.

The landscapes of bogs and swamps are to be found in the lowest parts of the Võrtsjärv and Peipsi depressions, in the regions of Kõrvemaa and Alutaguse, and in the Pärnu and West Estonian Lowlands. In the region of the mouth of the R. Emajõgi, as well as the upper reaches of the same river, fens and swamps abound, hemmed in by the broad expanses of forest on the slightly higher ground. The countryside is almost unpopulated, except for a few fishing villages scattered along the banks of the lakes and rivers, or on some of the highest humps in the fens. The chief natural resource of these areas is peat, but the stocks of cranberries (Vaccinium oxycoccus) are also of industrial

importance. Only in quite recent times have certain sectors been redeemed and taken under cultivation - the first polder areas in Estonia.

In modern times the utilisation of the land resources of Estonia has been drastically modified with a view to adapting it to the needs of large-scale socialist production. As compared with the period before the Second World War the area of arable land has to some extent diminished; on the other hand the forested area has considerably increased. Many of the smaller and less accessible fields, as well as some areas of low fertility have been forested. Many natural meadows have also been overgrown with shrubs or trees, and have since been reclassified as woodlands. On November 1st 1969, 0.3 % of Estonian territory was occupied by gardens, 18.2 % by fields, 8.3 % by hay-fields and 9.6 % by pastures, the total area of cultivable land being therefore 36.4 %. At the same time 38.0 % of the total surface was under forest and 3.6 % under shrubland. The rest of the territory is taken up by bogs and marshes, lakes and other inland waters, as well as the land occupied by settlements, communications, etc.

One of the most serious problems of land utilisation in Estonia has always been the pressing need for amelioration. At present 809,600 hectares of land are serviced by drainage networks, but only a part of them has been provided with a thoroughly up-to-date and efficient drainage system. In recent times an average of 40,000 additional hectares has been drained and brought under cultivation or forest every year.

A peculiar feature of the arable lands in Estonia is their disconnected and scattered character. Even after the considerable efforts made to create large expanses of fields on the collective and state farms the average cultivated unit does not exceed 2.8 hectares, and 35 % are less than one hectare in size. Thus, in addition to the imme-

diate task of amelioration with the object of securing optimal growth conditions, there is the enormous subsidiary task of uniting wherever possible the scattered units of arable land in such a way as to facilitate the introduction of large-scale mechanised cultivation.

Other changes in the landscape have been brought about by the growth of industry and the consequent regrouping of the population. Especially rapid has been the growth of the urban population, which on January 15th 1970 accounted for 65.0 % of the total population of the country (as compared to 33.6 % in 1940). As a result of this influx of the population into the towns, the absolute, and - still more - the relative figures for the countryside have sharply diminished.

The above-mentioned changes have given rise to extensive modifications in the Estonian landscape. Large industrial enterprises, new towns and thousands of kilometres of highways and electric cable have sprung into existence. The former small farmsteads have been replaced by modern rural settlements, new production centres and large livestock and poultry stations built by the collective and state farms.

As a result of the rapid advance of science and technology man's impact on his environment has increased almost beyond measure. The problems of regional planning are now very much on the order of the day, and are reflected in the new national project for regional development which is at present in process of elaboration. The aim of the investigations carried out in this field is to study and control the changes effected in the landscape, to guide the exploitation of the national resources along rational, complex lines, and to ensure that man's environmental conditions do not deteriorate as a result of increased production.

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**Maastiku muutumine inimtegevuse mõjul  
(Eesti NSV näitel)**

**E. Varep**

**R e s ü m e e**

Artiklis analüüsitakse inimtegevuse mõju looduslikule keskkonnale, lähtudes Eesti NSV-s esinevaist maastikutüüpidest. Põgusalt on peatunud viimastel aastakümnetel tööstuse arenguga, põllumajanduse sotsialistliku ümberkorraldusega ning linnastumisega seotud muutustel Eesti NSV maastikes.

**Изменение природного ландшафта  
в связи с деятельностью человека  
(на примере Эстонской ССР)**

**Э. Вареп**

**Р е з ю м е**

В статье анализируют, исходя из типов природных ландшафтов Эстонии, влияние человека на географическую среду. Коротко рассматриваются изменения в ландшафтах Эстонской ССР за последние десятилетия в связи с развитием промышленности, социалистическим преобразованием сельского хозяйства и урбанизацией.

## The Development of the Relief of the Käsnu Peninsula in the Holocene

E. Linkrus

A highly distinctive yet typical area of coastal forms in Estonia is the North Estonian coastal lowland, a narrow strip of land between the sea and the Baltic Glint. The coastal lowland is slightly broader (up to about 20 km) only in its central part, known as the Lahemaa (Bay area), which is characterized by peninsulas separated by deep bays. The peninsulas, the relief of which has developed mainly as a result of glaciation and sea processes, are geomorphologically rather varied but their relief has been little studied in detail.

The present paper examines one of the peninsulas of the Lahemaa Area - the Käsnu Peninsula (Fig. 1). In area it is the smallest, but it reflects the genesis of the region in general outline. The survey is primarily based on the author's field data, while stress is laid on the study of the surface forms in the present relief and on the development of the peninsula in the Holocene. For this purpose a detailed map of the surface forms was drawn up and the former shorelines were nivellated (1.2 km of profile per sq. km). In discussing the pre-Holocene the data of geological mapping<sup>1</sup> have been used in addition to the author's material.

The length of the Käsnu Peninsula is 6 km, its width 3.1 km and its area 13.3 sq. km. It is situated between the Bru and Käsnu Bays. In essence the peninsula represents,

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<sup>1</sup> Т. Илги, Э. Капа, О. Кээрди, А. Паскуора, В. Петерселе, Г. Эльтерман, Отчет Пайдеской партии о комплексной геолого-гидрогеологической съемке за 1963-1966 годы. Кейла, 1966. Manuscript in the Board of Geology of the Estonian S.S.R. Council of Ministers.

analogically with the other peninsulas of the Lahemaa Area, a ridge-shaped elevation extending into the sea. The mean height of the peninsula is 7.4 m, its maximum height is 22.95 m. Almost the whole of the peninsula is wooded. The only village - Käsmu, a popular seaside resort, is situated along the north-eastern coast of the peninsula.

The crystalline bedrock underlying the site of the village is 123 m below sea-level and is covered by a 100-metre layer of Vendian and Cambrian sandstones, aleurolites and clays. In the central part of the peninsula the bedrock rises somewhat higher than along the shore.

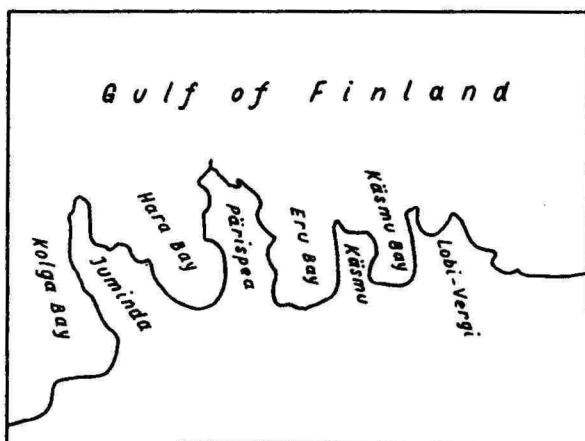


Fig. 1. The location of the Käsmu Peninsula.

The thickness of the surface stratum on the Käsmu Peninsula is mainly 20 to 50 m, in a small area in the south



Photo 1. Western shore of the Käsmu Peninsula.



Photo 2. Moraine coast in the north-western part of the peninsula.



Photo 3. Beach-ridge modified by the wind to the west of Käsmu Lake.



Photo 4. Area of coastal formations south of the lake.

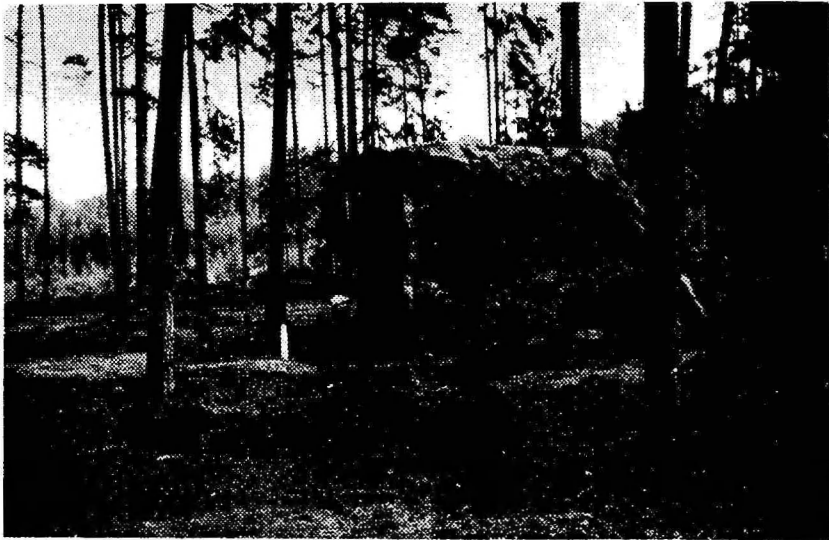


Photo 5. The Matsi Stone (Eremite) - one of the Käsmu erratic boulders placed under state protection.



Photo 6. Abrasional terrace in the northern part of the peninsula.



Photo 7. Dune area to the west of the lake.



Photo 8. Käsnu Lake.

- 50 to 100 m. According to the mapping report of the Board of Geology of Estonia the oldest deposits are those of the latest interglacial period. The surface stratum mainly consists of glacial, fluvioglacial, limnoglacial deposits of the Valdai glaciation and Holocene marine sediments. Aeolic and paludal sediments are to be found to some extent.

As elsewhere in the coastal lowlands Pleistocene land forms and deposits have played an important role in the development of the present surface structure. The most conspicuous Pleistocene surface form is the ridge-shaped elevation in the northern part of the peninsula. The relative height of the elevation in the west, by Eru Bay (Photos 1 and 2), is 17 m, in the east up to 14 m. According to the available data the elevation is made up of fluvioglacial deposits and moraine. We have here, as well as on the Pärissaare Peninsula to the west of Eru Bay (Linkrus, 1969), a drumlin-like elevation surmounted by an esker or two parallel eskers that are partially linked together. In the north-eastern part of the peninsula there is an area of varved clays which has played a less important part in the development of the present land forms.

Most of the Holocene relief forms on the peninsula have developed as a result of the action of the sea (Fig. 2). To this group of relief forms belong first of all the marine terraces, abrasional slopes and the cliffs connected with them, the beach-ridges, spits and groups of erratic boulders. Coastal dunes are also present on the peninsula.

In the formation of the marine terraces destructive and constructive sea processes have often been combined. These terraces, which are mainly the result of abrasion (Photo 6), are situated mostly within the area of the above-mentioned elevation and they are characterized by an abundance of boulders on the surface due to the ablation of finer material. Marine accumulative terraces are chiefly situated in the southern and south-western parts of the peninsula. The principal component of these latter terra-

ces is sand mingled with gravel and shingle, to the north-east of Kāsmu Lake (Photo 8) also loamy sand.

Stony abrasional inclined plains and slopes characterize the higher north-western and northern parts of the peninsula. Typical abrasional cliffs are rarer.<sup>2</sup> The maximum height of the abrasional slopes attains 6.4 m, their inclination seldom exceeds 10°. Approximately one-sixth of the slopes have a typical beach-ridge on the shoulder, or a beach-ridge modified by the action of the wind. Abrasional slopes with ridges at the foot occur with roughly equal frequency.

The height of the coastal cliffs is up to 8 m, the maximum inclination 48°. There are fewer ridges on the shoulder and at the foot of the cliffs than in the case of the abrasional slopes. Several cliffs, e.g. those on the site of Kāsmu village, in the farthest north-western extremity of the peninsula and on the western coast, are now carved down by the waves. In moraine areas the terrace underlying the abrasional slopes and cliffs is strewn with boulders.

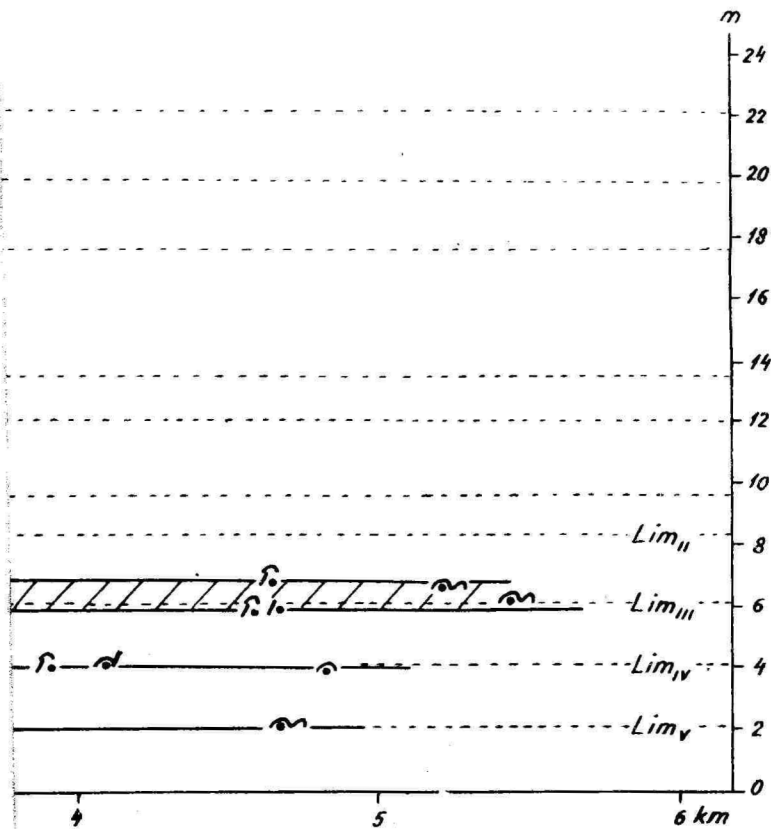
The average height of the beach-ridges is 1.5 m and their breadth 4.5 m; the larger beach-ridges may rise to 2.5 m. The inclination<sup>3</sup> of the seaward slope is a little over 4°, that of the landward slope is 3°. This is due to the fact that most of the ridges have arisen on the slopes of older relief forms. In such cases the relative height at the seaward foot is much greater than that of the landward slope.

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<sup>2</sup> Abrasional slopes and cliffs are classified on the basis of their inclination and the sharpness of the angle at the foot. Abrasional slopes with an inclination of  $\geq 15^\circ$  are regarded as cliffs.

<sup>3</sup> Inclinations have been found on the basis of nivellation data. The obtained number shows the mean inclination on the seaward or landward side of the ridge. The inclination on the slope in the narrower sense, without the smooth crest part, is bigger.





1. 2 3 4 5 6
- 1 - abrasional cliff;
  - 2 - abrasional slope;
  - 3 - abrasional slope with beach-
  - 4 - complex accumulative form.

In a few exceptional cases the beach-ridges have developed as accumulative slopes due to the initial relief. The height of the ridges at the foot of abrasional forms is 0.6 m on the seaward side (max. 1.1 m) and 0.25 m on the landward side. The width of the ridges is 25 m, and the inclinations on the seaward and landward sides are 3° and 2° respectively. The height of the shoulder ridges averages 0.6 m (max. 1.7 m), with an inclination of 3°. A few bar-like coastal forms also occur. Like the beach-ridges they are about 1.5 m high. They are roughly 150 m broad, with inclinations on the seaward slope of rather more than 1°, on the landward slope - nearly 3°.

In the north-western part of the peninsula the small promontories have given rise to spits. The lower part of the coastal formations that separated Lake Kāsmu from the sea in the west, is also a spit of this kind.

Specific accumulative forms are the ridges in the north-western and northern parts which are extraordinarily stony as a whole (Photos 5 and 6). The height of these stony ridges is up to 3.5 m, their width 50 to 70 m, the inclination of the slopes 2° to 4°. In addition there occur low stone heaps of irregular shape. Both types must be mainly attributed to the action of hummock ice.

Dunes occur to the west and south of Kāsmu Lake. They have been formed on the surface of an ancient spit. Hills with deflation hollows prevail. The relative height of the dune area south of the lake is 6 to 7 m, the height of the aeolic forms themselves is about 3 m (Photo 4). To the west of the lake only the seaward dunes attain a height of 3 m (Photo 3). One-fifth to one-third of the surface of the dunes is still free from vegetation (Photo 7).

Swamplands occupy 8 per cent of the surface area of the peninsula, and waterlogged areas (the thickness of peat is < 30 cm) are abundant in the south-eastern half. 91 per cent of the swamps belong to the type of fens and marshes, the rest are transitional bogs. All of the swamps are small,

the maximum surface area being 24.4 ha.

The development of the relief of the peninsula in the Holocene is directly connected with the emergence of the area from under the Baltic Sea as a result of the neotectonic uplift of the earth's crust, complicated by eustatic changes. In order to clarify the process of emergence a shoreline diagram (Fig. 3) was constructed on the basis of nivellation data. The azimuth of the isobases of the land uplift was calculated to be  $236^\circ$ , and the direction of the maximum uplift  $326^\circ$ .<sup>4</sup> Observable shorelines were compared with the diagrams constructed for the old Estonian shorelines of the Holocene (Kessel, 1961; Kõccex, 1961; Kõccex, Paykas, 1967). In order to facilitate the comparison the corresponding levels were transferred to Fig. 3 (the dotted lines show the evolution phases of the Baltic Sea). The correlation was carried out not only on the basis of abrasional forms (as recommended by A. Tammekann (1952)), but also of accumulative forms (in 23 per cent of the cases) since their feet are often clearly distinguishable. As the shoreline indicated by the old coastal forms may be taken to mark generally the high-water level, it must be remembered that the observable levels may be somewhat higher than the normal sea-level. As P. Kents' data show<sup>5</sup>, the average difference between normal and high-water levels in Estonia is 0.8 m. Levels which are marked by especially clear coastal formations are indicated with plusses in Fig. 3.

As the shoreline diagram shows, both the high-water coastal forms and those that came into being in conditions

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4 P. Kents, Postglatsiaalsed Läänemere rannajoone võnkumised Eestis, illustreeritud Kõpu poolsaarel /Post-glacial vibrations of the shoreline of the Baltic Sea in Estonia, illustrated on the Kõpu Peninsula/. Tartu, 1939. Manuscript in the Chair of Geology of Tartu State University.

5 See footnote 4.

of normal sea level have often been preserved. In such cases the former shorelines are expressed in form of level pairs. The difference between these level pairs (hatched in Fig. 3) is about 1 m, and the upper line of the shore of the corresponding phase is denoted by the better developed coastal forms. The same may be observed in other parts of the Lahemaa Area. It should be added that some of the coastal forms on the Käsmu Peninsula, as well as in other parts of the Lahemaa Area, are about 1 m higher than the present average sea-level.

Some variance from the existing shoreline diagrams of Estonia remains with respect to the Littorina stage (Fig. 3). The appearance of four levels or level pairs contradicts the standpoint that to the south-east of the 21 m isobase of the land uplift, where the Käsmu Peninsula and the whole Lahemaa Area lie, the highest shore of the Littorina Sea is the shore of the  $L_{IIb}$  phase (Кессел, Паукас, 1967). The number of discernible levels seems to contradict the fact that the second transgression of the Littorina Sea rose higher than the first one. Though it is difficult to explain the cause of this contradiction, all four levels or level pairs have been considered as phases of the development of the peninsula.

On the basis of the data obtained the general development of the relief of the Käsmu Peninsula took place in the Holocene as follows. During most of the Ancylus Lake stage 8,900 to 7,600 years ago (Кессел, Пундлит, 1969) the whole peninsula was submerged. In the fourth phase of the Ancylus Lake a stony islet emerged at the highest part of the Pleistocene elevation at low or normal water-level. This area has permanently been dry land since the  $A_V$  phase (Fig. 4, Table 1). During the  $A_V$  phase a small lake also began to take shape in the western part of the peninsula (on the site of the present Kaiasoo swamp), though it was still an arm of the sea at high water.

The subsequent stages of the Mastogloia Sea and Littorina Sea extend from 7,600 to 4,500 years ago (Кессел, Пау-

Table 1

## Growth of the land on the Käsmu Peninsula

Phases of evolution of the Baltic Sea	Approximate land area in each successive phase		Increase as compared with the previous phase	
	sq. km	% of present surface area	sq. km	% of present surface area
A <sub>V</sub>	0.17	1.3	0.17	1.3
L <sub>I</sub> +L <sub>II</sub> <sup>a?</sup>	0.27	2.0	0.10	0.7
L <sub>II</sub> <sup>b?</sup>	0.37	2.8	0.10	0.8
L <sub>III</sub>	1.26	9.4	0.89	6.6
L <sub>IV</sub>	2.52	18.9	1.26	9.5
Lim <sub>I</sub>	3.46	25.9	0.94	7.0
Lim <sub>II</sub>	4.70	35.2	1.24	9.3
Lim <sub>III</sub>	6.95	52.1	2.25	16.9
Lim <sub>IV</sub>	9.64	72.3	2.69	20.2
Lim <sub>V</sub>	12.37	92.7	2.73	20.4
The present time	13.34	100.0	0.97	7.3

кас, 1967; Кессел, Пуннинг, 1969). The area of the dry land during the *Mastogloia* stage and the extent of the transgression taking place at the beginning of the *Littorina* stage cannot exactly be determined by means of the existing data. During the L<sub>III</sub> phase two islets appear in addition to the former dry land area, one of them on the esker-like ridge in the eastern part of the peninsula. By the end of the *Littorina* stage the islets become united; in the northern part of the resulting island there is a shallow lagoon (Fig. 4, e).

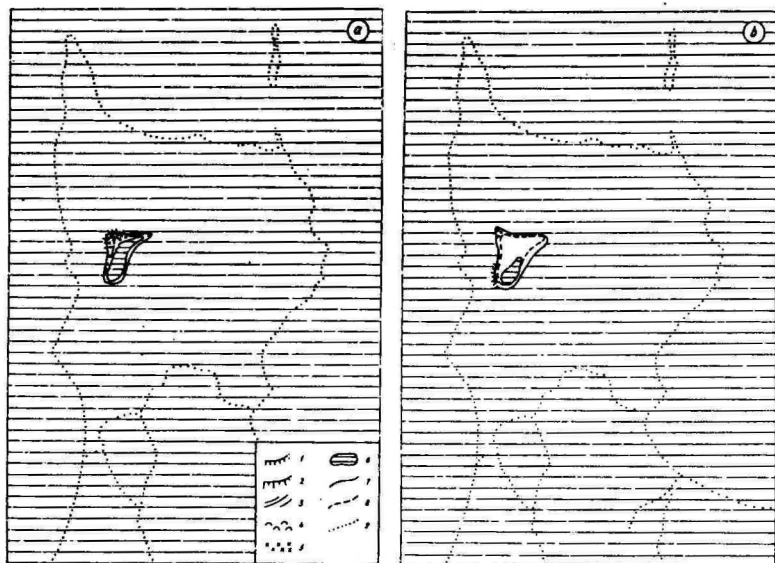
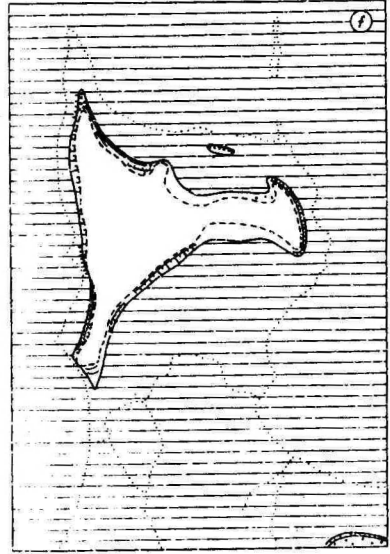
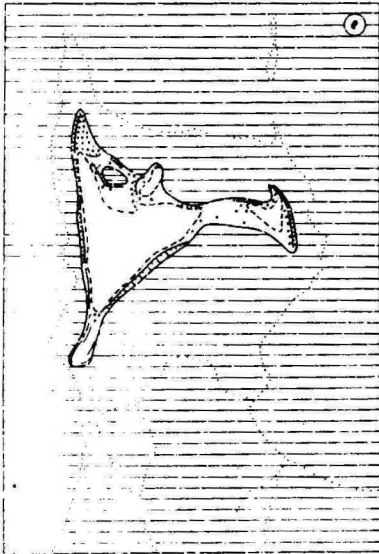
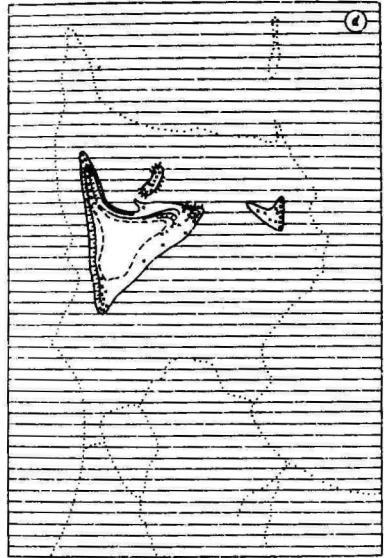
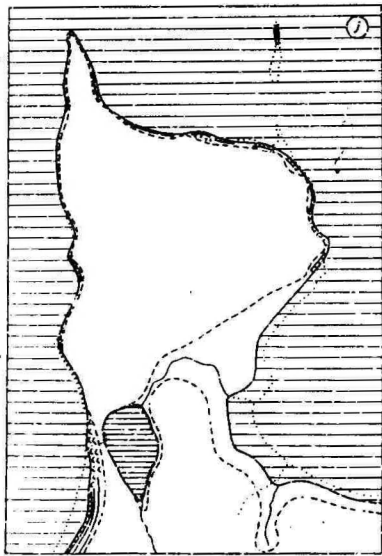
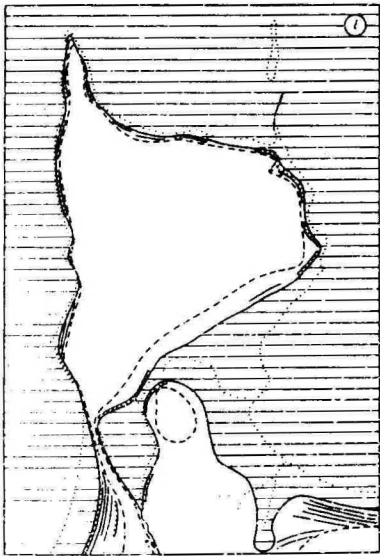
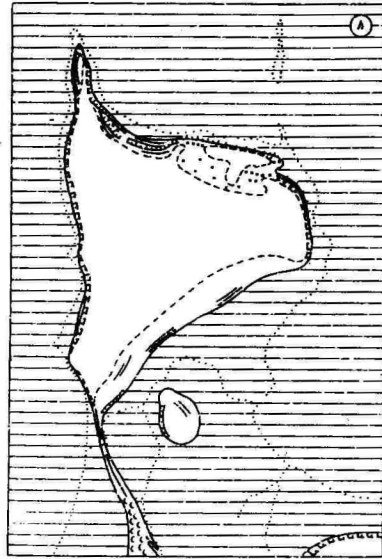


Fig. 4. Formation of the Käsmu Peninsula.

a - V phase of the Ancylus Lake; b - I and II<sup>a</sup> phase (?) of the Littorina Sea; c - II<sup>b</sup> phase (?) of the Littorina Sea; d - III phase of the Littorina Sea; e - IV phase of the Littorina Sea; f - I phase of the Limnea Sea; g - II phase of the Limnea Sea; h - III phase of the Limnea Sea; i - IV phase of the Limnea Sea; j - V phase of the Limnea Sea.

1 - coastal cliff; 2 - slope; 3 - beach-ridges; 4 - dunes; 5 - erratic boulders; 6 - lake; 7 - shoreline of corresponding phase in the evolution of the Baltic Sea; 9 - present shoreline.





At the beginning of the Limnea Sea stage, about 4,500 years ago a new stony islet arises on the site of the northern coast of the present peninsula, north of the former island. During the Lim<sub>III</sub> phase, i.e. about 3,300 years ago (Kesseli, 1965) the two are united (Fig. 4, h). During the Lim<sub>III</sub> phase a new sandy island emerges at low water to the east of the present Käsnu Lake; and the spits growing from the south and north towards each other to the west of the lake are united from time to time. Yet one cannot speak of a peninsula as a permanent formation because the strip of land was probably submerged at high water. The two spits were finally united during the Lim<sub>IV</sub> phase (Fig. 4, i). The fourth phase of the Limnea Sea also witnessed the formation of Käsnu Lake, which was initially an inlet connected with the sea by a narrow strait. The connection between the lake and the sea (if we disregard Kalaoja brook) was evidently broken during the Lim<sub>V</sub> phase. By that time the peninsula had acquired a shape similar to the present one. Since then the land has grown mostly to the south-west of the lake and on the smooth eastern shore of the peninsula.

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## Käsmu poolsaare reljeefi arengust holotseenis

E. Linkrus

### Resümee.

Käsmu poolsaar paikneb Põhja-Eesti rannikumadaliku keskosas, mida tuntakse Lahemaana. Autor kaardistas ning nivelleeris poolsaare pinnavormid. Nende materjalide põhjal on koostatud rannamoodustiste tõususpekter (joon. 3) ning poolsaare kujunemist illustreeriv joonis (joon. 4). Holotseeni-eelse perioodi lühiülevaate kirjutamisel on liiksaks oma andmetele kasutatud geoloogilise kaardistamise materjale.

Suure osa pärastjääajast oli kõnesolev ala Läänemere nõos olnud veekogude põhjaks. Järk-järguline vabanemine vete alt algas Antsülusjärve staadiumi lõpul. Maismaa juurdekasvu illustreerivad tabel 1 ja joon. 4 (a-j). Joonistel on näidatud ka vastavatel faasidel kujunenud rannamoodustised.

Nivelleerimisandmete alusel joonestatud profiilide ning rannajoonte tõususpektri põhjal (arvesse on võetud ka Lahemaa muid piirkondi) selgub, et mõne faasi puhul on teatud tingimustel säilinud nii kõrgvee kui ka keskmise, normaalse veeseisu ajal tekkinud rannamoodustisi. Teatud ebakõlaseniste uurimistulemustega esineb Litoriinamere varasemate tasemete puhul (joon. 3). See osutab vajadusele nimetatud keerukat staadiumi täiendavalt uurida.

## Развитие рельефа полуострова Кязму в голоцене

Э. Линкрус

### Резюме

Полуостров Кязму расположен в центральной части Северо-Эстонской прибрежной низменности, которая известна под названием Лахемаа. Автором статьи была произведена съемка форм рельефа полуострова и нивелировка древних береговых образований. На основе полученных данных составлен спектр эпейрогенического поднятия береговых образований (рис. 3, также рис. 4, изображающий постепенное возникновение полуострова). При составлении краткого обзора доголоценового периода кроме данных автора использованы материалы геологической съемки.

Большую часть послеледникового периода рассматриваемая территория представляла собой дно водоемов в бассейне Балтийского моря. Освобождение полуострова из-под вод названного бассейна началось в конце стадии Анцилового озера. Прирост суши иллюстрируют табл. I и рис. 4 (а-ж). На рисунках показаны и возникшие в соответствующие фазы береговые образования.

На основе геоморфологических профилей и спектра поднятия береговых образований (при этом учтены также остальные части Лахемаа) выясняется, что во время некоторых фаз при определенных условиях сохранились береговые образования, возникшие не только при нагонах, но и при среднем, нормальном уровне воды. Некоторое несоответствие уровней первых фаз Литоринового моря с имеющимися уже данными (рис. 3) указывает на то, что названная сложная стадия требует дополнительного изучения.

## The Väinameri - Inland Sea of Estonia

H. Mardiste

The Väinameri (also known as the Straits of Muhu) is a part of the Baltic Sea located between the Estonian mainland and the West-Estonian Archipelago (Saaremaa, Hiiumaa, Muhu). In scenery and natural conditions the area of the Väinameri is one of the most peculiar regions not only in the coastal area of Estonia, but also in the whole Baltic region. This area includes a great number of islets covered with juniper shrubs or in some places with forests side by side with shingle patches of land only just emerged from the water. Here limestone gravel coasts and a few cliffs subject to wave abrasion alternate with vast reed-fields abounding in waterfowl. But the above-mentioned area has not remained untouched by human activities. Coastal inhabitants have fished here for centuries; for over a century warm coastal waters and curative muds have attracted ailing people and holiday-makers from near and far. More and more intensive utilization of the local natural resources compels one to pay much attention to the relations between nature and humans in this area.

Formerly this part of the sea was called by different names: 'Moonsund', 'Muhu väin' (the Straits of Muhu), 'Suurväin' (the Large Strait). At the present time the name of 'Väinameri' (literally the Sea of Straits) has become attached to the area. The name of 'Väinameri' reflects the peculiarity of the area most expressively, so it has been universally accepted in Estonian (Varep, 1959). It is also defined in various ways. On the basis of the bottom relief and to a certain extent on the ground of the hydrological regime V. Astok (1958)\* defined it as follows: The northern

\* Astok, V., 1958. Väinameri. (Diploma thesis. Manuscript in the Library of the Geography Department of Tartu State University).

boundary is a line from the northeast point of the Tahkuna Peninsula to the northwest point of the Noarootsi Peninsula; from the Gulf of Riga the area is separated by the conventional parallel passing over Cape Kübassaare (the southeastern point of Saaremaa Is.) and the western boundary is defined as the shortest distance between the islands of Saaremaa and Hiiumaa. The area of the Väinameri within these boundaries amounts to 2,600 sq. km, but excluding the area of the islets it is 2,240 sq. km. The extent of the body of water from north to south along the line of Hari Strait - Viire Strait is about 80 km and the distance from west to east along the line of Soela Strait - Matsalu Bay is about 70 km. The volume of water in the Väinameri constitutes 10.6 cu. km.

In his work on landscape regions J.G. Granö (1922) divided the territory of Estonia into 16 water-regions. One of them was named by him as "West-Estonian inland sea of islands and valley-bays". Its boundaries almost coincide with the above-mentioned boundaries of the Väinameri.

The coast-line of the Väinameri is very strongly embayed. Its total length is 700 km, of which the islands constitute about 470 km. Shallow waters of the bays of Haapsalu and Matsalu extend deep into the mainland. The larger bays here include the Hullo Bay on the southern coast of Vormsi Is., the bays of Soonlepa, Käina and Jausa on the southern coast of Hiiumaa Is. and the Triigi Bay on the northern coast of Saaremaa Is. The large peninsulas of Noarootsi, Puise, Virtsu, Pammana and Sarve extend far into the Väinameri. There are three large islands in the Väinameri - Muhu (205 sq. km), Vormsi (93 sq. km) and Kassari (19 sq. km) and more than 300 islets, which depending on their size and vegetation are called 'laid', 'rahu' and 'kare' in Estonian. The number of islets is not permanently fixed. Due to the uplift of the earth's crust, some islets have merged with the mainland or with each other. At the same time ever more new patches of land rise from the water. The greater

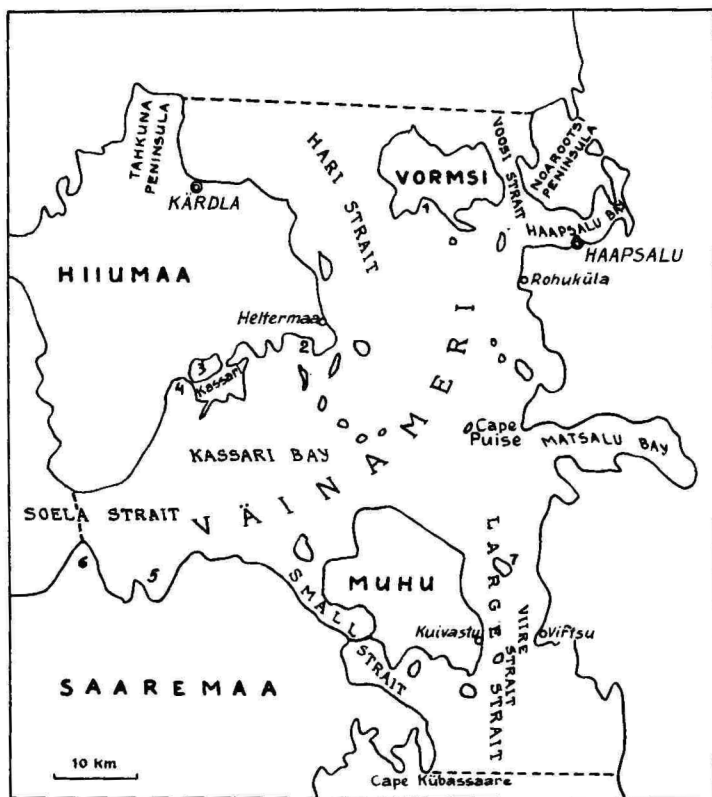


Fig. 1. The Väinameri

- 1 - Hullo Bay, 2 - Soonlepa Bay, 3 - Käina Bay,  
 4 - Jausa Bay, 5 - Triigi Bay, 6 - Pammana Pe-  
 ninsula, 7 - Kesselaid Islet.

part of islets emerged from the sea mainly during the Limnea Sea stage of the Baltic Sea. According to their age and their landscape, the islets of the Väinameri are divided into seven island types (Sepp, 1970). Studies of recent vertical movements of the earth's surface have shown that the uplift of land has taken place in the Väinameri area at a speed of about 3 mm per year (Zheltnin, 1966). Studies of old coastal forms and the comparison of the coast-line represented on old maps with recent maps give evidence of an earlier uplift.

Studies of the Holocene coastal forms ( Kөссөл, Паукас, 1967) show that to a certain extent isolated bodies of water in the region of the present Väinameri have existed since the last phase of the Littorina Sea stage, although already during the last regression of the Ancyclus Lake stage dry land had considerably increased in area. Since the end of the Littorina Sea (about 5,000 years ago), when the water level in the area of the West-Estonian Archipelago was 10-15 m higher than today, there has proceeded a continuous neotectonic uplift of land.

According to the "Atlas of Livonia" compiled by L.A. Mellin (1798) and a map of the province of Estonia by J.H. Schmidt (1844) there existed several islands in place of the present Noarootsi Peninsula (about 100 sq. km). At that time during storm surges it was possible to row in boats round the eastern side of these islands. By reason of the uplift of land the Virtsu Peninsula was formed and the area of the Matsalu Bay decreased. Dredging work in the delta of the Kasari River in the 1920s and the 1930s and the advance of reeds towards the west have contributed to the uplift of land in the Matsalu Bay (Hermann, 1970; Kumari, 1966; Parts, 1934).

The contemporary coast of the Väinameri is shoaly and belongs to the relatively slowly emerging coasts. The influence of the bedrock relief and earlier sediments on the contemporary coast is particularly great as the latter is

developing in conditions of a relative uplift of the earth's crust. Hence, the abrasive activity of waves within certain limits of the coastal zone is of relatively short duration, the intensity of abrasion at one and the same place and the accumulation of large masses of sediments are limited. Of the types of coast distinguished by K. Orviku sen. and K. Orviku jun. (1961) in the Väinameri area, the moraine coast and the turf coast are prevailingly represented. Mainly in zone of the West-Estonian Glint (Aaloe, Miidel, 1967) there occur coastal cliffs in the bedrock (the Kesse Cliff on Kesselaid Is., the Püssina and the Kautliku Cliffs on Muhu Is.) which are linked with each other by gravel and shingle coasts.

The bottom of the Väinameri is covered with Quaternary sediments displaced by waves and currents. Sands, sandy loams and gravels are widespread in the bottom of the sea; clay may be found in deeper places and muds are found in the shallow bays. Curative muds occur in the Voosi Strait, in the bays of Haapsalu and Käina and elsewhere. From the quantitative point of view the Haapsalu Bay deposits of curative muds (120,000 cu. metres) occupy second place in Estonia (Вейнер, 1969). Muds of the Haapsalu Bay have been used at the Haapsalu and Pärnu health resorts, but local resources make it possible to extend their utilization in the future.

The thickness of the Quaternary sediments in the coastal region is generally less than 5 m, only in the southern part of Hiiumaa it exceeds 20 m (Гидрогеология СССР, 1966). Ordovician (in the northern part) and Silurian (in the southern part of the Väinameri) limestones, dolomites and marls crop out in some places directly on the coastline of the islands or the mainland. Rather small outcrops occur on the western coast of Vormsi, on the southeastern coast of Hiiumaa, and west of Haapsalu. The large zone of outcrops extends from the mainland over the northern coasts of the islands Kesselaid and Muhu to the northern coast of Is. Saaremaa.

The Väinameri is a shallow body of water, its mean depth being only 4.9 m. The bottom of the Kassari Bay is comparatively level, ranging from 5 to 9 m in its central part, its greatest depth amounting only to 9 m. In the eastern part of the area in the direction from north to south or from northwest to southeast, rows of islets alternate with hollows. Headlands and islets orientated in this direction mostly mark the ásar formed in the last Glacial Period. The Hari and Large Straits exceed 10 m in depth. The deepest point of the area (22 m) is located between the islands of Muhu and Kesselaid. The southern part of the Large Strait is about 20 m deep. To improve navigation the Väinameri has been dredged extensively (Mey, 1924).

The Baltic Sea on the one hand and the mainland on the other hand exert a great influence on the climate of the area of the Väinameri. The relative maritime nature of the weather is well characterized by the air temperature. The mean annual air temperature in the area of the Väinameri is about 5.5° C, thus being higher than in eastern Estonia (at Tartu 4.8° C). In autumn the temperature usually falls below zero at the beginning of December, i.e. 2-3 weeks later than in eastern Estonia. In spring it rises above zero at the beginning of April. The coldest month is February, its mean temperature ranging from -4.5° to -5.5° C, which is about 2° warmer than the weather in eastern Estonia. The warmest month is July (16.5-17° C). The extreme temperatures are the following: the absolute minimum is -34° C and the absolute maximum is 34° C (Справочник по климату, II, 1965).

Because of lesser cloudiness the duration of sunshine is the greatest just in the area of the West-Estonian Archipelago. In the course of the year the sun shines there for 1,820-1,870 hours (45 % of the possible duration). In central and eastern Estonia the duration of sunshine is 1,630-1,740 hours. July is the month in which the period of sunshine is also longest in the area of the Väinameri - 280-

300 hours (58 % of the maximum possible) (Справочник по климату, I, 1966).

The Väinameri is one of the poorest areas of Estonia in precipitation. Annual precipitation is 500-550 mm. The largest amount of precipitation - 70-80 mm - falls in August and the smallest - 20-30 mm - in March. A permanent snow cover is formed in the coastal area at the beginning of January, which is about a month later than in southeastern Estonia and the snow melts at the end of March (Справочник по климату, IV, 1968).

Southwesterly winds predominate, accounting for 19 % of the recordings of the wind direction. Southerly (16 %) and westerly (12 %) winds are also frequent. The mean annual speed of the wind is 5-6 m/sec. In late autumn the speed is 6-7 m/sec and in spring and summer 4-5 m/sec. In the Väinameri area the wind is weaker than on the open coasts of the Baltic Sea, but appreciably higher than inland. For example, the number of days in the year when the speed of the wind exceeds 15 m/sec is on the western coast of Saaremaa 40, in the Väinameri 25-30 and on the mainland farther from the sea under 10 (Справочник по климату, III, 1966).

Currents in the Väinameri are non-periodical. The wind is the main force generating currents. The direction and the velocity of currents depend on the direction and the speed of the wind. In case the wind blows with an average force of 3-4 (Beaufort scale) the mean velocity of the surface currents in the centre of a strait is as follows: Hari Strait - 23 cm/sec, Voosi Strait - 20 cm/sec, Large Strait 21 cm/sec and Soela Strait - 15 cm/sec.

In the inner parts of the area the velocities are 5-10 cm/sec. When the wind blows in the direction of the axis of the straits, the water flow is stronger than in the case of other directions. In case the wind blows from one direction for a long period of time with an average force of 4-5, the velocity of the currents in the straits ranges

Table 1

Direction and Speed of Surface Currents Generated  
by Winds of Force 3-4 on the Beaufort Scale  
(from **Мартинс**, 1964)

Wind	Hari Strait			Soela Strait		
	Direction (degree)	Velocity (cm/sec)	Number of re- cord- ings	Direction (degree)	Velocity (cm/sec)	Number of re- cord- ings
N	161	24.5	16	276	16.5	10
NE	164	14.0	1	291	19.1	15
E	312	18.9	3	302	18.6	22
SE	329	17.9	15	308	11.8	16
S	348	18.3	25	89	12.1	10
SW	345	22.7	12	91	16.4	17
W	141	21.5	5	97	14.2	27
NW	160	27.8	25	97	14.8	20

from 40 to 50 cm/sec. In the period of storms the velocity of the currents exceeds 50-60 cm/sec. In November 1906 J. Mey (1924) recorded a velocity of 206 cm/sec in the Soela Strait. The direction of the currents depends on the direction of the wind. For example, in case of northerly and northeasterly winds, the water masses move through the Hari and Voosi Straits into the Väinameri and through the Soela and Large Straits out of the Väinameri. After a change in the direction of the wind as well as in cases when the wind has a force of 4-5 (Beaufort scale), the direction of the currents changes accordingly every 3-4 hours and the velocity acquires a permanent value after 5-7 hours (**Мартинс**, 1964).

Permanent currents in the Baltic Sea are due mainly to the influence of the discharge of rivers during long calm or weak wind periods. Aircraft surveys of currents show that permanent surface currents flow out of the Väinameri through the Soela and Large Straits (Бетви, Пантелеев, 1970). Permanent surface currents of the same direction were reported already in the scheme of currents drawn up by J. Mey (1927), although many authors believed in the existence of counterclockwise water circulation in the Baltic.

A continuous water exchange takes place through the straits lying between the Väinameri and the Baltic Sea and the Gulf of Riga. The mean volume transport in the straits is as follows: Hari Strait - 6,000-9,000 m<sup>3</sup>/sec, Voosi Strait - 600-1,000 m<sup>3</sup>/sec, Soela Strait - 1,500-2,500 m<sup>3</sup>/sec and Large Strait - 7,000-10,000 m<sup>3</sup>/sec. As no measurements have been made during storms, the possible maximum velocity of the currents and the respective volume transport are unknown. The meridional exchange of water through the straits of Hari and Voosi and Suur Strait exceeds by 7.5 times that through the Soela Strait.

The temperature regime of the Väinameri is determined by its geographical location, its shallow water depth and the water exchange through the straits. In summer the water warms up from the surface down to the bottom and temperatures are higher than in the surrounding open sea. In winter vice versa, due to the closeness of the mainland, the water cools down quicker than in the neighbouring sea.

The mean annual temperature in the surface water layer is about 7° C. In winter, from January to March, the temperature varies from -0.2° to 0.1° C. In the extraordinarily warm January of 1930 the temperature in the centre of the Large Strait fluctuated between 2.6° and 2.7° C from the surface to the bottom. The mean temperature of the coldest month - February - ranges from -0.2° to -0.3° C, the absolute minimum being -0.4° C. The nearshore temperature of the water is below zero for 105 days in a year - from the

middle of December to the end of March ( Марцисте, 1967).

The Väinameri belongs to the area with the severest ice conditions in the whole coastal area of Estonia. In the Bays of Matsalu and Haapsalu the ice is formed the earliest. The Väinameri is covered with ice within a comparatively short period of time. The first ice is usually formed at the end of November and by the beginning of January the largest part of the water between the islands has become covered with ice. The Hari and Soela Straits, on which the open sea exercises a certain influence, freeze over more slowly. At the beginning of March the ice is at its thickest. Near the coast the thickness of the ice is usually 40-45 cm, in severe winters being as thick as 75-80 cm (only in the shallow mainland bays it may be 100 cm). Coastal ice breaks up about the middle of April and by the end of the month the area is free from ice. Fluctuations in the average dates of the formation and the breaking up of ice are considerable. The extreme dates of the appearance of the ice near the western coast of Vormsi in 1892-1964 (except the years 1917-22 and 1940-47 when no records were kept) vary between October 24 and January 31 and the disappearance of ice between March 8 and May 26 respectively. The ice usually lasts in the Väinameri for 120-140 days. In the winter of 1916/17 the ice was observed in the Hari Strait for 171 days, but in 1948/49 for only 43 days ( Алексеева, 1967).

After the melting of the ice the temperature of the water begins to rise quickly and reaches its maximum in July. The mean temperature of July ranges from 17.5-18.5°C (Table 2). On the basis of the data of the coastal hydro-meteorological stations the temperature of the water persists above 15° C from June 9 to September 4. Absolute maximum temperatures in the nearshore waters fluctuate between 24° and 25° C (being higher only in the shallow bays) and in the centre of the straits between 21° and 22° C. In summer the temperature in the straits may perceptibly fall

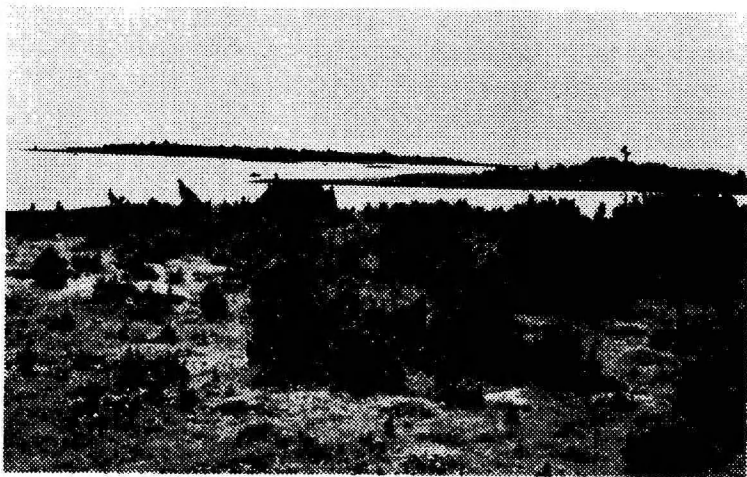


Photo 1. Islets off Kassari Island. Photo by  
H. Mardiste.



Photo 2. Matsalu Bay. Photo by I. Kala



Photo 3. Single coast of Kassari Island. Photo by  
H. Mardiste.

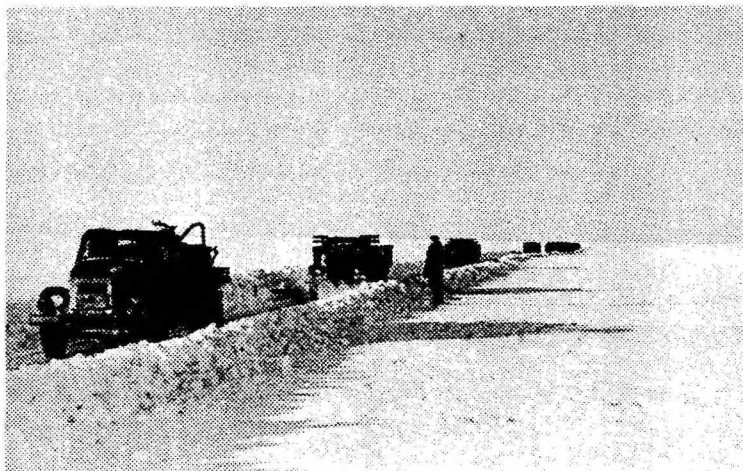


Photo 4. Road over the ice between Hiiumaa Island  
and the mainland. Photo by H. Mardiste.

Table 2

## Mean Water Temperatures in the Väinameri (°C)

Location	V	VI	VII	VIII	IX	X	XI
Hari Strait	7.2	14.4	17.2	16.8	14.2	10.3	6.2
Heltermaa	10.6	16.2	18.7	17.6	13.7	8.4	2.9
Large Strait	8.4	14.8	17.2	18.0	14.2	10.5	6.0

due to the cooler water carried here by currents from the open sea. For example, on July 24, 1959, the surface temperature of the water in the Hari Strait was 20.0° C, but on August 2, 1959 it was 6.9° C. In summer, diurnal fluctuations vary about 1°. Diurnal amplitudes of 3-4° are caused by currents and they take place in the outer parts of the straits. In spring, temperatures in the central part of the Väinameri are lower than near the coast (in May 3-4°), in midsummer they are equal, in autumn the situation is contrary to that in the spring (in November 3-4°).

Vertical gradients of the water temperature are insignificant on account of waves, currents and shallow water. In the Large Strait the mean monthly temperature is 1.1-2.3° C higher on the surface than in the bottom layer. In the autumn months this difference does not exceed 0.2° C. Sometimes in summer, when strong currents flow from the open Baltic, considerable vertical gradients may be observed.

The mean surface salinity (5-6 ‰) is lower than that in the northern part of the Baltic Sea (6,5-7,0 ‰), but higher than it is in the Gulf of Riga (Черновская и др., 1965). Salinity is highest in the Soela Strait, being at its maximum about 8 ‰ and at its minimum about 5 ‰. Due to the influence of the Kasari River, the water is freshest in the eastern part of the Matsalu Bay - 0.1-0.2 ‰. Salinity depends on the direction of the currents. At the inflow of water from the open sea salinity increases and vice versa.

The water level depends on the wind direction. Easterly winds lower the water level, but westerly winds raise it. The amplitudes of surge levels usually exceed those of the low levels. Absolute amplitudes as high as 2.5 m have been observed. Fluctuations of this kind, particularly surges, have caused rather considerable losses of property. Floods have taken place at Haapsalu and Kärdla. The water level is lowest in spring and highest in autumn.

Waves in the Väinameri are generated by the wind. Wave height ranges from 0.3-0.75 m. Local waves higher than 1.2 m are rare. During storms waves over 2 m high may be carried into the Väinameri from the open sea. Wave length generally fluctuates between 3 and 7 m, not exceeding 35 m (Kupkax, 1967).

Transparency and colour of the water depend directly on the season of the year and on the hydrometeorological conditions. In winter, transparency is greater than in summer and autumn. Waves and currents caused by high winds make the water muddy. The transparency of the water in the Väinameri measured by means of a Secchi disk is, as a rule, low - 2 to 3 m, being 0.3 m at its minimum. In the case of the currents flowing from the open Baltic Sea, transparency in the Hari Strait has been from 9-10 m in extraordinary circumstances. The colour of the water ranges from green to yellowish brown. As a rule, it is greenish yellow.

On account of favourable environmental conditions the flora and the fauna of the Väinameri are well-developed.

Due to the shallow water and the protection from high waves, the bottom vegetation is here one of the richest and most diverse in the whole coastal area of Estonia. The greater part of the bottom vegetation is constituted by algae, of which there are 68 species, varieties and forms. Vascular plants, particularly reeds, grow more in the mud of the Matsalu and Haapsalu Bays and of the Small Strait. Among the more open parts of the area, the Kassari Bay has

an abundant vegetation in its central part (about 200 sq. km). A thick layer of algae floats unfixed to the bottom at a depth of 5 to 9 m, the thickness of the algal layer is 5-10 cm, amounting to 15 cm at its maximum. Only the red algae Furcellaria fastigiata and Phyllophora brodiaei f. baltica are of some industrial importance, because they are gathered and processed for the extraction of agar (so-called est-agar). Besides the Kassari Bay, another area having an abundant vegetation is the Matsalu Bay (Trei, 1970).

In the waters of the Väinameri there occur marine, fresh-water, migratory and brackish-water fish. Many of them have found favourable spawning conditions here. The Väinameri provides 7-8 % of the total catch of fish in Estonia. The most important object of fishing is the Baltic herring, which constitutes three-fourths of the total catch here and about 10 % of the total catch of the Baltic herring in Estonia. Besides it, perch, ide and garfish provide greater catches (Erm et al., 1970).

The greater part of the islets in the Väinameri and several sections of its coast have a very abundant bird fauna. The Matsalu Bay and its environs are the largest haunt of waterfowl, coastal and marsh birds in the Baltic countries. The birds here have attracted the attention of naturalists already for a hundred years. For the protection and scientific study of birds in these parts the Matsalu National Reserve was founded in 1957. Its area is 135 sq. km, including over 50 islets, wide reed-beds, flood-plain meadows and coastal pastures. The Matsalu reserve belongs to the reserves of all-European importance. Some other areas and groups of the islets constitute reserves of republican and local importance, such as the environs of Puhtu, the Käina Bay, etc. (Renno, 1970).

The Väinameri has a firm place in the economy of the Estonian S.S.R. It is used for the maintenance of communication between the islands and the mainland. Continuous

freight and passenger traffic is maintained on the routes Rohuküla-Heltermaa, Virtsu-Kuivastu and Haapsalu-Sviiby and on the routes between Tallinn and the islands (in the latter case only freight is carried). In severe winters navigation is hindered by the ice cover. Then ice-roads are established across the straits. Such traffic continues for one to two months. Proposals have been made to join the islands and the mainland by causeways and bridges (Uustalu, 1969). Should they be constructed in future, it is necessary to consider the possibility of changes in local natural conditions. An illustration of that kind may be mentioned. Because of the construction of a causeway across the Small Strait between the islands of Saaremaa and Muhu in 1894-97, water circulation was disrupted and the oxygen concentration in the water, particularly in winter, decreased. As a result of the above-mentioned changes a formerly rich fishing area lost its economic importance. The relative importance of the Väinameri area for Estonian fishery has been described above.

An increase in the spare time of workers has called and will call forth demands for the creation of new holiday and recreational areas. The health resort of Haapsalu is well-known. Warm coastal waters, long duration of sunshine, curative muds, landscapes of a peculiar character, etc., are excellent preconditions for such a development. In planning a more intensive use of the area of the Väinameri one must proceed from the necessity of preserving its natural complexes (Kumari, 1970). Our inland sea deserves this.

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## Väinameri - Eesti sisemeri

H. Mardiste

### R e s ü m e e

Lääne-Eesti saarestiku ja mandri vahel paikneva Väinamere looduslikud tingimused on mitmeti omapärased. Mõju avaldavad nii mandri lähedus kui ka läbi väinade avamere ja Riia lahaga toimuv veevahetus.

Käesolevas artiklis antakse ülevaade Väinamere looduslikest tingimustest. Käsitlemist leiavad rannajoon, põhjasetted, ilmastikutingimused ja elustik. Veekogu hüdroloogilise režiimi elementidest peatutakse pikemalt hoovustel (1. tabelis on toodud hoovuste suunad ja kiirused Hari kurgus ja Soela väinas 3-4 pallise tuule korral), veetemperatuuril (2. tabelis on esitatud kuu keskmised pinnatemperatuurid maist oktoobrini) ja jääkattel. Nimetatud mereala järjest intensiivsem majanduslik kasutamine, sealhulgas puhke- ja turismialase tähtsuse tõus nõuab suurema tähelepanu osutamist tema loodusliku ilme ja elukoosluste säilitamisele.

## Вяйнамери - внутреннее море Эстонии

Х. Мардисте

### Резюме

Природные условия расположенного между Западно-Эстонским архипелагом и материком Вяйнамери (проливы Муху, раньше Моонзунд) во многих отношениях своеобразны. На них оказывают влияние как близость материка, так и водообмен через проливы с открытыми районами Балтийского моря и с Рижским заливом.

В статье дается обзор природных условий Вяйнамери. Рассматриваются береговая линия, донные отложения, метеорологические условия, флора и фауна. Из элементов гидрологического режима водоема автор останавливается подробнее на течении, температуре воды и ледовом покрове. В таблице 1 приведены направления и скорости течений в проливах Хари-Курк и Созла при 3-4 балловом ветре. В таблице 2 представлены среднемесячные температуры в поверхностном слое моря с мая по октябрь. Усиливающаяся интенсивность экономического использования ресурсов этого водоема, в том числе подъем его значения в сфере отдыха и туризма, требует большей работы по сохранению его природного облика и биоценозов.

Introduction to the Forest Regions of  
Estonia

J. Eilart

The ancient names of the largest forest areas in Estonia Alutaguse, Perävala, Kõrvemaa, Vändra, etc. have become generally known and are quite customary in everyday usage. They denote certain large areas in their entirety and in the course of time they have acquired quite a distinct geographical demarcation. However, the classification of all our forests according to certain characteristic, topographically similar features into forest districts or regions has not been solved yet. The possibility of such a division and their obvious validity becomes apparent from several regionalizations carried out from different aspects. Approximate configurations of the principal regions will appear from the agricultural land utilisation scheme of the Estonian S.S.R. and from the map of the distribution of cultivable land in the different districts of the republic. This is also evident from the scheme of the general distribution of forests and is with adequate causality related to A. Lillama's scheme of soil regions (1958) and E. Varep's geography of landscape districts (1968) and landscape types (1970). Naturally, the republic's forest regions are also reflected in the geobotanic division compiled by L. Laasimer (1965) and there is, of course, a large measure of coincidence between the forest regions of the republic and the areas of the so-called natural landscapes of the Estonian S.S.R. which have been distinguished both in the shape of larger and smaller tracts in the analysis of the distribution of our terrestrial mammals (Aul, Ling, Paaver, 1957).

Still, none of these schemes represents the regions of the forests of Estonia in a shape which would consider the specificity of the distribution of forests. Each scheme of regionalization has its own specific features that characterize the phenomenon under study uniquely, although they also imply more general aspects which, for instance, result from the regularities of the post-glacial development of the territory of Estonia. Each scheme of regionalization implies a certain degree of generalization which comprises some common general features that are typical of a large territory from a definite aspect.

In establishing the forest regions of Estonia an attempt has been made to take as a basis such differing characteristics as reflect natural causes as well as national economic and historical circumstances which are essential for the development of a certain area.

The first and most important characteristic is that of massive character, which is a complex feature combining several others. It is large forest expanses that have resulted in an increase in the role of forests in the spheres of human activity. Large forested areas reflect significant common features of genesis. Large forested areas also provide shelter for the forest mammals and birds which are growing ever rarer (such as the bear, the flying squirrel, the eagle, etc.). The persistence of large forested areas is due to the following principal reasons:

1. These areas have been edaphically (primarily due to swamp formation or sandy soils) little suitable for cultivation. Without exception large forested areas are located in regions where the average quality class of arable soils is low, scoring only 45 out of the possible 100 points. Such forests are found on the dunes of Kõpu, Hiiumaa Is., on the outwash plains of Karula-Hargla in southern Estonia, on the area of repeated transgressions of the Baltic Sea at Lahemaa in northern Estonia, etc.

2. Large forested areas have been difficult of access. Such were the large territories in the Alutaguse and Kõrve-maa districts.

The chief obstacles to access were large mire complexes (raised bogs) as well as rivers in case for some reason or other these had not become important for rafting. The persistence of a comparatively large forest cover within the basin of the Pärnu River (e.g. the large forested area in the triangle of Kurgja-Tõrvaagu-Kaansoo) is due to the presence of rivers. Peravald, a hinterland of old estates, has acquired its very name from its geographical inaccessibility.

3. On many occasions the persistence of large integral forest areas to this very day has been due to reasons of settlement history, modes of utilization and administration. The forests of Vihterpalu that were difficult to pass through were a marginal "hinterland" both for the Saare-Lääne bishopric and the areas in the possession of the Livonian Order. In the 11th to 13th centuries the Pärnu River together with its nearby forests abounding in bears was a borderland of the ancient district of Sakala. Afterwards it became an outlying region under the rule of the Teutonic Order. Similar circumstances conditioned the survival of relatively extensive forests within the limits of Setumaa, on the borderland between Estonia and Latvia and elsewhere. Numerous forests were preserved from Tihemetsa (Volveti) to Kikepera and Kariste in more recent times when feudal relations yielded to capitalist relations because the local forests belonged to the so-called crown estates where forests were not exploited intensively.

Smaller forested areas may also have resulted from a strongly dismembered relief (particularly in the midst of cultivated areas) which presented an obstacle to the hauling of logs from forests. The effect that oases have on the development of forests is well-known (e.g. the Neeruti

Hills in the cultivated area of Pandivere, the Paunküla oses, etc.). In more recent times the danger of erosion after clear cutting acted as an impulse to the preservation of small forested areas (e.g. the Karula Hills, wooded Vällamägi and Great Munamägi near Haanja, Little Munamägi, Tedremägi, Hobustemägi, and others near Otepää). A rarer reason for the persistence of forests is the presence of karsts, which may be observed at Orgmetsa in the district of Järvamaa.

It need hardly be emphasized that the later large-scale wood-processing enterprises (such as the Waldhof Wood Pulp and Paper Mill near Pärnu, the Türi Paper Mill etc.) exercised a great influence on the dismemberment of forested areas. The railways had a similar effect.

In addition to the consideration of large forested areas as a complex indicator in the differentiation of forest regions, the characteristics resulting from the nature of the surface stratum and the peculiarity of the post-glacial development of the area are also factors of decisive importance. Here, too, there appear the fundamental regularities existing between so-called high-lying Estonia and low-lying Estonia, i.e. the areas which have been either higher or lower than the transgressions of the sea while the contours of forested regions clearly indicate the barrier of intermediate Estonia which runs almost from north to south. Strictly speaking, forests, mires and bogs call forth this plant and zoogeographical boundary. Nevertheless, the peculiarities of post-glacial genesis and the surface stratum are by no means absolutely reliable guides to the identification of the boundaries of forest regions. This may be confirmed by the position of the eastern boundary of the forest region Vändra-Laiksaare which in the presence of forests is located considerably more eastward of the essential eastern boundary of the distribution of the deposits of the Baltic Ice Lake.

Although the factors determining the basic composition

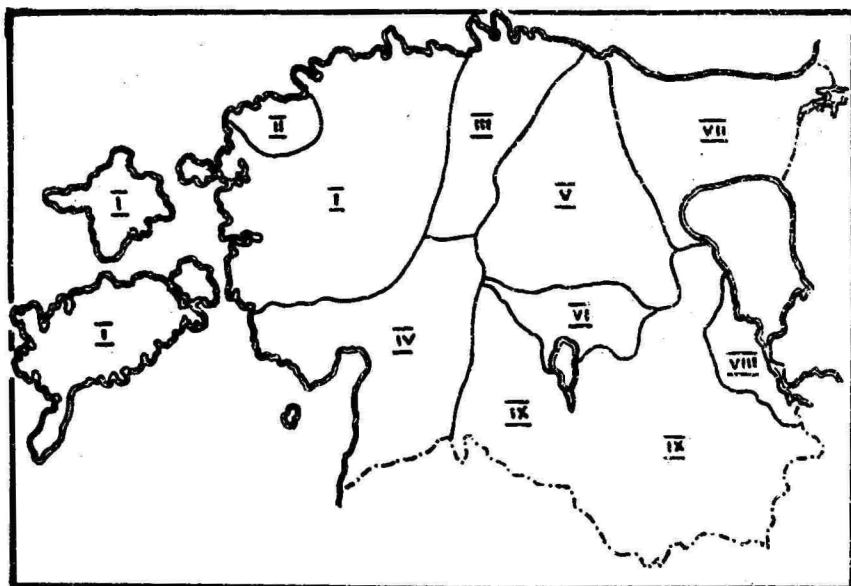


Fig. 1. Forest regions in Estonia

- I. The forest region of western Estonia and the western islands.
- II. The Vihterpalu-Nõva region.
- III. In the Kõrvemaa region.
- IV. The Vändra-Laiksaare region.
- V. The Järvamaa-Kurista forest region.
- VI. In the Laeva-Parika region.
- VII. For centuries the Alutaguse region.
- VIII. The Peravalla region.
- IX. The forest area of southern Estonia.

of forests (the dominant tree species) are reflected through the medium of the characteristics of the above-mentioned environment (site type), it has proved vital to consider this indicator also directly in the differentiation of forest regions.

On the basis of the dominant tree species and the prevalent forest site types, the establishment of the subunits (subregions) of regionalization should proceed primarily within the principal regions. Of the typological boundaries of regions, the boundary revealing itself in western Estonia and indicating the border from which alvar forests become indictory in the landscape must be regarded as the most substantial. Taking this circumstance into consideration, the region typical of the Estonian western islands extends far towards the east embracing the alvar forests of Märjamaa-Vardi, up to the transition area of intermediate Estonia (in the surroundings of Rapla-Kuusiku). If necessary, it is rather simple to differentiate such districts according to their principal regions.

The forest regions of Estonia that will be presented below are still rather heterogeneous, particularly since we have applied the principle that nearby areas where the proportion of forests is small have been joined to the forest area on which a forest region is based.

Thus the western boundary of the Alutaguse forest region, in an oversimplified way, has been drawn right along the River Kunda (Sämi), including landscapes of a strongly technogenous appearance on an Ordovician plateau surrounding the marshy area of forests from the north like a narrow strip.

In the Vändra-Laiksaare region there are extensive marshy forest areas along with coastal heath forests at Tõstamaa and Häädemeeste. Great local differences exist in the West-Estonian region embracing the good quality-class forests on the western elevation of Saaremaa Is. as well as alvar forests growing on limestone.

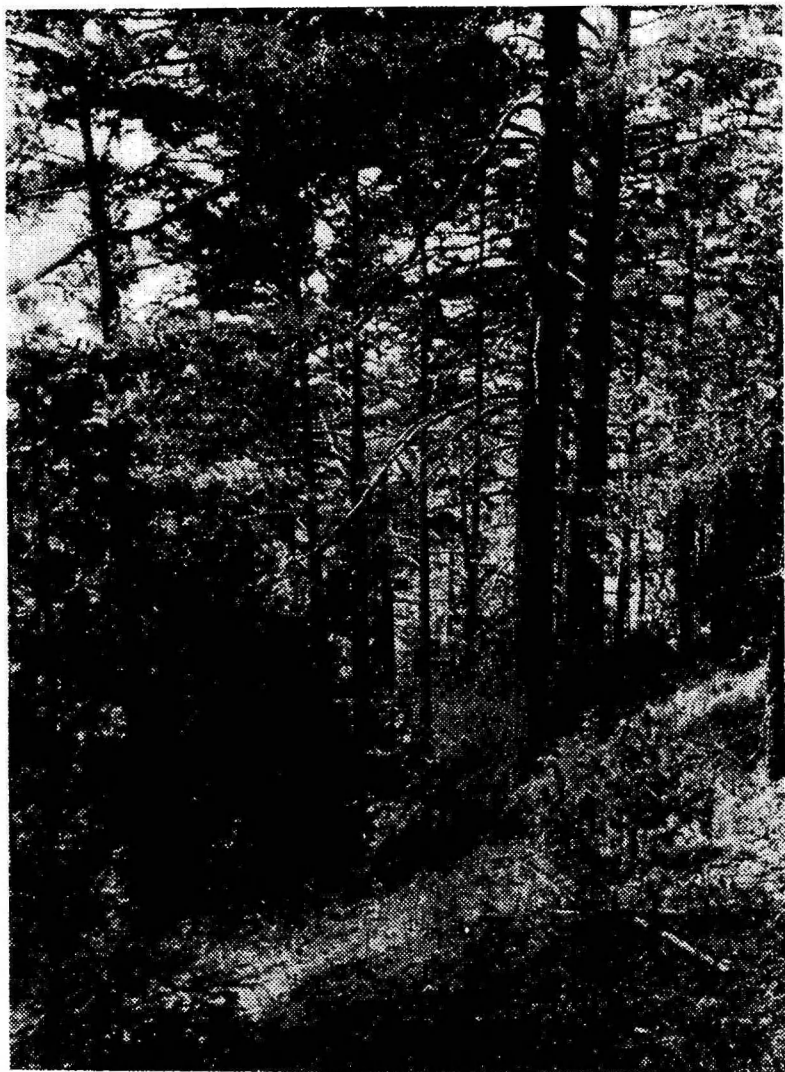


Photo 1. Pine and oak forest in the Viidumägi  
Nature Reserve. Photo by J. Eilart.



Photo 2. Flood plain forest in the Aegviidu-Nelijärve  
Landscape Reserve. Photo by E. Kask.



Photo 3. Pine forest in the Kõrvemaa area.  
Photo by A. Marvet.

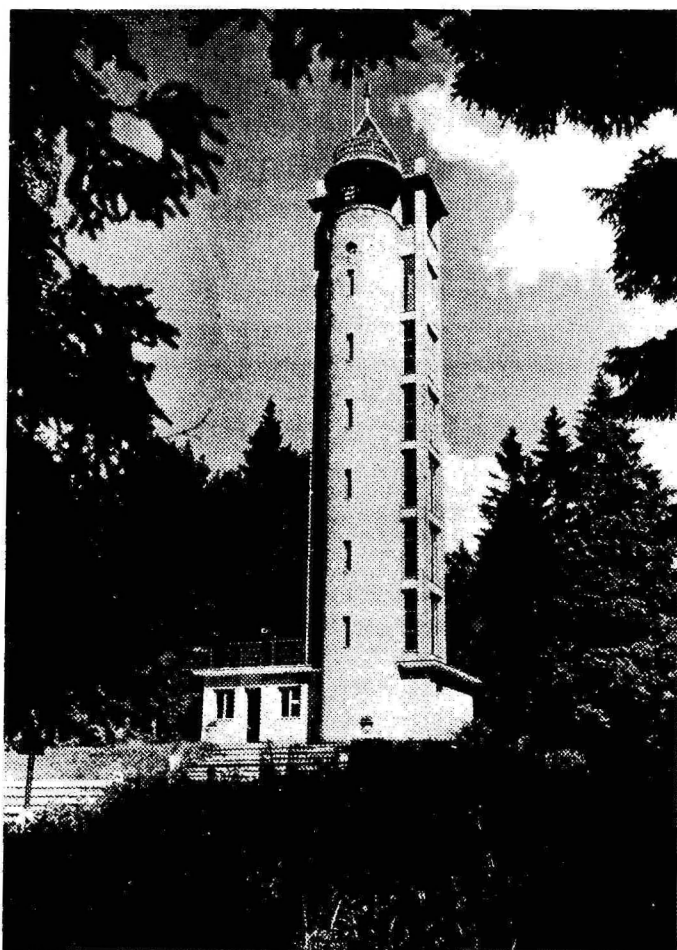


Photo 4. Forest-covered moraine hill in South Estonia. The Suur-Munamägi is the highest point of Estonia (317.6 metres) and has been placed under nature protection as a landscape reserve.  
Photo by E. Saar.

Considering many of the above-mentioned characteristics, it has proved expedient to differentiate the following nine forest regions in Estonia.

I. The forest region of western Estonia and the western islands. Here one can meet with characteristic alvar forests, valuable pine stands and comparatively numerous oaks growing mostly in the conditions of woody meadows. In this region there occur rare plant species such as *Taxus baccata*, *Hedera helix* and *Sorbus rupicola* (*S. salicifolia*).

II. The Vinterpalu-Nõva region with prevailing marshy forests.

III. In the Kõrvemaa region forests occur on higher land-forms (Lippmaa, 1935); in between them there are marshes, heath-forests prevail in the northern part, spruces are frequent in the southern part.

IV. The Vändra-Laiksaare region possesses valuable coastal forests which, however, are in their majority marshy. Stands of *Alnus glutinosa* are abundant.

V. The Järvemaa-Kurista forest region represents the area of the best Estonian spruce stands.

VI. In the Laeva-Parika region of the Võrtsjärve depression there prevail marshy forests, the river banks were previously overgrown with oaks.

VII. For centuries the Alutaguse region has been the most extensive forested area in Estonia. At present it is undergoing great technogenous changes due to the mining of oilshale. Below the glint on the coast of northern Estonia (with a height of up to 56 m) there occur excellent broad-leaved trees.

VIII. The Peravalla region (Eilart, 1963) is characterized by forests which are marshy in places, but it also includes good-quality spruce stands (with a forest yield of 600 cu. m per ha and trees up to 48 m high. The Kargaja

bog yields up to 1,200 tons of cranberries a year.

IX. The forest area of southern Estonia is overwhelmingly characterized by good pine stands with a forest-yield of up to 586 cu. m per ha. Spruce stands prevail in the northern part of the region which have a forest-yield of 737 cu. m per ha and an average increment of 9 to 10 cu. m per ha per year. On the Püstimäe Hill there is a larch stand with a forest yield of 1386 cu. m per ha. This region can boast of having the thickest oak in Estonia, the circumference of the trunk being 8.0 m.

In the forest regions presented above one can distinguish numerous subregions of differing character.

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## Sissejuhatus Eesti metsade valdkondadele.

J. Eilart

R e s ü m e

Artiklis antakse teoreetiline põhjendus metsade valdkondade piiritlemiseks Eesti tingimustes, esitades olulisema alusena nn. massiivilisuse, mis on komplekstunnuseks. Analüüsisid nii füüsilis-geograafiliste tingimuste, metsanduslike faktorite ja ajalooliste põhjuste kogumõju, eraldatakse Eesti NSV-s 9 metsade valdkonda.

## Введение к лесным районам Эстонии

Я. Эйларт

Р е з ю м е

В статье дается теоретическое обоснование для определения лесных районов в условиях Эстонии. В качестве более существенной основы приводится т.н. массивность, являющаяся комплексным признаком. Анализируя общее влияние физико-географических условий, лесных факторов и исторических причин, в Эстонской ССР различают 9 лесных районов.

## Partial Hierarchies of Settlements:

Their Concept and Identification in the Estonian S.S.R.

U. Pragi

The hierarchy of settlements has gradually become a basic concept of settlement geography. As is known, the first author to introduce this concept was W. Cristaller (1933). After him much work has been done on the problem of how to ascertain hierarchical ranks in a given group of settlements, and methodological as well as practical problems connected with this task seem to have been solved. The works of B.J.L. Berry and W. Garrison (1958a, 1958b) should be mentioned here. But the discussion of the basic shortcomings of the concept in question has been avoided in Western literature and not very much attention has been given to them in Soviet literature either. These shortcomings are the following.

1) It is not clear what the essence of hierarchy is.

2) Therefore the hierarchy of settlements is defined as an independent phenomenon without linking it with the role played by settlements in the economic life of a given society or state.

Before the solution of these basic problems the study of the geometrical or arithmetical forms of hierarchy could be of no use at all. This explains the ironical comments on hierarchical hexagons which were common in Soviet literature not so long ago. But these comments do not replace the need for the study of the interrelations of settlements, which has called forth the concept of hierarchy.

A paper worth most careful attention has been presented by V.V. Pokshishevsky (В.В. Покшишевский, 1962). The author advances in it some very promising ideas: the exist-

ence of many overlapping and interdependent hierarchies of settlements instead of a single hierarchy, connection between the hierarchical ranks of settlements and production stages located in these settlements. Some hierarchies have been described by V.V. Pokshishevsky and suggestions have been given for dealing with others. But it is a pity that the author has not developed his ideas further and has not later returned to the subject either.

It may be interesting to mention that an American geographer comes to the same conclusion about the existence of more than one hierarchy roughly in the same way - by connecting hierarchical ranks with stages of production (E. Dumm, 1970).

Most studies of Soviet geographers on hierarchical topics (quite numerous in recent years) conform to the empirical pattern. But the general line of investigation is the same: elaboration of indicators of hierarchical rank of settlements and application of these indicators to the given system of settlement. The appropriateness of various possible indicators is discussed, but this discussion must remain pointless before the above-named basic questions are settled. The author of the present paper hopes that his work will throw some light on these questions.

By now the view has become well established that all phenomena in nature and society do not exist apart, but form systems - groups of interrelated and interdependent objects. These objects form the structure of a system, the way they are related to each other - the organization of a system. A very general organizational form of systems is their integration into supersystems and their division into subsystems. In fact, all systems are part of some supersystem, but in relation to their components they themselves are supersystems. The relation of a subsystem to a system, of a particular system to its supersystem and so on is called the hierarchy of systems. So hierarchy is an organizational form of the relation of a part to a whole. And in order to

ascertain hierarchical ranks, the succession of systems needs to be identified.

We support the viewpoint that economic geography is spatial economy, i.e. the subject of economic geography lies in the spatial aspects of the economic activities of man. So all concepts of economic geography, except space itself, must have an economic basis, being only spatial expressions of economic phenomena. Since empty space has no hierarchical qualities, the hierarchy of settlements must be based on the hierarchy of economic systems. (Needless to say that economy cannot be limited to industry and agriculture alone, but embraces also communications, services, the production of nonmaterial goods and, last but not least, people as consumers and manpower as the first productive force).

Each system can be defined as a "black box" transforming input into output. So economy is also defined as a "black box" transforming natural resources into goods and services needed by society ( E.S. Ма́йму́нас , 1967). The subsystems of economy can also be defined as "black boxes" transforming a certain natural resource into certain kinds of goods or services. But it must be mentioned that the input of these subsystems cannot be only nature, but also the social organization of productive forces, internal with regard to the system of economy as a whole, but external with regard to its subsystems. Quite similarly, the preservation of the social organisation of productive forces may be regarded as the main output of a subsystem of economy.

Branches of the economy are not such subsystems. They lack internal unity and relative independence, which are the main characteristics of each system. No unity, almost no economic ties could be traced between shipbuilding, agricultural engineering and electronics - three components of the branch of engineering. Timber processing has some unity in itself, but it cannot be, not even relative-

ly, independent of forestry. No meaningful geographical study of the food industry can be carried out separately from agriculture. This induces some geographers to study "branch blocks" ( А.Г. АГАНБЕГЯН , 1969, Е.П. Маслов, 1969). But it can be seen that these "branch blocks" have been known since long ago as energy-production cycles ( Н.Н. Колосовский, 1947). Energy-production cycles are the most important special case of cycles in general - immediate subsystems of the economy as a whole. (For details see Н.И. Блажко, С.В. Григорьев, Я.И. Заботин, 1970).

The relation of a cycle to the economy is clearly the hierarchical relation of a subsystem to a system. But this relation cannot explain the hierarchy of settlements. First, because such a hierarchy consists only of two ranks; secondly, because the higher rank includes the whole economy, which cannot really be located in one settlement, however great. So we must search for the subsystems of a cycle.

Stages have been described in the literature as such subsystems ( Ю. Г. Саушкин, 1968 et al.). But a stage in general is not an immediate subsystem of a cycle. It is known that if the purpose of some system is subordinated to the purpose of another system and has a meaning only in the broader context of the latter purpose, the first system is a subsystem of the latter ( Е.З. Майминас, 1967). Exactly that is the case with stages. For instance, coal mining has no immediate meaning, coal itself is not needed by present-day society. Energy generated by burning coal, iron made by the use of coal coke - this is the purpose of coal mining. But these processes are the stages of the pyrometallurgical iron cycle or the coal energy cycle. The stages form a succession where lower stages are integrated as subsystems into higher stages. To put it briefly, if a cycle consists of  $n$  stages, then immediate subsystems of this cycle are the  $n$ th (highest) stage and an aggregate of other  $n - 1$  stages. The last system in its turn consists of the  $(n - 1)$ th stage and an aggregate of  $n - 2$  stages,

etc. Thus it can be seen that the stages of a cycle form a multi-rank hierarchy of systems. This is called the functional hierarchy of a cycle. When located in space, functional hierarchy will serve as a basis of the hierarchy of settlements. It is quite reasonable to assert that if a settlement serves as the location of a lower stage than some other settlement, the latter settlement hierarchically dominates the former.

But two considerations must be borne in mind when performing this operation of placing functional hierarchy of a cycle into space. First, the functional hierarchy of a cycle exists only within the limits of this cycle. Stages of different cycles are not related to each other in any manner of subordination, in fact, they need not be related at all. Each cycle is almost independent of the others, uses its own specific resources and fulfils its own specific purpose. Consequently, stages serving different purposes cannot be compared with regard to the degree of fulfilling these purposes. Since a settlement can serve as the location of enterprises of more than one cycle (and most settlements certainly do it), the above-described hierarchy, when placed into space, cannot yield integral hierarchies of settlements, but only partial ones. Spatial coincidences of these partial hierarchies form the integral hierarchy of settlements. Exactly that was asserted by V.V. Pokshishevsky in the above-mentioned work.

Secondly, spatial characteristics of economic-geographic systems are important enough to be able to modify functional hierarchies of cycles. In general, the system-forming process of economic systems is a functional division of labour between producers. But the functional division of labour never operates without a territorial division generating spatial systems; these are only two aspects of one and the same process - the process of the social division of labour. Stage rank in the functional hierarchy of a cycle reflects only the functional aspect. The par-

tial hierarchy of settlements is constituted by both aspects. Therefore the commensuration of these aspects is needed before it is possible to ascertain the rank of settlements in partial hierarchies.

Fortunately enough, there exists the commensuration method by means of the degree of development of economic-geographic systems (Н.И. Блажко, С.В. Григорьев, Я.И. Заботин, 1970).

This method ascribes to each cycle in each settlement a measure of the participation in social division of labour - cycle point. Comparing the number of cycle points given on account of some enterprises with the rank of these enterprises in the functional hierarchy of cycle, one can easily establish the correspondence between the rank of a settlement in partial hierarchy and the cycle point of it, i.e. ascertain hierarchical ranks of settlements on the basis of their cycle points. The question of which settlement dominates over which was settled by investigation of economic and other ties between settlements.

Cycles and stages of the economy of the Estonian S.S.R. are presented in Table 1. It could be seen that the list of cycles corresponds greatly to the list proposed by A.T. Chrushtshev (1969), but two non-industrial cycles are added. There are some more cycles in Estonian economy but they form only fragments of partial hierarchies and are of minor interest.

The stages of cycles roughly follow the stages of the use and processing of the main input of a given cycle: raw materials in most cycles, manpower in manufacturing cycle, transportation needs and needs for services.

The data on economic ties of Estonian urban settlements were collected by the research workers of the Chair of Economic Geography of Tartu State University in 1967-1970 (unpublished).

Eight partial hierarchies of Estonian urban settlements were ascertained on the above-mentioned methodological and data basis (see Figures 1-8).

## CYCLES AND STAGES OF THE ESTONIAN ECONOMY

Table 1.

Cycle	First stage	Second stage	Third stage	Fourth stage	Fifth stage
Oil-shale processing	Mining of oil-shale	Oil-shale concentrat- ing	Electric power stations burning oil-shale	Chemical processing of oil-shale	Republican level administration of the cycle, en- gineers training for the cycle, scientific research for the cycle.
Manufacturing	Handicraft. Single enter- prises producing various articles, employing work- ers with almost no skill, not needing special buildings or advantageous location. Home work usual.	Small enterprises and separate depart- ments with limited list of production articles, employing workers with some skill, but not need- ing special build- ings or advantageous location. Clothes' factories are typic- al	Large enterprises, employ- ing many skilled workers, needing special buildings and advantageous location. Typical in Textile indus- try.	Very large enterprises or enterprises employing high-skilled labour among them scientific workers.	
Agricultural produce processing	Agriculture	Primary processing of agricultural produce	Meat and milk industries, flax-milling, shoe in- dustry, etc.	Complicated processing of agricultural produce	
Fish processing	Fishery	Fish meal and chilled fish pro- duction	Canneries	-	
Wood processing	Forestry	Woodworking indus- try. Utilization of waste wood	Furniture and match factories	Chemical processing of wood	
Building	Quarrying of building materials (limestone, clay, etc.)	Production of build- ing materials (ce- ment, concrete, bricks, etc.)	Construction of dwellings	Complicated kinds of construction work	
Transportation	Road building and maintenance	Railway stations, motor depots, coastal shipping	Sorting and re-loading railway stations, en- gine and, wagon sheds	Seaports	
Services	Retail-trade, primary schools, libraries, administration	Secondary schools, hospitals, every- day services, news- paper publishing	Wholesale trade, secondary profession- al education, theatre	University, scientific research institute (if not in other cycles	

Each cycle comprises servicing branches of workers' training, repairs, machinery fabrication, etc.



Figure 3  
Partial hierarchy  
of agricultural produce  
processing

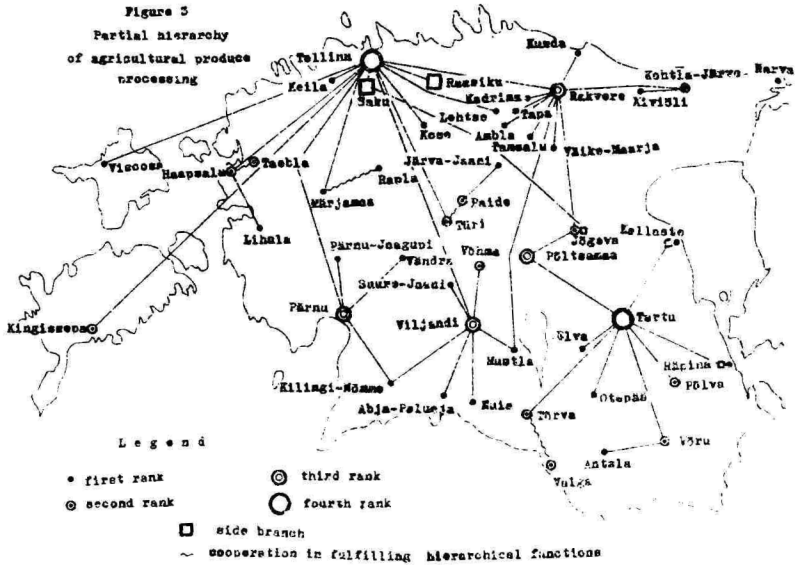
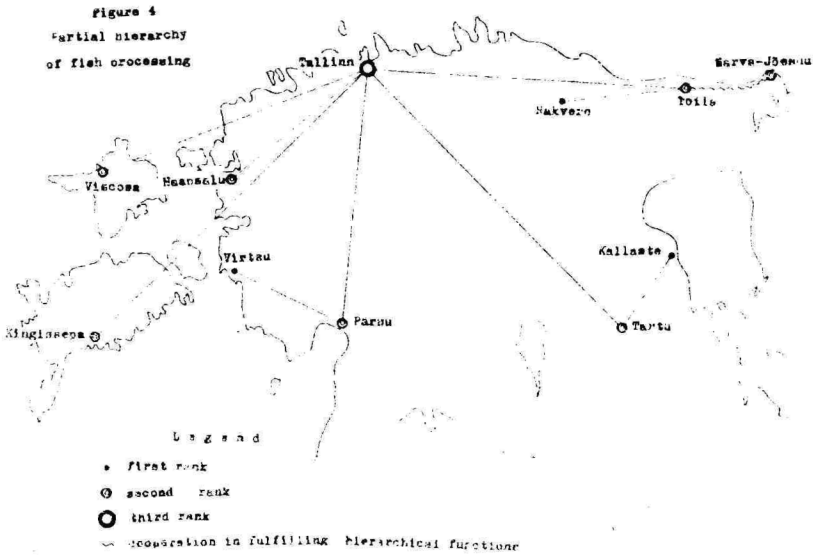


Figure 4  
Partial hierarchy  
of fish processing







The main conclusions that can be drawn from these preliminary schemes are the following.

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**Asulate osahierarhiats mõiste ja nende  
väljaselgitamine Eesti NSV-s**

U. Pragi

R e s ü m e e

Asulate hierarhia mõiste on geograafias juba laialt kasutusel, ent ikkagi ei ole veel lahendatud kaks temaga seotud väga olulist küsimust: 1) mis on üldse hierarhia ja 2) kuidas asulate majanduslikud funktsioonid resulteervad nende hierarhilises alluvuses. Ilma nende küsimuste lahendamiseta ei saa hierarhia uurimine olla kuigi tulemusrikas.

Toetudes üldisele süsteemide teooriale, väidab autor, et hierarhiline suhe on üldiselt mingi süsteemi kui terviku ja selle süsteemi suhteliselt iseseisva allsüsteemi vaheline suhe, osade ühendamiseviis tervikuks.

Majandussüsteem kui tervik jaguneb tsükliteks - spetsiifilisi eeldusi spetsiifiliseks resultaadiks muundavate majandusliku tegevuse alade süsteemideks. Tähtsaim tsükli tüüp on energia-tootmisttsüklid. Tsüklid omakorda jagunevad staadiumideks, mis erinevad üksteisest tsükli lõppresultaadi saavutamise astme poolest. Seetõttu on võimalik staadiume selle astme alusel reastada. Saadud rea iga kõrgem staadium moodustab süsteemi koos kõigi madalamate staadiumide kooslusega ja seetõttu domineerib hierarhiliselt viimase koosluse üle. Sellist hierarhiasuhet nimetatakse tsükli funktsionaalseks hierarhiaks. Kuna kahe tsükli vahel ei eksisteeri osa-terviku suhteid, moodustab iga tsükkel omaette funktsionaalse hierarhia.

Majandus, aga seega ka tsüklite funktsionaalsed hierarhiad, paiknevad ruumis, s.t. teatud asulates. Ruumis paiknevad ja territoriaalsest tööjactusest osavõtu astme järgi modifitseerunud funktsionaalsed hierarhiad määravad

seega asulate osahierarhiad. Osahierarhiate eventuaalne territoriaalne kokkulangemine ja selle alusel tekkivad vastasmõjud nende vahel loovad võimaluse asulate üldise e. integraalse hierarhia kujunemiseks. Osahierarhiate suhe integraalsesse hierarhiasse on sama liiki mis tsüklike suhe kogu rahvamajanduse süsteemi.

Lähtudes neist seisukohtadest on Eesti NSV-s välja selgitatud 8 asulate osahierarhiat (joon. 1-8) 5 hierarhiaastmega (nullastme tsentrid ei ole kantud joonistele). Nende võrdlus kinnitab ühelt poolt integraalse hierarhia objektiivset olemasolu, teiselt poolt näitab aga, et osahierarhiate kokkulangemine ei ole kaugeltki täielik.

#### Содержание понятия частных иерархий поселений и их установление в Эстонской ССР

У. Праги

#### Р е з ю м е

Понятие иерархии поселений широко используется в экономической географии, хотя до сих пор неясно, что вообще представляет собой иерархия и каким образом иерархия поселений вытекает из их народнохозяйственных функций.

На основе общей теории систем автор утверждает, что иерархическое отношение, обобщенно, является отношением частей какой-то системы к этой системе в целом, формой организации подсистем в единое целое — систему.

Система экономики состоит из подсистем — циклов. Циклами называются совокупности видов экономической деятельности, связанные между собой преобразованием определенной предпосылки, общей для всего цикла, в определенный результат, тоже общий для всего цикла. Важнейшим типом циклов являются энергопроизводственные циклы.

Циклы в свою очередь делятся на стадии - подсистемы, различающиеся по степени достижения общей цели цикла. На основе этой степени стадии можно ставить в ряд. В полученном ряду каждая высшая стадия вместе с совокупностью всех низших образует систему определенного ранга, и ввиду этого иерархически преобладает над этой совокупностью. Такое иерархическое отношение называется функциональной иерархией цикла. Так как между двумя циклами нет отношения части и целого, каждый цикл образует свою собственную функциональную иерархию.

Размещенные в пространстве (т.е. в тех или иных поселениях) и модифицированные согласно степени участия в территориальном разделении труда, функциональные иерархии циклов превращаются в частные иерархии поселений. Возможное территориальное совпадение частных иерархий и возникшие на этой почве взаимодействия их образуют общую, интегральную иерархию поселений. Отношение частных иерархий к интегральной - такого же рода, как отношение циклов к системе экономики.

Исходя из этих соображений и применяя метод определения ступеней развития поселений в системе, для Эстонской ССР выявлено 8 относительно развитых частных иерархий поселений, состоящих из 5 ступеней каждая (рис. I-8; нулевая иерархическая ступень на рисунки не нанесена). Сравнение их подтверждает объективное существование интегральной иерархии, но в то же время показывает, что совпадение частных иерархий далеко не полное.

On growth and migration types of towns  
in the Estonian S.S.R.

A. Marksoo

Introduction

The aim of the present article is to analyze the peculiarities of the process of urbanization in the Estonian S.S.R., proceeding chiefly from two aspects. First, the author tries to establish the general dynamics of the population of the urban settlements having a different size and a different hierarchical-functional type as well as the role of both the natural and the migrational gain of the population. Secondly, the author investigates the extent of the area of the formation of the population of different types of towns and the question of an account of which towns and rural districts their population increases or decreases.

The analysis is based on the data covering the years 1959-1969, i.e. the period between the last two censuses. To understand the position of the above-mentioned period in the history of the urban development of the Estonian S.S.R., the first part of the article presents a brief outline of the development of the urban network in the Estonian S.S.R. in the course of the entire Soviet period. The corresponding section also characterizes the hierarchical-functional system of towns in the Estonian S.S.R. The second part of the paper presents an analysis of the migration and natural growth of the population, i.e. the components of the growth of towns, which is based on the average characteristics of the whole period under study (1959-1969) which have been calculated on the basis of current

statistics. The third part of the article deals with the materials collected during the census of 1970 to characterize the territorial distribution of migration.

1. Some peculiarities of the development of the urban system of the Estonian S.S.R.

Bourgeois Estonia was overwhelmingly an agrarian country where the concentration of the population in towns was comparatively slow. On Jan. 1, 1941, in the first year of the establishment of the Soviet regime in the country, Estonia (in its present confines) embraced 31 towns with a total population of 383,700, i.e. 34 % of the then population of the Republic. Eleven of those towns had acquired the rights of a town already under feudalism, the remaining twenty - in the years of the bourgeois period (Fig. 1). The majority of the last-named ones were small towns. In spite of the numerical predominance of small towns, the two largest and oldest cities - Tallinn and Tartu - included three-fifths of the total urban population of the Republic (Table 1). Actually the total urban population as well as that of the urban settlements was slightly higher than indicated above because the rights of a town had not been assigned in bourgeois Estonia to Kohtla-Järve and Kiviõli, centres of the oil-shale industry, whose population according to approximate data amounted to 5,000 and 2,500 respectively.

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\* At the 1970 census one-fourth of the population were questioned on the basis of an extended questionnaire. All the persons who had settled down at the present place of residence during the years 1968 and 1969 were registered.

Table 1

Grouping of the urban settlements of the Estonian S.S.R.  
according to size in the years 1941, 1959 and 1970\*

Population in thousands	Jan. 1, 1941				Jan. 15, 1959				Jan. 15, 1970			
	No. of settlements	% of No. of settlements	Population in thous.	% of population	No. of settlements	% of No. of settlements	Population in thous.	% of population	No. of settlements	% of No. of settlements	Population in thous.	% of population
Below 2	11	35,6	16,1	4,2	19	31,1	25,5	3,8	15	26,0	20,1	2,3
2 to 5	10	32,2	30,0	7,8	23	37,8	68,7	10,2	21	37,1	60,9	6,9
5 to 10	3	9,7	18,7	4,9	7	11,5	51,1	7,6	7	12,3	45,2	5,1
Total of 2 to 10	24	77,5	64,8	16,9	49	80,4	145,3	21,6	43	75,4	125,2	14,3
10 to 20	3	9,7	34,5	9,0	7	11,5	88,3	13,0	8	14,0	108,4	12,3
20 to 50	2	6,4	48,8	12,7	3	4,9	85,9	12,7	2	3,5	67,1	7,6
Total of 10 to 50	5	16,1	83,3	21,7	10	16,4	174,2	25,7	10	17,5	175,5	19,9
50 to 100	1	3,2	59,6	15,5	1	1,6	74,3	11,0	3	5,3	216,6	24,6
Above 100	1	3,2	176,0	45,9	1	1,6	281,7	41,7	1	1,8	362,7	41,2
Grand total	31	100,0	383,7	100,0	61	100,0	575,5	100,0	57	100,0	881,2	100,0

\* The table has been compiled on the basis of the data presented in the statistical collections "Eesti NSV rahvamajandus 1969. aastal" (National Economy of the Estonian S.S.R. in 1969), Tallinn 1970, and "25 aastat Nõukogude Eestit" (25 years of Soviet Estonia), Tallinn 1965.

\*\* In the case of the town of Paldiski the data for 1940 have been used.





World War II, accompanied by the occupation of Estonia by fascists which lasted for three years, produced a setback in the development of many towns. On account of the havoc caused by the war, the population of several large towns, particularly Narva and Tartu, decreased. In the post-war years thoroughgoing social and structural changes took place in the national economy of the republic. The role of industry increased rapidly. Agriculture passed over to the mode of socialist large-scale production. Along with that there started a new stage in the development of the network of towns. First, the rate of the concentration of the population in the existing towns increased. More and more people poured into the towns both from the rural districts of the republic itself and from other Union Republics. Secondly, a great number of previous rural settlements as well as several new industrial centres that had arisen in the post-war period received the rights of a town or an urban-type settlement.\* The most radical administrative changes took place in the system of urban settlements within the period of 1945-1950 when there arose three new towns and twenty-three new urban-type settlements (Fig. 1). In the years 1951-1957 one town and three urban-type settlements were added to them.

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\* An alev (Russ. посёлок городского типа, Germ. Flecken, a small town with a municipal corporation similar to an English municipal borough, but not to be identified with a parliamentary borough) juridically belongs to the category of urban settlements which have their own municipal corporation called executive committee. In the Estonian S.S.R. alevid 'municipal boroughs' do not differ in population size and economic structure from small towns. For this reason, if the juridical aspect does not need to be emphasized, they are later on in this paper referred to as small towns or urban-type settlements.

Over half of the new urban settlements were small with a population below two thousand inhabitants. In the post-war years the assignment of the rights of an urban-type settlement ensured better economic and cultural servicing of the population of these settlements. In 1951 the administrative division of the republic was reorganized and the previous maakonnad (Engl. counties) were replaced by rajoonid (Engl. rayons or districts). Then a great many small towns which had come into being during the bourgeois period or in the post-war years of the Soviet period were assigned the rights of district centres, which stimulated their further growth for the time being. But later on, chiefly in the early 1960s, in connection with the gradual reorganization of administrative districts, the larger part of them lost the status of a district centre and hence were deprived of a factor which had stimulated their development.\*\*

At the time of the 1959 census there were 35 towns and 26 urban-type settlements in the Estonian S.S.R. with a total population of 675,500, i.e. 56.4 % of the total population of the republic. Compared with 1941, i.e. the last pre-war year, the total urban population had increased by 291,800 or 76 %, thus on an average by 4.2 % per year. Nearly two-thirds of the increment (i.e. 186,400 inhabitants) fell to the share of the so-called "old" towns which had arisen before World War II and which (according to the census data) concentrated circa 84 % of the total urban population. Consequently, the new towns and urban-type settlements affected rather the total population of the urban settlements than that of the towns.

\* Est. maakond, Russ. уезды, Germ. Kreis, Engl. county.  
Est. rajoon, Russ. район, Engl. rayon or district.

\*\* These include the following: Kiviõli, Loksa, Tapa, Keila, Märjamaa, Lihula, Türi, Vändra, Pärnu-Jaagupi, Kilingi-Nõmme, Suure-Jaani, Abja-Paluoja, Elva, Rääpina, Otepää, Antsla, Mustves and Kallaste.

To sum up the foregoing, one may state that the post-war period up to the 1959 census was a stage of an extraordinarily rapid growth of towns in the Estonian S.S.R. which was characterized by a multitude of administrative changes. The number of urban settlements doubled, due to which the role of small towns increased (Table 1). In the years 1959-1960 following the census the next administrative changes took place in the oil-shale basin of north-eastern Estonia where there had arisen an agglomeration of several urban settlements concentrated around numerous oil-shale mines and quarries. Contrary to the previous period, no more new urban-type settlements were created but their number was reduced by merging several of them. Thus the towns of Ahtme and Jõhvi and the urban-type settlements of Kohtla, Kukruse and Sompä were joined to the town of Kohtla-Järve, as a result of which there arose a single town - Kohtla-Järve - with a population of over 50,000.

In 1961 the rights of urban settlements were assigned to the district centres of Põlva and Väike-Maarja, but the latter enjoyed these rights only during the years 1962 and 1963, after which it lapsed back into its previous status. Since that time the number of urban settlements has remained unchanged. Administrative reorganization has concerned only the territories of a few towns which have been extended at the expense of chiefly suburban villages that had actually merged with the respective towns.

According to the 1970 census, the Estonian S.S.R. comprised 33 towns and 24 urban-type settlements with a total population of 881,200, i.e. embracing 65 % of the population of the republic. In the period of 1959-1970 the urban population increased by 205,700 citizens or by 30.5 %. The average annual gain was approximately 2.5 %. The total number of urban-type settlements in the period under consideration decreased; at the same time the role of the small towns diminished while that of the larger towns increased (Table 1). The latter was due not only to the administra-

tive merging of the Kohtla-Järve agglomeration but also to the very rapid growth of the town of Narva.

When we generalize the peculiarities of the period under review, we see that the growth of the urban population proceeded chiefly on the basis of the already established urban network while the administrative factor (i.e. the formation of new towns) did not play a significant role. Depending on that circumstance, the average growth rate of the urban population was somewhat slower than in the previous years. Consequently, the development of the towns of the republic had reached the stage of stable development. The analysis of the results of that stage should be more reliable in the ascertainment of further trends than the data on the previous period which was characterized by a non-uniform development. The tendency towards stabilization in urban development corresponds to the similar tendency in the national economy of the whole republic. The period under study embraces a seven-year-plan (1959-1965) and a five-year-plan (1966-1970). By the beginning of this period the chief trends of specialization in the industry and the agriculture of the Estonian S.S.R. had taken final shape. The latest numerous changes in the republic's administrative distribution also occurred in the first half of the seven-year-plan period. In this connection the trends in the development of the majority of towns, their functions and their mutual hierarchy had become established in general outline.

The hierarchical-functional system of the towns of Estonia has been discussed by several investigators. Relying on the papers by S. Nõmmik (1969) and U. Pragi (1970), it is possible at the present time to distinguish in the republic's urban hierarchy basically four groups of towns subordinated to each other.

Tallinn, the capital of the republic, is on the highest level of development. In the capacity of a polyfunctional large town (with a population of 362,700 in 1970).

Tallinn heads the urban system under consideration and at the same time it serves as a regional centre of north-western Estonia.

The second group of towns consists of the following polyfunctional region centres of republican importance: Tartu (popul. 90,500), Kohtla-Järve (popul. 68,500) and Pärnu (popul. 46,100). All of them are towns of republican subordination and centres of the administrative districts bearing the same name. At the same time their immediate sphere of influence also embraces neighbouring districts. According to the size and the productional potential, the present group of towns of the second level also includes the industrial town of Narva (popul. 57,700) with its many branches of economy. Being a frontier town, its close hinterland on the territory of the Estonian S.S.R. is considerably more limited than that of the above-mentioned towns.

Towns of the third level represent polyfunctional district centres: Rakvere, Viljandi, Valga, Paide, Haapsalu and Kingissepa, all of which have developed from centres of previous districts (maakonnalinnad, Russ. уездные города Engl. county towns).

According to the standards of the republic they are of medium size, i.e. their population ranges from 10,000 to 20,000.

All the remaining towns and urban settlements belong to the fourth group, the lowest level of urban settlements, since according to their sphere of influence they are local centres (of microdistricts). The overwhelming majority of them are small towns with a population under 5,000. Only three of these towns have a population of over 10,000: Sillamäe, Kiviõli and Tapa. According to the peculiarities of their functions, they can be divided into two subgroups: a) narrowly specialized, chiefly industrial centres and b) polyfunctional centres. The latter subgroup is more numerous than the former. It has to be remembered that in

the case of small-town settlements polyfunctionality means not so much an abundance of their functions as the fact that they have no established leading function. They mostly embrace small industrial enterprises and various establishments which serve the agriculture and population of the surrounding area.

Bearing in mind the aim of the present article - to study the growth rate of towns and the regional peculiarities of their migration, we must besides what has been said already draw attention to some other circumstances.

The functions of the administrative centres, above all the position of the district centre, in most cases stimulates the growth of the respective settlement, strengthening its power of attraction in concentrating the people living in the neighbourhood. For this reason it is necessary to separate from the fourth group of urban settlements (i.e. local centres) the so-called young centres of administrative districts: Jõgeva, Põlva and Rapla. Because of the small size of their population, they do not attain the level of the larger and older district centres in the concentration of productive forces, but considering the type of their links with their close hinterland, they still resemble them.

The development of a settlement and the intensity and trends of migration are affected by the function of a satellite, which places the small towns in the neighbourhood of Tallinn and also some of the small towns round Narva, Tartu and Pärnu in a special position.

It is also necessary to consider the educational function. The presence of various specialized educational es-

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The town of Kärđla is also the centre of an administrative district, but due to the limitations of its hinterland and its isolated insular position its preconditions for development are not equivalent to those of the other district centres.

establishments does not so much stimulate the growth of the population as it increases the mobility of the population, affects the numerical composition of migrants and widens the area of migration. The principal educational centres of the Estonian S.S.R. are Tallinn and Tartu. Several specialized secondary educational establishments are also located in other regional centres. Agricultural educational institutions are characteristic of both the district and the local centres (Paide, Kallaste, Järva-Jaani, Rāpina). The latter cannot compete with larger towns in the number of pupils, but it is in the course of the population migration of these small towns that the peculiarities of the migration of pupils stand out clearly.

Depending on what has been said above, the satellite character and the educational function of towns have been used in the following section to differentiate the respective functional subgroups. The towns of the fourth group, which simultaneously serve as centres of administrative districts, have been referred to the third group of towns as a separate subgroup.

## 2. Natural and migrational components of the urban growth in the Estonian S.S.R. in 1959-1969

A. In the years 1959-1969 the total urban population of the republic increased by 30.5 %, of which in its turn 64 % fell to the share of migration, 32 % to natural gain and 4 % to administrative changes.

The figures presented show that in the conditions of a low birth-rate characteristic of Estonia, migration is the chief factor of the growth of towns. The mean coefficient of migration gain was 15 persons per 1,000 of the population per year. At the same time individual towns

showed considerable differences. The migration gain in Narva, Paldiski and Põlva three times exceeded the respective mean figure for the towns of the republic, while the population of 15 urban settlements decreased as a result of migration, including Viivikonna where the migration loss was 40 persons per 1,000 of the population per year.

Migration studies have shown that migration gain increases at the expense of the growth of the basic funds of towns, which is accompanied by an increase in the number of jobs and the expansion of housing. In the opposite case, particularly in connection with a decrease in the number of jobs, the balance of migration becomes negative. A similar dependence is apparent in the case of the towns of the Estonian S.S.R. When we relate migration gain to the hierarchical-functional types of settlements, we may state the following:

1. The migration balance has been negative or slightly positive chiefly in two types of towns. The first group includes small polyfunctional local centres (i.e. centres without any leading function) of which several had been temporarily centres of administrative districts in the 1950s but later were deprived of this growth factor (Pärnu-Jaagupi, Lihula, Tõrva, Mustvee, Kallaste, Antsla, Suure-Jaani). The second group embraces some narrowly specialized industrial settlements, primarily centres of oil-shale and peat production such as Kiviõli, Viivikonna and Lavassaare. In these branches of production the need for labour has decreased as a result of the mechanization of operations, on account of which people leave the town in greater numbers than they arrive. Migration loss also occurs in some old centres of the manufacturing industry which at the present time have an unfavourable transport-geographical location (Järvakandi, Mõisaküla).

2. In the majority of the republic's larger polyfunctional towns - regional and older district centres - migration gain approaches the mean of the republic (10 to 20

persons per 1,000 of the population). The gain is considerably lower at Kohtla-Järve where oil-shale mining plays a great role in industry.

3. Towns with the largest migration gain include three types of towns. First, industrial centres where new enterprises were being set up or old ones were being extended in the period under review. These towns are headed by Narva - a town with which the largest industrial new buildings of the republic are associated. Then follow several narrowly specialized industrial centres such as Maardu, Tamsalu, etc. Secondly, to this group belong "young" centres of administrative districts such as Jõgeva, Rapla and Põlva, which were not on the necessary level with regard to the structure of their functions when the respective districts were created. Thirdly, several satellite towns - primarily Keila, likewise Aegviidu, Klva and Narva-Jõesuu - have made a rapid growth at the expense of migration.

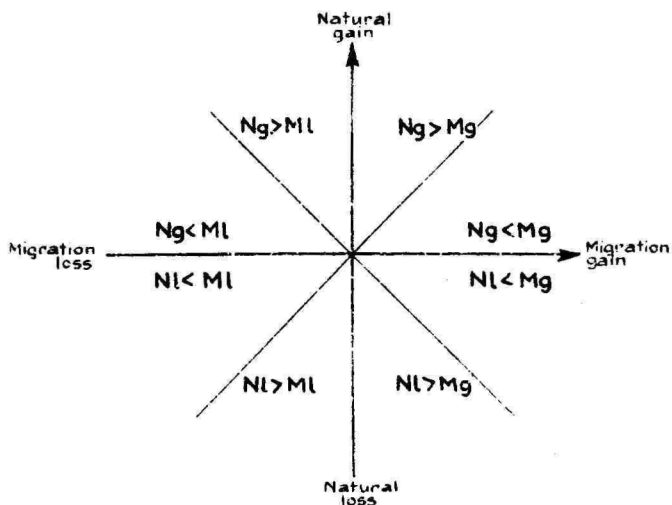
As can be concluded from the distribution of the general population gain, the natural gain of the urban settlements of the republic as a whole has been by a half smaller than migration, on an average 8 persons per 1,000 of the population per year. As to natural gain, there also occur considerable variations among individual towns, but unlike migration gain, the mean natural gain of all the urban settlements of the Republic has been positive.

The size of natural gain depends on the peculiarities of the sex and age distribution of the population. These are in their turn affected by migration since migrants are overwhelmingly young people, mostly 15 to 30 years of age. For this reason there is a certain correlation between natural and migrational gain: natural gain is usually low in the urban settlements which steadily show migration loss, and vice versa - natural gain is mostly rather high in the urban settlements which have a high migration

gain. The age composition of the population and through its medium the natural growth of the population are also affected by several other factors - the character of the most important occupations, housing conditions in the respective settlement, etc. Thus, the majority of the branches of industry, particularly heavy industry, need chiefly workers in the younger age groups. Hence the regularity holds good that urban settlements with the highest natural gain are most frequently industrial centres such as Maardu, Kunda, Tootsi, Viivikonna, Kohtla-Järve. The two last-named are towns of the oil-shale industry where migration gain is low or where there may even occur migration loss. At the same time natural gain is relatively high also in some towns where the branches of activity servicing agriculture - construction of production buildings for large-scale farms, land reclamation, etc. - play a large role (Lihula, Pärnu-Jaagupi, Nuia). They concentrate young people who have just left villages and who have preserved the tradition of having many children. At the same time migration gain need not be high in the given settlements. We pointed out above that in many satellite towns, including Aegviidu, Elva and Narva-Jõesuu, migration gain has been higher than the mean of the republic. Besides, these settlements in the capacity of holiday resorts have a large percentage of elderly and old people, due to which fact natural gain, particularly at Aegviidu and Narva-Jõesuu, has been considerably lower than the mean of the republic.

The data presented above convince us of the fact that under the influence of various factors natural and migrational components combine differently in individual urban settlements. J. Webb (1963) has shown that theoretically the relations between natural and migrational may appear in eight different proportions (Fig. 2).

Since the mean natural gain in all the urban settlements of Estonia has been positive within the eleven years studied, the lower part of the scheme proposed by J. Webb



<b>Ng</b> natural gain	<b>Mg</b> migration gain
<b>Nl</b> natural loss	<b>Ml</b> migration loss

**Fig. 2.** Schematic representation of the types of the movements of population

will be dropped and on the basis of growth components we may classify the urban settlements of the republic into four groups as follows:

1. The migration balance is negative, natural gain is positive, but it does not make up for migration loss, due to which the population diminishes ( $Ng < Ml$ ).

2. The migration balance is negative, natural gain is positive, making up for migration loss. Consequently, the population increases only at the expense of natural growth ( $Ng > Ml$ ).

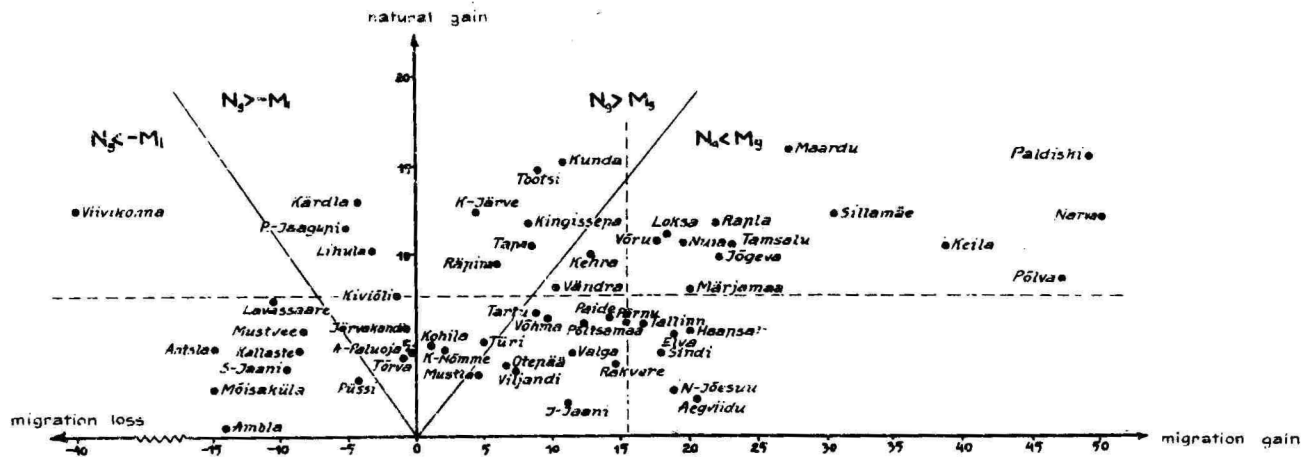
3. Both migrational and natural gain are positive, natural gain being greater than the migrational one. Due to that circumstance the population increases chiefly at the expense of natural growth ( $N_g > M_g$ ).

4. Both migrational and natural gain are positive, the migrational gain being greater than the natural one. Due to that, population growth proceeds chiefly at the expense of migration ( $N_g < M_g$ ).

It is evident from Fig. 3 how the urban settlements fall into the groups mentioned. It appears that the first group comprises 9, the second - 7, the third - 9 and the fourth 32 urban settlements. It is also apparent that natural and migrational gain or loss differ considerably within the limits of one group, on account of which the general growth rate of the towns of the same group is far from being alike. Tables 2 and 3 supplement what has been presented in Fig. 3. In these tables the urban settlements have been grouped on the basis of the general growth rate and the functional type of each settlement has been indicated.

Designations of the functional types of towns  
used in tables 2 and 3

- narrowly specialized local centre
- ⊙ polyfunctional centre of administrative district
- ⊙ polyfunctional town of republican subordination
- polyfunctional local centre
- ε educational function
- s satellite function
- $N_g$  natural gain                       $N_l$  natural loss
- $M_g$  migration gain                     $M_l$  migration loss



----- the average of the Republic.

Natural gain and migration gain or loss given in persons per 1000 of the population

Fig. 3 Natural and migrational gain in the towns of the Estonian SSR (on the basis of the mean for the years 1959 - 1969)

It emerges from Table 2 that in the years 1959-1969 the total population has decreased in nine urban settlements, in eight of them as a result of migration loss, in one of them as a result of both migration loss and changes in administrative boundaries. All the settlements of the group under discussion are small, having considerably under 2,000 inhabitants. Here belong chiefly industrial settlements that have arisen on the basis of old enterprises where production has not been expanded since their establishment as well as polyfunctional local centres. Of the last-named ones, the majority are previous centres of administrative districts.

Urban settlements whose population has increased by up to 20 % in the period under review may be regarded as slowly growing ones (the mean of the republic being 30.5%). Four-fifths of them are simultaneously small urban settlements with a population of up to 5,000, the majority of them being polyfunctional local centres (several being previous district centres). In some of the urban settlements under consideration, the migration balance is negative, nevertheless in over half of them it is positive. The slowly growing group of towns includes only two towns of medium size (judged by the standards of the republic) - Viljandi, a district centre, and Kiviõli, a centre of the oil-shale industry.

The group of urban settlements with a medium to rapid growth rate of the population presented in Table 3 is more numerous and hence more varied in their functional types. The group of towns of medium growth (with a general gain of 20-30 %) includes the capital and all the polyfunctional region centres which due to the large size of their population affect the formation of the mean of the republic. Among them Tallinn has a high migration gain, but a rather low natural gain. At Kohtla-Järve, the reverse is the case. We are surprised to find Viivikonna in this group since this urban settlement shows the highest migration

Table 2

Towns with diminishing and slowly growing population in 1959-1969

Diminishing population				Growing population							
Urban settlement	Size group	Functional type	Gain type	Urban settlement	Size type	Functional type	Gain type	Urban settlement	Size type	Functional type	Gain type
1. Mustvee	VI	○	Ng<M1	1. Lihula	VII	○	Ng>M1	1. Türi	V	○	Ng>Mg
2. Kallaste	VII	⊕	Ng<M1	2. Kärđla	VI	⊙	Ng>M1	2. Rāpina	VI	⊕	Ng>Mg
3. Ambla	VII	○	Ng>M1	3. Abja	VII	○	Ng<M1	3. Vōhna	VII	○	Ng<Mg
4. P-Jaagupi	VII	○	Ng>M1	4. Mustla	VII	○	Ng>Mg	4. Otepää	VI	○	Ng<Mg
5. Suure-Jaani	VII	○	Ng<M1	5. Tōrva	VI	○	Ng>M1	5. Jārva-Jaani	VII	⊕	Ng<Mg
6. Antsla	VI	○	Ng<M1	6. Kilingi-Nōme	VI	○	Ng>Mg	6. Viljandi	III	⊙	Ng<Mg
7. Püssi	VII	⊖	Ng<M1	7. Kohila	VI	⊖	Ng>Mg				
8. Mōisaküla	VII	⊖	Ng<M1	8. Jārvakandi	VI	⊖	Ng>M1				
9. Lavassaare	VII	⊖	Ng<M1	9. Kiviōli	IV	⊖	Ng>M1				

\* Growth has been affected by administrative changes

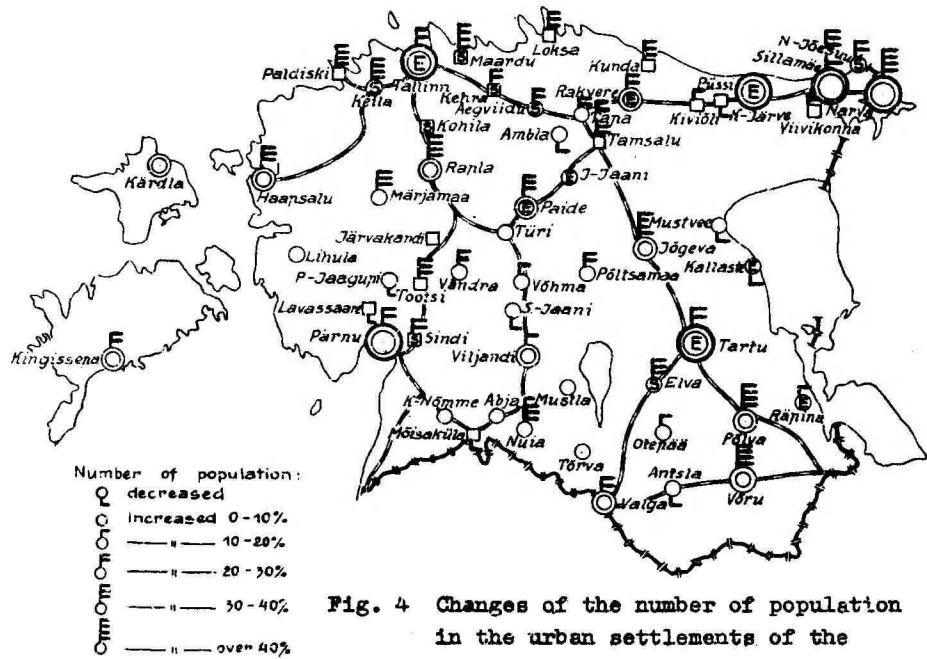


Fig. 4 Changes of the number of population in the urban settlements of the Estonian SSR in 1959-1969

loss in the republic. The population growth of Viivikonna as compared with the year 1959 is the result of the fact that the settlement of Sirgala, which arose near the oil-shale quarry of the same name, was later administratively joined to Viivikonna. A large number of people from the population of Viivikonna itself have been resettled at Sillamäe where the housing and natural conditions are better. At the same time natural gain at Viivikonna is remarkably high.

In the overwhelming majority of fast growing towns (with the general gain exceeding 30 %) the principal component inducing growth is a high level of migration gain.

We have already analyzed the functional types of the towns with a respective gain: they are polyfunctional district centres (particularly those where the complex of administrative and servicing establishments have developed insufficiently); a large number of industrial towns where new enterprises have been founded or the existing ones have been expanded; satellite settlements of larger towns, and small towns that are closely associated with the agriculture of the surrounding area. The same functional types (with the exception of satellite settlements with a slant to holiday resorts) also belong to the towns with a higher natural gain.

To sum up, we have seen that towns making a medium to rapid growth include settlements of any size and of any functional type. Taking into account the duration of development, it may be assumed that polyfunctional administrative centres, likewise Keila (the nearest satellite town of Tallinn) and Narva (an industrial town with several branches of industry), have preconditions for developing steadily in an ascending line. As for the narrowly specialized industrial settlements, their growth will in most cases be jerky, accelerating in the period of the reconstruction of their respective enterprises and then slowing down. This can be illustrated by the dynamics of the population of Kunda.

Table 3

Towns with medium and rapid growth of population in 1959-1969

Growth of population											
Urban settlement	Size group	Functional type	Gain type	Urban settlement	Size group	Functional type	Gain type	Urban settlement	Size group	Functional type	Gain type
1. Tallinn	I	⊕	Ng<Mg	1. Haapsalu	IV	⊙	Ng<Mg	1. Narva	II	⊙	Ng<Mg
2. Tartu	II	⊕	Ng<Mg	2. Paide	V	⊕	Ng<Mg	2. Põlva	VI	⊙	Ng<Mg
3. Kohtla-Järve	II	⊕	Ng>Mg	3. Märjamaa	VI	○	Ng<Mg	3. Jõgeva	VI	⊙	Ng<Mg
4. Pärnu	III	⊕	Ng<Mg	4. Elva	V	⊕	Ng<Mg	4. Rapla	VI	⊙	Ng<Mg
5. Valga	IV	⊙	Ng<Mg	5. Tootsi	VII	□	Ng>Mg	5. Võru	IV	⊙	Ng<Mg
6. Rakvere	IV	⊕	Ng<Mg	6. Kunda	V	□	Ng>Mg	6. Nuia	VII	○	Ng<Mg
7. Kingissepa	IV	⊙	Ng>Mg	7. Loksa	VI	□	Ng<Mg	7. Keila	V	⊕	Ng<Mg
8. Põltsamaa	VI	○	Ng<Mg					8. Sillamäe	IV	⊕	Ng<Mg
9. Vändra	VI	○	Ng<Mg					9. Paldiski	V	□	Ng<Mg
10. Kehra	VI	■	Ng<Mg					10. Maardu	V	■	Ng<Mg
11. Viivikonna*	VI	□	Ng>Mg					11. Tamsalu	VI	□	Ng<Mg
12. Sindi	VI	■	Ng<Mg								
13. Tapa	IV	○	Ng>Mg								
14. Narva-Jõesuu	VI	⊕	Ng<Mg								
15. Aegviidu	VII	⊕	Ng<Mg								

\* Growth has been affected by administrative changes.

The functional types of towns with a decreasing or a slowly increasing population are considerably more one-sided. Here belong chiefly small functional urban settlements or narrowly, specialized industrial centres with old enterprises. It follows from here that the urban network of the republic is so to say oversaturated with them, it has become too dense for them to have enough growth reserves. These urban settlements will, of course, not disappear but will continue to exist; however, they will not essentially affect the process of urbanization of the republic.

### 3. On the area of urban migration and gain in the Estonian S.S.R.

Earlier studies on urban migration have shown that the area of the concentration of population in towns and the corresponding number of migrants depend chiefly on the size and the growth rate of towns. In order to compare the relative power of attraction of towns of different size in the concentration of population and to ascertain the effect of different functions on the extent of the demographic hinterland of a town, it is possible to use the method of scoring points and of distance zones. With regard to each town we distinguish the following zones:

- Zone I - an administrative region to which a town belongs.
- Zone II - the neighbouring districts.
- Zone III - the remaining districts of the Estonian S.S.R.
- Zone IV - districts adjacent to the Estonian S.S.R.: the Latvian S.S.R., the Pskov and Leningrad Regions, the city of Leningrad.
- Zone V - the remaining districts of the Soviet Union.

Further, we shall establish, on a percentage basis, how many of those who arrived in a town in the years 1968 and 1969 came from the individual zones indicated. We shall then multiply the percentage obtained by the number of points scored, bearing in mind that 1% in zone I corresponds to 1, in zone II to 1.5, in zone III to 2, in zone IV to 3 and in zone V to 3.5 points. In the case of border towns such as Narva and Valga we shall reduce the value of points of zone IV, which enables us to compare them more properly with other towns. The total number of points thus scored does not depend on the absolute number of migrants but indicates the relative extent of the area of migration of a given town. At the same time it also reflects the decline or rise in the intensity of migration according as distance increases.

As can be expected, the sum total of the points scored by the migration area of different urban settlements varies greatly. The corresponding indicator ranges between 100 and 320 points. The score of points is strikingly great not only with larger towns but also with smaller ones. Below we shall try to establish what factors will affect the area of migration besides the size of a town.

First of all, we shall relate the extent of the migration area (expressed in points) to migration gain per 1,000 of the population. It appears from Fig. 5 that there is no direct correlation between the two parameters under study: towns with a wide migration area include settlements with a high and a low migration gain as well as settlements with a migration loss. The same phenomenon is seen with towns with a narrow migration area. At the same time it appears that several settlements of the same functional type are concentrated in the figure comparatively close to each other, basically constituting four groups. In the right section of the figure we find towns with a wide migration area - Tallinn, the capital of the republic, as well as several towns among whose functions industry and transport play an impor-

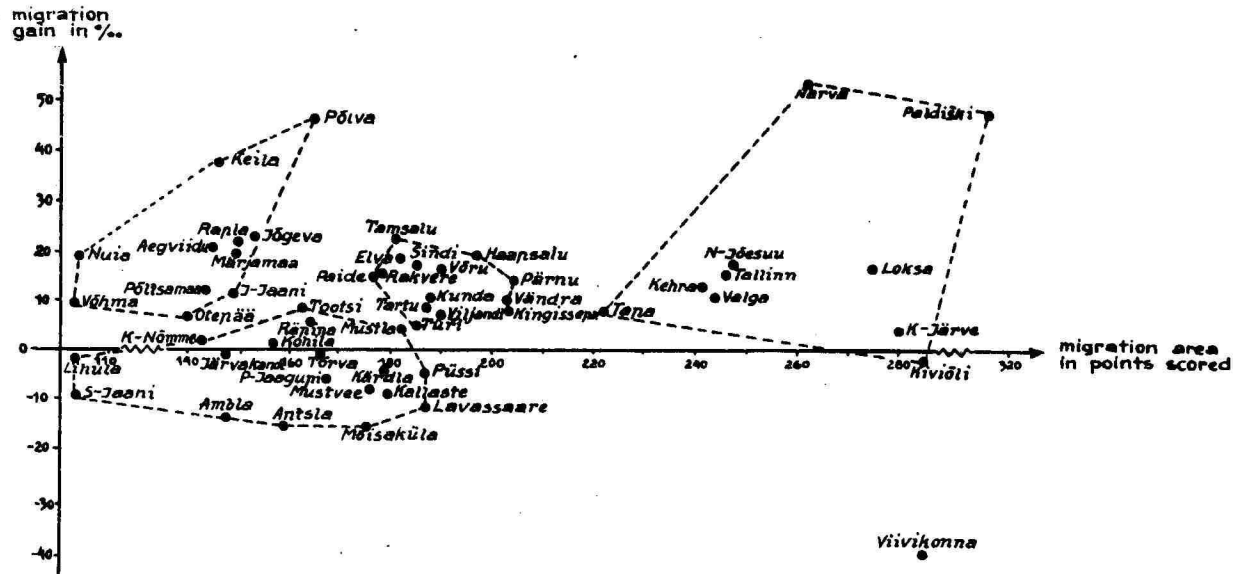


Fig. 5 Migration gain and extent of migration area in the urban settlements of the Estonian SSR

tant role. In the middle part of the graph is the group of towns located close to each other among which predominate polyfunctional region centres and older district centres. On the left margin of the figure we find young district centres and the local centres developing on the basis of the agriculture of the surrounding area. The fourth group embraces small towns with a negative migration balance.

These results point to the fact that the extent of the migration area depends more on the peculiarities of the functions of a town than on the relative size of migration gain. The spheres of activity which usually attract labour in larger numbers from remoter districts embrace industry, construction and transport.

Fig. 6 relates the proportion of the people employed in industry, building and transport (calculated from the total number of working people in a town) to the extent of the migration area. It appears that regardless of a relatively great scatter of the points there is a corresponding correlation in the case of the majority of towns: the greater the proportion of those employed in industry, construction and transport, the wider the area of concentration of the population.

At the same time we see that with a certain group of urban settlements this dependence is weak: the proportion of the spheres of activity studied is great but the migration area is comparatively narrow. This irregular group consists basically of small towns - industrial settlements that have become narrowly specialized, where the migration balance is negative in several of them. The second group of towns belonging here consists of small towns where industry is very closely related to the agriculture of the surrounding area. It follows from here that with small industrial centres, particularly in a situation where total employment does not increase, the effect of towns in the concentration of population be-



comes weaker, embracing only the close hinterland of a town. It is natural that besides industry, building activity and transport, the extent of the migration area is influenced by several other functions. Above all, one must recall the educational function. Thus, the migration links of Tartu with the remaining districts of the republic are closer on account of the migration of pupils. In Pärnu the number of migrants coming from outside the republic is raised by the pupils of fishery and navigation schools. The migration area of Järva-Jaani, Rääpina and Kallaste would be considerably narrower if the local agricultural schools would not attract pupils from other districts of the republic.

Above we have dealt with the general area of urban migration, i.e. the total area within the limits of which proceeds the reciprocal migration of those who arrive in towns from outside as well as those who leave them (i.e. in- and out-migration). To determine the immediate sphere of influence of towns it is necessary to ascertain the districts and towns on the basis of which either net migration gain or net migration loss takes place. We shall try to do this below.

Let us start with the urban towns which grow as a result of migration. An analysis has shown that on the basis of the extent of the gain area the towns studied fall into six groups. Taking also into consideration the growth types (Table 4.)

It can be seen from the table that the larger part of small towns grow either totally or chiefly at the expense of the population of their own district. Among these towns predominate polyfunctional local centres, particularly those that develop on the basis of the agriculture of the surrounding areas, and some smaller centres of administrative districts.

The gain area of Elva and Kallaste is of a peculiar nature. They lose more people to their nearest district

(including the town of Tartu) than they gain from it, and they themselves grow at the expense of remoter districts of the republic. Elva in the capacity of a satellite town of Tartu forms a preliminary stage on the way of migration to Tartu. Part of the people who come to Tartu for work or study settle down at Elva either temporarily or permanently. Kallaste attracts people from other districts because of its educational facilities.

The larger part of the region centres headed by the capital Tallinn and the majority of the district centres have two sources of migration gain - districts of the Estonian S.S.R. and other Union Republics. At the same time the gain area of the majority of the district centres within the republic is narrow, being confined only to the district subordinated to the respective town. Their migration balance with the other districts of the republic is negative. The gain area of region centres embraces almost the entire republic. In the migration gain of some of the towns under discussion (such as Narva and Sillamäe) the people who have arrived from other Union Republics play the greatest role while in other towns (Tartu, Võru, Viljandi and Jõgeva) the arrivals from other districts of the Estonian S.S.R. form the overwhelming majority of migrants.

The number of the towns whose migration gain proceeds only at the expense of other Union Republics is comparatively small. Here belong some industrial and transport centres located in northern Estonia, including Kohtla-Järve and Tapa whose gain from migration is in general small.

Below we shall deal with the towns which lose population to other settlements as a result of migration. We can roughly distinguish two kinds of towns. The first group includes towns whose migration balance with all distance zones is negative (Otepää, Mõisaküla, Järvakandi, Püssi, Viivikonna, Kiviõli). As a rule, the greatest number of people leave these towns for the capital of the republic or for other closer towns of larger size. A considerable part

Table 4

Classification of the urban settlements of the  
Estonian S.S.R. according to growth rate and gain area of migration

Gain area Growth rate	Only one's own district	Chiefly one's own district	Other dis- tricts of the Eston. S.S.R.	One's own district and other Union Re- publics	Eston. S.S.R. and other Union Re- publics	Other Union Re- publics				
slow		K-Wõrme Aegviidu	○ ⊙	Kiva ⊙	Kingissepa ○		K-Järve Sapa	⊙ ○		
moderate	Võhma Mustla Tõrva	○ ○ ○	Rapla Räpina Tootsi	⊙ ⊙ □	Kellaste ⊙	Raapsalu Valga Viljandi	○ ○ ○	Tallinn Tartu Pärnu Rakvere N-Jõesuu Türi	⊙ ⊙ ⊙ ⊙ ⊙ ○	Kehra ■
rapid		Põlva Paide Huis Põltsamaa J-Jeani Märjamaa Keila Sindi	⊙ ⊙ ○ ○ ⊙ ○ ⊙ ⊙		Harva Sillamäe Võru Jõgeva Tamsalu Maardu	○ ⊙ ○ ○ □ ■		Paldiski Loksa	□ □	

The table includes only those urban settlements which grew in the years 1968-1969 from migration. For the explanation of conventional signs denoting functional types of urban settlements see p.

of the population of Viivikonna and Kiviõli, which during the earlier period of rapid growth consisted chiefly of arrivals from other Union Republics, move to other Union Republics.

The other group of towns is more numerous. Their migration balance as a whole is negative but with regard to some districts it may be positive. According to the data for 1968-1969, to this category belong Kunda, Kohila, Mustvee, Suure-Jaani, Lihula, Pärnu-Jaagupi, Antsla, etc. The greater part of these towns attract rural inhabitants from their own districts in modest numbers, but the gain does not make up for the loss of population to other towns and rural districts.

It is evident from the above that the gain areas of towns of different size and functional type often overlap. The gain areas of towns with a smaller or weaker power of attraction remain inside the gain areas of towns of larger size and greater power of attraction. Such towns whose sphere of influence embraces the spheres of influence of a great many smaller towns include first of all the capital Tallinn, further the region centres Tartu and Pärnu. The basic migration mechanism of intrarepublican towns has taken shape under the influence of the above-mentioned larger towns while the remaining towns chiefly affect the migration trends of secondary importance. This is reflected in the two following figures.

In the case of any town in Fig. 7. the arrow points to the town with which it has the greatest negative migration balance. Already from this simplified figure it is apparent what an extremely strong attractive power Tallinn exercises on the rest of the urban population of the republic. From nearly any town in the republic more people migrate to Tallinn than leave it for other places. The power of attraction of Tallinn decreases only in the towns which form the close hinterland of Tartu and Pärnu.

Fig. 8. shows the main trends of the country-city mi-

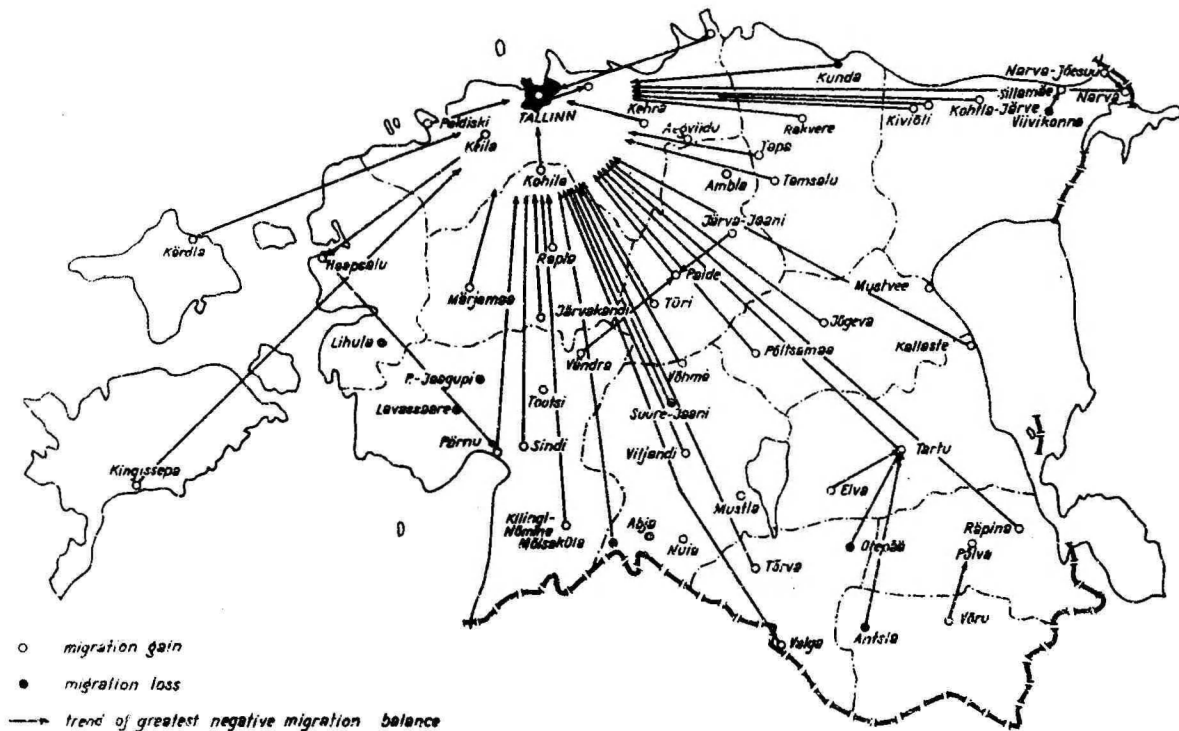
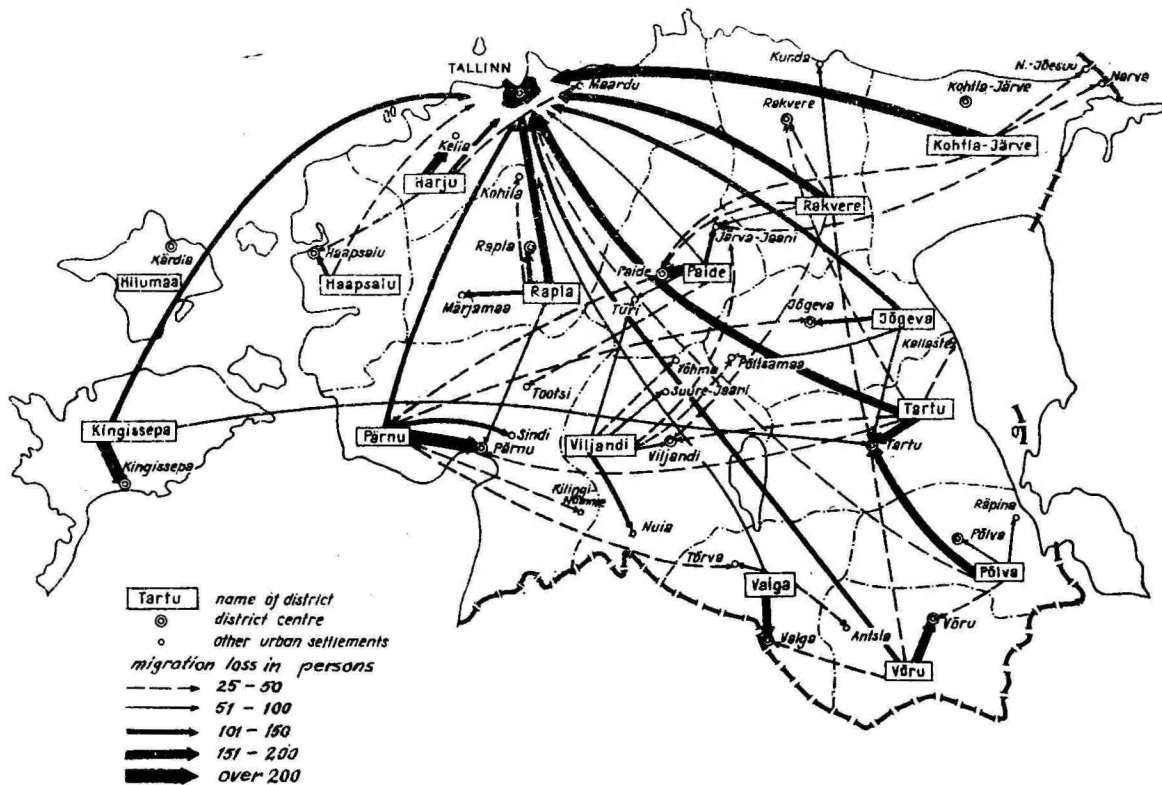


Fig.7 Principal trends of inter-town migration  
 in the Estonian SSR in 1968-1969



**Fig. 8** Principal trends in the concentration of rural population in the towns of the Estonian SSR in 1968-1969

gration according to administrative districts. Similarly to the previous figure, Fig. 8 is based on the negative balance of migration. In each district the towns have been indicated where the migration loss of the rural population in 1968 - 1969 exceeded 25 persons. It appears that Tallinn is an overwhelmingly predominant centre in concentrating the rural population. It attracts people from some districts even in greater numbers than the towns located in the respective district. Alongside Tallinn, the towns of Tartu, Pärnu and Paide are centres of attraction of the rural population which are worth pointing out.

x            x  
                 x

The urban network of the Estonian S.S.R. has become dense and diversified with regard to hierarchical-functional types. The process of differentiation of urban settlements proceeds against the background of the steady growth of total urban population. Some towns grow rapidly, others grow slowly or have ceased growing altogether. In small towns (with fewer than 2,000 inhabitants) representing polyfunctional local centres or narrowly specialized old industrial settlements, the population is either diminishing or growing very slowly. The role of these functional types of towns in the concentration of the urban population of the republic will decline in future. In the period under consideration (i.e. in 1959-1969) the small towns with a population of 2,000 to 10,000 made a rapid growth, but in the majority of cases their growth was of a temporary nature (being due to the foundation of a new enterprise or the reconstruction of an old enterprise). The process of urbanization will continue and make further progress chiefly as a result of the future development of large and medium-sized polyfunctional towns and their satellites.

The chief component in the growth of the towns of the Estonian S.S.R. is migration. The gain areas of individual towns correspond mainly to their functional types and their stages of development as well as their position in the hierarchical urban system of the republic. Comparing the gain area to the general area of migration, we see that the former is in greater agreement with the hierarchy of towns. The lower the stage of development of a town, the more limited and narrower is the area from which it gains its population. Depending on the peculiarities of the functions of towns, the national composition, and other factors, some small towns may grow at the expense of their remoter hinterland, e.g. other republics in the form of new arrivals from them. At the same time their influence in carrying out the concentration of the population of their closer surroundings is weak or may be entirely lacking. Consequently, the gain area of such a town is narrower than that of larger polyfunctional region and district centres which regularly gain new inhabitants from remoter areas as well as grow at the expense of their close hinterland.

The gain areas of the towns that are on different levels of development overlap, although that may happen on different planes. The latter expresses itself primarily in the number of migrants. Thus, the majority of district centres obtain the major part of their gain from the same district. This number of people is usually higher than the number of persons who migrate from the same district to the capital. At the same time Tallinn attracts more rural population from the entire republic than any other region centre or district centre.

On account of the small dimensions of the Estonian S.S.R., the concentration of rural population direct in the capital is rather extensive in all parts of the republic. Parallel to that there proceeds the stepwise migration of the population, first from the countryside to small local urban-type centres and from there on to major centres.

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Linnalike asulate kasvu ja migratsiooni  
tüüpidest Eesti NSV-s

A. Marksoo

R e s ü m e e

Artikli eesmärgiks on analüüsida urbaniseerumisprotsessi iseärasusi vabariigis peamiselt kahest aspektist lähtudes. Esiteks käsitletakse erineva suurusega ja hierarhilis-funktsionaalse tüübiga linnalike asulate elanike arvu üldist dünaamikat a. 1959-1969. Seejuures selgitatakse, millist osa üksikute asulate kasvus etendab loomulik ja mehaaniline liikumine ning milline on nende vastastikune mõju. Teiseks püütakse kindlaks teha, kui ulatuslik on erinevat tüüpi linnalike asulate rahvastiku migratsiooni ja kasvu areaal. Viimati mainitud küsimusi analüüsitakse 1968.-1969.a. andmete alusel, mis koguti 1970.a. rahvaloenduse käigus.

Типы роста и миграции  
городских поселений Эстонской ССР

А. Марксоо

Р е з ю м е

В статье анализируются особенности процесса урбанизации в республике, исходя из двух аспектов. Во-первых, рассматривается общая динамика численности населения в разных по величине и функционально-иерархическому типу городских поселениях в 1959-1969 гг. При этом выясняется, какую роль имеют естественное и механическое движение в росте отдельных поселений, а также их взаимное влияние. Во-вторых, устанавливается величина ареалов миграции и роста разных по типу городских поселений. Анализ последних вопросов дан на основе материалов 1968-1969 гг., собранных в ходе переписи населения 1970 г.

On the Study of Settlement\* Systems  
(with reference to the Estonian S.S.R.)

S. Nõmmik, V. Murel

Settlements have been a most widely treated subject in Soviet as well as in foreign economic geography. As a rule, urban and rural settlements have been dealt with separately: one group of scientists have specialized in the field of rural settlements and another group in the area of urban ones. There exists already an extensive literature dealing with settlements. Settlement geography has become an essential part of economic geography. Settlements have but been seldom investigated as regional systems which they in reality are. V.G. Davidovich (1967) should be pointed out as a most prominent representative of this trend in Soviet geography. It must be admitted that the investigation of settlement systems is a very labour-consuming field of research and it demands evaluation of extensive information. In the present paper the authors summarize the results of their investigations into the settlement systems of the Estonian S.S.R.

Among many complicated problems that are to be solved within the framework of complex territorial planning, the problem of the settlement system is of special importance. After all, the system of settlements is the special form of the existence of productive forces - population and

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\* The word "settlement" has been used in this article as a general term to denote any kind of human habitation irrespective of its size and function. In addition the term "settlement" may denote the process of settling a territory, e.g. the system of settlement or the settlement system.

invested labour. Hence the establishment of the regularities of the development of an integral body of settlements creates preconditions for the prediction of the further development of the spatial organization of productive forces.

Estonia belongs to those parts of the Soviet Union where work is under way on the drafting of a scheme of the complex territorial planning of productive forces. For this reason the problem of the future settlement system of the republic was posed already at the first stage of complex territorial planning. Many research workers of the republic have made contributions to the solution of this problem (H. Paalberg, R. Kärlich, V. Tarmisto, K. Laas, U. Fragi, etc.). The study of the settlements of the republic in the form of regional systems was initiated and basically solved by the authors of the present paper.

Our theoretical conception of the origin and development of settlements and on the questions of the territorial organization may be put briefly as follows.

1. The formation of settlements is to be regarded as an integral process, a transition from a simpler (rural) form to a more complex (urban) form. This process implies the rise of the nonrural forms of human activities alongside the rural ones and an increase in the role of the former. A qualitative leap in this process is the moment when the nonrural forms begin to prevail over the rural ones in the functional structure of a settlement. Part of urban settlements comes into being as nonrural ones, as factory settlements, transport-settlements, etc.

The formation of settlements can be schematically represented in generalized form as shown in Figure 1.

2. Regularities of the development and the location of the settlements are chiefly due to the formation of their social-economic basis. Through the medium of the latter the natural-historical basis also exerts its in-

A Logical Scheme of Forming Rural and Urban Settlements

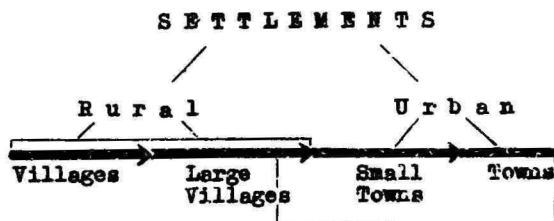


Fig. 1

fluence on the development and location of the settlements. The social-economic basis can be rural, semirural and non-rural. The forms of human activities (agriculture, forest management, etc.) are based on land as the principal means of production and hence they have a continuous distribution. The body of settlements arising on this basis adapts itself to the mode of production and acquires a dispersed character. Similarly to the clusterlike location of natural resources, the clusterlike location of settlements corresponds to the semirural forms of human activities (extractive industry, etc.). Nonrural forms of human activities (manufacturing industry, higher stages of servicing, municipal economy, etc.) depend little on the local properties of the territory (with the exception of the geographical location, which plays a special role in the case of these forms). An essential precondition for their existence is the accumulation of manpower and basic funds on

the one hand and the concentration of consumers at a certain place on the other hand. For this reason the nonrural activities are characterized by a strong tendency towards concentration at a favourable geographic location.

(C. HERNANDEZ, 1969 <sup>2</sup>)

3. The formation of a body of settlements is to be understood as a general historical process within the scope of the spatial concentration of productive forces. A differentiated treatment of the above-mentioned social-economic basis helps to clarify the mechanism of this process and the formation of the special types of settlements. The process of concentration primarily involves nonrural and semi-rural forms of human activities which become the basis of urban life.

The hinterland of urban settlements is chiefly the scene of the rural activities of humans and thus also the arena of the rise and development of rural settlements. These forms are so to say attached to the land and are therefore less subject to the influence of central (urban) settlements and display a certain inertia in the process of the spatial concentration of productive forces.

As a result of steady communication in the sphere of production and servicing, there develops an integral regional system of settlements between the central (urban) settlement and the rural settlements located in its hinterland. The decisive role in this regional system belongs to the central settlement. This is due to the fact that the latter concentrates the most dynamic forms of the social-economic basis in itself. It is these forms that act as forces that set the development of the system in motion.

4. Settlements constitute concentric hierarchic and regional systems with their sub- and supersystems at each stage of the hierarchy. The character of the system and that of each of its elements is determined by the function of the social-economic basis and the place they occupy in the hierarchical system of settlements.

The theoretical propositions set forth above were the starting point from which we proceeded in the choice of the methods to be applied in the study of the specific characteristics of the settlement of the Estonian S.S.R. At the same time the fundamental stages of the study were established as follows: 1) the functional and hierarchical typology of the settlements of the Estonian S.S.R. and 2) the study of the regional systems of settlements.

Functional typification is widely known as a method for studying settlements and needs no special justification. However, there arises the question of what criteria were applied to carry it out. The problem of the functional typification of the urban settlements of the republic was investigated by T. Rea, H. Paalberg, R. Ehrlich, U. Pragi, S. Nõmmik, etc. Generalizing the scientific experience obtained in the study of the problem of the typification of urban settlements, we took into consideration the following: a) the relation between the spheres of production and non-production: b) the specific weight of industry and building activity in the functional structure of an urban settlement: c) the characterization of the functional structure as a whole was performed by the application of the Shannon formula of entropy modified by B.L. Gurevich for the study of geographical phenomena. On the basis of these assumptions three basic types of all settlements were distinguished: a) polyfunctional settlements and b) polyfunctional settlements with one predominant function, and c) settlements with narrowly specialized functions.

To determine the place of a settlement in the hierarchy of settlements, economic links of settlements and the complex of the institutions of the spheres of production and non-production in a settlement and their radius of action were studied. Assuming the existence of a

regular relation between the population of a settlement and the area of its hinterland, an index was derived which represents the relation of the size of population to the area of the hinterland. On the basis of such data the following six hierarchical stages of the republic's settlements were distinguished: 1. the capital, 2. region centres, 3. district centres, 4. local (interfarm) centres, 5. intrafarm centres (centres within a collective farm) and 6. villages. (С.Хммонк 1969<sup>B</sup>, В. Мыеель 1969).

Tallinn, the capital of the Estonian S.S.R., should be placed at the top (the first stage) of the settlement hierarchy of the republic. In the capacity of a polyfunctional town its influence extends over the whole republic.

The second stage embraces regional centres such as Tartu, Pärnu and Kohtla-Järve. Tallinn also belongs here since it performs the functions of the regional centre of the north-western part of Estonia. All the towns of this stage take part in the intrarepublican as well as interrepublican distribution of labour.

The third stage is represented by district centres Rakvere, Haapsalu, Paide-Türi, Viljandi, Võru and Valga. Their major functions embrace the territory of the corresponding district but their industrial functions extend over the whole republic and some of them even to other Union Republics and foreign countries.

The fourth stage includes local centres - small towns (43) as well as large villages (86) performing mainly administrative, organizational and productive functions, i.e. they act as centres of village soviets, centres of collective farms or include small industrial enterprises processing agricultural raw material, etc.

Collective farm centres were ascertained as the fifth hierarchical stage. Their main functions are organizing ones, therefore they include central institutions of collective farms (office, workshops, everyday servicing enterprises, etc.) and contain some small agricultural (EAT)

and industrial (dairy-farm) enterprises.

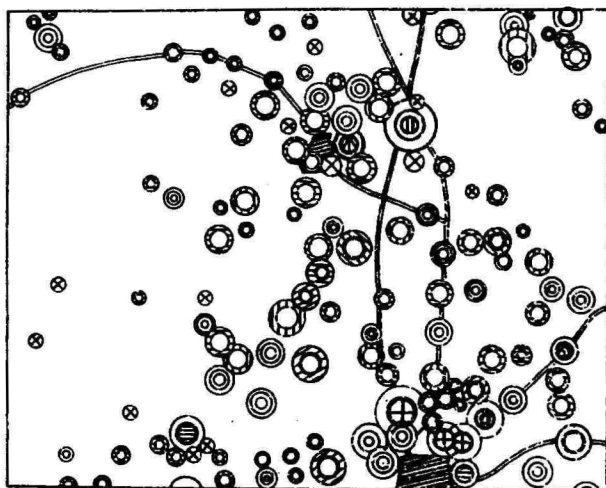
The sixth and the lowest stage embraces villages as bearers of the main agricultural functions; here and there they include a single workshop or a servicing enterprise and sometimes even the office of a collective farm. These villages, which lack employment possibilities (productive as well as servicing ones) fulfill only dwelling functions. They constitute the basis of the settlement hierarchy and represent the type of dwelling villages.

In the functional-hierarchical typology of settlements we relied on the idea that the system of external links of a settlement is formed as a result of the reciprocal effect of the functions of the settlement itself and the other settlements located in its hinterland on the one hand and the functions of the settlements being at a higher stage of the hierarchy on the other hand. Here lies the idea of the unity of the functional and hierarchical classification. The comparison of the functional and the hierarchical types shows that the same functional types occur at all stages of the hierarchy. Bearing that in mind, a hierarchical gradation or scale of settlements was taken for the framework of functional-hierarchical typology. 57 urban and 7,100 rural settlements were subjected to an analysis from the point of view of typology. Fig. 2 represents the functional-hierarchical schematic map of urban settlements and Fig. 3 represents a fragment of a map of rural settlements.

In the differentiation of regional systems of settlements we proceed from the idea that each larger settlement is a source of social influence through which it embraces the settlements of its hinterland and thus constitutes a system of regional settlements. The spheres of influence of two settlements are indicated by a line at the place where their influence is equal. Settlement B, however, belongs to the sphere of influence of the larger neighbouring settlement A, whose influence on settlement B is greatest. On the other side we took into consideration the proposi-



A Fragment of the map of rural settlements in the Estonian S.S.R.



- local centres
- ⊙ farm centres
- ⊗ villages
- ⊗ dwelling villages

Fig. 3

tion of geographical logic, which says that in each part of the territory representing a certain social-economic whole, the objectively largest settlement is also the central settlement of the regional system. Proceeding from these assumptions and employing applications of the field theory, we determined the boundaries of the regional systems, which were verified by the study of definite economic links.

By the method of the potential of the effective demographic field the problem of regionalization was solved on the scale of the urban settlements of the entire republic. The results were summarized in a map (Fig. 4). From this map it is already evident where we can look for centres of regional settlement systems at the second and third stages of the hierarchy. By the same method the problem was solved in greater detail on the level of local centres, using the data of the district of Viljandi (Fig. 5). In both cases an electronic computer of the Ural-4 type was used for calculating the results.

It appeared that the method of the demographic field potential was no longer efficient on account of too small distinctions in the differentiation of settlements of rural systems. Therefore each agricultural farm was regarded as a regional system. The structure of these systems, the concentration of their functional peculiarities were studied by means of an appropriate system of parameters (number of elements, amplitude and interval of the size of settlements, coefficient of concentration) (V. Murel, 1970). Complexes of the functional types were derived. Villages were treated as an initial element of settlement systems (sixth stage of the hierarchy) (Table 1).

Relying on the above-mentioned data, the settlement system of the Estonian S.S.R. includes four regional systems, (C. Няммк, 1969 <sup>B</sup>) north-western Estonia, north-eastern Estonia, south-eastern Estonia and south-western Estonia. The western archipelago constitutes a special sub-

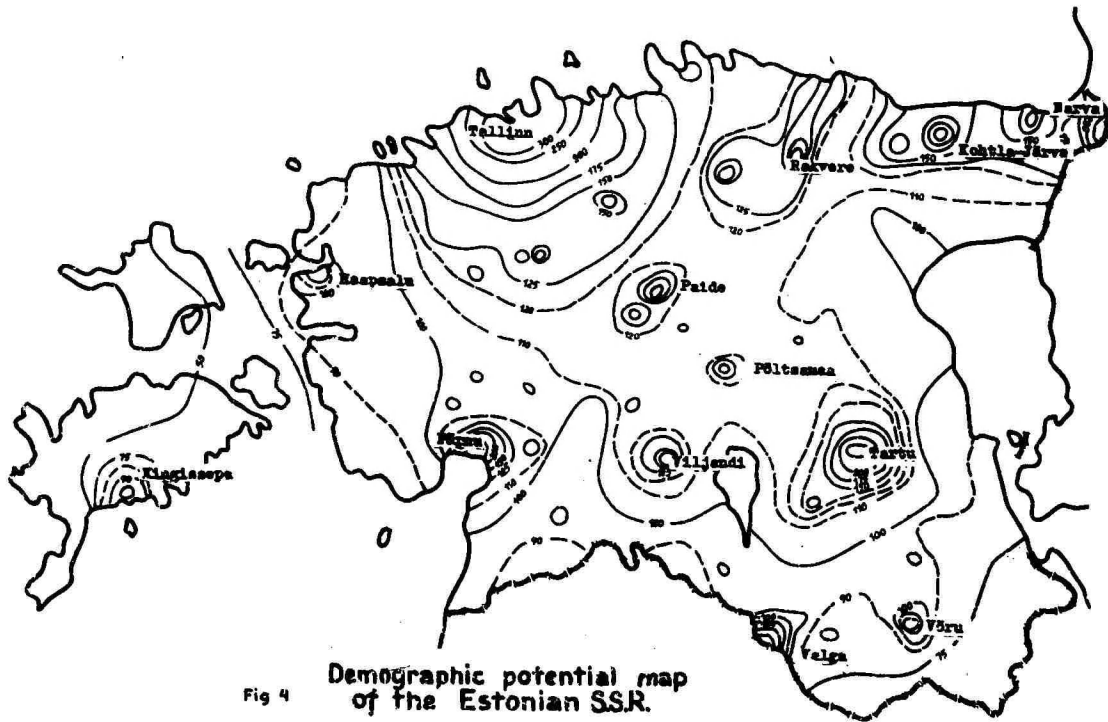


Fig 4

Demographic potential map  
of the Estonian SSR.

system in the framework of north-western Estonia (Fig. 6). Within the limits of these four regional systems were established 13 district systems, 129 local and 380 intrafarm systems (B. Hypeik 1969).

The entire body of settlements in the republic is characterized by the size and the concentration of the social-economic basis in the northern and particularly in the north-western part, and also by a high degree of convergence towards, and the intensity of urbanization at the centre (round Tallinn) (Fig. 4). The concentration of settlements decreases towards the south-east and the west being smallest on the frontier with the Latvian S.S.R. and on the western islands. The functional structure of the system also changes: in the north towns predominate among the settlements, towards the south-east and the west rural features prevail over the urban ones.

Of the four regions, north-western Estonia represents the core of the republic's settlement system, which is characterized by the features indicated above. In addition, we have to note that here we have to do with a powerful centre of concentration of productive forces in the shape of Tallinn, an old economic and cultural centre. It has clearly influenced the process of forming the Estonian settlement system as a whole, in particular the development of urban as well rural settlements situated in its surrounding area. The system under discussion is characterized by a high concentration of urban population: 74.8 % of the whole population of the system live in towns. Tallinn has influenced the differentiation of the discussed settlement system, too. As a result, polyfunctional settlements of all stages of hierarchy predominate in this region. The only exception is the immediate environs of Tallinn where narrowly specialized agricultural settlements prevail.

Tallinn also attracts the weakly urbanized region of the western islands where the rural elements clearly predominate. Two-fifths of the rural settlements there are

Potential field of rural settlements of  
Viljandi District in the Estonian S.S.R.



Table 1

## Systems of Settlements of the Estonian S.S.R.

Hierarchical type	Functional type			Regional system	
	Polyfunctional	Polyfunctional with one prevailing function	Narrowly specialized		
1. Capital	Tallinn	-	-	Republican system	
2. Region centres	Tartu, Pärnu	Kohtla-Järve	-	Region systems	
3. District centres*	Rakvere, Paide-Türi, Võru, Valga, Viljand, Haapsalu	-	Narva	District systems	
4. Local centres	18 small towns and 39 large villages	10 small towns and 29 large villages	15 small towns and 18 large villages	Local	
5. Farm centres**	ca. 170 villages	65 villages	145 villages	Intrafarm systems	
6. Villages	-	ca. 1450 villages	ca. 2200 villages	2900 dwelling villages	Primary element of the system

\* Some district centres are also regional centres (the 2nd hierarchical stage) while others belong partly to the 4th stage, as well.

\*\* Farm centres belong partly to the 4th as well as the 6th hierarchical stage, therefore their number does not coincide with the number of farms.

dwelling villages which lack any productive functions. Most centres of the collective farms and the fishing villages are situated near the seashore.

The central settlement of north-eastern Estonia is Kohtla-Järve, a young and rapidly developing conurbation of the oil-shale industry. This settlement system is characterized by a narrowly industrial and semirural social-economic basis, which is also reflected in the settlements which have come into being there; the clusterwise located, narrowly specialized type predominates in the urban (industrial) and the rural (agricultural) settlements. The network of local centres is irregular in the eastern part, well-developed and dense in the western part of this regional system of settlements. The last-named circumstance has been caused mainly by the great distance from Kohtla-Järve as well from Tallinn. Peculiarities of natural surroundings are the main reason of this pattern.

The centre of south-eastern Estonia is Tartu, an ancient town whose recorded history goes back to the year 1030. The system of settlements here has been formed on an agrarian and industrial social-economic basis which developed at a slow rate. The settlements are polyfunctional; the purely industrial type is absent. The network of local centres (urban settlements) is well-developed. There is a certain balance between all the stages of hierarchy. In accordance with the mainly agricultural economic foundation the specific weight of dwelling villages is coming to the fore.

The dual system of south-western Estonia has developed around the towns of Pärnu and Viljandi which are separated from each other by large forests and bogs. Therefore the network of settlements is irregular. Nevertheless, the industrial and agrarian economic basis has produced a well-developed polyfunctional network of local centres. A few narrowly specialized industrial urban settlements, such as the small peat-cutting towns of Tootsi and Lavassaare as well as the meat-processing town of Võhma are situated on

Regional hierarchical systems  
of the settlements of the Estonian S.S.R.

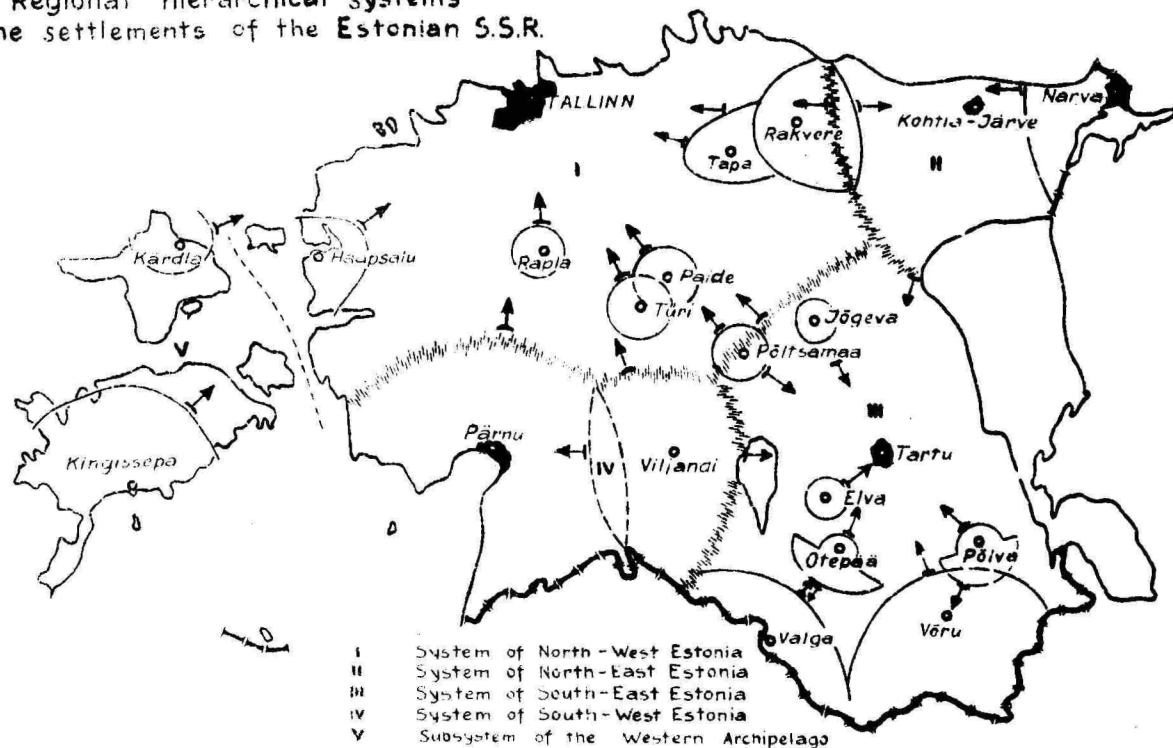


Fig. 6



of the settlement system of the Estonian S.S.R. The data presented above have already been included in the scheme of the complex territorial planning of the republic.

Settlement systems form the framework in the spatial concentration of productive forces and particularly in the formation of social-economic territorial complexes; thus the subdivision of territory among settlement systems is in content also economic regionalization. The latter is an essential precondition for the spatial organization of productive forces, particularly for complex territorial planning at its second stage, which synthesizes data on various branches of the economy on a territorial basis according to regions in its complexity.

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**Asulate süsteemide uurimisest  
(Eesti NSV näitel)**

**S. Nõmmik, V. Murel**

**R e s ü m e e**

Käesolevas artiklis esitatakse Eesti NSV asulastiku detailise uurimise kokkuvõte. Lugejale antakse teada linnalike ja maa-asulate funktsionaal-hierarhiiliste regionaalsete süsteemide tunnetamise metodoloogilised lähtealused, metoodika ja uurimise konkreetsed tulemused.

**К изучению систем расселения  
(на примере Эстонской ССР)**

**С. Ныммик, В. Мурель**

**Р е з ю м е**

В настоящей работе подводятся итоги детального изучения расселения Эстонской ССР. Читателю представляется методология и методика выделения функционально-иерархических региональных систем городских и сельских поселений республики и дается их характеристика.

On the Typology of Territorial Industrial  
Production Complexes

T. Kaare, S. Nõmmik

The basic regularity of the Soviet national economy's development is the formation of large scale territorial production complexes. This concept came into Soviet economic geography already with the plan of GOELRO. But its content was defined by N.N. Kolosovsky only in the post-war period (1947). His definition reads as follows, "A production complex is such an economic combination of enterprises in one industrial point or region as a whole by which a certain economic effect is achieved by a successful choice of enterprises in accordance with a region's natural and economic conditions, transport and geographical position" /2/. The above-presented definition is given from the standpoint of industry, it does not take into account agriculture and transport, thus it is essentially a definition of an industrial territorial production complex.

N.N. Kolosovsky's work has been carried on by A.E. Probst /4/, A.T. Khrushchov /6,7/, N.I. Schrag /8,9/, et.al.

A.E. Probst has studied general regularities of the territorial organization of industry, and analyzed the role of energetics and transport in the formation of a region. He has discussed methodological problems connected with the location of industry.

A.E. Probst has presented an interesting treatment of the structure of industrial complexes. According to it we can distinguish the following main parts of a territorial production complex:

(i) the core of a forming complex consisting of the production of different branches of industry, connected with the common production-technological whole through a complex use of raw material or fuel or through processing raw material in successive stages.

(11) the external centre which incorporates enterprises economically linked with the core and determining together with the core the specialization of the complex. /4/ Thus it appears that A.E. Probst equalizes a territorial industrial production complex with a territorial production complex.

He says, "The ever progressing concentration of modern industry creates objective preconditions not for the location of isolated enterprises, but for territorial production complexes." /4/

One must agree with the authors who claim that a territorial industrial production complex represents the determining part of a territorial production complex /3,5/.

A.T. Khrushchov and N.I. Schrag have made a great contribution to the study of territorial industrial production complexes /6,7,8,9/.

According to them a territorial industrial production complex (or an industrial complex as they call it) must have two principal characteristics, namely (1) an organic unity of industrial enterprises and (2) a common territory. A.T. Khrushchov adds two more characteristics, viz. (3). The conformity of a territorial production combination with local economic and natural conditions (including also peculiarities of the geographico-transportational situation, and (4) the achievement of necessary economic effect by means of a rational locational combination of enterprises forming an industrial complex.

But a number of other authors /3,10/ deny the need for a common territory of an industrial complex. For instance A.M. Moshkin says, "The cluster of industry has two characteristics viz. common territory and interrelation of the main enterprises. For an industrial complex only one characteristic is indispensable, viz. interrelation and interconditionality. Territorial unity is not necessary." One cannot agree with the above said. It is not possible that 10 or 100 economically interrelated industrial enterprises,

the distance between which may amount to thousands of kilometres, form an industrial complex. N.I. Schrag was correct in declaring that out-of-territory complexes do not exist /8/.

A.T. Khrushchov attaches special importance to an industrial complex's internal links reflecting differences between local economic and natural conditions.

The typology of territorial industrial production complexes (including the cluster of industry) has been presented by a number of scientists /4,5,6,7,8,9/.

N.I. Schrag is of the opinion that the following characteristics may be taken as a basis for the classification of industrial complexes: (1) the characteristic of territory, (2) the basic development factor, (3) the complex's structure and level of development, (4) the basic specialization.

On the ground of the first characteristic he distinguishes the following complexes: republican, zonal, those of major economic regions (macro complexes), and intraregional ones, viz. complexes of the cluster of industry and the centres (towns).

N.I. Schrag has given 13 basic development factors, which have been divided into 3 groups: (1) socio-economic factors, (2) geographico-natural, and (3) political ones.

N.I. Schrag's classification of industrial complexes on the basis of the third factor is of great theoretical and practical interest. On this basis he distinguishes the following industrial complexes: 1) those in the initial stage of formation and development, 2) fundamentally formed and intensively developing complexes, and 3) all-sidedly and fundamentally developed ones which include a large number of basic and service enterprises.

As to the typology of industrial complexes, their structure and specialization are of importance since the method of cycles makes it possible to consider the struc-

tural differences of industrial complexes. A.T. Khrushchov takes the cycle of power production for a basis when analyzing the structure of industrial complexes. Thus he distinguishes 11 cycles of power production in the complex of heavy industry.

But N.I. Schrag takes mainly branched specialization as a basis for classification, declaring at the same time that the classification on this basis is rather conventional as an industrial complex is formed and its specialization defined not by one but often by two or more leading branches of industry (e.g. metallurgy, machine building and chemistry in the Don-Dnieper region, machine building, chemistry and textile industry in Moscow, etc.).

It is evident from the above said that a large number of investigators have dealt with the problem of territorial industrial production complexes. The given typology has in view mainly structural peculiarities, but in the other case structural and territorial ones. Below the typology of industrial production complexes will be presented proceeding mainly from the geographical aspect of the raw material.

A territorial industrial complex is a scientific theoretical concept. It reflects the real combinations of industrial branches. As all concepts, it is an abstraction. It comprehends only one part of a socio-economic territorial complex, but this is the determining one. Every spatial complex of industry results from the drawing by man into economic turnover of local natural resources, and preconditions connected with the geographical division of labour. The preconditions for the formation of industrial production complexes vary from place to place. The level of being supplied with raw materials, fuel and man-power resources cannot be the same over the whole territory. Every part of the latter has its own specific features, fostering or impeding, its participation in inter-regional geographical distribution

of labour and transportation of raw material and fuel from other regions. All these specific features result in the economic-geographical differentiation of territories and bring about the formation of territorial industrial production complexes different in structure, territorial organization, and importance in the geographical distribution of labour.

The place of procuring raw material is of special importance among the preconditions of the development of these complexes. One can distinguish between two geographical aspects of procuring raw material. The first category includes all resources of a complex's own historico-natural basis, such as agricultural, fish, forest, and mineral raw material. This category is called local raw material. The other category, called imported raw material, includes resources transported from other regions for industrial processing. Analyses show that the geographical aspects of procuring raw material have a strong effect upon the formation process of industrial production complexes. Generalizing these peculiarities we get the following three types of industrial production complexes: (i) the territorial industrial production complex of agriculture and forest husbandry, (ii) the complex of the extractive industry, and (iii) that of the manufacturing industry.

The industrial production complexes of agriculture and forest husbandry arise on the basis of industrial enterprises processing local agricultural raw material (e.g. the sugar, raw flax and timber industries). That is why they are of a rural character, simple in structure, and show little inclination to attract other industrial enterprises. The basis procuring raw material for them lies in agricultural production and forest extraction. As to the dispersion of the location of enterprises of agriculture and forestry as the source of raw material this type of territorial industrial production complex is in its spa-

tial organization a scattered one. Enterprises are scattered over a region of agriculture or forest husbandry and located mainly in rural or small urban settlements. At that they often act as a core for forming primary socio-economic territorial complexes. Their external economic links are simple and the supply is limited only to auxiliary materials, fuel and technical equipment. As to marketing, their economic links are one-sided and include only one or two items.

The regularities of development of specialization and location of the territorial industrial production complexes of agriculture and forest husbandry show a clear correlation with the specialization of the development and the territorial organization of agriculture, but also with those of forest husbandry. Like agriculture and forestry, the industrial production complexes springing up on their basis are conservative and not very dynamic. In the Estonian S.S.R. the most characteristic territorial industrial production complexes of this type have formed on the basis of the milk, flax and timber industries in small and larger urban settlements. They prepare raw material in their neighbourhood and sell their products to local as well as distant consumers through central marketing organizations.

A more distinct type of the territorial industrial production complex is that of the extractive industry formed chiefly on the basis of mineral resources (iron, ore, coal, oil-shale, etc.). The combinations of the extractive industry in space, being grounded on its own historico-natural basis, include branches of a lower manufacturing phase, and at the higher level of development, those of a higher manufacturing phase, too. They are directly (but sometimes also indirectly) interrelated with the extractive branches. This type is considerably dynamic and shows a clear tendency to attract enterprises of contiguous branches and improving the complex as a whole. That is why the system of internal links of this type of ter-

territorial industrial production complex is rather complicated and is characterized by the unity of technological processes of the main branches of the complex.

As to its links with the historico-natural basis, this type of complex is semi-rural. In its territorial organization it is located at the site of the main resource, i.e. deposits of mineral resources. This is the reason why the organization of the territorial industrial production complexes of the extractive industry is of clusterlike location determined by the deposits of the main resource. This type acts often as a basis for forming urban agglomerations in the so-called 'basins' (coal, shale, etc.).

The Estonian Oil-shale Basin in the north-east of the republic is a vivid example of the industrial production complex of the extractive industry. It has come into being mainly on the basis of oil-shale in the last 40 years. In north-eastern Estonia the extraction of oil-shale resulting from the need for fuel for St. Petersburg began on the eve of World War I. In 1917 the first shaft (at Kukruse) was built as a result of geologo-prospective work on the site of present-day Kohtla-Järve. Oil-shale was used as fuel locally and elsewhere. This stage of the development of the oil-shale complex may be considered to be the very beginning of the formation of this type of the territorial industrial production complex of the extractive industry; it was made up of only two links.

After World War I, in 1920, new enterprises of both the extractive and manufacturing industries cropped up one after another. The first plants of low-temperature carbonization were built. As a result, new links of the complex came into being (Fig. 1).

At the same time the railway from Kohtla to Kukruse was built.

New factory settlements were formed on the basis of these enterprises.

# Internal Links of Oil - Shale Complex in 1925

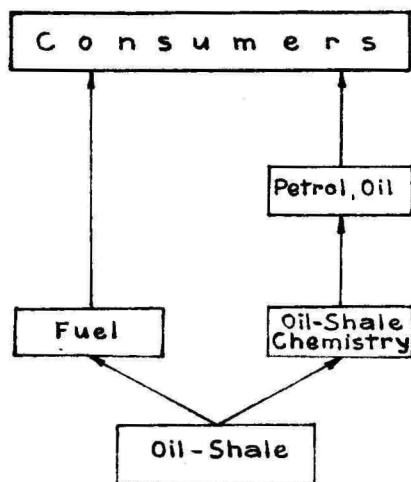


Fig. 1.

During the next decade the development of the oil-shale industry was slow as the demand for oil-shale products was not great. In 1930s the situation changed. The recognition of oil-shale as a strategical raw material brought a new customer - fascist Germany. The production of oil-shale went up from 288,000 tons in 1925 to 1,473,000 tons in 1938; during the same period the output of shale oil increased from 10,000 to 180,000 tons (I).

Simultaneously, the structure of the oil-shale industry complex acquired new links. At first oil-shale was needed only as fuel, but by that time it had become an im-

portant raw material for the chemical industry; for shale oil, petrol, varnish, bitumen, formalin, phenol, etc. In connection with this the relative importance of the manufacturing phase inside the oil-shale complex increased. The centre of the complex was situated on the territories of the present towns of Kohtla-Järve, Kiviõli and Sillamäe. Thus the centre of the urban agglomeration of Kohtla-Järve was formed. At that time the population was about 8,000.

After World War II the enterprises of the oil-shale industry destroyed during the war were immediately reconstructed and expanded. There appeared new shafts, open-cast pits, large power stations, oil-shale processing enterprises, among the latter the first shale-gas plant in the world.

The study of the physico-chemical qualities of oil-shale and oil-shale ash opened new fields for the industrial consumption of this valuable raw material. New enterprises of the chemical industry and the building materials industry (mineral wadding, building blocks, etc.) were founded. Oil-shale ash was taken into use in agriculture as a mineral fertilizer.

But the territorial industrial production complex expanded not only on the basis of extracting oil-shale. Besides the main raw material peat began to be used in the economy. In 1964-65 the Oru peat-briquette plant was put into operation. It was to supply the Oil-Shale Basin and also the whole of East Estonia with fuel. Besides this, the lumbering and wood-working industries were expanded. At the same time, new branches of the manufacturing industry connected with the oil-shale complex only through manpower resources or electric energy appeared here. Such branches are the metal-working, machine-building and sewing industries, and also a comparatively new branch in the Oil-Shale Basin - the industry of nitric fertilizers.

The industrial production complex of the Oil-Shale Basin exhibits strong internal links, characterized chief-

ly by a complex use of raw material and common technology. Both the extractive and manufacturing phases of industrial production are present. The first phase consists in extracting oil-shale, peat and harvesting timber crops. The lower level of the manufacturing industry is represented by processing oil-shale, producing electric energy, making peat briquette, cutting wood, etc. On the higher level this complex has basic and minor chemistry, production of building materials out of oil-shale ash, etc. In the industrial production complex of the extractive industry the extractive phase is highly predominant, occupying about 60 per cent of all those employed in the whole complex.

This brings about rather complicated external links. At the initial stage of the formation of an industrial production complex of the extractive industry, the procuring links are limited chiefly to auxiliary materials and technical equipment. When branches of industry using raw material from outside appeared (natural gas, metal, cloth, etc.), the oil-shale complex expands. In the sphere of economic links of marketing besides electric energy, fuel, oil, chemicals, and building materials there appeared new items of export, e.g. transformers, working clothes, and the latest one - nitric fertilizers, etc.

The above-said reveals the dynamic character and intensity of the formation process of the territorial industrial production complex of the extractive industry. On a higher level of the complex's development still more new links, even those only indirectly connected with the main branches of the territorial production complex appear (Fig. 2, Table I).

The territorial industrial production complex of the manufacturing industry (e.g. the town of Tartu) is essentially different from the above discussed one. It is formed chiefly on the basis of local man-power resources, raw material transported from outside and a favourable

# Internal Links of Industrial Production Complex of Oil Shale Basin of Estonian S.S.R. in 1968

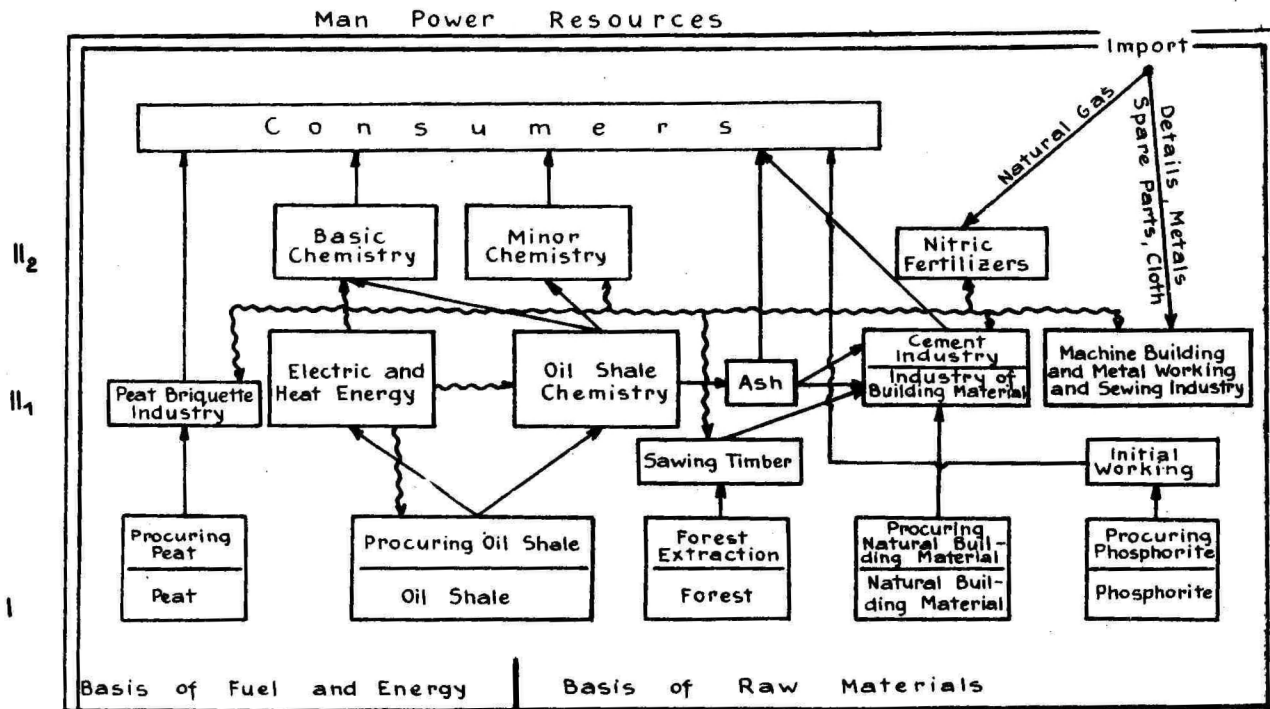


Fig.2

**Resource-Geographical Matrix of the Oil-Shale Basin of the  
Republic S.S.R. (in conditional units)**

Branches of Industry	Total production	Total	Local Industrial Consumption										Consumed by Local Population	Export	Among them						
			Among them Branches												North-West Estonia	North-East Estonia	South-West Estonia	South-East Estonia	Others	Not Differentiated	
			Electric and Heat Energy	Fuel Industry	Chemical Industry	Machine Building and Metal Working	Timber and Wood Working	Light Industry	Food Industry	Not differentiated											
1. Electric and Heat Energy	28520	17670	-	150	17090	70	70	100	90	200	-	880	9970	-	9710	310	-	-	-	-	3930
2. Fuel Industry	125880	40180	9570	-	20610	-	-	-	-	-	-	300	85400	2220	70430	1210	-	-	-	8870	2670
3. Chemical Industry	112230	16400	-	-	14130	-	-	340	-	-	1930	-	95830	23200	3140	4440	3050	330	60940	1110	
4. Machine Building and Metal Working Industry	7050	6030	-	6030	-	-	-	-	-	-	-	-	1020	1020	-	-	-	-	-	-	-
5. Timber and Wood Working	1330	-	-	-	-	-	-	-	-	-	-	80	1230	390	100	210	60	10	430	30	
6. Industry of Building Materials	26440	8670	-	-	-	-	-	-	-	-	8670	-	17770	4420	2400	3250	1220	210	3910	2730	
7. Light Industry	11230	-	-	-	-	-	-	-	-	-	-	560	10670	2880	640	620	200	30	6280	-	
8. Food Industry	34920	-	-	-	-	-	-	-	-	-	-	27770	7130	940	930	4370	10	-	640	-	
9. Others	890	-	-	-	-	-	-	-	-	-	-	-	890	130	10	10	10	-	710	-	
<b>Total</b>	<b>348430</b>	<b>88950</b>	<b>9570</b>	<b>6180</b>	<b>61830</b>	<b>70</b>	<b>70</b>	<b>440</b>	<b>90</b>	<b>100</b>	<b>1080</b>	<b>25590</b>	<b>22930</b>	<b>35220</b>	<b>69420</b>	<b>14630</b>	<b>4330</b>	<b>620</b>	<b>80980</b>	<b>10530</b>	

Region of Import	Import Total	Including										
		Consumption by Population	Industrial Consumption	Among them Branches								
				Electric and Heat Energy	Fuel Industry	Chemical Industry	Machine Building and Metal Working	Timber and Wood Working	Industry of Building Materials	Light Industry	Food Industry	Others
1. North-West Estonia	10720	3196	7528	-	-	1522	960	-	2260	2708	3196	78
2. North-East Estonia	25724	19396	6368	-	-	16	-	504	2600	3266	15396	-
3. South-East Estonia	1888	1654	230	-	-	2	-	-	212	16	1658	-
4. South-West Estonia	1006	312	694	-	-	-	-	-	348	346	312	-
5. West Estonian Islands	404	404	-	-	-	-	-	-	-	-	404	-
6. Outside the Republic	25082	3092	21990	-	-	15822	160	3894	2114	3092	-	-
7. Abroad	172	172	-	-	-	-	-	-	-	-	172	-
8. Not Differentiated	56	-	56	-	-	-	-	56	-	-	-	-
<b>Total</b>	<b>69112</b>	<b>28230</b>	<b>16886</b>	<b>-</b>	<b>-</b>	<b>17364</b>	<b>960</b>	<b>720</b>	<b>9314</b>	<b>8430</b>	<b>28230</b>	<b>78</b>

geographical position. Thus, it is of a nonrural character. Formed on the basis of raw material and fuel from outside, i.e. on the basis of remote economic links, this type of complex has no extractive phase. The manufacturing phase, in particular its higher levels, is the basis for the development of the whole complex. As a rule, the internal links of the complex are weak. Various branches of industry are interrelated through the unity of territory and service, but also through the common resource of man-power. Such a type of territorial industrial production complex is weakly connected with its own historico-natural basis. As a rule, it occurs in large cities having a favourable geographical position. The most typical branches of industry are the machine-building, metal-working and textile industries. On the basis of this type urban agglomerations are formed only around large cities.

Every industrial town (Tartu may be considered as one since more than 50 per cent of its active population are engaged in industry and construction) is a definite territorial industrial production complex. Tartu's population is approximately equal to that of the urban agglomeration of Kohtla-Järve. Considering Tartu as an example we can show the difference between the two industrial production complexes more vividly.

The industry of Tartu is based on raw material transported from its own surroundings as well as from distant regions. For this reason there is no extractive phase of industrial production. Branches of high levels of the manufacturing industry are predominant. The raw material imported into the town goes through the extractive phase and lower levels of the manufacturing phase in the regions of delivery. Thus, in the industry of Tartu 72.5 per cent of those employed in industry work in the higher levels of the manufacturing industry, and only 27.5 per cent in the lower ones. As can be clearly seen on the logical diagram the internal links of the complex are quite weak (Fig. 3).

The industrial production complex examined above is characterized by a stable structure and slow development. Already for about 50 years the machine-building and metal-working industries combined with the wood-working, food and other industries have been the traditional predominant ones in Tartu.

The territorial industrial production complex of the manufacturing industry has more ramified external economic links of procuring as well as of marketing. Its existence is fully dependent upon the import of raw material and fuel and upon the export of products. The branches coming into being on the basis of local raw material and meant only for local consumers play a minor role in this complex.

### Internal Links of Industrial Production Complex of Tartu

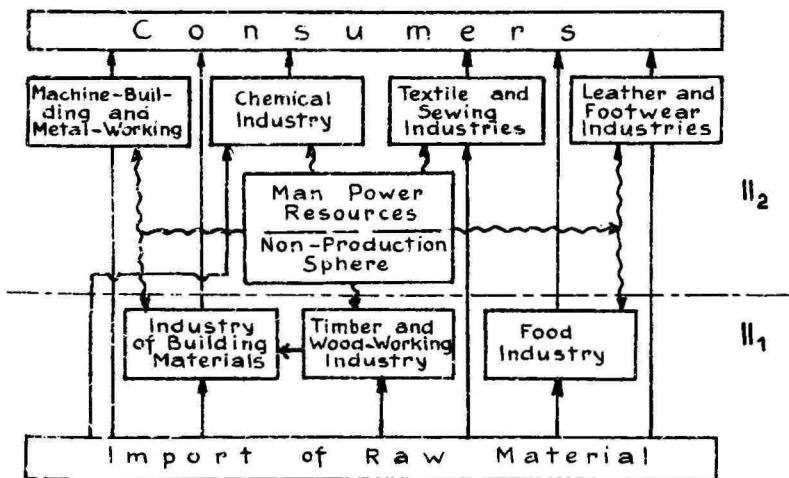


Fig. 3.

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## Territoriaalsete tööstuslike tootmiskomplekside tüpoloogias

T. Kaare, S. Nõmmik

### R e s ü m e e

Tööstuslike territoriaalsete tootmiskomplekside probleem on käsitletud väga mitmed uurijad. Artiklis antakse lühike ülevaade tööstuslike territoriaalsete tootmiskomplekside kohta ilmunud töödest. Senised tööd tööstuslike territoriaalsete tootmiskomplekside tüpoloogia kohta peavad ühel juhul silmas peamiselt struktuurseid, teisel juhul struktuurseid ja territoriaalseid iseärasusi. Antud artiklis esitatakse tööstuslike territoriaalsete tootmiskomplekside tüpoloogia, lähtudes peamiselt tooraine geograafilisest aspektist.

Tööstuse territoriaalsed tootmiskompleksid on tootlike jõudude ruumilise organisatsiooni määravateks lülideks. Nende sisu aga on paiguti erinev nagu muutuvad nende arengu eeldusedki. Tööstuslike tootmiskomplekside kujunemine sõltub suurel määral tooraine paiknemise geograafiast. Sellest lähtudes eraldatakse 1) põllu- ja metsamajandusliku, 2) hankiva tööstuse ja 3) töötleva tööstuse territoriaalsed tootmiskompleksid. Põllu- ja metsamajanduse tööstuslik territoriaalne tootmiskompleks on struktuurilt lihtne ja paigutuselt dispersne, seega on rursalse iseloomuga; hankiv faas peitub põllumajanduses (piima-, suhkru-, toorlina- jne. tööstus) ning välissidemed lihtsad.

Hankiva tööstuse territoriaalsel tootmiskompleksil, mis kujuneb peamiselt maavarade baasil, on olemas nii domineeriv hankimisfaas, kui ka töötleva tööstuse alamad ja kõrgemad astmed. Tööstuse põhiharud on omavahel seotud tehnoloogilise protsessiga. See tootmiskompleks kujuneb tavaliselt põhitooraine leiukohas, on dünaamiline ajas ja

diskreetne-koldeline ruumis - esindab seega poolruraalset kompleksi. Töötleva tööstuse territoriaalne tootmiskompleks areneb peamiselt juurdeveetaval toorainel, mille töötu välismajanduslikud sidemed on keerulised. Puudub hankimisfaas ja domineerivad töötleva tööstuse kõrgemad korrused. Tööstusharude omavahelised sidemed on enamikus nõrgad; neid ühendavaks lüliks on mittetootmissfäär, ühine tööjõualikas ja territoorium. Niisugune tüüp kujuneb peamiselt hea geograafilise asendiga suuremates linnades ja seose mõttes looduslik-ajaloolise alusega on mitteruraalne kompleks.

#### О типологии промышленно-производственных территориальных комплексов

Т. Кааре, С. Ныммик

#### Р е з ю м е

В статье рассматривается проблема промышленно-производственных территориальных комплексов в советской экономической литературе и дается их типология, исходя из географического аспекта доставки сырья. Выделяются следующие типы производственно-территориальных комплексов: 1) сельскохозяйственно-лесохозяйственный, 2) комплексы добывающей и 3) обрабатывающей промышленности.

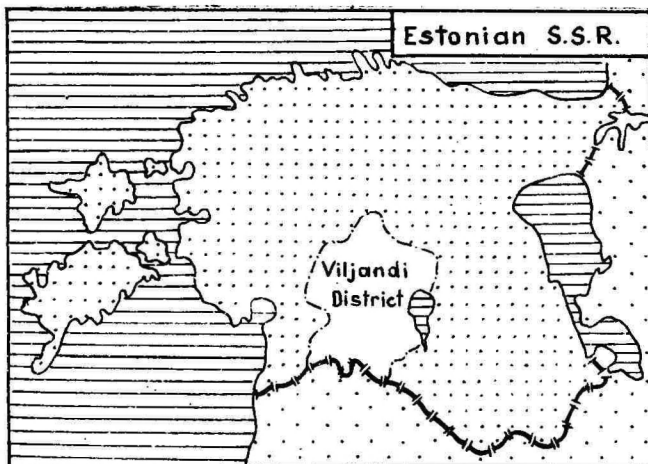
**On the Evaluation of Territorial Differences  
in Production Conditions Obtaining in Agriculture**

**E. Tsopp**

In the geographical literature published so far agriculture has been mostly treated from a descriptive point of view. To assess the activities of large-scale collective and state farms, various analytical indicators are used which characterize different aspects of the economic life of the respective farms, such as the volume of the production of agricultural produce and the density of cattle per 100 ha of the land resources, labour productivity, utilization of manpower, production cost and profitability, etc. In the present paper the author tries to find ways for the complex evaluation of the conditions of agricultural production. Below we shall present the preliminary results of our study, using the statistical data on the farms of one administrative district of the Estonian S.S.R. for that purpose.

The District of Viljandi lying on the southern frontier of the Estonian S.S.R. (Fig. 1) is, on account of its fertile soils, one of the oldest cultivated regions in the republic. Even at the present time agriculture still prevails over the other spheres of activity of the people living in this district. Animal husbandry clearly predominates in the production structure of the farms (Table 1). The collective and state farms of the district chiefly specialize in cattle and pig breeding.

The District of Viljandi is rich in agricultural land and in forests compared with the average data of the republic. The abundance of arable land in the district is conspicuous, while the area under meadows and pastures is



Location of the Viljandi District

Fig. 1

somewhat below the average. In spite of the comparatively small area of the district (ca 3,614 sq. km), the natural and economic conditions for the development of production vary considerably in various parts of the district. Assessing the potential possibilities of this or that farm for the development of production, one must take into account not only differences in natural conditions (which are reflected in the land resources), but also peculiarities of the economic-geographic location (the distance from major centres and main roads, etc.). Great territorial differences also obtain in the availability of manpower and the supply of the means of production. These factors, however, are of major significance from the point of view of agricultural production.

In the present study the author is going to use the so-called index of potential working capacity in the evaluation of the conditions for agricultural production in

T a b l e 1

Production structure of farms

Group	Number	Proportion of collective and state farms (%)	Distribution of income (%)		
			Animal hus- bandry	Plant breeding	Other branches
I	8	25	85.1-90.0	7.0-15.5	1.5-4.5
II	7	22	80.1-85.0	12.0-16.0	2.0-5.0
III	9	28	75.1-80.0	13.0-24.0	1.0-4.5
IV	8	25	under 75.0	28.0-36.0	1.5-5.5

different regions of the district. This index has been derived from the relationship of three factors (manpower, basic funds and agricultural land) which are most essential from the point of view of productive activity /3/. The index of potential working capacity (p) established for a particular large-scale farm is expressed by the formula

$$p = n \frac{Q_i^* \cdot F_i^*}{S_i^*}$$

where n is the number of the farms under consideration;

$Q_i^* = \frac{Q_i}{Q}$  denotes the ratio of the number of workers on the i<sup>th</sup> farm to the total number of workers on the farms of the district;

$F_i^* = \frac{F_i}{F}$  signifies the ration of the cost of the basic funds of production on the i<sup>th</sup> farm to the cost of the basic production funds on the total farms of the district;

$S_i^* = \frac{S_i}{S}$  represents the ratio of the amount of agricultural land on the i<sup>th</sup> farm to the total area of agricultural land in the whole district.

Agricultural land is abundant in the central and southern parts of the district, i.e. on the farms located in the

# Specific weight of arable land in the land resources

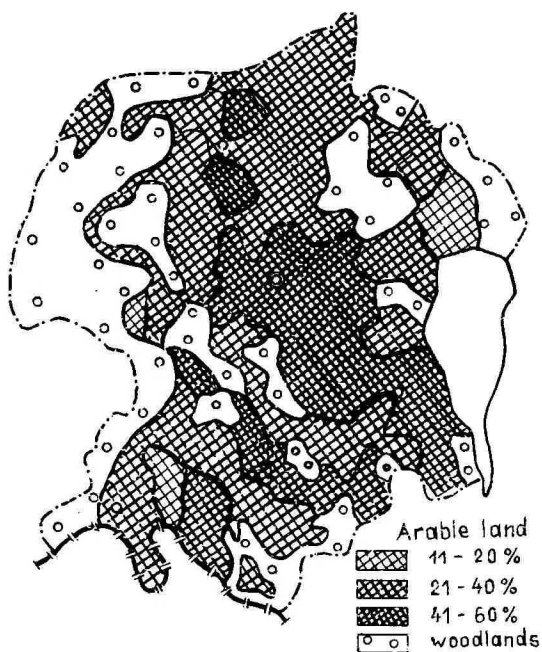


Fig. 2

## Fertility of arable lands

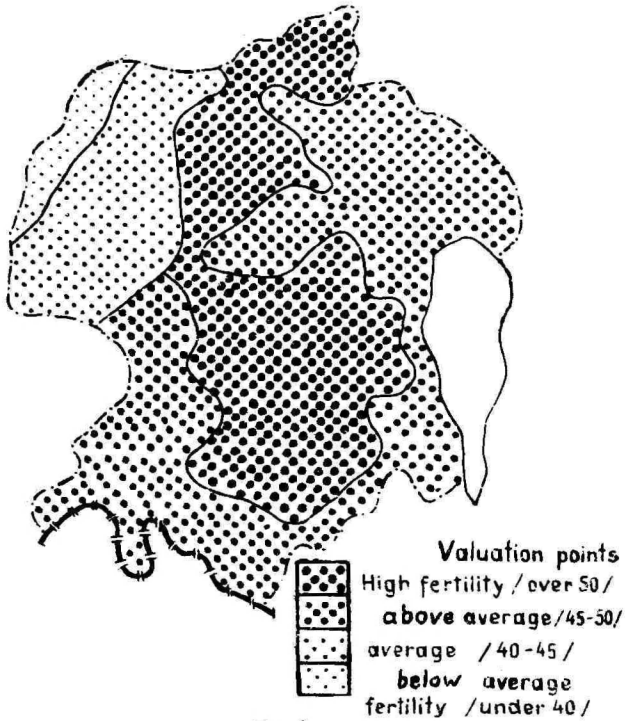


Fig. 3

Sakala Uplands; however, the farms situated in the central and northern parts of the district have arable lands which are more fertile than elsewhere in the district (Fig. 2 and 3). The farms located in the areas with worse natural conditions (in the Pärnu Lowlands and in the depression of Lake Võrtsjärv) have to spend some extra money on the fertilization of less fertile lands and on amelioration. It is here where we have occasion to calculate differential rent.

The cost of the basic production funds of the farms characterize the possibilities existing for the development of production from the point of view of the material basis. The basic means of production in agriculture are buildings used for the purposes of production, farm machinery and equipment. Their amount per worker shows the provision of collective and state farms with equipment for performing work (Table 2). There are great differences among individual farms in their provision with equipment.

T a b l e 2

Provision of farms with farm equipment

Group of collective and state farms	Number	Proportion (%)	Basic production funds per worker (in roubles)
I	11	34	3,500 - 4,500
II	12	37	4,501 - 5,000
III	9	29	over 5,000

Those farms are in a better position which have put up comparatively many new buildings and are better provided with farm equipment (Group III). In this group must also be included the collective farms located on the borderland of the district in spite of the fact that on these farms manpower is scarce - the number of agricultural labourers is small and even those that are available are in their majority elderly people.

As is well-known, the number of persons engaged in agriculture is declining steadily. This is completely justified since it is in agreement with the increase of labour productivity on the farms. In many rural regions located at great distances from urban settlements and major rural centres people are continually migrating from the countryside to towns. The result is that in those regions there is a shortage of agricultural labourers. The same can be said of a few regions of Viljandi District. The number of persons engaged in agriculture is small on the farms located on the borderland of the district, particularly in the vicinity of the Pärnu depression where economic activity is less intensive.

On the basis of the index of potential working capacity we can distinguish regions with differing conditions of production in the District of Viljandi (Fig. 4). The region in the immediate vicinity of the town of Viljandi has the greatest potential working capacity. The farms surrounding the district centre have comparatively better preconditions for agricultural production: they have a favourable economic-geographical location (with regard to large rural centres and main roads), an abundance of fertile arable land, and there is no shortage of labour. Those farms are also well provided with basic production funds, i.e. production buildings and farm equipment. Another region having better preconditions for production is in the south-south-western part of the district in the vicinity of urban settlements (Mõisaküla, Abja-Paluoja, Nuia). Already in the past few centuries this was one of the wealthiest regions known as the country of the Mulks (Mulgimaa). The farmers of that region grew flax in their fields, which was a profitable commodity previously. Today flax has lost its economic importance. The nearest hinterland or tributary area of the town of Mustla is conspicuous for its high working capacity. The collective farm located here has plenty of fer-

## Areas of working capacity

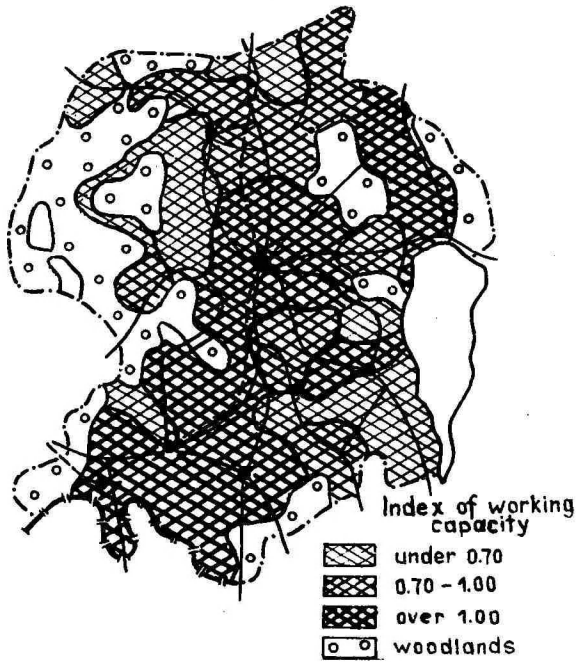


Fig.4

tile arable land, is well provided with basic production funds and has enough agricultural labourers. The production results of this farm correspond to the existing preconditions - the farm is one of the most advanced in the district.

Regardless of the fact that the index of working capacity in the north-eastern part of the district is rather high, the production results of the local farms are below the average level of the district. This can be explained by the fact that the organization of production in those parts demands considerably larger capital investments. The natural conditions in the drumlin landscape of Kolga-Jaani and in the depression of Lake Võrtsjärv are much worse than in the Sakala Uplands: there is less cultivated land and this is of smaller fertility, there is more wooded land and a large amount of excessively wet land which needs to be drained. The abundance of lands fit for cultivation offers possibilities for the improvement of the structure of the land resources. The area under field crops can be extended at the expense of natural grasslands and thickets.

The index of working capacity of the farms located in the northern part of the district is unjustifiably low. The natural preconditions for farming are good here: the fertility of soils is high, the degree of the parcelling out or fragmentation of land is low. The location of the farms with regard to major rural centres and main roads is favourable - they are situated in the vicinity of Suure-Jaani and Võhna. However, the farms are inadequately provided with basic production funds. This circumstance will improve during the current five-year-plan period thanks to the erection of new production buildings provided for in the development plan.

The index of potential working capacity applied in the present study indicates the possibilities existing for productive activity on the farms (Table 3). It would be

Table 3

Some examples about farms with  
different working capacity

Collective or state farms	Basic production funds		Area under cultivation per workers in ha.	Index of potential working capa- city
	per workers in roubles	per 100 ha of agricul- tural land in 1000 roubles		
Kariste	3900	27.8	11.4	0.28
Paistu	4820	42.5	9.6	0.74
"Lembitu"	4050	43.7	9.0	1.14
Heimtal	4370	75.0	6.5	2.24
Gagarini	5300	83.0	5.0	3.37

only logical to expect better results in production from farms having a high index of working capacity. Nevertheless, such a regularity can not always be observed in practice. This can be explained by the subjective conditions of development of agriculture - by the quality of the management of farms.

Of the three components of the production process - manpower, means of production (basic production funds) and the object of labour (land resources) - the basic funds can be regarded as the most dynamic ones. Manpower is characterized by a tendency towards a certain reduction in the number of workers. If this proceeds at the expense of labour productivity in agriculture, the decrease will not become an inhibiting obstacle even to the extension of production. From the point of view of land resources, the quantitative increase of land is not essential, but the improvement of its structure and of its qualitative properties is significant. Some essential changes in agri-

cultural land can be prognosticated for the Pärnu Lowlands and the depression of Lake Võrtsjärv where there is relatively more land available for cultivation and where the efficiency of ameliorative work is also higher. A certain increase in the basic production funds will take place on each farm. This is natural as a result of the introduction of new machinery and new techniques of production, the application of advanced forms and methods of organizing work. According to the new five-year plan the rate of the increase of the basic funds on farms varies greatly. Buildings and structures constitute a large part of the basic production funds of the farms. The steady extension of agricultural production requires the erection of new production buildings. In this way the volume of planned buildings will greatly contribute to the increment of the basic funds of collective and state farms. In order to create equal conditions for production on all the farms of the district, first of all the material and technical basis of all backward farms should be improved, i.e. the structure of the basic funds should be changed and their amount should be increased. When drawing up plans for the erection of new buildings, one should proceed from the principle that the volume of new buildings should be greater on the farms which have comparatively few modern structures.

Analysis of the data of the new five-year plan shows that in general the rate of building activity in the coming period will be comparatively more rapid on the farms where the basic funds are small (Table 4). As regards the volume of construction work, however, the farms with limited basic funds will stay behind the best farms. But this does not apply to all farms. Territorial changes in the provision of farms with basic production funds will play a very important role. A comparison of the actual supplies of the basic production funds with the planned increase

Table 4

Changes in the provision of farms with  
basic funds

	Basic production funds per 100 ha of agricultural land		
	40	40.1-45	45.0
1. Existing production funds per 100 ha of agricultural land on an average (in thous. roubles)	34.8	43.2	56.0
2. Volume of building and in- stallation work per 100 ha of agricultural land (in thous. roubles)	38.2	37.0	42.4
3. Increment in the basic funds (in %)	110	85	76

proceeding at the expense of building and installation work shows that differences in the material and technical resources at the present distribution of building activity will not disappear during the current five-year plan period. As a result, differences in the working capacity of the farms of Viljandi District will persist in the near future.

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**Tootmistingimuste territoriaalsete  
erinevuste hindamisest põllumajanduses**

**E. Tsopp**

**R e s ü m e e**

Käesolevas artiklis on tehtud katse hinnata komplekselt rajooni tingimusi põllumajanduse arenguks. Selleks on kasutatud nn. potentsiaalse töövõime indeksit, mis on tuletatud kolme tootmistegevuse seisukohalt kõige olulisema teguri - tööjõu, põhifondide ja põllumajandusliku maa - seosest.

**К оценке территориальных различий  
в условиях развития сельского хозяйства**

**Э. Тсопп**

**Р е з ю м е**

В настоящей статье описывается опыт комплексной оценки условий производства в сельском хозяйстве. Использовался т.н. индекс потенциальной работоспособности, выведенный из связи трех, с точки зрения сельскохозяйственного производства, самых главных факторов - рабочая сила, основные фонды и качество сельскохозяйственных угодий.

## On the Coastal Recreational Areas of South- Western Estonia

A.M. Remmel

Contemporary architectural planning like any kind of planning in general cannot confine itself to the internal organization of a certain territory as an isolated geographical unit; it must proceed from the truth that this territory as a unit is part of a whole. The task is not only to place means consisting of certain material and aesthetic values at the disposal of mankind, but also to create an organic specific environment which would correspond to a definite sphere of human activity.

Complex planning of recreational management must turn the environment into a means of recreation, i.e. of resoring the working capacity of people. At this all hierarchical systems of recreational territories and complexes must constitute a logical whole, not a sum total of individual elements. At the same time this particular recreational whole must fulfil its specific role in the system of general complex planning.

Every integrated recreational area constitutes a link in the system of general recreational territories, including concretely interrelated territorial as well as functional-typological structures. There is a large number of factors affecting the practical application of both the territorial and functional-typological structure, of which natural and economic-geographic conditions (the network of roads, the existing settlements, etc.) must be regarded.

When evaluating natural conditions as the most essential factor in planning the recreational area, the aesthetic aspect must also be stressed. Beside it the properties of the individual components

(forest, body of water, soil, hinterland) that shape the natural environment are of essential importance.

The spatial continuity or discreteness of suitable and favourable natural complexes leads to the internal structure of particular recreational areas, the territorial and functional-typological structure, the nomenclature, distribution and size of recreational establishments. The character of the network of roads and other factors must be combined and logically reflected in the final result of planning. Schemes presented in Figures 1, 1<sup>A</sup> and 1<sup>B</sup> express one possibility of planning and integrated recreational area.

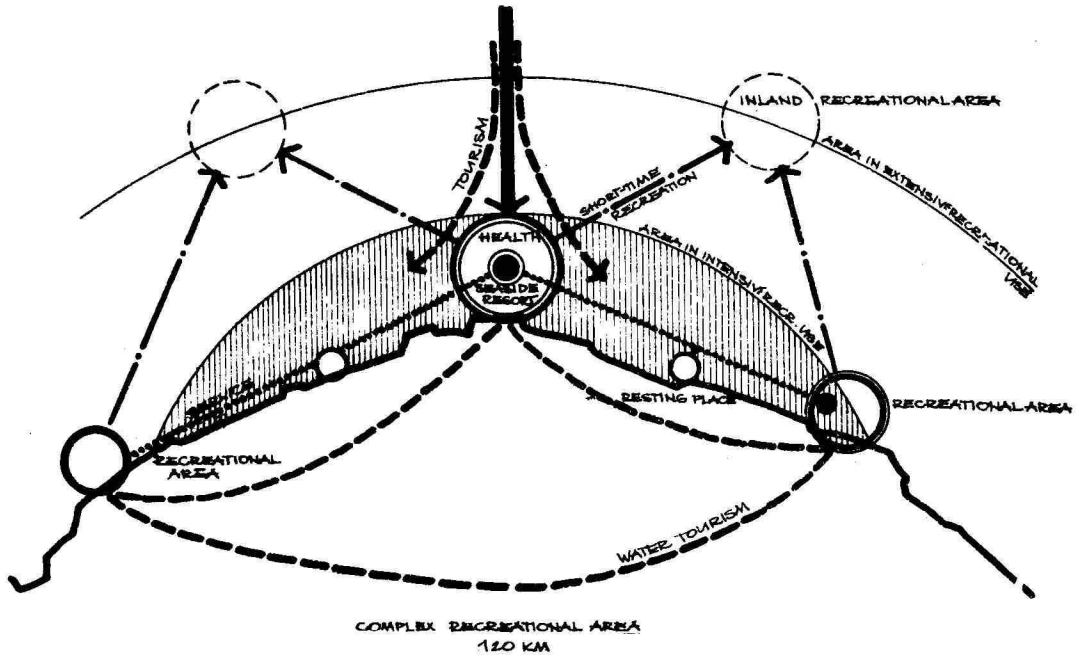
The above schemes served as a basis for the planning of the coastal areas of south-western Estonia from the point of view of recreational management (Fig. 2).

The most prominent holiday resort in the Estonian S.S.R. that of Pärnu constitutes as organizational centre for the recreational area on the above-mentioned coastal stretches (Fig. 1).

The coastal areas of south-western Estonia vary in their landscape character falling into two distinct parts which have quite different natural conditions: 1) the northern coastal area (Pärnu-Paatsalu), and 2) the southern coastal area (Pärnu-Ikla). Kihnu and Ruhnu (islands in the Bay of Pärnu and the Gulf of Riga) constitute a special recreational unit.

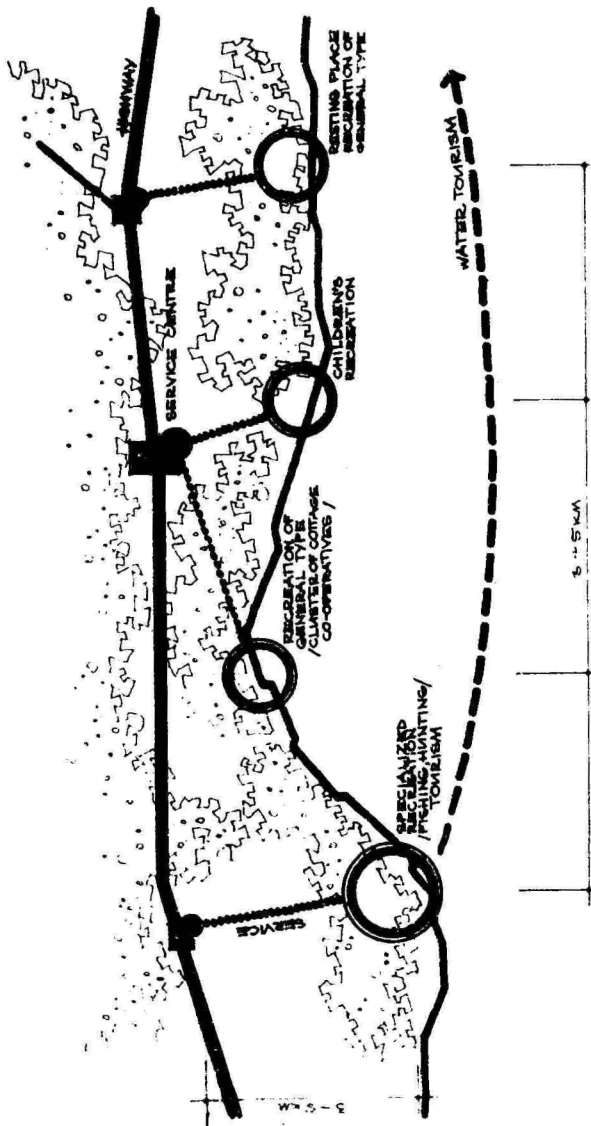
North of the town of Pärnu, the suburban holiday zone ends in the recreational complex of Valgerand, which basically is a continuation of the town's holiday zone and at the same time is the final point of the walking route for holiday-makers.

There are few settlements and no extensive sandy beaches in the northern part of the coastal area; the highway is comparatively far from the coast, but there are extensive marshy areas between the highway and



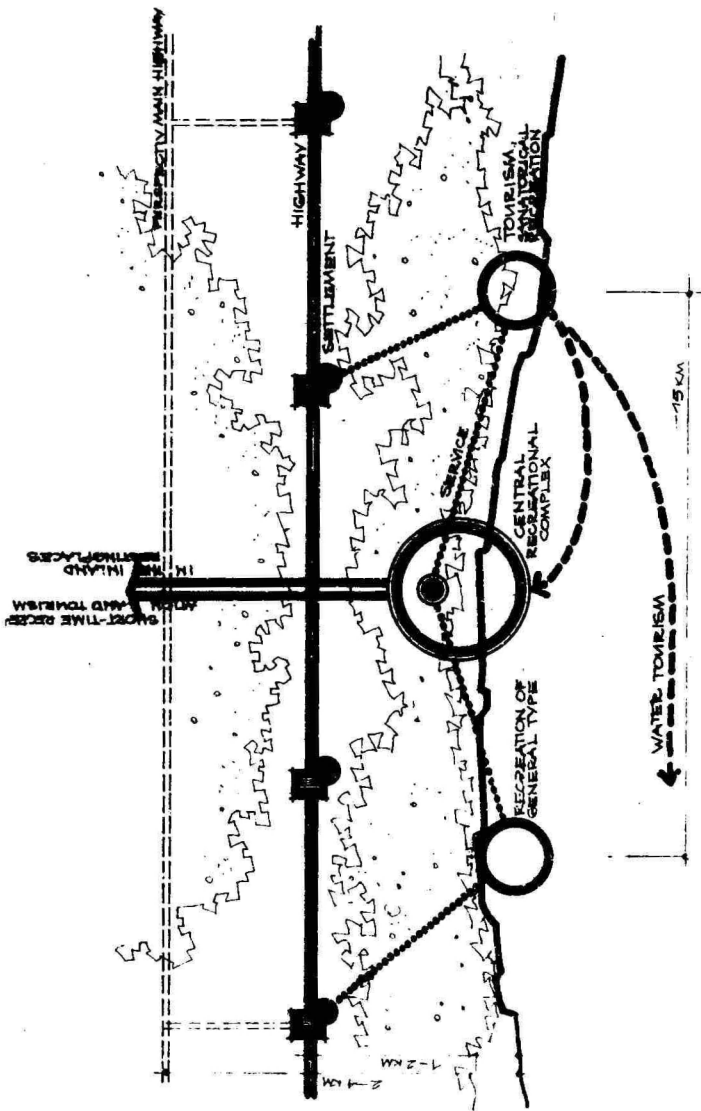
A THEORETICAL DESIGN OF A COMPLEX RECREATIONAL AREA

FIG. 1



A THEORETICAL DESIGN OF A DISCRETE  
 COASTAL RECREATIONAL SITES

FIG. 1A



A THEORETICAL DESIGN OF A CONTINUOUS  
COASTAL RECREATIONAL SITES

Fig. 18

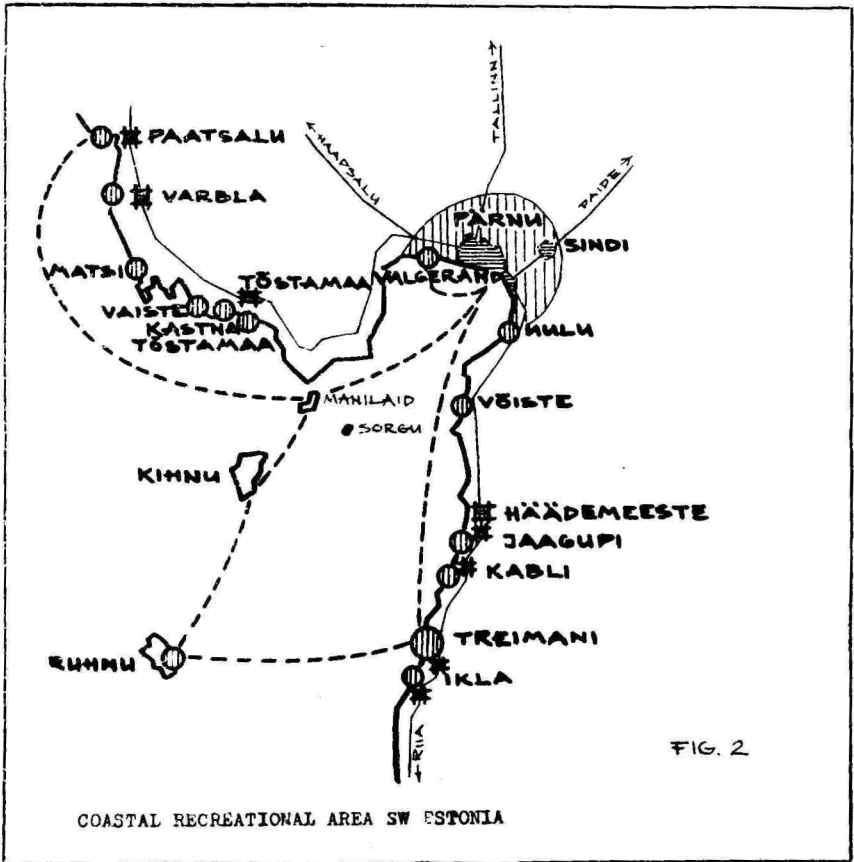


FIG. 2

COASTAL RECREATIONAL AREA SW ESTONIA

the coast, but here and there one can find a fine sandy beach coupled with a dry fine forest (Matsi, Varbla); coastal stretches of exceptional beauty covered with juniper shrubs (Vaiste, Kastna), etc. An analysis of landscape shows that the northern coastal area has no potential advantages of developing into an intensively used recreational area; yet it can become a zone of organized quiet rest.

The character of the existing natural conditions (only a few places are fit to be used for holiday purposes) makes it necessary to use a discrete system of the distribution of holiday places (Fig. 1<sup>A</sup>). The lastnamed are neither functionally nor through a servicing linked up with each other, but are subordinated to the central complex of a holiday resort as more or less equal units. Every one of these resting-places fulfils a particular function (specialized rest, resting-place for children, resting-place of a general type, etc.) and has a more or less definite number of resting units corresponding to the concrete natural conditions. There will undoubtedly remain a few reserves which after the transformation of nature can be used as resting-places.

1. In the investigated northern part of the coastal area, resting-places will be established on the coastal stretches of Paatsalu, Varbla, Matsi, and Vaiste-Kastna-Tõstamaa.

a) On the basis of its natural capacity Paatsalu might take about 300 resting units. In the case of a partial (50 %) afforestation of natural grasslands, the number of resting units can be raised to 800. In course of time Paatsalu should become a tourist centre. An indented coast-line provides a good opportunity for building a harbour as a final point of water-tourist routes for the whole of Pärnu Bay, likewise a possibility for establishing a summer camp for water tourism. Paatsalu is well-known as a place rich in fish. For this reason

it is expedient to establish rest-homes of institutions and fishermen's summer cottages there.

b) The coast and surroundings of Varbla with its peculiar nature, holms and coastal area with fine juniper shrubs is also a place suitable for the construction of the necessary premises for smaller holiday institutions, and forms of specialized rest (fishing, yachting). The capacity index of 250 resting units is optimal under the existing conditions and fit for a zone of quiet rest. In case marshy forest areas are drained, it is possible to raise the number of resting units by 20 %.

c) With regard to natural conditions, Matsi is suitable for children's holiday institutions. The indented coast-line creates shallow coves with warm water, behind the dune barrier there is a plain covered with groves and protected from sea breezes where it is possible to fit in one- or two-storeyed blocs of houses.

d) Rest-homes and summer cottages may be built by various institutions along the coastal stretches of Vaistse-Kastna-Tõstamaa.

The architectural solution for the structures to be put up on these coastal areas should conform to the landscape and confine itself to houses of one or two storeys.

2. The southern part of the health and holiday resort area of the Pärnu bay is in a different situation. With regard to nature, these coastal areas also have a different character. The coastal stretch between Häädemeeste and Ikla has particularly favourable natural conditions for the building of a complex of intensively used holiday structures of a wide profile. One finds here a fine sandy beach and beautiful dry dune forests. There are also deposits of curative mud and a supply of mineral waters. Nevertheless, the territorial planning of the area is complicated on account of the most unsuitable location of the trunk road. On this stretch the Pärnu-Riga high-

way runs close to the coast-line (in places only at a distance of 100 metres), cutting off the narrow strip of the forest surrounding the fine sandy beach from a second quality-class forest of the dune zone.

Due to concrete natural conditions, it is possible in this locality to implement the central system of a recreational area (Scheme 1<sup>A</sup>), where the central complex would be the local service centre and the resting-places in the vicinity would be subordinated to it both in the functional and the servicing sense.

A short-term holiday zone south of the town of Pärnu comprises Reiu Park and ends in the region of the Uulu Canal where in future a catering establishment (cafe-restaurant) will be built to service both short-term holiday-makers and those interested in a complex of camping-place, motel and tent-camp, to be built at the road junction.

a) There is a fine locality south of the Uulu Canal suitable for constructing a complex of holiday homes with 150 resting units. Architecturally, these holiday homes should be compact and of the urban architectural type.

b) The stretch between Uulu and Tahkuranna has rather large forests which are in a good state. However, this stretch can be taken into consideration as a promising holiday area only in the future since the low-lying land on the coast is sparsely forested and at this particular place the wooded stretch of sand dunes is located at a distance of 2 km from the sea. By means of additional afforestation it would be possible to create good conditions for vacationing there.

c) At the end of the Uulu-Tahkuranna stretch where the peculiar coastal landscape of Võište starts, there exist conditions for the establishment of a complex of sports buildings which would operate throughout the year. The so-called Võište Hills are suitable for skiing, and there is a narrow stretch of a sandy beach on the coast. By artificially widening the sandy beach and by construct-

ing a system of swimming-pools the problem of swimming throughout the year would be solved.

d) The approaches to Häädemeeste and its surroundings are at present well-known as a hunting area. There are no necessary conditions for the development of other forms of recreation since the coast is overgrown with bulrushes and is unsuitable for bathing.

e) There are attractive coastal stretches on the area between Häädemeeste and Kabli which are quite appropriate for the establishment of smaller holiday establishments there.

Still, the stretch between Häädemeeste and Kabli has no prospects of coming to be intensively used as a recreational area since the stretch of the coast between Kabli and Treimanni provides a greater attraction for holiday-makers with its extensive sandy beaches. The stretch between Häädemeeste and Kabli will be so to say a "suburb" of the holiday area. For these reasons this stretch can be recommended to summer-cottage co-operatives:

f) The coastal stretch between Kabli and Treimanni represents an integrated recreational area on the model of a central system which starts south of Kabli.

It can be said on the basis of an analysis of the natural complex that there is a great disproportion between the capacity of wooded areas (dune forests) and that of the beach. Very disturbing factors in this area are the dense population and the above-mentioned trunk road.

Nevertheless, the area between Kabli-Treimanni and Ikla has the natural advantages needed for becoming a second large recreational centre on the coast of south-western Estonia alongside the holiday resort of Pärnu. But a precondition for the creation of an integrated recreational area is the shifting of the present trunk road to a distance of 3 to 4 km from the coast.

Taking into account the capacity of the local forests, it is possible to accommodate 3,250 long-term holiday-makers on the total area under consideration (including Ikla). Of that total capacity, the capacity of the Ikla forests (constituting the sanatorium zone of this recreational area) is only 250, which shows the great disproportion existing between the capacity of the beach and that of the forests. Still, with some effort it will be possible to create 400 to 500 sanatorium places at Ikla. It is obvious that it will be necessary to plant new forests and to reshape the area between the sandy shore and the existing forest by drainage, establishment of artificial bodies of water, afforestation, etc..

On the whole, the stretch between Kabli and Treimanni will hold holiday establishments for 3,000 vacationists. One should set up here holiday establishments with a free regime - summer hotels, boarding-houses, state-owned rest-homes, etc.

It will be possible to extend the capacity of the Kabli-Treimanni recreational area by raising the level of general amenities and the organization of public services as well as by a more extensive exploitation of the lands lying beyond the dune barrier. The increase of recreational complexes should proceed in the direction of inland forest areas, which at this particular place would supplement the narrow stretch of the coastal dune forest.

Due to the existing dense population of the area between the highway and the sea as well as of the plain beyond the dune zone, one cannot occupy extensive areas for holiday premises. The architectural solution of these structures should provide for multi-storey buildings and a system of one or two-storey blocks of houses linking the multi-storey buildings. The dune forest should remain basically untouched. An appropriate place for another complex of recreational structures is the

surroundings of Loodeoja, which is situated nearly in the centre of the complex of holiday structures.

The land under the existing road and the bare places by the sea overgrown with grass may be used for the premises of the service centre. Catering centres should be so located that they might be used also by those who visit the beach. Other structures of the recreational complex should be set up on the plain beyond the zone of the dune forest. This part of the recreational complex should be built so that it might be used throughout the year.

Treimanni may be developed into one of the fundamental tourist nodes on the coastal area south of Pärnu. A hotel (combined with a motel) should be built there for the servicing of tourists.

g) Of the islands situated in Pärnu Bay, Kihnu (with a population of 820) is overpopulated. The capacity of the forest growing on the island and that of the beach are altogether 450 vacationists. Taking into account the size of the population, it is clear that it is impossible to construct there any holiday establishments operating all the year round. However, the island of Kihnu with its ancient farm-houses and its population which has preserved their old folk customs and national dress will, undoubtedly, remain an object of great attraction for tourists.

Since water and air transport is dependent on weather conditions (i.e. departure from the island is not always guaranteed), a hotel should be built on the island which would provide overnight accommodation for tourists.

h) The island of Ruhnu is less densely populated than Kihnu. The capacity of its forest and beach is also considerably larger. Considering the distance of the island from the mainland (which makes the island rather difficult of access), Ruhnu may be considered as a place where tourists could spend a few days in quiet. Due to its uniqueness, the recreational complex on Ruhnu should include a set of hotels which should be accessible to the general public and have a free regime.

The suggestions presented in the report have grown out of the practical need to work out a reasonable system and practical structure of the recreational areas on the south-western coast of Estonia. The report forms a constituent part of complex territorial planning of the Estonian S.S.R.

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## Edela-Eesti mereranniku puhkealadest.

A.M. Remmel

Р е з ю м е

Artiklis käsitletakse Edela-Eesti mereranniku puhke-  
kontade territoriaalse organiseerimise ja arhitektuurili-  
se kujundamise küsimusi. Autor näitab, et Pärnust lõuna  
ja põhja poole erinevad looduslikud ja majanduslikud eel-  
dused tingivad ka erinevad planeerimis- ja arhitektuuri-  
lised lahendused.

## О прижорских рекреационных территориях Юго-Западной Эстонии

A.-M. Реммель

Р е з ю м е

В статье рассматривается вопрос о территориаль-  
ной организации и архитектурном оформлении мест отды-  
ха на побережье юго-западной Эстонии. Автор показыва-  
ет, что отличающиеся от курорта Пярну на север и на  
юг природные и экономические условия требуют также  
различных планировочных и архитектурных решений ор-  
ганизации мест отдыха.

## Tourist Maps and Their Improvement

L. Vassiljev

Tourism in the Soviet Union is growing with every day. The number of plan-contracted tourists is rising by about 30 % a year, and in 1970 their number was about 50 millions. Much greater and difficult to estimate is the number of "wild" tourists who travel every summer without contract licenses by car, train, boat or on foot. All these travellers need maps in order to choose their routes, trace the way and find objects of interest during their journey. For this reason tourist maps have been compiled. About 35 different tourist maps with a circulation of approximately two million copies are published in the Soviet Union each year.

Soviet tourist maps are intended for the contract routes of the Central Council of Tourism which offers more than 200 general and some thousands of local routes. The available tourist maps illustrate mainly the general routes for tourists travelling in large groups by train, ship or bus. These maps show only the most important objects on the route, and are not complete enough to satisfy the requirements of other kinds of tourist groups.

The present Soviet tourist maps can be classified as follows:

- I. Review-scheme-maps which show the whole territory of a republic, region or province.
1. Orthogonal scheme-maps. These middle- and large-scale maps from 1 : 600 000 up to 1 : 25 000 are altered and simplified topographic maps of single republics, mountain regions, recreation areas and memorial or nature conservation terrains. The maps carry 5 to 20 various signs denoting objects of interest to tourists. Such

maps include the tourist scheme-maps of "The Baltic Republics", "Karelia", "Ropino-Prizozersk-Vyborg", etc.

2. Perspective scheme-maps. Generalised pictures of a wide territory which are represented as a "view from a space-ship", for example scheme-maps "The Crimea", "District of the Caucasian mineral waters", "The Georgian S.S.R.", etc.
3. Tourist block-diagrams which show a mountain region in an anconometric projection with vertical profiles in two general directions, as "The Central Caucasus", "Teberda-Dombay", etc.

II. Route scheme-maps. These maps may be drawn up as continuous route maps, which represent the neighbourhood of the tourist object or path, and as fragmentary route maps, which show a narrow strip bordering the road or several rectangular sections of it, which are mounted on successive pages of a booklet. All these route maps may be indicated as

1. Plane route-schemes, which show the locality of much-visited reservation or recreation areas, as "Pushkin-Sanctuary", "Lake Tsherenetskoye", "Moscow-Yasnaya Polyana", "Skhodnya-Lissitsky Bor", etc.
2. Mountain route-schemes, with an detailed representation of only one, most dangerless path, as the "Sukhum Military Route", "Georgian Military Route", "Alma-Ata - Przhevalsk", etc.
3. Waterpath route-schemes, which represent all objects located on the banks of a navigable river, as "Moscow-- Astrakhan", "Moscow-Ufa-Perm", "Down the Dnestr"; or a much visited wild (canoe) aquatic route, as "Down the Gauya", "Run on Belaya", "Run on Tshussovaya", etc.

III. City plans are necessary for different purposes.

1. Ordinary city plans show the streets, squares and parks of a city, for example "Moscow", "Leningrad", "Kiev", etc.
2. City communication plans, for example "How to get about in Moscow", "How to get about in Tashkent", etc.
3. City plans with tourist objects, which represent the location of museums, theatres, cinemas, exhibitions, stores, etc., as "Riga", "Sights of Leningrad", "Key to Tallinn", etc.

Beside these popular separately published tourist maps there are two different groups of tourist maps, which appear in journals and atlases. The first of them is a series of maps published in the "Tourist" magazine. Every number of the monthly magazine is provided with a coloured small-scale tourist map of some interesting tourist area, which shows the most significant objects of that region. The thematical content of these maps is not of a sufficiently high level.

The second group of tourist maps is more remarkable. These are the tourist maps in the complex regional and republic atlases of the U.S.S.R. During the last ten years more than 20 scientific atlases have been published and they also contain tourist maps. These maps are considerably more detailed than the ones mentioned earlier on, but their small scale (less than 1 : 1 500 000), different content and different ways of representation lessen their importance. The best of them are the tourist maps published in the Leningrad, Pskov and Orenburg regional atlases.

The quality of the ordinary tourist maps is rather low. The reason is the fact that the tourist maps have been compiled without the participation of geographers. Usually tourist maps are compiled with the assistance of the Tourist Council. The latter hands in descriptions of some important tourist objects, especially cities,

whose attraction is without doubt. The choice of these objects is often dubious and deficient. The contents of tourist maps might be much better if experienced geographers would take part in their compilation.

An example of such collaboration is the third edition of the scheme-map of the Estonian S.S.R. The first (1962) and second (1969) editions were very poor and were extensively criticized. The third edition has been prepared in co-authorship with the Chair of Physical Geography of the Tartu State University. The Department had earlier carried out a considerable investigation in order to ascertain, describe and estimate the tourist resources of the Estonian S.S.R. The tourist objects were grouped according to contents and importance. Historical, archaeological, biographical, architectural, natural and contemporary (industrial and agricultural objects were distinguished on the basis of contents with regard to their significance objects were classified as of international, union, republican, regional and local importance. The lists of objects were submitted for approval to various scientific institutes and government institutions. These lists and punch cards were used as initial data in the compilation of tourist scheme-map. The new map carries about 200 tourist objects - eight times more than the preceding edition. The new map is much more valuable than the previous ones because many items of information are published for the first time.

The collective work of geographers and cartographers is the most promising way of improving the quality of tourist maps.

## Turismiskeemid ja nende paremstamine

L. Vassiljev

R e s ü m e e

NSV Liidus ilmuvaid turismiskeeme võib jaotada ülevaate-, marsruut-skeemideks ja linnade plaanideks. Turismikaarte ilmub ka ajakirjas "Turist" ja vabariikide ning oblastite kompleksatlastes. Turismikaartide kvaliteet võiks olla märksa kõrgem, kui nende koostamisest võtaksid osa geograafid ja kodu-uurijad. Sellise koostöö kogemused on olemas Eestis, kus Tartu Riikliku Ülikooli füüsilise geograafia kateedri ja Geodeesia ja Kartograafia Peavalitsuse ühistööna on valminud uus, senisest märksa täielikum Eesti NSV turismiskeem.

## Туристские схемы и их совершенствование

Л.М. Васильев

Р е з ю м е

Издаваемые в СССР туристские картосхемы можно условно разделить на обзорные, маршрутные схемы и планы городов, которые в свою очередь подразделяются на различные виды. Туристские картосхемы публикуются также в журнале "Турист" и комплексных атласах республик и областей. Качество этих схем могло бы быть значительно выше, если бы в их составлении участвовали географы и краеведы. Опыт такого сотрудничества имеется в Эстонии, где в результате совместных усилий кафедры физической географии Тартуского государственного университета и Главного управления геодезии и картографии была создана новая туристская схема Эстонской ССР, значительно более содержательная, чем предыдущие.

**Johannes K is - Introducer of Group  
Work in Estonian Schools**

**A. Benno**

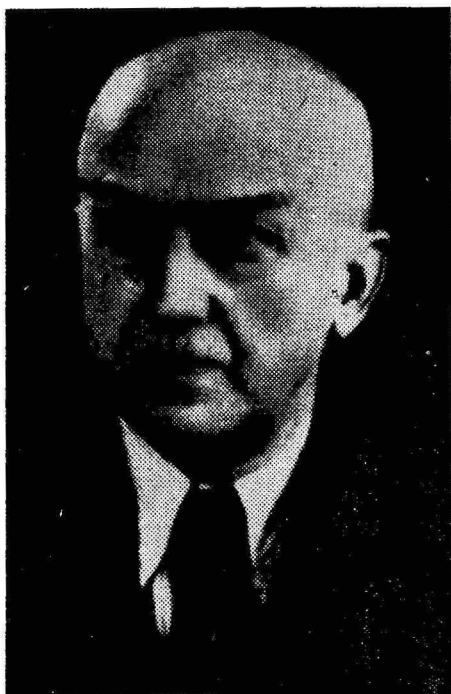
Johannes K is (1885-1950) is one of the most outstanding Estonian educationists who has well deserved of his country as a fighter for new education. His activities contributed to the spread of several new pedagogical ideas of that time in Estonia. As a result of J. K is' energetic work a number of teaching methods recommended by reform pedagogy spread in the Estonian schools of general education and this had a fruitful influence on the development of the bourgeois Estonian school.

Johannes K is was born in Estonia in the district of P lva. He came of a family of public school teachers. In 1918 he graduated as an external student of natural science from the St. Petersburg University. While studying he worked as a teacher in Riga and in Soviet Russia from 1917 to 1920. From 1921 to 1930 he was director of the Estonian Seminary of Teachers at V ru. Owing to J. K is the Seminary became a school where everything new and progressive in teaching was always supported. To this period belongs the elaboration by J. K is of the system of individual teaching which is one of the most essential features of his pedagogical system. When this educational institution was closed in 1930 (mainly for political considerations), his work was still in progress. In 1931 J. K is retired on a pension but continued elaborating his pedagogical system, editing the journal "Kooliuenduslane" ("New Educationalist"), he was also a frequent contributor to other pedagogical magazines.

In 1940, immediately after the establishment of Soviet power in Estonia, J. K is was called to the Ministry

of Education to help to draw up new study programmes for elementary schools and to work as editor of the journal "Nõukogude Kool" ("Soviet School"). During the fascist occupation J. Käs was imprisoned. After his release he worked in the country as a farmhand and made occasional translations. After the liberation of Soviet Estonia from the fascist occupation, J. Käs continued to work in the Ministry of Education where he organized the publication of textbooks and pedagogical literature. In 1945 J. Käs was awarded the title of Honoured Teacher of the Estonian S.S.R.

J. Käs is respected for his tremendous capacity for work. He published over 200 articles and books, a number of manuals and copy-books for practical work. At the beginning of his activities he was known as the introducer of the activity school (1) and general education (2), and later as a supporter of the individual work-system. Group work is first mentioned by J. Käs in 1928 when characterizing the Dalton plan. Besides individual work he stresses also group work as he writes in his article: "... Miss Parkhurst's principles might be put into practice also here, certainly step by step and in accordance with our conditions, since this reform will surely bring about greater success in education and teaching" (3, p. 235). In 1930 a new education week was organized which represented the introduction to a new epoch in the new education movement in Estonia. A large number of methodical literature and new materials for individual work began to come out. During this period J. Käs published a series of articles about group work. He says that the limits of individual work are widened if work is organized in groups (4), thus characterizing group work as an intermediate stage between purely individual work and work with the class as a whole (6). He writes: "The freedom of action of an individual cannot be unrestricted, because certain demands are presented to him by the



Johannes Käis  
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community and society whose member he is. Therefore the principles of individuality are combined with the demands of social education" (7, p. 255). In his article "Isetegevuse psühholoogilise-pedagoogilise aluse" ("Psychological)Pedagogical Fundamentals of Independent Work") he states that the educative value of independent work prevails more in group work than in individual work (8, p. 7). At the same time recommendations were also published on the use of group work in different subjects, as were opinions on this way of working. In "Kooliuenduslane" ("New Educationalist"), for instance, B. Rea recommends this method at lessons of biology and geography (12). In the journal "Kasvatus" ("Education") H. Stamm deals with group work at physics lessons (13). For extending the skill and knowledge of pupils in their sphere of interest J. Kõis suggests also inter-class working groups. He writes: "It is necessary that in the senior classes of secondary schools there should exist a possibility to work in inter-class groups for at least two hours" (4, p. 265).

Group work occupies an important place also in J. Kõis' later articles. In 1944 he mentions that there may be three main ways of working in class: common, collective work, group work and individual work (9).

In order to determine the frequency and effectiveness of group work in the schools of bourgeois Estonia, A. Ivask organized a questionnaire in 1969. It appears from the obtained answers that group work was used in elementary forms in 59 and in secondary schools in 70 cases (11, p. 84). It is evident that these indices were far higher during the new education period. All the answerers estimated group work as useful.

The idea of group work seems to originate from H. Parkhurst's Dalton plan. Proceeding from G. Kerschensteiner's principle of individuality J. Kõis recognizes the need for social education. In 1935 he writes that

"the principle of individuality together with the other essential pedagogical principle - that of sociality - forms the basis of the new education pedagogy, its core" (7, p. 254). In the same year he stresses that "there are two essential principles in new education pedagogy: the principles of individuality and sociality" (5, p.6). Here he refers to J. Dewey, P. Natorp and W. Rein. J. Käis' meeting with A.J. Lurch (a supporter of the Dalton plan) who made a report during the new education week in Tallinn in August 1930, is also of importance. J. Käis acquainted himself with school work in Berlin, London, Vienna, Zürich and Finland and received some inspiration from the West-European pedagogical new education movement. In his later papers he mentions the Jena plan and working groups outside classes in Leipzig, Dresden and Hamburg. He was also familiar with the application of group work principles for the brigade (team) method in the Soviet Union, as is evident from his references to the works of V. Ivanov ( *Организация и планирование работ в комплексной системе, Ленинград 1926*) and L. Huber's papers (*Der Dalton-plan in der russischen Arbeitsschule, "Neue Bahnen" 1927, Nr. 6-8*).

When propagating group work J. Käis stresses first of all its value as a collective way of working. For the first time he summarizes the aims of group work in 1935 in his paper "Isetegevus ja individuaalne tööviis" ("Independent and Individual Way of Working"). These are the following: "creating possibilities for independent work, striving for the aims of social education by means of working together, mutual help, serving the wholl and developing the sense of responsibility, expedient distribution of work" (5, p. 85). At the same time he says that the educative effect of group work is especially valuable. He writes that "collective work brings about the necessity for mutual help, one must teach and guide the weaker, and also ask for help from

one's groupmates, consult the others. Group work develops responsibility for the results of the work and joins the class into a real working society" (5, p. 87). Collective work in a group gives the child courage and confidence in his activity. In his manuscript paper "Õpetuse alused ja teed" ("Fundamentals and Ways of Teaching") J. Käis writes: "As children's school life is mainly spent at lessons, teaching should be used as efficiently as possible for fulfilling the tasks of social education" (9, p. 334). In this paper he states more precisely the aims of group work: social- to promote social education by means of serving the whole, mutual help and instilling collective feeling and the sense of responsibility: psychological-methodical - to create better conditions for individual work and thus raise the pupils' working efficiency (9, p. 330). As we can see, two main aims become evident: educative and didactic. Apart from the educative importance group work influences the results of teaching. Being under the glances of other pupils impels one to greater effort. J. Käis says that "the child's will gains normal efficiency if he works among his fellow-pupils striving for the same aim, and not separately" (9, p. 334).

Characterizing the pupils' inclination for group work J. Käis says that the individual differences of children (imagination, fantasy, thinking) appear in school at an early age. Children themselves notice them and express certain opinions that help to form society. Social feelings grow on the basis of general development as well as on the basis of life in a class (10). Most children are sociable and feel the necessity for organizing. The period of puberty is less suitable for common work because then the interests of girls and boys begin to differ considerably. At the same time their friendship strengthens and that should be taken into account in group work. The social feelings of young people who have reached maturity are rather strong. "Thus, there are preconditions for

group work at every stage, beginning at the age of 10 to 11" (9, p. 332).

External conditions for group work according to J. Käis include the existence of special classrooms for different subjects, and corresponding libraries. The suitable furniture consists of tables and chairs which can be rearranged if necessary.

A necessary precondition for success in group work is the suitable number of pupils in a group and its composition. J. Käis considers 3 to 5 the most suitable number. In a group that is too big the possibilities for common work are limited and such groups are usually divided into subgroups of 2 to 3 members. The advantage of a two-member group is that its members can sit at an ordinary schooldesk. But this group usually develops into a so-called "friendship group" which does not always have the preconditions for successful work. The optimum number of groups in a class is 3 to 4. In big classes side-groups should be organized, i.e. 2 to 3 groups get the same subtopic (10, p. 122). As to the composition of groups, there appear certain differences between J. Käis' earlier and later standpoints. In his first papers he suggests that pupils should join into groups at their own wish (4). But in 1935 he writes: "Experience with group work has shown that it does not gain the necessary aim if groups are formed on the basis of personal likes and friendship. In such groups working zeal may be lacking and the endeavour to reach one's aim by means of work becomes weak" (5, pp. 88 to 89).

Preliminary division into groups may take place at the pupils' wish, but it is the teacher who should ultimately carry out final division. Mutual understanding and agreement is important because forced formation of groups would not give the desired results. During their first group work pupils are shown fixed places in a classroom, so that later on the formation of groups would be

easy. As to their composition groups are more or less stable but not rigid. Taking account of new experience during work and also the character of a subject, slight alterations in the composition of groups are not only permissible but necessary. It is also said that a group should consist of the pupils who have more or less similar interests. Differences in abilities do not hinder the joint work of a group but, on the contrary, favour it. "It would be wrong to separate stronger and weaker pupils into different groups as this would lower the results of group work and, moreover, weaken its educational effect" (5, p. 88).

In his last, manuscript paper J. Käis presents somewhat different standpoints. He writes that children should have freedom in their choice of workmates. "In most cases wholly suitable groups are formed in this way" (9, p. 333). He is of the opinion that "work in a group may be successful if each member has a certain minimum efficiency level. Who is not able to take part in common work makes no contribution to the group and he himself derives little good from work" (9, p. 333). Therefore J. Käis no longer recommends the formation of groups of the pupils with a different level. But at the same time he is against wholly homogeneous groups which would disintegrate the collective of a class. Such groups are possible only if the aim of group work is the acquisition of knowledge. It is not clear whether J. Käis was influenced by analogous tendencies and experiments in Finland and Austria where the same conclusions were reached. The above mentioned paper was written during the years of war and later when information about what was taking place in other countries was quite insufficient.

In the formation of groups, especially in younger classes, the pupils' attitude towards common work must be considered. One should keep in view that ambitious children would not take over the whole work in a group. Quiet and modest pupils are not suitable workmates for them. One should also take into account the pupils who do not work

willingly with others, and also timid children and those who feel inferior. Common work in a suitable group in a smaller circle helps them to get used to work. The pupils' hearing and eyesight must certainly be considered.

In J. Käis' system group work is an intermediate stage between individual and collective work (the latter involving the whole class). It is regarded, however, first of all as one possibility of independent work which can bring variety and freshness into lessons (5, p. 125). He recommends group work especially when dealing with larger topics which are divided between groups in order that pupils might work more thoroughly. J. Käis states that group work may take place in the following ways: the theme is common, the pupils are divided into groups for fulfilling a common task given to the whole class; the theme is divided into sub-parts while each group gets a different task; and the work of all the groups forms a more extensive thematic whole; working at sub-parts is carried out in succession, tasks are divided for a longer period (e.g. a month) and pupils go through all the sub-parts in a different order. Mastering each topic should then take a more or less equal period of time.

Group work assumes that pupils work independently, helping each other after they have received necessary oral or written instructions. As soon as the tasks are carried out, a summary follows which integrates the whole work. This is an essential feature of group work. Each group elects the maker of a report who uses all the data of his group. Poor work becomes evident in a weak summary. In this case responsibility is far greater than that of an individual pupil in ordinary class work. The summary must be short and matter-of-fact, containing only the important ideas, rules, numerical data. J. Käis is not in favour of long written reports because they are often bad as to their content. Writing and reading long reports takes much time. As all the pupils have worked at the same sub-

ject and used also the same literature, they are prepared to improve their knowledge by means of the summaries of other groups. "The most valuable and steady work for each pupil is that carried out by him independently in group work" (5, p. 90).

Already in his first papers J. Käis warns that working in groups during the whole course in a subject is naturally not recommended although the character of the subject would enable that. Group work must be a change only of it proves to be the most suitable in a given situation.

x  
x                      x

Well organized group work surely contains several educative values. Here such relations arise between pupils and the teacher as exist within society. Common work and responsibility help to develop the sense of duty. That brings about also a better level of knowledge. A number of practical examples and theoretical standpoints about organizing group work can be used also nowadays. Therefore the study of J. Käis' works is interesting and useful for every teacher.

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Johannes Käis rühmatöö tutvustajana  
Eesti koolides

A. Benno

R e s ü m e e

Artiklis antakse lühikene ülevaade Johannes Käisi (1885-1950) eluloost ja tegevusest kooliuuenduse eest võitlejana. Üksikasjalikumalt on iseloomustatud tema seisukohti rühmatöö organiseerimisel ja kasutamisel, kuna J. Käis oli esimesi rühmatöö tutvustajaid Eestis.

Иоханнес Кяйс как пропагандист  
принципа группового обучения в эстонской школе

A. Бенно

Р е з ю м е

В статье дается краткий обзор жизни Иоханнеса Кяйса (1885-1950) и его деятельности в борьбе за обновление обучения.

Подробнее характеризуются его точки зрения в области организации и применения групповой работы, так как И. Кяйс был одним из первых пропагандистов групповой работы в Эстонии.

Geography Department of Tartu State University  
1964 - 1971

E. Varep

During the years 1964 - 1971 the development of the Geography Department of Tartu State University followed the trends established earlier.<sup>1</sup> During this period much was done to strengthen the organisation and raise the proficiency of the staff. The scientific research work of the Department has become considerably more intensive and its scientific contacts with other research centres have expanded.

In former years there was only one chair - the Chair of Geography - in the Department. Since September 1968, there have been two chairs - those of physical and economic geography. A Nature Conservation and Local Lore Centre (established on 25th of November, 1969) has been attached to the Chair of Physical Geography. The teaching staff of the Department has now 14 members, 9 of whom belong to the Chair of Physical Geography and 5 to that of Economic Geography. Certain special courses of lectures are conducted by members of the Academy of Sciences of the Estonian S.S.R., the Estonian Academy of Agriculture and other scientific and official institutions. There are 11 such specialists, beside the regular staff, now working for the Department. In addition we have 5 research studentships for graduates preparing to take up scientific or teaching work; two of these are extramural. There are also a number

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<sup>1</sup> E. Varep. The Geography Department of Tartu State University. Publications on Geography IV. Transactions of the Tartu State University, Fasc. 156 (Tartu, 1964), pp. 140-145.

of technical and research workers, some of whom work on contract at the Department.

During this period the number of regular students admitted to the Department has been as follows: 1964 - 30 students, from 1965 to 1969 - yearly 22 students and in 1970 - 32 students. Up till 1968, from 20 to 30 students were enrolled in the extramural department, but this line studies has now been closed. Neither have any new students been admitted to the Teacher's Training College attached to the University, the last of our students having finished the course in 1968. At present (as from 15th March, 1971) we have 107 regular members and 64 extramural students.

As to the curriculum, no fundamental changes have been made. Some alterations have been introduced into the special subjects in order to increase the proficiency of the students in mathematics. A few modern branches of study have also been added. The full course lasts, as before, for 5 years (6 years for extramural students). From the third year onwards the students are divided according to their special subjects, e.g. the teaching of geography (at secondary school level, with biology as an additional subject), physical geography, meteorology-climatology, hydrology and economic geography. Specialized training in such subjects as oceanography, nature conservation, medical geography etc. is given in small groups or on an individual basis. Considering the great demand for teachers, the number of students receiving training as teachers has been increased. In former years, the female students far outnumbered the male students, but during the period in question the latter have substantially increased, and now constitute one-third of the new students admitted in the beginning of the academic year.

The following chart shows the number of students that have graduated from Tartu State University during the period in question.

Group	Year	No of graduates from Geography Department		No of graduates from Teacher's Training College
		Regular	Extramural	
XV	1964	14	1	14
XVI	1965	14	1	18
XVII	1966	15	-	10
XVIII	1967	22	1	6
XIX	1968	18	6	3
XX	1969	20	7	-
XXI	1970	18	5	-
T o t a l		121	21	51

During the above-mentioned seven years, 142 geographers, of which 121 were regular and 21 extramural, have graduated. According to their special subjects, these were divided as follows: physical geography - 20, meteorology-climatology - 15, hydrology - 16, economic geography - 34, and those who will work as teachers - 57. To these may be added 51 students of the Teacher's Training College who have received their final diploma in geography. Graduates in geography work as teachers or are employed in various branches of administrative, commercial or research work.

The scientific activities of the Department mainly centre round the study of the natural conditions and resources of the republic, as well as problems of population and economy. Some attention has also been paid to problems of cartography, teaching methods, the history of geography and historical geography.

The Chair of Physical Geography is now a leading centre for studies in the natural conditions and resources of Estonia. The chief fields of this research work have been problems of the genesis and structure of the Estonian landscape types, and of their classifica-

tion and distribution, together with the theoretical aspects of landscape planning and conservation. These surveys have also been concerned with various aspects of historical development. Other important lines of inquiry have included the morphological structure and evolution of the valleys, climatic conditions and the inland and coastal waters. All this research work has, to a certain extent, been reinforced by the fresh data amassed by the students in their diploma theses. During the last few years the Chair of Physical Geography has collected much valuable material on various aspects of the land and other natural resources. All this work has been carried out on the basis of contracts concluded with other Estonian research centres and the results have been utilised in the draft projects for territorial planning.

In the Chair of Economic Geography research has been mainly concentrated round the complex study of the fundamental productive units of the different economic regions. On the basis of the data gathered the following theoretical and practical problems are studied: 1) the projection of a single, unified regional population system and the functional hierarchic classification of the urban and rural settlements; 2) internal population migration; 3) the territorial distribution of the industrial productive units; 4) division of the national territory into economic and administrative regions and the complex characterisation of Estonian economic geography. Modern mathematical methods are widely used in solving these problems.

The list of works published by members of the Department from page 225 to 257 will give a fair idea of the problems in which they have been engaged.

The following scientific conferences and discussions were organized by members of the Geography Department (partly in collaboration with the Estonian Geographic Society and other organizations): 1965 - a methodological conference for Estonian teachers of geography; 1967 - an

all-Union summer course on the application of mathematical methods in geography; 1967 - an inter-Republican conference on territorial planning; 1969 - a special conference dedicated to the 50th anniversary of Estonian geography; 1970 - celebration of the bicentenary of the great navigator and explorer Admiral A.J. von Krusenstern. Members of the Department have participated in a large number of conferences in other Soviet republics and abroad.

On March 15, 1971, the staff of the Geography Department of Tartu State University consisted of the following persons:

#### Chair of Physical Geography

Endel Varep, Head of Chair, Docent, Cand. Sc. (physical geography of the Estonian S.S.R.; history of geography).

Lev Vassilyev, Docent, Cand. Sc. (geodesy; cartography; cartographic drawing; economic cartography).

Ants Raik, Docent, Cand. Sc. (climatology; agrometeorology the climate of the Estonian S.S.R., applied climatology; tourism).

Agu Kongo, Docent, Cand. Sc. (general physical geography; the geography of soils; methods of geographical field research; landscape science).

Ivar Arold, Senior Lecturer (physical geography of the parts of the world; the geography of foreign countries; landscape planning).

Aino Benno, Senior Lecturer (teaching methods in geography; pedagogical practice).

Jaan Eilart, Senior Lecturer (nature conservation; the flora and vegetation of the Estonian S.S.R.; the study of natural resources; maintenance of landscapes; local lore).

Endel Hang, Senior Lecturer (geomorphology; the physical geography of the U.S.S.R.; palaeogeography).

Leo-Peter Kullus, Senior Lecturer (general hydrology; hydrology of the inland waters; hydrological computations; hydrological prognosis; hydrography of the Estonian S.S.R.; organisation and inspection of the hydrometeorological observation network).

#### Chair of Economic Geography

Salme Nõmmik, Head of Chair, Professor, D. Sc. (introduction to economic geography, economic geography of the Estonian S.S.R.; industrial geography of the U.S.S.R.; economic regionalization of the U.S.S.R.).

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Tartu Riikliku Ülikooli geograafiaosakond

1964 - 1971

E. Varep

R e s ü m e e

Artiklis antakse ülevaade Tartu Riikliku Ülikooli geograafiaosakonna struktuurist ning õppe- ja teaduslikust tööst aastail 1964 - 1971.

Географическое отделение  
Тартуского государственного университета  
в 1964 - 1971 гг.

Э. Вареп

Р е з ю м е

В статье дается обзор структуры, учебной работы и научной деятельности географического отделения Тартуского государственного университета в годы 1964 - 1971.

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Compiled by V. Koorits

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Tartu Riikliku Ülikooli geograafia osakonna  
liikmete trükis ilmunud tööde  
bibliograafia

V. Koorits

R e s ü m e e

Esitatakse Tartu Riikliku Ülikooli geograafia osakonna isikulise koosseisu poolt alates 1964. aastast publitseeritud tööde nimestik.

Библиография  
трудов членов географического отделения  
Тартуского государственного университета

В. Кооритс

Р e з ю м е

Дается список трудов членов географического отделения Тартуского государственного университета, опубликованные начиная с 1964 года.

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ТРУДЫ ИО ГЕОГРАФИИ

УИ

На английском языке

Резюме на русском и русском языках  
Тартуский государственный университет  
СССР, г. Тарту, ул. Вильгельма, 18

Vastutavad toimetajad S. Edmiks ja E. Varep

ISS reprint 1971. Paljundamiseks antud 6.VII 1971.  
Trükipeegeld 16,5 + 1 trükk. Kleeblinnid. Arvestus-  
peegeld 15,2. Trükiary 500. Paber 30 x 45. 1/4.  
IS 02033. Tell. nr. 592.

Hind 1 rubl. 20 kop.

2 - 7