Project update: August 2017

We started working on our project in September 2016. This report summarises the intermediate results obtained since our previous update (February 2017).

1) Expeditions

The main study areas in June-July 2017 were Soltsy and Tebza mires in Kostroma Oblast (middle Russia) (**Fig. 1-3**).

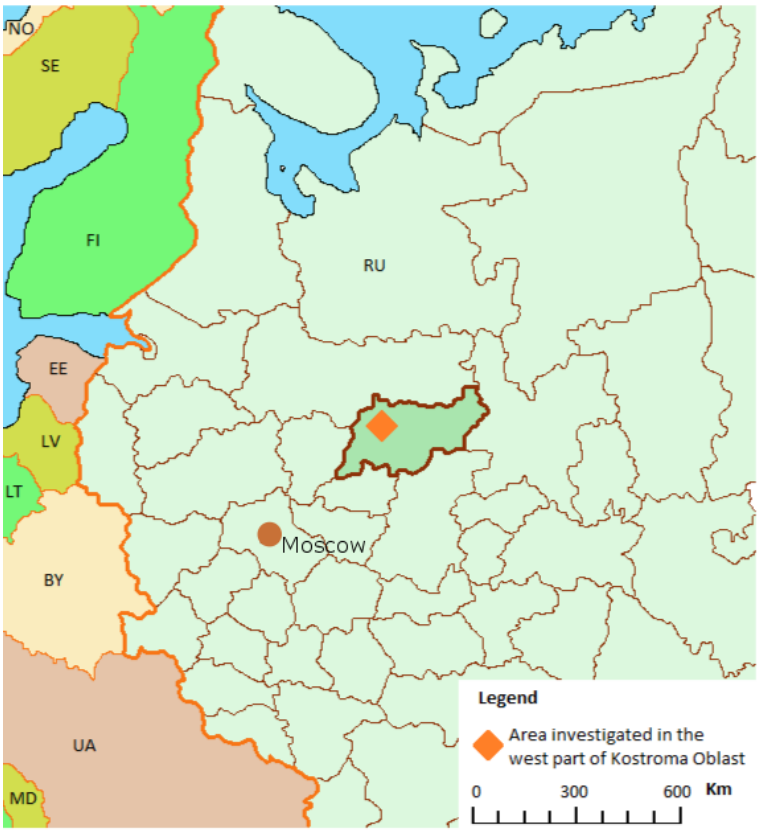


Figure 1. Location of the area investigated in middle Russia.

Field investigations in June 2017 were not as efficient as we expected due to unseasonably cold and rainy weather which caused shifting growing season on approximately 3 weeks. So, the blossoming of many flowering plants has started significantly later.

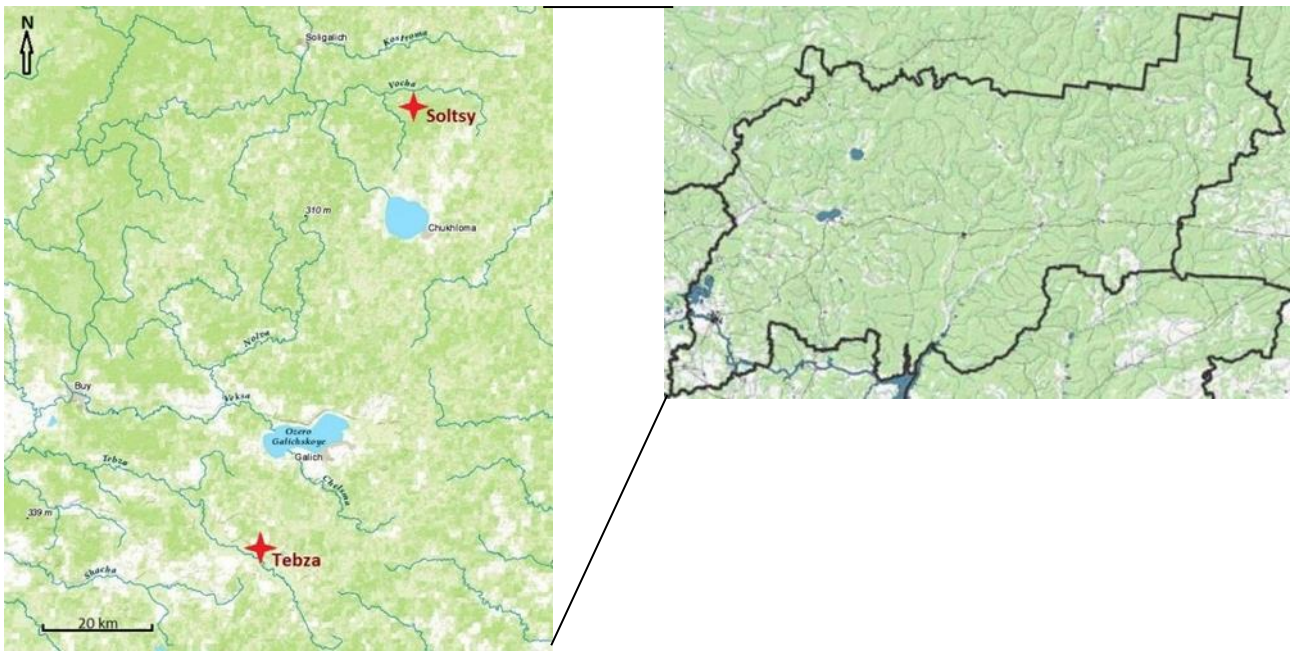
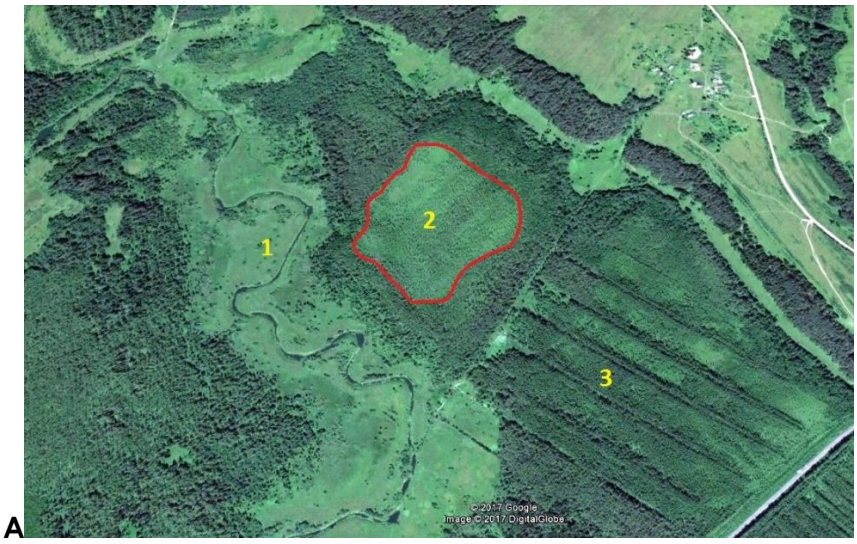


Figure 2. Location of the two mires investigated in the west part of Kostroma Oblast.



A

B

Figure 3. A – One of the mire sites investigated in Tebza mire: 1 – floodplain of the Tebza river, 2 – minerotrophic mire site, 3 –drainaged mire site. **B** – Three mire sites investigated in SW part of Soltsy mire (asterisks), 1 – cutover patches, 2 – the Vocha river.

- **Soltsy mire**

In June and July 2017 we made two short expeditions to Soltsy mire (**Fig. 4**).

A  **B** 

Figure 4. Expeditions to the Soltsy mire. **A** –15th July. The SW part of Soltsy mire (Soligalich district), Artyom Leostrin – leader of the project. **B** – 4th June. The NE part of Soltsy mire (Chuhloma district), Svetlana Nesterova (from the left) – forestry specialist, Anna Efimova – botanist, member of the team.

Apart from inventorying vascular flora we decided to collect some materials of lichens, liverworts and mosses to make a preparatory review on diversity of these taxa in the studied area. It is known that many cryptogamous species could serve as excellent indicators of old-growth (ancient woodland) and less disturbed forest ecosystems. So, we assume that there might be such indicator species in Soltsy mire, the most interesting area within the project.

The tentative results of our survey are prominent. We found several indicator species such as *Riccardia latifrons*, *Lobaria pulmonaria* and *Hericium coralloides*.

Riccardia latifrons is a rarely occurring liverwort in the middle Russia and it is a good indicator of old-growth forests with permanent presence of decaying fallen trees. This is the first record of the species for Kostroma Oblast. The species was found in spruce-aspen forest at decaying fallen spruce (*Picea fennica*) trunk (**Fig. 5, A**).

Lobaria pulmonaria (lung lichen) is in the Red Data Book of Russia. The investigation of its distribution at national and regional scale is in progress now (see web-page: http://lobaria.ru). *Lobaria pulmonaria* occurs mainly in the east part of Kostroma Oblast and only sparse localities were known from west part of the region. Two localities of the species were found in mixed forests (*Picea fennica*, *Populus tremula*, *Betula pubescens*) at the aspen trunks (**Fig. 5, B**).

A  B 

Figure 5. A – Decaying fallen tree covered with mosses and liverworts, a habitat of the Riccardia latifrons. **B** – Thallus of the Lobaria pulmonaria on aspen tree trunk.

Hericium coralloides, a rare xylotrophous fungus, was found in wet mixed forest (*Picea fennica*, *Pinus sylvestris*, *Betula pubescens*) at the standing dead birch trunk. This species is rare and protected in many regions of the European Russia. There were only several records of the species in Kostroma Oblast. It has been recommended to the next edition of regional Red Data Book.

Other cryptogamous taxa collected in Soltsy mire will be identified later.

According to recent observations we suppose that a number of forest sites around Soltsy mire system have features of old-growth or less disturbed forests such as numerous decaying fallen trees and tree throws (**Fig. 6, A, B**). These forest ecosystems present a habitat for some rare species having important conservation significance and been a kind of buffer zone to the Soltsy mire system. Unfortunately, total area of these forest sites a minor compare to surrounding secondary forests and cutover patches.

A  B 

Figure 6. A – Spruce forest with decaying fallen trees. **B** Our team member Anna Efimova near tree throw (Picea fennica)

Study of vascular flora of southwest part of Soltsy mire brings some new discoveries. We found three regionally protected species new to the studied area at once. These are *Corallorhiza trifida* (early coralroot) (**Fig. 7, A**), *Carex atherodes* (wheat sedge) and *Ranunculus propinquus*. Last species was previously known only in two places in Kostroma Oblast. *Ranunculus propinquus* is considering as indicator of less disturbed forests.

The most fascinating finding of this expedition is record of *Cladium mariscus* (swamp sawgrass) (**Fig. 7, B**) in southwest part of Soltsy mire. This is an extremely rare species in East Europe which is nationally protected in Russia. The species grows in sedges- and grasses-dominated open rich fen site with brown-mosses (*Tomentypnum nitens*) cover. The stands of the *Cladium mariscus* cover at least 400-500 m^2. It is remarkable to find one more halophyte species in the investigated mire system.

A **B**

Figure 7. Vascular plants new to Soltsy mire. **A** – Corallorhiza trifida. **B** – Cladium mariscus.

- **Tebza mire**

Three daylong trips were made to the Tebza mire (Galich district). There were no any sufficient data on plant diversity of this mire system before. Tebza mire system occupies part of the Tebza river valley (**Fig. 8**). Three open mire sites were investigated. Sedge-moss plant communities of Tebza mire appear to be similar to previously known ones in west part of Kostroma Oblast as we expected. Ten red-listed vascular plant species was found in this place. Two small populations (about 40 individuals) of nationally protected fly orchid (*Ophrys insectifera*) add conservation significance for this mire. A big population of musk orchid (*Herminium monorchis*) numbers about 200 individuals was the most interesting

finding. According to our data, this is the biggest population of musk orchid in Kostroma Oblast.

Figure 8. The depression, an ancient fluvioglacial valley, occupied by Tebza mire.

- **Rare vascular plant species: *Saxifraga hirculus***

Special attention was paid to the populations of marsh saxifrage (*Saxifraga hirculus*). It is known that the species was spread through all the territory of middle Russia, but almost all previously known populations are extinct or vulnerable now. So, we suppose that marsh saxifrage populations in Kostroma Oblast are most numerous and stable in middle Russia playing significant role in conservation of the species. *Saxifraga hirculus* is presented in several minerotrophic mires in Kostroma Oblast: Susanino, Shoksha, Soltsy and Tebza. We observe all these populations during field trips in 2016-2017 and found them in quite good state counts from tens to hundreds of individuals.

- **Hypnum peat mosses (brown-mosses) records**

During our field trips in 2016-2017 we obtain a lot of new data on distribution and occurrence of hypnum peat mosses in investigated fens (**Table**). Such species as *Tomentypnum nitens*, *Helodium blandowii* and *Paludella squarrosa* were considered as extremely rare species in the Kostroma Oblast before and were included in regional Red Data Book. But in fact there were no enough data on their distribution at regional scale. According to our recent observations *Tomentypnum nitens* and *Helodium blandowii* are common dominants or co-dominants in moss cover of the rich fens. *Paludella squarrosa* (**Fig. 9, A**) and *Hamatocaulis vernicosus* are rarer and occur in wetter conditions (frequently associated with habitats of *Saxifraga hirculus*). Three brown-mosses species, *Campylium stellatum*, *Pseudocalliergon trifarium* and *Scorpidium scorpioides* (**Fig. 9, B**) were found in July 2017 at the investigated area (in Soltsy mire) for the first time. These species are quite rare in whole territory of middle Russia due to rarity of their habitats. Some species of brown-mosses were not identified yet.

Table. Occurrence of some brown-mosses species in four minerotrophic mires in Kostroma Oblast.

Species	Number of records			
	Susanino mire	**Tebza mire**	**Shoksha mire**	**Soltsy mire**
Campylium stellatum, Yellow Starry Feather-moss	0	0	0	1
Hamatocaulis vernicosus, Varnished Hook-moss	2	1	2	11
Helodium blandowii, Blandow's helodium moss	3	4	4	17
Paludella squarrosa, Tufted Fen-moss	3	3	2	21
Pseudocalliergon trifarium, Three-ranked Spear-moss	0	0	0	1
Scorpidium scorpioides, Hooked Scorpion-moss	0	0	0	1
Tomentypnum nitens, Woolly Feather-moss	5	5	4	28

A

B

Figure 9. Brown-mosses recorded in rich fens. **A** – Paludella squarrosa. **B** – Scorpidium scorpioides.

- **Estimation of tree's age**

We conduct a preliminary estimation of *Pinus sylvestris* tree's age in forest site in the south part of the Soltsy mire system. The study site was chosen in coniferous pine-spruce forest where big trees of *Pinus sylvestris* were noted (**Fig. 10, A**). The estimation of the age of trees was performed by extracting wood cores with Haglof increment borer (**Fig. 10, B**). Tentative results of tree rings count show that age of some tree reach 120 years at least.

A

B

Figure 10. A – Large tree (Pinus sylvestris) aged approximately 120 years. **B** – Extraction of wood core with increment borer.

- **Measurement of ecological parameters: surface water**

To obtain some ecological parameters of mire communities we carry out a series of measurement of pH end conductivity of surface water in Soltsy mire. We use Hanna Combo pH/Conductivity tester – HI98130. These parameters were measured in hollows, mire ponds and streams. The measurement shows that water pH value varies from 6.00 to 7.90 and conductivity varies from 46 to 183 (μS cm^{-1}) in different sites of mire.

A

B

Figure 11. A – Mire pond in Soltsy mire. **B** – Measuring pH and conductivity of surface water.

2) Publications
Some data on new vascular plants of Kostroma Oblast found in Soltsy mire was published in Bulletin of Moscow Society of Naturalists (Russian scientific journal).

Citation: Leostrin A., Efimova A. (2017). Records of new and rare vascular plants in Kostroma province. Bulletin of Moscow society of naturalists. 3: 58–61. [In Russian].
Data on some other interesting records are in press now.

3) Participating in a conference
A summary review on vascular flora of mires of Kostroma Oblast was reported on XXIV all-Russian conference of young scientists «Topical problems of biology and ecology» held in Syktyvkar (the Komi Republic) on 3rd–7th April 2017 (Conference website: https://ib.komisc.ru/add/conf/mol_conf/). Special role of fens in replenishment of regional mire flora was shown. The data on vascular plants composition of fens to a large extent was obtained during surveys in mires in the west part of Kostroma Oblast (Soltsy, Susanino, and Shoksha) in 2016.

Acknowledgements
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