

## HUMAN IMPACT ON THE DEVELOPMENT OF LANDSCAPE STRUCTURE OF THE ISLETS OF WEST ESTONIA

Urve RATAS and Elle PUURMANN

Institute of Ecology, Kevade 2, EE-0001 Tallinn, Estonia

Presented by J.-M. Punning

Received June 22, 1993; revised version received October 22, 1993; accepted November 1, 1993

**Abstract.** The West-Estonian islets are young and rapidly evolving. The majority of the islets emerged from the sea during the Limnea Stage in connection with the neotectonic uplift of the Earth's crust. Human activity has played an important role in the formation of the present-day landscape of islets. The history of land utilization on Estonian islets can be divided into three main periods. The most intensive exploitation of the islets took place from the middle of the 19th century to 1940. This period of human activity changed the landscape structure of islets towards diversity and variability. During and after World War II the islets became more or less unpopulated. The fields have been left uncultivated, haylands and pastures have overgrown with brushwood—the landscape structure has altered towards poorness and uniformness.

**Key words:** landscape, islets, human impact, Estonia.

### INTRODUCTION

Islands, whose number reaches almost 1500, take up approximately 9.0% of the territory of Estonia. The majority of the islands are located in the West-Estonian Archipelago. The largest islands are Saaremaa (2671 sq km), Hiiumaa (989 sq km), Muhumaa (198 sq km), and Vormsi (93 sq km). They are surrounded by numerous islets. It is namely these islets that make the landscape of the West-Estonian Archipelago unique.

The majority of the islets emerged from the sea during the Limnea Stage of the Baltic Sea, in the Sub-Boreal and Sub-Atlantic climatic periods from 4200 years ago to the present day. Nowadays the islets are very different in terms of their natural state. The ancient relief and lithological composition of sedimentary rocks as well as the hydrological regime of the sea have played an important role in landscape formation.

The soils and vegetation of the islets are young and highly dependent on the geomorphology of the islets. Widespread soil types are saline littoral soils, rendzic leptosols on limestone bedrock, pebble till, and coastal deposits (shingle). Vegetation types found on the islets include seashore (coastal) and dry meadows and forests. Human impact on the geocomplexes of the islets is relatively recent.

The landscape pattern on the islets can be divided into marine (littoral) and supramarine (supralittoral) zones, depending on the strength of the sea water influence. Approximately 30 different types of geocomplexes have been distinguished on the islets. Every landscape unit (geocomplex) could be looked upon as a long-term state in the evolutionary process of landscapes (Kokovkin & Ratas, 1992). The landscape structure of the West-Estonian islets is rather diverse. Eight basic landscape types representing different stages of development (Fig. 1) can be distinguished (Orviku & Sepp, 1972).


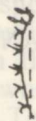

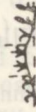

















No.	Islet types	Area, ha	Height, m	M : S	Typical islets	Schematic profiles
I	Very low islets with an active shore	<0.5	0.5—0.8	10 : 0	Valgerahu, Kuivarahu	
II	Very low islets with a dying-out shore	0.5—28.0	0.4—0.8	10 : 0	Näripea, Porgirahu	
III	Low islets with an active shore	<2.0	1.5—2.5	4 (8) : 6 (2)	Sipelgarahu, Lankekare, Hanerahu	
IV	Low islets with a dying-out shore	<5.0	1.2—2.0	5 (8) : 5 (2)	Tagarahu, Esirahu, Mustakivi	
V	Islets of medium height, with Quaternary cover	10.0—20.0	2.0—4.0 (6.0)	4 (5) : 6 (4)	Tondirahu, Kumari, Uuluf	
VI	Islets of medium height, with a nucleus of bedrock	>15.0	2.0—3.0	4 (6) : 6 (4)	Viirelaid, Suurlaid, Vöilaid	
VII	High islets with Quaternary cover	>20.0	4.0—9.0	2 (4) : 8 (6)	Saarnaki, Hanikatsi, Kõverlaid	
VIII	High islets with a nucleus of bedrock	>15.0	3.0—15.0	2 (4) : 8 (6)	Kadakalaid, Vohilaid, Kessulaid	

Fig. 1. The islet landscape types of the Väinameri Sea (after Ratas et al., 1988).

Legend to Fig. 1:

-  reed beds on foreshore
-  coastal meadows on flooded saline littoral soils
-  coastal meadows on wet saline littoral soils
-  marshy meadows on gleysols
-  wet calciferous meadows on gleyic soils
-  coastal ridges with sparse vegetation
-  dry calciferous meadows on rendzic leptosols on coastal deposits
-  dry alvar meadows on rendzic leptosols on limestone bedrock
-  alvar forests on rendzic leptosols on till
-  nemoral forests on gleysols on till
-  deciduous tree
-  juniper
-  boundary between the marine (M) and supramarine (S) microzones

Human activity has played an important role in the formation of the present-day landscape of Estonian islets. The possibility of using the islets for human activity depends on their landscape diversity and their size. Isolation has been of secondary importance, because the majority of the islets lie near the mainland or larger islands.

In this paper, we discuss the landscape problems of islets of the Väinameri (the West-Estonian Inland Sea), located between Saaremaa, Hiiumaa, and the mainland. Their exploitation is typical of all the West-Estonian islets.

### METHODS

There are very limited possibilities for investigating the human impact on the islets during early times. Archeological finds on the islets are scarce, there is hardly any cultural layer, and even paleobotanical research is limited as peat deposit sequences are missing. It is only possible to make suppositions about the land use on the islets in early times, relying on historical materials on the land use on the larger islands and coastal areas of the mainland. Old archival material (maps, population census data, etc.), oral information, and old literature are of essential importance in studying the process of land utilization on small islands.

One indicator of human impact on the natural environment is the distribution of arable land, where changes reveal the process of bringing land under cultivation and the pattern of human activity at different times. The first maps of the islets date from the end of the 17th century.



(Saaremaa, 1934). It is likely that the settlement of the islets was to a great extent the result of estate owners' desire to guard haylands on the islets and, either in conjunction with this or as a separate activity, to secure a supply of fresh fish for their kitchens (Tiik, 1970). The famines of the 17th century also contributed to the exploitation of the islets: fields were planted on them. For some islets, proximity to transportation routes (sailing or sledging) has been an important factor in their settlement. On the majority of the islets, there have been one to three farms; on some (Kessulaid, Kõinastu), even a small village. The number of the inhabitants on the islets varied in time. The most numerous population has been recorded on Kõinastu: 81 inhabitants in 1850 (Saaremaa, 1934).

A comparison of old maps reveals that the most intensive exploitation of the islets took place from the middle of the 19th century to the 1940s (Figs. 2 and 3).

The permanent land uplift has increased the size of the islets during the period of human exploitation (Fig. 4). There have been changes in the elevation and moisture conditions in soils. Social-economic conditions have also influenced the land use on the islets. For example, Vohilaid and Heinlaid were cultivated in connection with the famine in the 1740s.



Fig. 3. Utilization of the Vänameri islets in the beginning of the 20th century.  
1 village, 2 farm(s), 3 windmill, 4 lighthouse, 5 landmark.

(Sæverman, 1934). It is likely that the settlement of the islets was to a great extent the result of estate owners' desire to guard haylands on the islets and, better in conjunction with this, as a separate activity to secure a supply of fresh milk for the kitchen (Timp, 1970). The farmers of the 17th century also continued to exploit the islets' fields; fields were planted on the islets; and, in the 18th century, hay-making routes leading to the islets have been important. The number of the islets has increased, but the islets have been used for different purposes; on some islets, the islets have been used for different purposes. The number of the islets has increased, but the islets have been used for different purposes. The number of the islets has increased, but the islets have been used for different purposes.

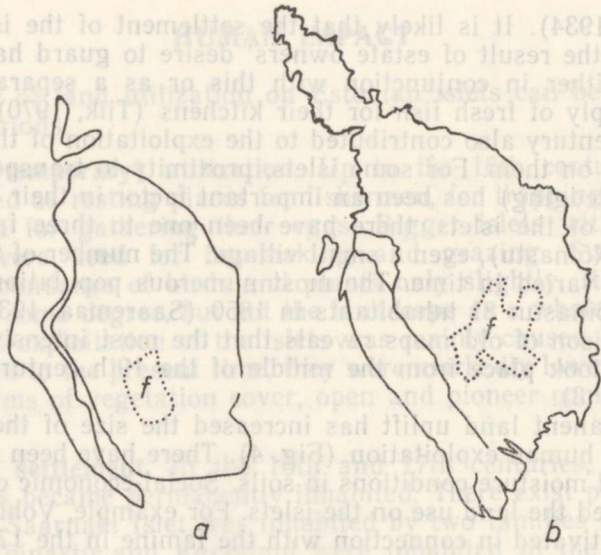


Fig. 4. Change in the configuration of Vohilaid Islet. a early 19th century; b early 20th century; f field.

Fig. 5 shows the land use of three islets (all about 2 sq km in area) at the beginning of the 19th century. On Kessulaid and Kõinastu, where drought-sensitive and moderately moist calcareous soils predominate, arable land accounts for about 10–30% of the area. The grasslands of the islets were used primarily for grazing. Much of the land used for hay-making was found on neighbouring islets. On Tauksi Islet, where overly moist gleysols predominate, fields accounted for less than 1%. The islet was used primarily for hay-making, practically the whole islet used to be mowed.

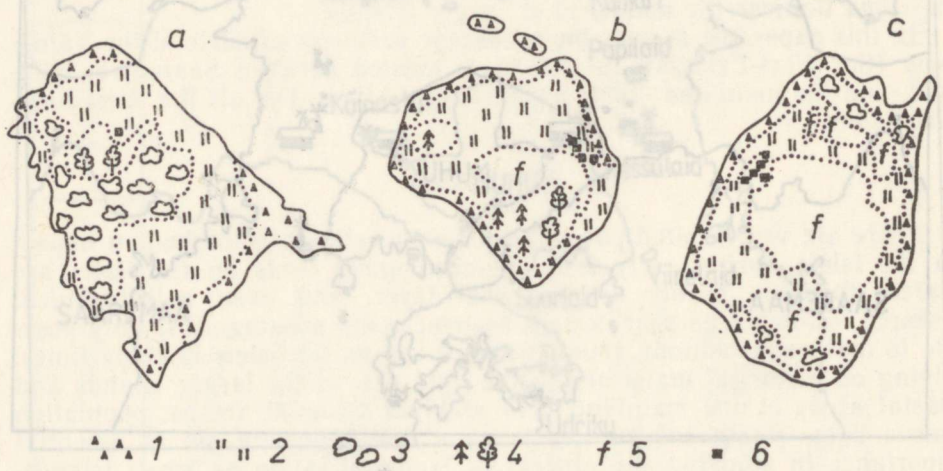


Fig. 5. Land use on Tauksi (a), Kessulaid (b), and Kõinastu (c) islets in the beginning of the 19th century. 1 plantless area, 2 hayland, 3 shrubbery, 4 forest, 5 field, 6 farm.

Through centuries, fields have been located on higher elevations, where rendzic leptosols on limestone bedrock or pebble dominate today. These rather infertile patches have been fertilized with seaweed or manure, since the 1930s also mineral fertilizers have been applied. The crops grown included wheat, rye, potatoes, and vegetables. The largest were fields at Kõinastu—up to 10 ha. Mostly a two- or three- but also a four-field system of crop rotation was used.

Haylands were located on lower ground, with gleysols. As a consequence of mowing, the plant communities of the meadows and wooded meadows which developed and endured were rich in species. A great number of the unsettled islets were used as haylands.

Grazing land was found in the coastal meadows and higher elevations with sparse vegetation. As a consequence of prolonged, unvaried, and more or less steadily intensive use, namely sheep grazing, a characteristic alvar plant community developed. In addition to sheep, horses and heifers were grazed on the islets. Grazing prevented the meadows from becoming overgrown with brush, and regulated the growth of reeds at the shore.

The islets were scantily wooded, so bushes growing on the haylands and pastures were used for firewood. Small groves grew only on a few islets. The main tree species were Scots pine and common birch. Broad-leaved forest was found only on Kõinastu and Hanikatsi, Norway spruce forest occurred on Kessulaid.

Stones were gathered from the crop fields and haylands, to be put on piles or stone fences. The latter formed the boundaries of the lands of farms, or separated patches of arable land. To obtain additional grassland, ditches were dug and swales (mostly between beach ridges) were drained. The islets were also exploited for sand, clay, gravel, and much more rarely limestone; all mostly for local use. For example, there is data about the existence of a limestone quarry on Kaevatsi Islet in 1778 (Tiik, 1970).

Keeping animals played an important role in the economy of islet farms. Animals were raised for household consumption as well as for sale. Fishing was also significant. Every farm had boats and contact with the outside world. At the beginning of the 20th century, there were summer houses on some islets, for example, on Kessulaid (Made, 1923).

In the 19th century, the islets played an important role on the winter sledging routes connecting Saaremaa, Muhumaa, and Hiiumaa islands with the mainland. At the inns on the islets (Fig. 2) horses were rested and travellers sought shelter from bad weather. For example, an inn is known to have existed on Hanikatsi already in 1826 (Tiik, 1970). As many of the islets are located near important shipping lanes, landmarks and lighthouses have been built on them since the mid-19th century. A boarding landmark was built on Harilaid Islet in 1849 and a lighthouse on Viirelaid Islet in 1857 (Luige, 1974). Thus maritime services (lighthouse keepers, rescue crews, pilots, etc.) became an occupational category of some importance to the islanders. In 1764, a law was passed that declared woods within 50 fathoms of the island and mainland shores as protected zones, in order to preserve their silhouettes and make it easier for seafarers to orient themselves (Margus, 1973).

By the end of the 1930s, the landscapes of the West-Estonian islets were greatly affected by human activity. The structure of the landscape became more varied. Fields were interspersed with woods, wooded meadows, clumps of bushes, and meadows. Farms, windmills, and stone fences added to the diversity of the landscape. The way the islets were exploited was environmentally sound and this made them appealing to people.

Altogether about 20 of the West-Estonian islets have been settled at some time. Most of them belong to types VI—VIII in the islet landscape typology (Fig. 1).

**3. Perishing settlement.** During and after World War II, the Estonian islets became more or less unpopulated. Inhabitants left Harilaid Islet already in 1939. In the course of the war, many islanders fled abroad. Most of the islets became part of the frontier zone of the Soviet Union. The islanders were deprived of their boats, and sea travel was restricted. This made living on the islets difficult and many of the residents left for the mainland or larger islands. In the early years of collectivization, fields were still planted on some of the islets, and hay-making and grazing continued. Gradually, the fields were left fallow, hay-making declined, and the islets became grazing land where great herds of young animals were brought, without regard for what the environment could tolerate. This changed the distribution of plant species drastically; the broadleaf groves suffered especially severely. With the cessation of mowing the haylands and wooded meadows began to overgrow with brush. Many rare plants and even valuable grasses found no place to grow. Pine, and in some places birch, began to intrude into juniper groves.

World War II and the new social order that followed ruined the way of life that had evolved on the islets over the centuries.

Beginning in 1957, a great number of the West-Estonian islets have been brought under protection, which at least saved them from overgrazing. The problem of how to protect the rich and varied natural and semi-natural plant communities which used to characterize the islets, has arisen.

Nowadays, over 50% of the vascular plant species of the Estonian flora occur on the West-Estonian islets (Rebassoo, 1970). For many of them this is the limit of their range of distribution. Also some unique coastal plant communities are found on these islets (Rebassoo, 1978). The islets have a diverse and abundant avifauna. The islets are resting places on bird migration routes.

Thus, the landscape structure of the islets has become impoverished after the war. Both cultural landscapes (fields) and semi-natural plant communities (wooded meadows) are disappearing. Today only two islets are inhabited. In recent decades a few have also been used for recreation. In terms of environmental conditions, the islets are suitable as stopping places for water tourism. Considering the landscape types of the islets (Fig. 1), the most suitable for recreational purposes are those in types V—VIII (Ratas, 1983).

Privatization of land may bring about problems with regard to the usage and protection of the islets. The islets currently under protection should, in addition to the preservation of nature, gain importance as resources for education and ecological tourism. Likewise, the islets are valuable objects of investigation for scientists, especially those interested in investigating processes of landscape development. The importance of islets has grown in research involving environmental monitoring.

In order to ensure the protection of nature on the Estonian islands, promote an environmentally friendly economy, and restore forms of human activity that have evolved over millennia, Estonian scientists appealed for the designation of the islands as a biosphere reserve. On 27 March 1990, a proclamation saying that the West-Estonian Archipelago Biosphere Reserve meets international criteria and merits recognition as one of the world's biosphere reserves, was signed.



## CONCLUSION

The West-Estonian islets are young and rapidly evolving. The development of their landscapes has been influenced in major ways by human activity, which is manifested foremost in the vegetation cover, an easily mutable component of the landscape.

In terms of human impact, the islets can be divided into three groups:

1. Islets with various open plant communities unsuitable for grazing or hay-making. There has been no direct human activity on the islets which belong to types I and III of the islet landscape typology (Fig. 1).
2. Islets (landscape types II, IV—VI) with meadow and brush plant communities which have been exploited for grazing and hay-making. Mowing preserved their semi-natural plant communities for centuries.
3. Inhabited islets (landscape types VI—VIII) where in addition to the above-mentioned activities people cut firewood, constructed buildings, and cleared fields for planting. Cultural complexes became part of the landscape of these islets.

As the islets became unpopulated after World War II, a marked decline has occurred in centuries-old patterns of their use. Fields went fallow, meadows and wooded meadows became overgrown with brush, and even grazing on the islets decreased significantly. As a consequence, small patches of woods have grown on the islets. Thus we can see that human activity inhibited the forestation on the islets for centuries.

The impending privatization of the land will change the appearance of the islets' landscape and the distribution of arable land in the near future. Thus, the course of political developments and the form of ownership they produce also determine the course of the development of the landscape.

## ACKNOWLEDGEMENT

We are very grateful to Ain Haas for preparing the English text.

## REFERENCES

- Kokovkin, T., Ratas, U. 1992. Evolution of the islets in the Väinameri, Western Estonia. — Proc. Estonian Acad. Sci. Ecol., 2, 2, 33—49.
- Luige, A. 1974. Eesti tuletornid. Eesti Raamat, Tallinn.
- Maide, J. 1923. Kesselaid. — Loodus, 4, 223—230.
- Margus, M. 1973. Kaitsemetsadest Eesti meresaaudel ja rannikul. In: X Eesti Loodusuurijate päeva kokkuvõtted, ENSV TA Rotaprint, Tallinn, 38—42.
- Orviku, K., Sepp, U. 1972. Stages of geological development and landscape types of the islets of the West-Estonian Archipelago. In: Estonia. Geographical Studies. Tallinn, 15—25.
- Ratas, U. 1983. Looduskaitse ja puhkus Väinamere saudel. In: Looduskaitse ja puhkus. Valgus, Tallinn, 90—97.
- Ratas, U., Puurmann, E., Kokovkin, T. 1988. Genesis of Islets Geocomplexes in the Väinameri (the West-Estonian Inland Sea). Acad. Sci. Estonian SSR, Department of Chemistry, Geology and Biology, Tallinn.
- Rebassoo, H.-E. 1970. Milline on laidude taimestik ja kuidas ta kujuneb. — Eesti Loodus, 6, 374—377.
- Rebassoo, H.-E. 1978. Hiiumaa laidude kaasaegne seisund ja kasutamisevõimalused tulevikus. In: Põllumajandusmaastiku ökoloogia. ENSV TA Rotaprint, Tallinn, 26—28.
- Saaremaa. Maateaduslik, majanduslik ja ajalooline ülevaade. 1934. Eesti Kirjanduse Seltsi kirjastus, Tartu.
- Tiik, L. 1970. Saared ja laiud Hiiumaa ümber. — Eesti Loodus, 9, 525—527.