

Additional Material

Physical features of the site

The Nemunas delta lowland is part of the lower reaches of Pajūris. Its relief was formed in Pleistocene by a glacier in the lower reaches of Nemunas. Later it was changed by glacier-dammed lakes and deltaic sediments of Nemunas silt. The Curonian Lagoon started forming in the Littorina Sea period 5000-4500 years ago. The delta lowlands are still changed by the branches of the Nemunas delta (Gilija, Rusnė, Atmata, Skirvytė) and the deltas of Minija, Šyša, Tenenis and other rivers merging with the Nemunas delta. Owing to a growing amount of silt at the mouth of Nemunas, the delta is slowly increasing and moving towards the Curonian Lagoon. For example, since 1800, the delta at the mouth of Skirvytė moved westwards by over 2 km. The Nemunas delta starts 48 km from the mouth (beneath Tilžė), where Nemunas splits into the Rusnė and Gilija branches. Thirteen kilometres from the mouth (near the town of Rusnė) Rusnė splits into Atmata and Skirvytė. Every year, Nemunas brings an average of some 21 km² of water to the Curonian Lagoon through the delta. The bulk of the annual amount of water (approximately 41-46%) is brought in spring. Some 16-29% of Nemunas discharge goes to Gilija and the rest of it goes to the Rusnė branches: Skirvytė (48-54%) and Atmata (23-30%). In addition, the delta is crossed by a number of small streams, oxbows, channels, and detached branches that have turned into streams or oxbow lakes. The Nemunas delta lowland descends from the east to the west. Its average height is 0.6-1.2 m above sea level. In the east, the delta lowland starts with a wide Nemunas floodplain. A flat lowland area extends westwards of Šilutė. The delta is dominated by alluvial deposits. There are moors buried under alluvial deposits. Ventė–Kintai surroundings afford a view of peripheral moraine formation crests. Some 25% of the delta area is covered by swamps (Aukštumalė, Rupkalviai, Medžioklė, Berštai and other). The delta includes the largest Lithuanian island of Rusnė (area – 45.2 km²) and the largest lake of estuary origin, Krokų Lanka (area – 7.8 km²), which formed after Nemunas silt partitioned part of the Curonian Lagoon. The mouth of the River Nemunas is surrounded by very fertile water meadows. Spring floods last for an average of 60 days. During floods, the water level in the delta rises to up to 2-3 m, flooding large areas (up to 20,000 ha). Some 5-20t/ha of silt is deposited in the delta during floods every year.

The average air temperature of the warmest month (July) is +16.8°C and that of the coldest month (January) is –2.6°C. The annual amount of precipitation averages 810 mm.

Physical features of the catchment area

The surface of the current regional park is covered by a shallow low-lying (the average height above sea level is 2–5 metres) alluvial Nemunas delta plain, whose relief was formed in Pleistocene by a glacier in the lower reaches of Nemunas during the last glacial period. Later this surface was changed by glacier-dammed lakes and deltaic sediments. All of these processes have been accompanied by neotectonic sinking (at present is makes up 1–2 mm per year). The transport and accumulation of alluvium have intensified as a result of intensifying agriculture in the Nemunas basin, deforestation and the washing away of large areas by surface water. It accumulated in the delta plain, river mouths, blocking the opening of some depositaries. Detached oxbows have turned into separate lakes (oxbow lakes). Deltaic deposits have partitioned Lake Krokų Lanka, which used to be a bay before. A large amount of silt has resulted in fast growth of the front part of the delta and formation of new silt deposits and islands (Briedžiai, Kubiliai, Triušiai, Kiemas, Vitas). Owing to such deltaic deposition, the deltaic bank has moved 4–8 km westwards. In addition, this process still continues in the Rusnė avandelta. Every year, silt deposits move towards the lagoon by a dozen of metres.

The park is covered by forests (10.3%), water bodies (17.3%), swamps (13.0%), agricultural land (51.6%), settlements (0.6%) and other areas (7.2%). It embraces part of the Nemunas delta and Ventės Ragas, the Rusnė island, the nearby islands of Ragininkai and Galzdonai, Lake Krokų Lanka, Aukštumalė, Rupkalviai and Medžioklė swamps. The Nemunas Delta Regional Park is part of the alluvial deltaic plain landscape. There are three catchments: Šilutė, Kintai and Rusnė. Šilutė is the largest catchment extending from the south-eastern boundary of the park to the lower reaches of the River Minija. There are three units of landscape: a wavy fine sandy loam plain scenery, largely swampy sandy loam floodplain scenery and

largely swampy sandy loam non-floodplain scenery. The southern part of the Kintai catchment is covered by the landscape of a chain of moraine hills containing two sceneries: largely wavy sandy loam plain and wavy fine sandy loam plain sceneries. The Rusnė catchment covers the youngest part of the delta. This plain and the lowermost part of the park have the densest network of surface waters. The catchment is dominated by a loamy floodplain scenery with summer and winter polders and fertile and infertile meadows.

Most of the Nemunas Delta Regional Park territory, except washed-away raised moraine surfaces, is affected by various bog formation processes. The main upland bog and lowland bog complexes of the park are as follows: the Aukštumala bog (3,018 ha, actually unaffected – 1,017 ha), the Rupkalviai bog (3,410 ha, actually unaffected – 166.7 ha), the Medžioklė bog (1,450 ha, actually unaffected – 208.1 ha), the Berštai bog – 517 ha, the Leitgiriai bog (166 ha). The very valuable deltaic upland bogs create favourable conditions for the growth of unique plant communities. These are the only deltaic upland bogs of the kind in the Lithuania.

The Nemunas Delta Regional Park is part of the Pajūris Lowland climatic sub-district. The average air temperature in the Nemunas delta ranges between -3.5 and -2.5°C in January, +5.0°C in April, +17°C in July, +7.0 to +7.5°C October. The minimum air temperature in winter: -23°C (average), -35°C (maximum). The first autumn frosts on the surface of the ground occur on around 10 October. Frost affects an average of 80 cm of the ground. The frost period lasts from 15 December to 3 April. A steady snow cover forms on 25 to 30 December. The thickness of the snow cover averages 10–15 cm (30–35 cm in harsh winters). The snow cover persists for 75–80 days per year. The last spring frosts end on 10–12 May. The vegetation period without frosts lasts 160–170 days. The average annual amount of precipitation in the park territory is 700–750 mm per year. The bulk of precipitation falls in September (75–85 mm) and the smallest amount of it falls in March (35–40 mm). South-western, north-eastern, south-eastern and north-western winds prevail in the Nemunas Delta Regional Park in January, north-western, south-eastern, western and eastern winds in April, western, eastern, north-western and south-eastern winds in July, western, eastern, south-western and north-eastern winds in October. Total solar radiation averages 85 kcal/cm² per year in most of the park territory and rises to 87 kcal/cm² per year in the western part of the park (the Rusnė island near the lagoon).

Ecosystem services

Hydrological values

In terms of hydrographical regionalism, the Nemunas Delta Regional Park is part of the Baltic Sea coast area. Inland waters of the park include the eastern periphery of the water area of Curonian Lagoon with Kniapūpas Bay and a dense hydrographic network of inland waters – the deltaic river system of Nemunas, river mouth channels, lagoon-origin (Krokų Lanka) and oxbow lakes, polder canals, fishing ponds, deltaic upland and lowland swamp complexes, and shallow ground waters.

Most of the Nemunas Delta Regional Park (except the sloping part of Ventės Ragas) lies within the Nemunas basin. The stream channel of the main river system artery – the River Nemunas (Rusnė – Skirvytė – Tiesioji to be precise) (some 35 kilometre-long) coincides with the southern periphery of the regional park. The northern periphery of the park is also connected with the rivers: the lower reaches of Minija and Tenenis, the left tributary of Minija. The mouth of the River Veržė (Veizas), a right tributary of Nemunas, is on the south-easternmost periphery of the park between Šilininkai and the Galzdonai island.

The Nemunas Delta Regional Park is crossed by the rivers Leitė, Voryčia (right tributaries of Rusnė); Šyša, Minija (right tributaries of Atmata), Upaitė, a branch of the mouth of Minija (flows into Kniapūpas Bay), Aukštumala (an Atmata branch flowing into the Lake Krokų Lanka), Pamatukas, Kampė, Kurpinė (the small tributaries of Krokų Lanka), Purvalankis (a lake canal connecting it with the River Minija), and Rupkalvė, a canalised left tributary of Šyša.

Rusnė, the main branch of the delta of the River Nemunas, splits into two branches of the river mouth near the town of Rusnė: Atmata (13 km) and Skirvytė (9 km), with the River Pakalnė (9 km) branching off from it several hundred metres away. Leaving its oxbow (the old Skirvytė), on the right bank, the Rusnė island, just before the river mouth, Skirvytė splits into two branches: Tiesioji and Vytinė. Tiesioji (the southern branch), which divides the Briedžiai island from the Kaliningrad Region seacoast, coincides with the boundary of the park, while Vytinė splits into a number of smaller canals surrounding deltaic deposits

delivered by Skirvytė.

Pakalnė splits into two canals, namely Rusnaitė and Vorusnė (Skatulė). In addition, there are two independent stream systems on the Rusnė island, which are separated from the main streams by deltaic deposits. These are the Naikupė stream, which has no tributaries and flows directly into the Curonian Lagoon, and the Ulmas stream, a left tributary of Atmata, which has a dense network of regulated streams and canals.

The water yield of the main branches of Nemunas flowing across of the park or along its peripheries is distributed as follows: an average of 23% of Rusnė water per year flows in Atmata and 77% in Skirvytė. During spring floods, 35% of water flows in Atmata, 62% in Skirvytė and 3% in Pakalnė. River silt is distributed in a similar way, with 5–20 t/ha of alluvial sediments deposited in the delta during spring floods every year.

An ice covering starts forming in Nemunas and its tributaries, except Minija, on 19–23 December. Ice drifts occur on 16–20 March.

Lakes cover 909.1 ha of Nemunas Delta Regional Park. In terms of their origin, these lakes are divided into 3 groups: lagoon-origin, oxbow and upland bog lakes. The first group includes Krokų Lanka covering an area of 787 ha. It is the largest lake of the regional park: it is 4.1 km in length, its maximum width is 3.3 km and the maximum depth is 2.5 m. The lake has low-lying sandy and boggy shores in the northern part. The shallows of Krokų Lanka are almost entirely covered by bulrushes, reeds and cattails.

Fluvial (oxbow) lakes in the territory of the park are concentrated on the Rusnė island (the young delta) and floodplains in Paleičiai–Girininkai–Šilininkai surroundings. The total area of oxbow lakes is 92.6 ha. The largest of them are Didysis Žiogis (14.6 ha), Dumblis (10.9 ha) and Kalnupžiogis (4.4 ha).

Small lakes of the Aukštumala upland bog, most of which are located in the convex centre and unaffected eastern part of the bog (their total area is some 16 ha), form a specific group.

The Nemunas delta is the only territory in Lithuania where river water filtering through the banks replenishes ground water reserves rather than ground water feeds rivers.

Depending on their severity, floods in Pamarys cover quite large areas of the Nemunas delta. The territory flooded in the Nemunas delta extends from the Rambynas hill to the Curonian Lagoon. The total area of the flooded territory is approximately 600 km², including some 400 km² on the right bank delta belonging to Lithuania. In some places water covers an area of up to 56 km from the river bed. Owing to higher embankments in the left bank delta belonging to the Kaliningrad Region, water covers a much smaller area of up to 1.5 km. Only near Skirvytė it may spread up to 5 km.

Spring, autumn and winter floods covering large areas of summer polders, except the chain of moraine hills in Ventės Ragas, winter polders and relatively higher areas of summer polders, are typical of Pamarys. Spring floods in the lower reaches of Nemunas start on around 19 March. The average duration of floods is 16 days and the maximum duration is 51 days. Floods reach the maximum level 6–8 days after the river overflows its banks. The average water level in the park territory near Rusnė during floods is 150–200 cm. In order to protect settlements and agricultural land from floods and high water (irregular floods), embankments have been built in Lithuania since the start of the last century. Embankments surround separate territories, whose name is derived from the Dutch word ‘polder’. Polder is a low-lying drained (usually mechanically) and cultivated area protected from regular or periodic floods by embankments. There are two types of polders in the Nemunas lowland: winter and summer. They differ in the height of embankments and the likelihood of flooding. The higher ones, winter polders, are built to protect settlements and cultivated fields. They may be flooded only during extreme floods occurring once in a century. The purpose of summer polders is to protect meadows from floods in the summer – autumn period, so that cultivated meadows are not affected by water. These polders are flooded during spring floods. Summer polders (there are 17 of them) occupy 82% of flooded polder areas.

Polders have been built in Lithuania since the start of the last century. The first polder was built in Uostadvaris (on the Rusnė island) in the lowland of Nemunas in 1907. It covers an area of 1,952 ha. Eight polders covering a total area of 7,500 ha were built in Lithuania prior to World War II. The first summer polder system was arranged as late as 1954 (Smalkai summer polder). Some 1,400 km of different-size ditches have been dug in polders.

Social and cultural values:

The most impressive structures reflecting the relationship between the population of the region and water are the Uostadvaris and Ventė lighthouses, the engineering complex of the old water lift station and the old polder engineering equipment. There is a unique folk architectural ensemble of the Skirvytėlė village. The

Mingė village is called the Venice of Lithuania, as the River Minija has become its main street. Rusnė has a distinctive old town.

The majority of the region's population were "water culture" people. Many of them have been fishing in the Nemunas delta and the seacoast since ancient times. A specific lifestyle, traditions, fishing tackle and fishing methods, homesteads and buildings of local fishermen have developed over hundreds of years. Reed craftsmen would cut reeds on the seacoast in winter and use them for roofing local buildings. Water meadows in the Nemunas delta would be used by stockbreeders. Newcomers would settle in the peripheries of Rupkalviai, Aukštumalė, Berštai and Medžioklė swamps, which would be partly drained and used for agriculture and stockbreeding. They would also mine and export peat.

Nowadays important site for nature conservation, agriculture and fishery, science and education, a unique ethnocultural district, the Aukštumalė bog is one of the first bogs studied in detail in the world.

Current scientific research and facilities:

- Monitoring of species and habitats included in Annexes of the EU Habitat and Bird directives (carried out by the direction of Nemunas delta regional park and scientific organisations);
- Monitoring of water level in Aukštumalė swamp (carried out by the direction of Nemunas delta regional park);
- Monitoring of dynamic of rare mammals and breeding birds (carried out by the direction of Nemunas delta regional park);
- Hydrological monitoring of wetland (carried out by the direction of Nemunas delta regional park);
- Landscape monitoring of regional park territory (carried out by the direction of Nemunas delta regional park);

Since 1929, birds' ringing station at Ventės Ragas cape exists, more than 60-70 thousand migratory birds are ringed annually.

Hydrological and ichthyologic studies are carried out by Vilnius University Ecological institute.

Current communications, education and public awareness (CEPA) activities related to or benefiting the site

An information centre providing information on leisure opportunities in the Nemunas delta is located on the Rusnė island. The regional park directorate offers sightseeing trips around the Nemunas delta by bike, horse and car, photo-hunting, bird watching, cheap amateur fishing licences (for foreign tourists as well), an opportunity to enjoy holidays at local residents' homesteads, park campsites and guesthouses, a young naturalist camp, boat, bike, tent and other tourism equipment rental, as well as information for tourists.

There are recreational areas – the bank of Nemunas in front of the town of Rusnė and the Šyša village, Švyturys surroundings, the Šilininkai recreational complex and its surroundings.

The most popular activities in the delta are amateur fishing, which is allowed everywhere except the Avandelta reserve, Lake Krokų Lanka and Kniaupas Bay. In winter, thousands of ice-fishing enthusiasts gather on the frozen Curonian Lagoon.

Very popular water tourism is also allowed in all water bodies except the abovementioned ones. One can canoe in Nemunas branches, the rivers Minija, Šyša and Leitė to admire the distinctive beauty of the surroundings. There are three quite big ports in the regional park, namely Šilutė, Rusnė, Uostadvaris ports, and a number of quays, such as Šilininkai, Rusnė, Pakalnė, Šyša, Ventė, Šturmai and Minija quays.

One can travel in the Nemunas Delta Regional Park by car, by bike or on foot. There are nature trails, an ornithological route with bird watching towers.

Boats, bikes and other tourism equipment are available for rent at the regional park information centre. They are also rented by private persons.

There is a museum at the Ventės Ragas ornithological station where one can familiarise oneself with the nature of the delta, bird migration studies and the history of bird ringing, and an ethnographic homestead-museum in the Skirvytėlė village.

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