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Assessment of the Conservation Value of Abandoned Land on Gogland Island, Baltic Sea

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Abstract: Gogland Island, located in the Gulf of Finland in the Baltic Sea, was densely populated in the past but has been nearly abandoned since the Second World War. The self-restoration of wildlife takes place there. Recent research on the island aimed to evaluate the conservation value of this process. It was expected that the island would demonstrate a standard for the perfect state of protected areas of the boreal zone of Europe. The island has been overgrown with forests; open areas occupy insignificant parts and tend to shrink. Picturesque landscapes have been formed, but the conservation value of these areas are questionable as the biodiversity is rather low there. They contain "empty forest" that is partly impassable. The island demonstrates that to achieve the maximum effect for biodiversity conservation, the abandonment of land without any management would be insufficient. The fate of the island partly supports the concept of Pleistocene rewilding: a mosaic of forests and meadows, maintained by ungulates, should be considered a normal state of environments.

Keywords: afforestation; island; normal state of environment; threatened species; biodiversity

Citation: Popov, I.; Iurmanov, A.; Abakumov, E. Assessment of the Conservation Value of Abandoned Land on Gogland Island, Baltic Sea. *Land* **2023**, *12*, 1946. https://doi.org/10.3390/land12101946

Academic Editor: Alejandro Javier Rescia Perazzo

Received: 11 September 2023
Revised: 15 October 2023
Accepted: 17 October 2023
Published: 20 October 2023

1. Introduction

The establishment of protected areas where anthropogenic activities are either restricted or prohibited is one of the most effective measures for environmental protection [1,2]. However, in Europe, these areas are being created in places that have long been subjected to anthropogenic pressures; felling, grazing, the extermination of wild animals, and other human activities have progressed in these locations over several thousands of years. Perceptions about the normal state of the environment have shifted over time [3–5]. Therefore, it is no longer clear how to manage protected wildlife areas: either to strive to eliminate all human activities or somehow influence the areas to improve their state. To answer this question, it is important to assess areas that have existed for a long time under extremely weak anthropogenic impacts. Gogland Island located in the Gulf of Finland in the Baltic Sea is one such area. It has been nearly abandoned since the Second World War, although the nearest mainland is densely populated and suffers from strong anthropogenic pressure. The island was (and still is) not a protected area officially, but in fact, it was strongly protected. Access to the island was limited for a long time because it is located close to the state border zone and has military significance. In the 1990s, several changes were made in this regard, and since then, the island has been visited by various researchers. In particular, the Russian Geographical Society has been carrying out expeditions to the island for several years, in which we took part. Our research aimed to characterize the habitats and biodiversity of the island and to reveal the objects representing special value in terms of environment conservation. It was expected that the island would demonstrate a standard for the perfect state of protected areas of the boreal zone of Europe.

2. Materials and Methods

2.1. Study Area

Gogland Island has the shape of an elongated oval that is 11 km long and 1.5–3 km wide. The distance to the mainland is 44 km in the north and 55 km in the south. There are several smaller islands at a distance of 10–18 km around it. Before World War II, Gogland belonged to Finland and was densely populated; the population was approximately 1000 people. They lived in several settlements and were mainly engaged in fishing, seal hunting, and sea transport. Part of the island was used for agriculture. To arrange farmlands, a system of dams and ditches was created in the central part of the island. In the 1920s, the island became a recreational place; restaurants and hotels were built and their number increased. The number of visitors reached up to 10,000 per summer [6]. After the Second World War, the island was annexed to Russia, the local population was evicted, and economic activity was essentially stopped [7]. The presence of humans on the island has been insignificant; several military posts, a weather station, and two lighthouses occupy a small portion of the island.

2.2. Methodology

To assess the state of the island, we used the approaches developed during the design and survey of the protected areas [8,9]. To determine the nature conservation value of an area, the research focused on the variety of habitats and the objects demonstrating the following: high biodiversity, concentrations of animals, a presence of threatened species (listed in the regional red data books or classified as threatened in the IUCN Red List), uniqueness, and aesthetic value. Particular attention was paid to the registration of vertebrates or traces of their occurrence because these animals are good indicators of the state of the environment. Since they require a relatively large space, their presence reflects ecosystems that include other animals and plants.

To collect this information, the following methods were used:

1. Literature search: We gathered publications on Gogland Island by examining the Russian Science Citation Index [10] and Scopus databases [11], as well as by searching in the libraries of the Russian Academy of Sciences and St. Petersburg State University.
2. Survey of the island: We walked around the island along the coastline and crossed it lengthwise, i.e., from north to south, and in several places from east to west or vice versa, and observed the inland water bodies. A schematic map of the habitats was composed by combining the observation results with aerial pictures. Moreover, we focused on the animal species that had not been sufficiently studied by other researchers. We registered bats during the nighttime with the assistance of an ultrasonic detector (Patterson D 200) and photographed them. To identify bat species, we used sound records [12]. To study the carnivorous mammals, we installed camera traps (Bushnell Nature View). To attract the animals, we used fish as bait (Crucian carp *Carassius carassius* caught on-site). Our surveys were performed during four expeditions: September 2015, August 2018, June 2021, and September 2022.

3. Results

3.1. Habitats

The island was almost completely overgrown with trees. Most of the forests were composed of pines (*Pinus sylvestris*) and spruce (*Picea abies*), and fallen tree trunks were numerous. In some places, windblows occupied an area of several hectares. Such areas were practically impassable because they were comprised of a continuous layer of fallen trunks and dense thickets of young trees. Open areas occupied an insignificant part of the island. Arboreal vegetation was scarce only in rocky areas, where there was no continuous soil cover (Figures 1 and 2). In some places, signs of forest fires were evident, but even these plots were covered by dense thickets of small trees. There were several meadows near the meteorological station and the military posts, as well as on the sites of abandoned

villages. However, the overgrowth of arboreal vegetation still progressed there. Relatively stable meadows were found only near houses.

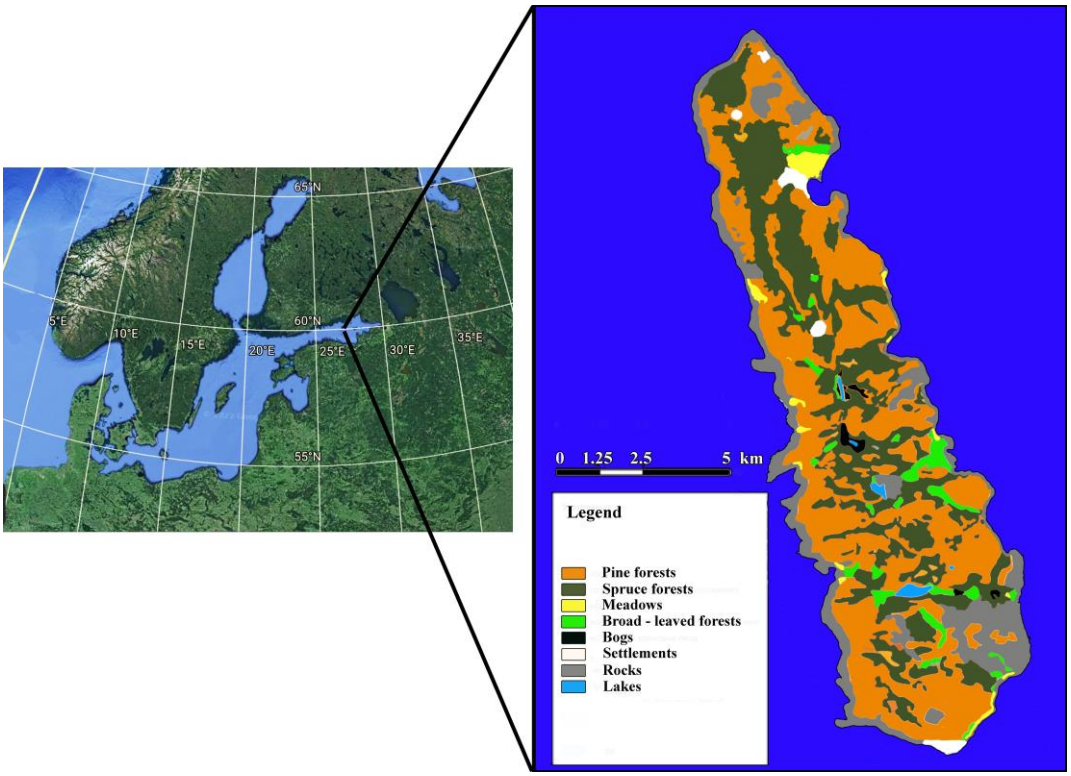

Figure 1. A scheme of habitats on Gogland Island.

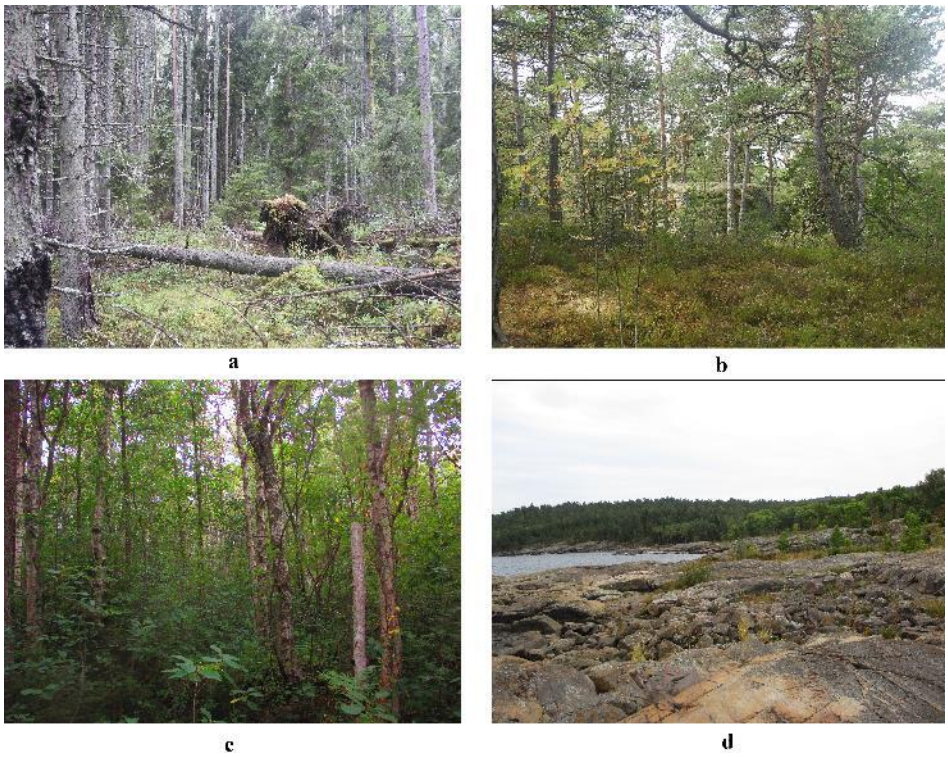

Figure 2. Habitats of Gogland Island: spruce forests (**a**), pine forests (**b**), broad-leaved forests (**c**), and rocks (**d**).

3.2. Biodiversity

During the re-exploration of the island by biologists in the period of 1990–2000, 663 species of vascular plants [13,14], 178 species of mosses [15], and 385 species of lichens [16] were recorded. This list of local flora and fauna has been minimally supplemented [17], the process of which is gradually continuing. The number of known species is higher on the nearest mainland. Relevant estimates were not made for all taxa, but it is known that there are at least 824 species of higher plants [18] and 722 species of lichens [19]. At the same time, six species of vascular plants and several species of mosses not registered on the mainland were recorded on the island [14,17].

As for the animals, most of the data concern vertebrates (the invertebrates are understudied and comparing the island with the mainland in this respect is problematic). There are three species of amphibians (the toad *Bufo bufo*, common frog *Rana temporaria*, and common newt *Lissotriton vulgaris*) and three species of reptiles (the common viper *Vipera berus*, grass snake *Natrix natrix*, and common lizard *Zootoca vivipara*) [20]. Such numbers are slightly higher on the nearest mainland, where six other species of reptiles and amphibians occur.

During the studies performed in the 2000s, 113 bird species were registered [21]. We also observed some of them and added one (the grey heron *Ardea cinerea*) (Table 1). The total number of bird species for the area around the island is two times larger [22].

Table 1. Species of birds recorded on Gogland Island.

No.	Species	IUCN Category	No.	Species	IUCN Category
1	Arctic loon *Gavia arctica*	LC	38	Northern lapwing *Vanellus vanellus*	LC
2	Red-throated loon *Gavia stellata*	LC	39	Arctic jaeger *Stercorarius parasiticus*	LC
3	Great crested grebe *Podiceps cristatus*	LC	40	Mew gull *Larus canus*	LC
4	Mute swan *Cygnus olor*	LC	41	European herring gull *Larus argentatus*	LC
5	Whooper swan *Cygnus cygnus*	LC	42	Lesser black-backed gull *Larus fuscus*	LC
6	Tundra swan *Cygnus columbianus*	LC	43	Great black-backed gull *Larus marinus*	LC
7	Greylag goose *Anser anser*	LC	44	Black-headed gull *Larus ridibundus*	LC
8	Greater white-fronted goose *Anser albifrons*	LC	45	Arctic tern *Sterna paradisaea*	LC
9	Barnacle goose *Branta leucopsis*	LC	46	Common tern *Sterna hirundo*	LC
10	Brent goose *Branta bernicla*	LC	47	Razorbill *Alca torda*	LC
11	Mallard *Anas platyrhynchos*	LC	48	Common woodpigeon *Columba palumbus*	LC
12	Common teal *Anas crecca*	LC	49	Stock dove *Columba oenas*	LC
13	Common eider *Somateria mollissima*	NT	50	Common cuckoo *Cuculus canorus*	LC
14	Tufted duck *Aythya fuligula*	LC	51	European nightjar *Caprimulgus europaeus*	LC
15	Velvet scoter *Melanitta fusca*	VU	52	Common swift *Apus apus*	LC
16	Common goldeneye *Bucephala clangula*	LC	53	Eurasian wryneck *Jynx torquilla*	LC
17	Red-breasted merganser *Mergus serrator*	LC	54	Black woodpecker *Dryocopus martius*	LC
18	Goosander *Mergus merganser*	LC	55	Great spotted woodpecker *Dendrocopos major*	LC
19	Grey heron *Ardea cinerea*	LC	56	White-backed woodpecker *Dendrocopos leucotos*	LC
20	White-tailed sea-eagle *Haliaeetus albicilla*	LC	57	Three-toed woodpecker *Picoides tridactylus*	LC
21	Greater spotted eagle *Clanga clanga*	VU	58	Eurasian skylark *Alauda arvensis*	LC
22	Northern goshawk *Accipiter gentilis*	LC	59	Barn swallow *Hirundo rustica*	LC
23	Eurasian sparrowhawk *Accipiter nisus*	LC	60	Western yellow wagtail *Motacilla flava*	LC
24	Eurasian buzzard *Buteo buteo*	LC	61	White wagtail *Motacilla alba*	LC
25	Rough-legged buzzard *Buteo lagopus*	LC	62	Tree pipit *Anthus trivialis*	LC
26	Eurasian hobby *Falco subbuteo*	LC	63	Meadow pipit *Anthus pratensis*	LC
27	Peregrine falcon *Falco peregrinus*	LC	64	Rock pipit *Anthus petrosus*	LC
28	Western capercaillie *Tetrao urogallus*	LC	65	Red-backed shrike *Lanius collurio*	LC
29	Common crane *Grus grus*	LC	66	Northern wren *Troglodytes troglodytes*	LC
30	Corncrake *Crex crex*	LC	67	Dunnock *Prunella modularis*	LC

Table 1. *Cont.*

No.	Species	IUCN Category	No.	Species	IUCN Category
31	Common ringed plover *Charadrius hiaticula*	LC	68	European robin *Erithacus rubecula*	LC
32	Eurasian oystercatcher *Haematopus ostralegus*	NT	69	Thrush nightingale *Luscinia luscinia*	LC
33	Green sandpiper *Tringa ochropus*	LC	70	Common redstart *Phoenicurus phoenicurus*	LC
34	Common greenshank *Tringa nebularia*	LC	71	Whinchat *Saxicola rubetra*	LC
35	Common sandpiper *Actitis hypoleucos*	LC	72	Northern wheatear *Oenanthe oenanthe*	LC
36	Eurasian woodcock *Scolopax rusticola*	LC	73	Eurasian blackbird *Turdus merula*	LC
37	Jack snipe *Lymnocryptes minimus*	LC	74	Fieldfare *Turdus pilaris*	LC
75	Redwing *Turdus iliacus*	NT	95	Great tit *Parus major*	LC
76	Song thrush *Turdus philomelos*	LC	96	Eurasian blue tit *Cyanistes caeruleus*	LC
77	Mistle thrush *Turdus viscivorus*	LC	97	Eurasian treecreeper *Certhia familiaris*	LC
78	Marsh warbler *Acrocephalus palustris*	LC	98	Yellowhammer *Emberiza citrinella*	LC
79	Common grasshopper warbler *Locustella naevia*	LC	99	Reed bunting *Emberiza schoeniclus*	LC
80	Garden warbler *Sylvia borin*	LC	100	Common chaffinch *Fringilla coelebs*	LC
81	Eurasian blackcap *Sylvia atricapilla*	LC	101	Brambling *Fringilla montifringilla*	LC
82	Common whitethroat *Curruca communis*	LC	102	European greenfinch *Chloris chloris*	LC
83	Icterine warbler *Hippolais icterina*	LC	103	Eurasian siskin *Spinus spinus*	LC
84	Willow warbler *Phylloscopus trochilus*	LC	104	Common rosefinch *Carpodacus erythrinus*	LC
85	Greenish warbler *Phylloscopus trochiloides*	LC	105	Red crossbill *Loxia curvirostra*	LC
86	Common chiffchaff *Phylloscopus collybita*	LC	106	Eurasian bullfinch *Pyrrhula pyrrhula*	LC
87	Wood warbler *Phylloscopus sibilatrix*	LC	107	House sparrow *Passer domesticus*	LC
88	Goldcrest *Regulus regulus*	LC	108	Common starling *Sturnus vulgaris*	LC
89	Spotted flycatcher *Muscicapa striata*	LC	109	Eurasian golden oriole *Oriolus oriolus*	LC
90	European pied flycatcher *Ficedula hypoleuca*	LC	110	Siberian jay *Perisoreus infaustus*	LC
91	Red-breasted flycatcher *Ficedula parva*	LC	111	Northern nutcracker *Nucifraga caryocatactes*	LC
92	Long-tailed tit *Aegithalos caudatus*	LC	112	Eurasian magpie *Pica pica*	LC
93	Willow tit *Poecile montanus*	LC	113	Carrion crow *Corvus corone*	LC
94	Coal tit *Periparus ater*	LC	114	Common raven *Corvus corax*	LC

Seven mammal species were recorded on the island in the 2000s: red fox *Vulpes vulpes*, raccoon dog *Nyctereutes procyonoides*, European mink *Mustela lutreola*, mountain hare *Lepus timidus*, red squirrel *Sciurus vulgaris*, common shrew *Sorex araneus*, and yellow-necked mouse *Apodemus flavicollis* [23]. We added four species of bats to them: Daubenton's bat *Myotis daubentoni*, pond bat *Myotis dasycneme*, Nathusius's pipistrelle *Pipistrellus nathusii*, and northern bat *Eptesicus nilssonii*. Two species of seals were registered on the island, ringed seal *Pusa hispida* and grey seal *Halichoerus grypus*, but they only visit it in small numbers. The number of mammal species is 4–5 times higher on the nearest mainland [24].

In the past, ungulates existing on the island were reported. Feral goats and sheep were included in the list of local fauna. Their number was estimated as 100–200 in the 2000s. Moreover, the arrival of white-tailed deer *Odocoileus virginianus*, which are bred on the nearest mainland (Finland), was recorded. The other visitor was the Eurasian lynx *Lynx lynx* [23]. However, both had not settled on the island. During our survey, we did not find any traces of ungulates or other large mammals over most of the island, with only a small number of goats and sheep kept at the lighthouses.

3.3. Concentration of Animals

The island is located within a zone of the North Atlantic bird flyway. Numerous birds fly over the island during spring and autumn. Some birds linger there for some time under certain circumstances (during storms) [21], but the particular role of the island as a migratory stopover has not been noted. It is likely that the flyway of bats also passes there. Our bat surveys took place in August–September, which is a season of bat migrations.

3.4. Threatened Species

Several dozen plant species occurring on the island are listed in the local red data books [25]. However, they are not threatened on a global scale. The island is at the edge of their range, which is mostly located outside of Russia. Regarding animals, the most remarkable species is the European mink, which is a critically endangered species (it has almost disappeared over most of its native range because of competition with an invasive species of American mink, *Neovison vison*) [26]. It had been observed on the island in 2003 [23], but no other information about this was obtained afterwards. We found the scat of minks on two occasions in 2018 and 2021. However, the registration of minks using camera traps failed (foxes and raccoon dogs were photographed). Several other vertebrate species (bats and some birds) are listed in the regional red data books, but most of them are classified in the "Least Concern" category in the IUCN Red List. One of the local species, the velvet scoter, is considered vulnerable on a global scale [27], and three species are considered near-threatened: the pond bat [28], Eurasian oystercatcher [29], and northern lapwing [30]. The northern lapwing was observed once in 2004 [21], but its stable existence on the island is hardly probable because of the lack of open areas. Islands often serve as a refuge for pinnipeds, which are threatened animals, but in this case, they were extremely small in number [31]. They prefer small islands without trees.

3.5. Uniqueness and Aesthetic Value

There were many picturesque objects on the island, including rocks at the seashore, steep (up to 50–70 m) hills, grottoes, streams, lakes surrounded by rocks, and trees on rocks. The common pine and spruce often acquire unusual forms when they grow on stones. A unique object was a "stone river", which is a plot without vegetation covered with rounded boulders, similar to a river bottom; there were several such rivers. Several "seids", i.e., large stones on supports, were found on the island (Figure 3). The entire island, when viewed from the sea or from above, is perceived as an aesthetically valuable object.

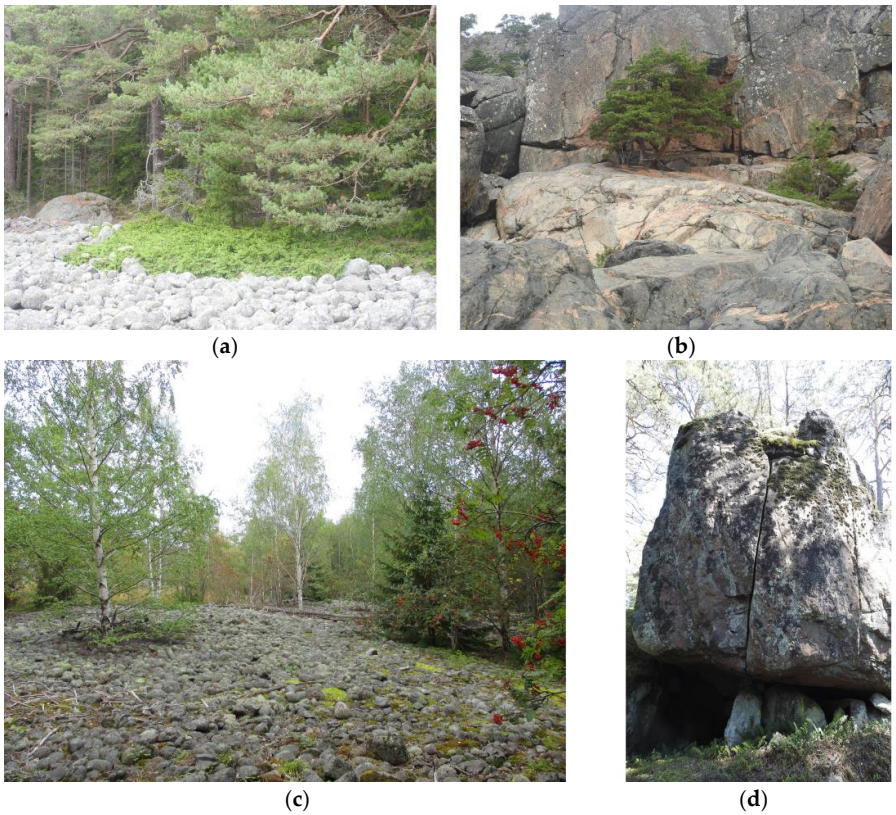

Figure 3. Sights of Gogland Island: "creeping spruce" (**a**), "dwarf pines" (**b**), "stone river" (**c**), and "seid" (**d**).

4. Discussion

Gogland Island demonstrates that open areas in the Baltic region can disappear without anthropogenic activities. The area of plots on the island without forests is insignificant and is predicted to decrease. Fires, windblows, and other natural processes can barely resist complete afforestation. The conservation value of this process provokes doubts. The island can hardly be considered a standard for the perfect state of wildlife. Among the criteria used to assess the value of the studied area, aesthetics was almost the only criterion that was clearly expressed. The island corresponds well to the characteristics of the "empty forest" [32] or "empty landscape" [33]: it seems to be in a good state but is defaunated. (Although the analysis of these "empty" lands concerned the tropics, the situation in a boreal zone seems to be similar). The biodiversity on the island is relatively high only for some plant taxa, but it is rather low as a whole. This is only partly explained by the small area and distance from the mainland and is probably related to "excessive" afforestation. The visits by lynx and deer showed that other ungulates or carnivorous mammals can reach the island by either walking on ice or swimming (e.g., elks, wild boars, or wolves), but they cannot settle there. This means that there is no favorable environment for them. Dense forest with numerous fallen tree trunks is unsuitable, not only for humans but for large mammals as well. They need a larger portion of open areas. The same is true for several bird species. Any bird species could easily visit the island, but some "common" species from the mainland are absent there (e.g., several grouses and waders) as they need either open areas or a combination of open areas with forests. With the exception of the European mink, the list of local species is rather trivial. Meanwhile, the local mink population is very small and it may be on the edge of extinction. Usually, the minks inhabiting the island can easily be recorded as they are used to feeding at the coastline, but in our case, they were well observed only once 20 years ago. It is perhaps the case that the transformation of the island is not favorable for this species.

Afforestation on Gogland Island shows that to achieve the maximum effect for biodiversity conservation, the abandonment of land without any management could be insufficient. In a boreal environment, some activity to keep a number of open areas is desirable. Open areas could be maintained by ungulates, but in this case, a small number of feral goats and sheep turned out to be insufficient to resist afforestation; they have decreased in number and disappeared over the last few decades. To maintain a significant portion of open areas, the ungulates should be larger and/or more numerous.

The case of wildlife restoration on Gogland Island is interesting with respect to assessing the normal state of vegetation in Europe. Since the Neolithic period, forest area has been continuously decreasing there [4,34]. This means that the overgrowth of open spaces and settlements with forests is a return to the original or normal state. However, overgrowing forests can be undesirable as open spaces can also be valuable habitats with high biological productivity. The overgrowth of grasslands with arboreal vegetation is often viewed as a negative process as it reduces ecosystem services and exterminates endemic ecosystems [35]. Protests against "the tyranny of trees" have occurred [36]. A "war" against forests and swamps of the boreal zone was declared with the concept of a Pleistocene park [37]. According to this concept, modern taiga and tundra represent an abnormal dominance of arboreal vegetation and mosses, which originated because of the extermination of large herbivores at the turn of the Holocene–Pleistocene period. In the past, tundra-steppe covered most of the northern part of Eurasia; its existence was supported by a large population of herbivores, and because of their extermination, shrubs, mosses, lichens, and trees expanded instead of grasses. This means that to restore the norm, it is necessary to introduce various ungulates (bison, horses, yaks, etc.), which could facilitate a reverse transformation. Experiments on such a transformation have been conducted in Pleistocene Park, a protected area in Yakutia. They have demonstrated that introduced ungulates survive, but because of their low abundance, no significant transformation of habitats has taken place to date [38]. The question of the possibility and feasibility of "returning to the Pleistocene" remains open. At the moment, such rewilding is a dream of several enthusiasts, which seems to be unrealistic. However,

at least a partial return to the "Pleistocene" is a promising perspective. The fate of Gogland Island testifies rather in favor of this concept as it demonstrates well the opposite extreme: without large ungulates, an area becomes covered in an impassable mass of trees. This means that a norm for the environment should be assessed based not only on historic data but on prehistoric data as well.

5. Conclusions

Gogland Island demonstrates that in a boreal environment, the abandonment of land can result in total afforestation, which, in turn, results in a decline in biodiversity. In spite of the strong level of protection, the island hardly became a standard for the perfect state of a wildlife area. To achieve the maximum effect for biodiversity conservation, the abandonment of land without any management could be insufficient; human interventions might be appropriate aiming to maintain a number of open areas and the enrichment of fauna. A mosaic of forests and meadows inhabited by various animals would likely be more beneficial than a total overgrowth of forests. Otherwise, defaunated habitats could materialize ("the empty forests" or "empty landscapes"). The fate of the island partly supports the concept of Pleistocene rewilding: the baselines for nature conservation should be sought in the remote past, when large herbivores were much more numerous than now.

Author Contributions: Conceptualization, I.P., A.I. and E.A.; methodology, I.P., A.I. and E.A.; software, I.P., A.I. and E.A.; validation, I.P., A.I. and E.A.; formal analysis, I.P., A.I. and E.A.; investigation, I.P., A.I. and E.A.; resources, I.P., A.I. and E.A.; data curation, I.P., A.I. and E.A.; writing—original draft preparation, I.P.; writing—review and editing, I.P.; visualization, I.P., A.I. and E.A.; supervision, I.P.; project administration, I.P., A.I. and E.A.; funding acquisition, E.A. All authors have read and agreed to the published version of the manuscript.

Funding: The work by Evgeny Abakumov was supported by the Russian Science Foundation, project No. 23-16-20003, dated 20 April 2023, and the Saint Petersburg Scientific Foundation, agreement No. 23-16-20003, dated 5 May 2023.

Data Availability Statement: The data are contained within the article.

Acknowledgments: The authors thank the Russian Geographical Society for organizing the expeditions to Gogland Island. Anton Iurmanov acknowledges Tsitsin Main Botanical Garden Unique Scientific Installation "Fund Greenhouse" for their assistance in the analysis of data.

Conflicts of Interest: The authors declare no conflict of interest.

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