Roman Gramsz **29.09.2021**

Implementation report

For project

Protection of Luronium natans, Breisjøen 2019/2020/2021

Innvilget tilskudd til kartlegging og overvåking av flytegro i Breisjøen 2021 - Roman Gramsz. Ref. 21SE14E9

In this project, 3 methods were used to protect *Luronium natans*: **Transplanting, irrigation and flooding.**

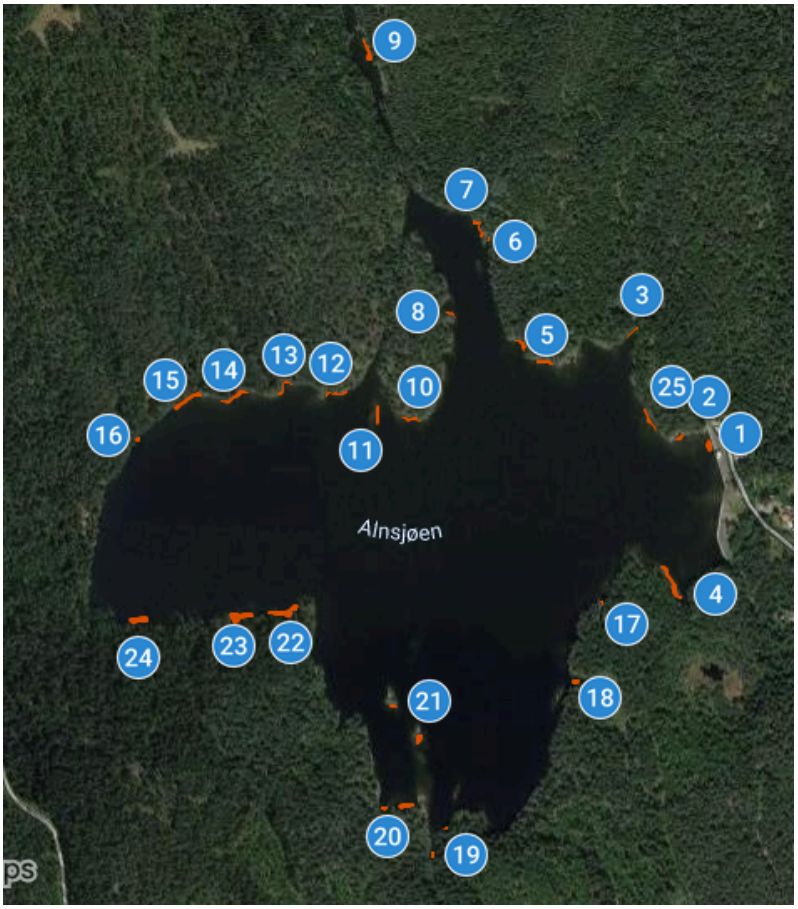
The transplanting was to remove some of the plants from the endangered site to Alunsjøen and the Botanical Garden in order to survive the rebuilding of the Breisjøen dam.
It was also important to enrich the population of *Luronium natans* in Alunsjøen.

Irrigation was to protect the plants on site, on the drained bottom of Breisjøen. This method used the ability of *Luronium natans* to survive as a land form if high substrate moisture was provided.

Flooding was an attempt to provide the plant with the most natural conditions by building dams and maintaining a certain water level above the *Luronium natans* population.

1. Transplanting.

In 2019, about 5,000 *Luronium natans* plants were transplanted from Breisjøen to 25 sites in Alunsjøen (Map 1.)
Approximately 100-200 plants were donated to the Oslo Botanic Gardens.



Map 1. Planting places in Alunsjøen along with the numbering of these stands. Planting places are marked in red.

In 2020 checking the effectiveness of transplanting plants to Alunsjøen was carried out on July 23 and July 31 - August 1 with the use of a pontoon and a tube for underwater observation (vattenkikare).

The result was not very impressive – live plants were found in 8 locations out of 25.

In 2021, in the period from July 26 to July 28, a thorough search was carried out using boats and diving.

Live plants were found in 11 places out of 25 where they were planted in 2019.

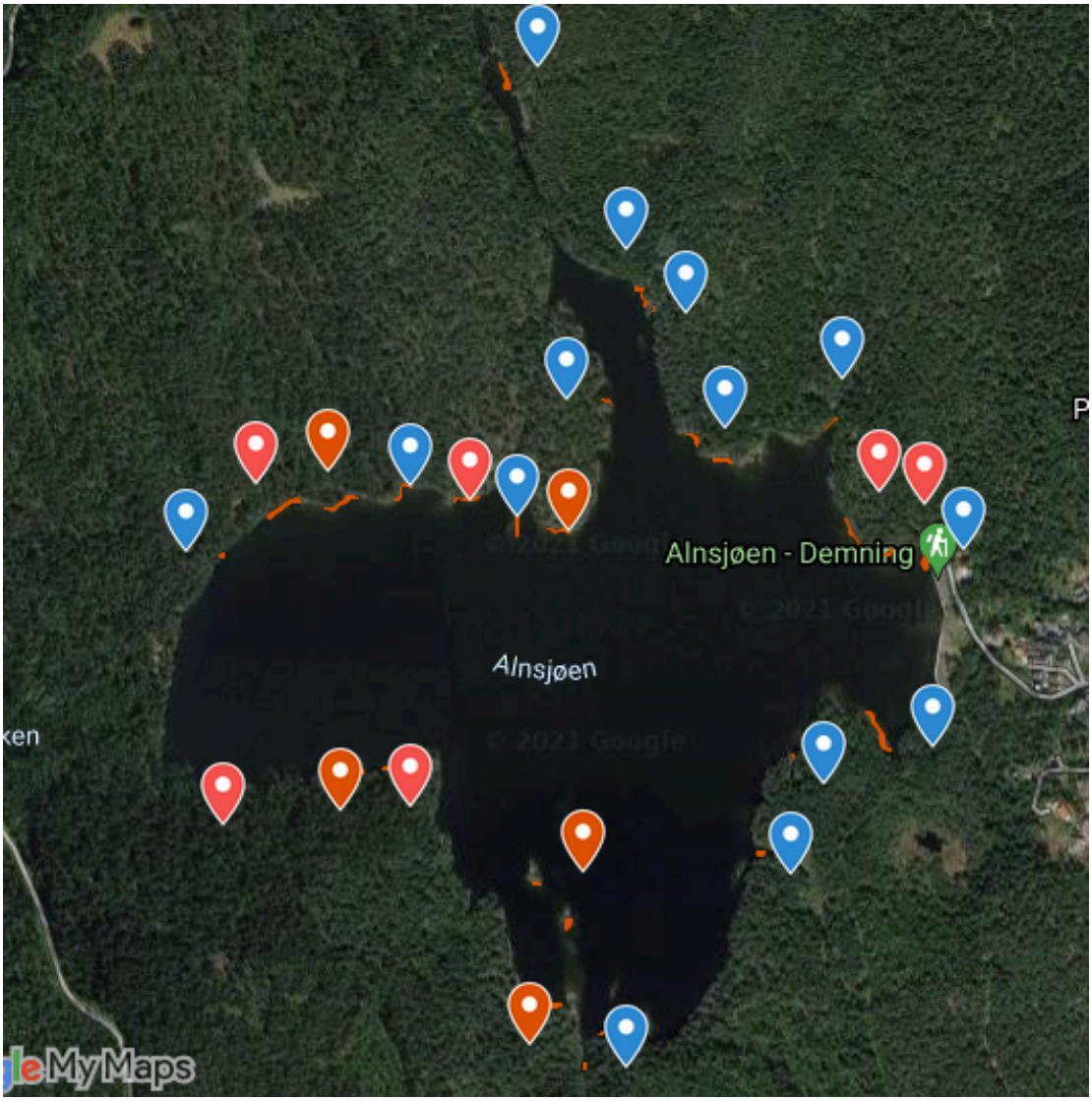
At these sites, from a few to a dozen plants were found, which gave a total of about 100 plants that were adopted in Alunsjøen.

This result is far below my expectations, but it shows how difficult it is to replant delicate

aquatic plants. Therefore, transplanting plants from temporarily endangered places to another reservoir and then replanting them back is not very effective and risky.

The main advantage of our action is that we managed to enrich the population *of Luronium natans* in Alunsjøen, where almost 100% of the plants died during the reconstruction of the dam in 2008-2009.

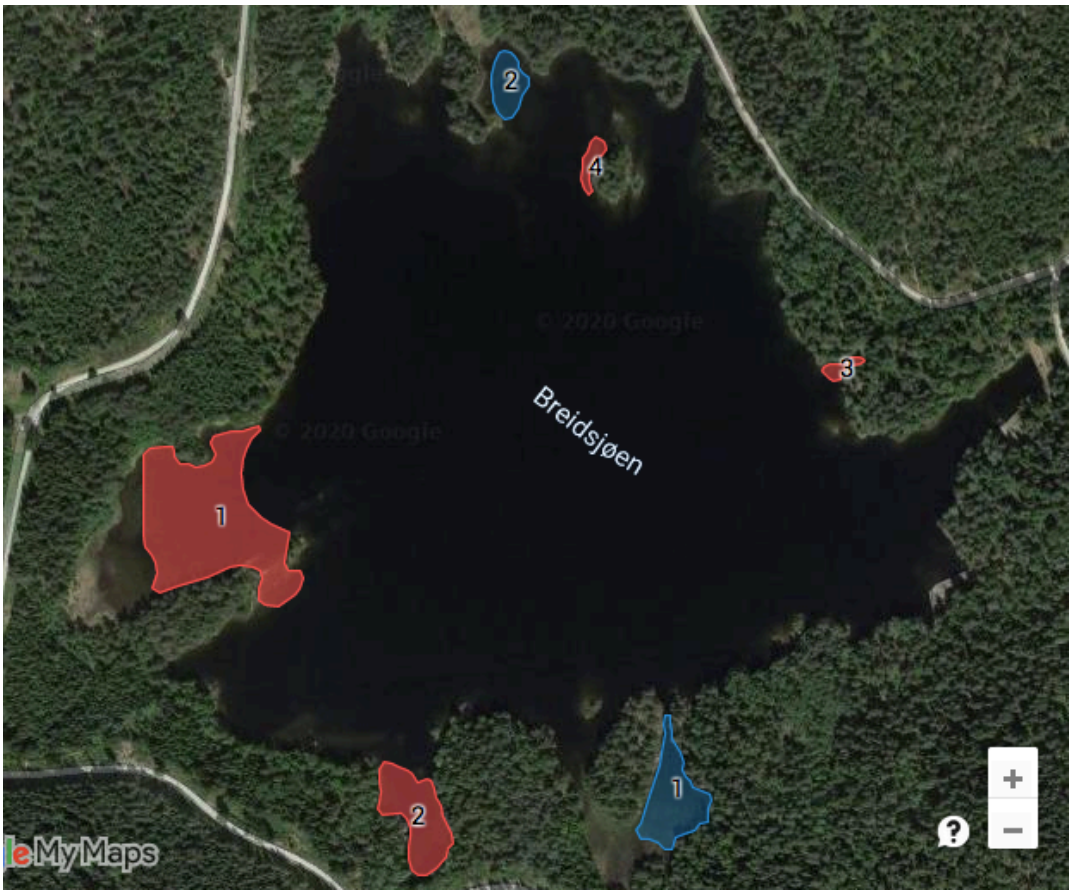
On the map 2. all the planting sites and the sites where the plants have adopted are marked.



Map 2. Result of transplanting *Luronium* to Alunsjøen. As of July 28, 2021. The 2019 planting locations (areas) are marked in red. Places where the presence of *Luronium* has been confirmed in 2021 - red points. Blue points - not confirmed.

2. Irrigation and Flooding.

At the beginning of April 2020, Vav started draining Breisjøen. During the first working meeting with representatives of Vav and Consto (contractor) on April 22, 2020, the water level in Breisjøen was already 2m lower and most of the *Luronium natans* - flytegro were visible on the dry shore. After a local inspection of the lake, I was asked to make a map with the marking of individual places and ways to protect the flytegro. (see Map 3.)



Map 3. Preliminary map of the distribution of areas intended for irrigation (red) and for flooding, construction of small dams (blue).

This project has been approved for implementation with the exception of area no 2 (red). The project aimed to protect the flytegro in different ways in different depth zones and habitats.
Work on the construction of the dams and the installation of irrigation systems began immediately, but it took over a month to bring them to proper functioning. (Pumps were not immediately placed at the appropriate depth and, as the water level continued to decline, they became clogged with silt or remained on the dry shore)

Map 4. Completed layout of irrigation areas and dams after border correction and construction of "our dam" no 3.

The following irrigation systems and dams were built: (see Map 4.)

1. No 1 (red) Irrigation of the bay and peninsula in the Western part of the lake.

This vast bay with a slightly sloping, silty bottom and abundant flytegro occurrence could ensure the survival of the plants if it could be kept wet or at least moist. An irrigation system was installed across the bay so that the sprinkled was a 20m wide strip and excess water flowed down below, moistening the rest of the exposed bay bottom. In this boggy bay, plank footbridges had to be built to provide access to the sprinklers.
3 sprinklers were placed higher on the peninsula to support plants in other habitats (at a depth of about 50 cm and 2 m from the normal water level)
This system worked well - it allowed most of the plants on the irrigated surface to survive and grow as a terrestrial form. Some plants have been destroyed or damaged by grazing of the Canadian goose family and ducks. The system was dismantled on 10/21/2020 when most of the plants were already under water again.
Detailed observations of the diving method carried out in the summer of 2021 confirm that *Luronium* has survived well, especially in the NW part of the bay. In the SW part, they survived a bit worse, probably due to the strong, competitive development of *Juncus bulbosus*. Watering the plants on the shallower bottom of the peninsula saved fewer plants than in the bay, but without this watering, most or all of the plants would probably have died. (Compare on maps from 2018 and 2021.)

Photo 1. No 1 (red) Irrigation on the western bay. 16.07.2020.

2. No 3 (red) Irrigation of the small bay and the slope of the bottom in the eastern part of the lake.

Plants growing on the bottom slope with a small layer of clay and silt at a depth of 30 cm to 1.5 m were to be protected here. There are 3 sprinklers here.
At this place, it was necessary to made the tape fence due to the frequent visits of people and the trampling of the plants.
This system worked well - it allowed most of the plants on the irrigated surface to survive and grow as a terrestrial form.
Observations from 2021 confirmed the survival of many plants, especially in bottom depressions with more clay and silt. In the remaining places where the clay and silt were washed away, the plants survived in smaller numbers.
(Compare on maps from 2018 and 2021.)

3. No 4 (red) Irrigation of the shores of the island in the northern part of the lake.

Similarly to site "3", plants growing on the slope of the bottom with a small layer of clay and silt at a depth of 30 cm to 1.5 m were to be protected here. There are also 3 sprinklers here.
This system worked well but relatively few plants survived here due to the washing away of the clay and silt.
Observations from 2021 confirm the positive effect of irrigation, because only on the W side of the island a small number of plants survived, while on the non-irrigated S and E side of the island the plants did not survive.
(Compare on maps from 2018 and 2021.)

Photo 2. No 3 (red) Irrigation of the small bay and the slope of the bottom in the eastern part of the lake. 28.06.2020.

4. No 1 (blue) Dam in the southern part of the lake.

This dam was supposed to keep the plants shallow (20 -30 cm deep) what should enable their survival and cause a strong development of floating leaves and flowers.
This dam did not have the expected effect. A thick layer of organic sediments flowed to the surface of the water and the plants growing there died (?)
Only the plants on the shores of the pond survived. (Compare on maps from 2018 and 2021.)

5. No 2 (blue) Dam in the northern part of the lake.

This dam was to provide the plants with "normal" living conditions throughout the reduced water level in Breisjøen.
At the end of May, when the water level was already 5 m below normal and all flytegro occurrences were exposed, we decided together with Bjørn Smevold that it would be worth building one more dam below the dam no.2. It would flood a large flat area of the bottom with abundant flytegro occurrence. With the approval of the Vav administration, we built this dam (no 3) out of plastic sandbags with the help of volunteers from Norsk Botanisk Forening.

Photo 3. No 1 (blue) Dam in the southern part of the lake. 11.06.2020.

Photo 4. No 2 (blue) Dam (on right), “our dam” no 3 and wet area no 3+ (center), No 4 (red) Irrigation (left) in the northern part of the lake. 11.06.2020.

These dams and irrigation system (no 4) in N Breisjøen has ensured the protection of the flytegro in a variety of habitats and throughout its depth zone. Many means of protection have been used here and it was a great success:
Dam no 2 with a water depth of up to 60 -80 cm enabled the plants to rebuild an underwater, vegetative rosette of leaves. "Our dam" no 3, with a depth of up to 20 -30cm allowed the lush growth of the form with floating leaves and flowers. The deliberately overflowing water from dam no. 2 irrigated the surface of a large flat area (no 3+) of the bottom above "our dam" contributing to a very lush growth of the flytegro terrestrial form. Sprinkling on the slope of the island (no 4 (red)) kept some plant alive in terrestrial form.
Unfortunately, this area suffered from bird feeding. Some damage was done by the Canadian goose family in May and June, but the ducks feeding in autumn at night did a great deal of damage already during the filling of Breisjøen in October. Almost 100% of plants with floating leaves and a large part of the terrestrial form were destroyed.
Observations from 2021 confirm the enormity of damage caused by the autumn feeding of ducks. Virtually the entire area of "our dam" was completely devoid of plants. Fortunately, most of the area irrigated by the “dam 2” overflow with the developed land form of *Luronium* has survived. Also, the plants within “dam 2”, despite being persecuted by ducks, have mostly survived.
Summing up, however, this area of the greatest intensity and variety of protective measures fulfilled our expectations because we managed to protect a large part of the population growing in the entire depth and habitat range. (Compare on maps from 2018 and 2021.)

As a protection against night frosts in September and October, we used frequent sprinkling of plants. Thanks to intense rains in October and an additional quantity of water from Aurevann, Breisjøen was filled before real frosts. So, fortunately, no other measures were needed to protect the plants from frost.

Photo 5. Well developed form with floating leaves and flowers in “our dam”- all this plants have been demaged by ducks in October 2020. 19.08.2020.

3. Erosion.

Photo 6. Waves washed away clay and mud from the steep parts of the shore. 19.05.2020.

Photo 7. The amount of the washed out sediment is clearly visible on the exposed stones. 19.05.2020

Photo 8. Erosion of the silty-clay layer depending on the intensity of waves during lowering the water level. 19.05.2020.

Photo 9. After rinsing the silt-clay layer and exposing the roots, *Luronium* had no chance of surviving. 19.05.2020.

4. The results of observations carried out in 2021 - diving method.

The result of these studies is the *Luronium natans* population distribution map in Breisjøen in the summer of 2021.
The same method was used to make a map of the *Luronium* population distribution in Breisjøen in 2018, prior to the rebuilding of the Dam. Thus, the comparison of these two maps allows to assess the changes and the effectiveness of the protective measures taken with the *Luronium* population after the lake was emptied during the rebuilding of the dam in 2020

On Breisjøen, plants survived on 73% of the 2018 area.
Thus, the area occupied by the *Luronium natans* population decreased from 37716 m^2 in 2018 to 27746 m^2 in 2021.
Plants in the shallow and steep parts of the bottom were the most affected and the best surviving in large bays with a thick layer of silt. Also the areas with plants that survived the drainage of the lake are significantly thinned out. See Table 1.
The positive effect of our protective activities can be demonstrated, although to a lesser extent the plants managed to survive also in places where we did not conduct any protective activities. It is due to rather cool and rainy summer and also due to the fact that the lake was filled up before winter!

Interesting facts include the survival of plants that germinated from seeds during the summer of 2020 on the then exposed bottom with moist silt at a depth of 4 - 6m. This is a depth that the *Luronium* in Breisjøen did not grow at.

Photo 10. *Luronium natans* which germinated from seeds in summer 2020 on a muddy bottom (5m deep from the maximum water level). These plants survived until the summer of 2021 - on the map 6. marked in pink "C". Shallow flooded in the photo – 08.08.2020.

Photo 11. Vegetative form of *Luronium* pulled out from the depth of 5m. 23.07.2021.

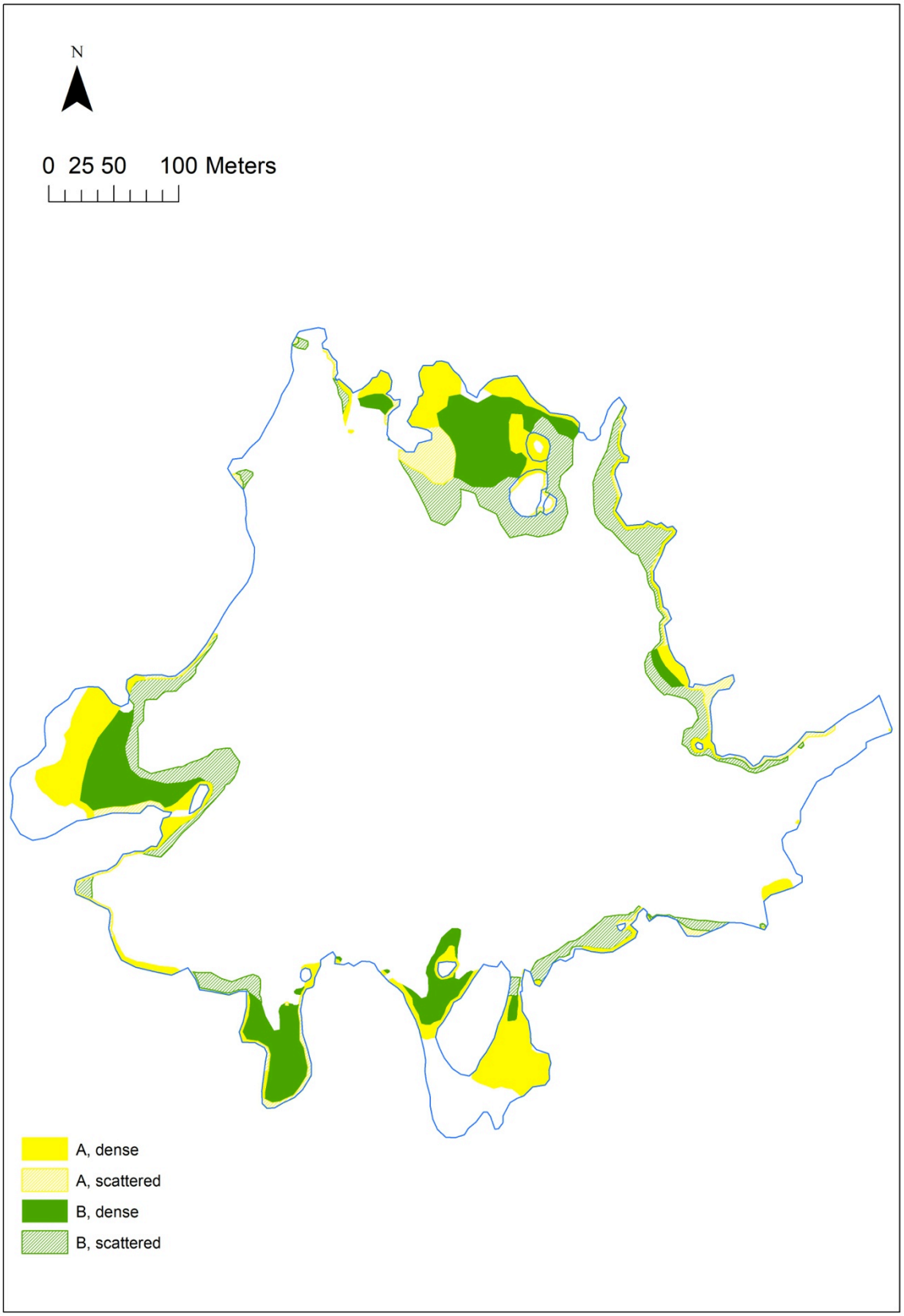
Description for table and maps:
A: form with floating leaves and flowers. Usually growing to a depth of 0 - 1.5m

B: submerged vegetative form. Usually growing to a depth of 1.5 – 4m

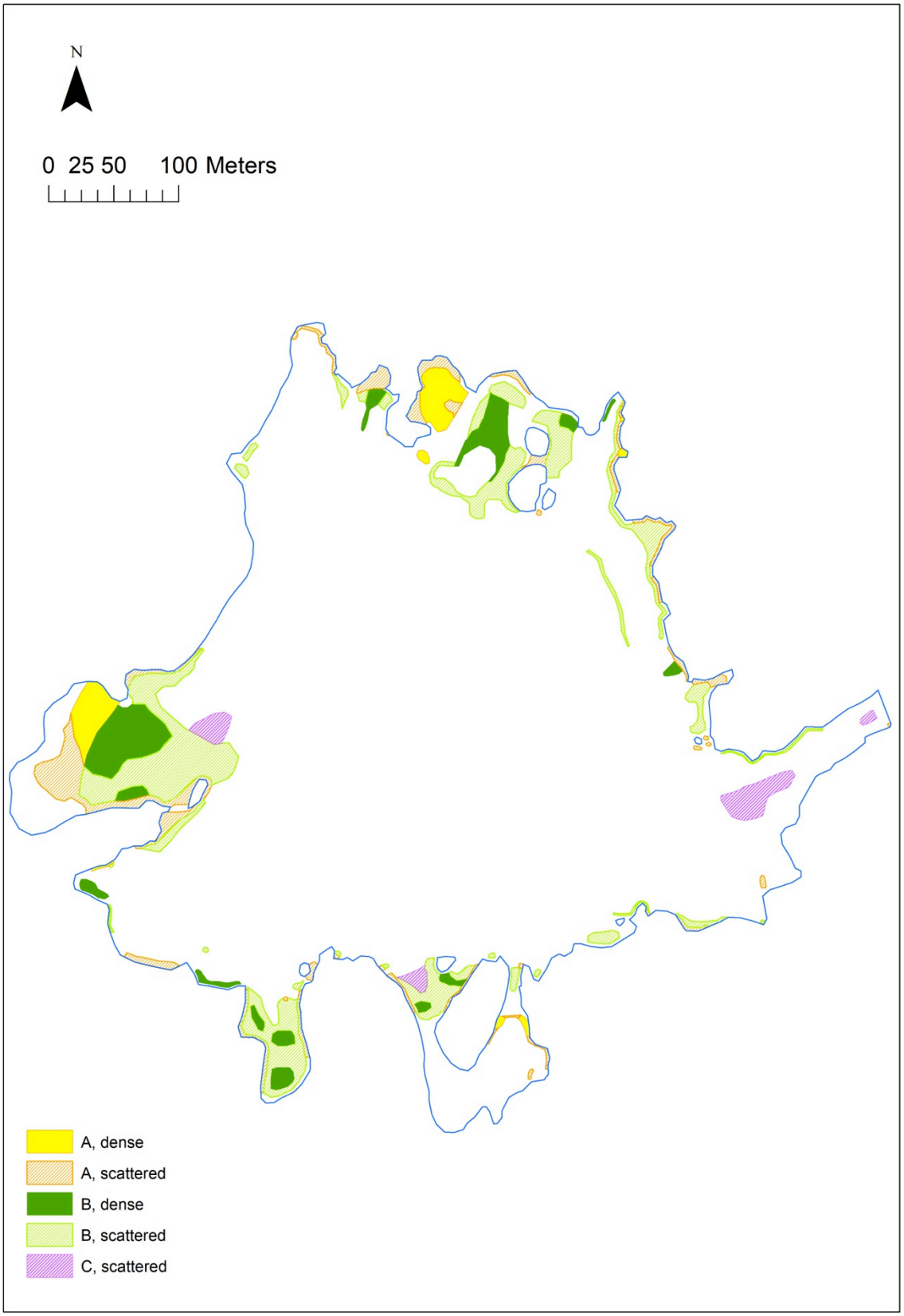
C: plants from seeds germinated in the summer of 2020 in a moist mud at a bottom depth of 4 - 6m, below the depth at which *Luronium natans* grew under normal conditions.

Luronium forms	2018 area/m^2	2021 area/m^2	% of 2018 area	
A dense	11296	2587	< 23 %	
A scattered	3683	5448	> 148 %	< 54 %
B dense	10999	5225	< 47 %	
B scattered	11739	12635	> 107 %	< 78 %
C scattered	-	1850	>	>
Sum	37716	27746	< 73%	< 73 %

Table 1. Areas occupied by *Luronium* forms before (2018) and after (2021) the reconstruction of the Breisjøen dam.



Map 5. Breisjøen. Distribution of the *Luronum natans* population in 2018. Authors: Katarzyna Bociąg & Roman Gramsz.



Map 6. Breisjøen. Distribution of the *Luronum natans* population in 2021. Authors: Katarzyna Bociąg & Roman Gramsz

Conclusions:

1. Two new methods used to protect *Luronium* on site in a drained lake (irrigation and flooding) proved to be effective and useful. Transplanting turned out to be the least effective in our case.

2. Bottom erosion and washing out of sediments were the most destructive factors for the *Luronium*'s habitat. The greatest erosion of the slope of the lake bottom caused waves during the slow lowering of the water level. (this is a topic for discussion with the recommendation to drain water slowly to protect crayfish).

3. Actions should be taken to prevent damage caused by wild animals.

4. The filling of the lake against winter frost was probably very positive, if not crucial for the protection of *Luronium.*

5. Further monitoring of the population status of *Luronium natans* in Breisjøen is highly recommended. Significant habitat change caused by clay and silt erosion may result in population decline rather than its regeneration in the coming years.

Photo 12. Diver, Katarzyna Bociąg at work. 26.07.2021.