

Good morning Ladies and gentlemen,

First, I would like to thank Floodplain Meadow Partnership for the invitation to give a talk at this Conference and visit beautiful UK meadows.

I am representing a big team of botanists specialised in meadow studies in different parts of Russia. All these people contributed into the small project stretched across a big geographical range in 2016. In my talk today I will start with a brief description of meadow research in Russia; before going in to more details about *Sanguisorba* meadows, their diversity, productivity and floristic differences across geographic gradient.

Being relatively flat country, Russia has great resources of floodplains. Until recently, the highly productive floodplain meadows provided a critically important agricultural crop of high quality hay. Similar to Europe and the UK, many meadows have been 'improved', however the areas of unimproved and traditionally managed meadows still exists.

Because of their recognised economical value, the floodplain meadows across Russia have been extensively studied for over 100 year. Long-term monitoring of the vegetation was carried out in five locations shown on the map. 48-years data from Ugra river have been published, the book is presented here at the conference.

In 2016, the first attempt of across continent project was carried out using the same methodology to measure biodiversity and productivity of the floodplain meadows with *Sanguisorba officinalis*. Floodplain meadows are considered as azonal or intrazonal vegetation which does not change in different climatic zones. We have chosen the meadows with dominant species *Sanguisorba officinalis* to test their similarity in different geographical locations.

Most northern point was on Severnaya Dvina, just 225 km South from the Arctic Circle. Most-Eastern site was at Baisa River in Lake Baikal area, which lays 8,500 km east from the most western point on the river Thames. Khoper River in Southern Russia is located at the same latitude as Thames and Baisa.

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*Sanguisorba officinalis* (Great Burnet) is almost a cosmopolitan species occurring from mountains to the floodplains on several continents

According to my observations on the islands of different age in the Northern Dvina river estuary, *Sanguisorba* meadows can be found on a range of soils on a condition of a good drainage. Great Burnet grows on the very young alluvial soils as well as on the well developed soils of several hundred years old. Soil compaction has a devastating effect of Great Burnet populations and plant community as a whole.

On the floodplains, it is one of pioneer species starting a vegetation succession on the newly-formed alluvial deposits like sand and gravel bars.

Unlike many other pioneer species, Great Burnet does not disappear when a plant community closes up. Adult plants compete well by forming large clones, slowly spreading vegetatively across the meadow. Old clones have the spaces in between their ramets allowing small species of grasses, sedges and forbs to grow there, increasing biodiversity in the community.

That brings us to the first hypothesis we wanted to test across a wide geographical gradient. Are communities with Great Burnet more species-rich than communities without it?

On the most of the meadows studied in the project, as well as on a range of British meadows (according to the data from Floodplain Meadow Partnership data base), species richness is significantly higher on the plots where the Great Burnet is present.

However, the high biomass of *Sanguisorba officinalis*, like in Nothern Dvina and Khoper rivers, does not positively correlate with the species richness of the communities. The lower biomass of Great Burnet on Thames and Baisa is associated with a bigger number of plant species per 1 square meter. Similar patterns we can see on the Graph B showing correlation between productivity of the communities and species richness.

Largest presence of Great Burnet in the biomass samples was observed at the Khoper river. The total biomass was largest on Vyatka river due to other herbs. The smallest amount of Great Burnet was recorded at Baisa river where the vegetation is exposed to the dramatic climatic changes because of extremely continental climate in the area. It's appeared that even the large amount of *Sanguisorba officinalis* can't guarantee the top-range species diversity on the plots, it insures the sustainable biomass production due to the long-lived clones.

The data by Elena Neskryabina collected at the Khoper River demonstrated the substantial annual dynamic in the productivity of both treatments – hay-cut and uncut monitoring plots. However, as we can see from the Graph, the regular hay cut maintains a lower oscillation of the biomass of Great Burnet which has some moderating effect on the total biomass fluctuation, and make the meadow productivity more consistent. Fifteen years of observation on the *Sanguisorba* meadow in Wester Siberia published by Valeriy Tyurin showed a dramatic decline of the Great Burnet in the absence of either hay-cut or fires on the plots. Spring fires which remove an excessive litter and kill trees seedlings is one of the natural factors which support meadow vegetation on a great scale in Western Siberia as well as in European North of Russia.

NMS ordination of the species composition of the five sites studied in 2016, highlighted four most significant factors affecting vegetation. Not surprisingly, the East-Siberian site at Baisa river appeared to be most distinctive on the axis of continentality. Khoper meadow appeared to be most diverse in soil moisture but very similar with the Thames site in terms of soil nutrients and climate. Two northern sites appeared to be colder, dryer and less nutrient rich comparing to the sites from more southern latitudes.

Having found how much ecologically different *Sanguisorba* meadows appeared to be, we looked at their floristic diversity across geographical gradient. Two most northern sites, Nothern Dvina and Vyatka showed an absolute prevalence of the boreal species, such as *Vicia cracca* and *Phleum pratense* and some presence of Subarctic species like *Equisetum arvense*. Forest-steppe species are common on all meadows, but have a bigger proportion in the continental area where the true steppe species like *Artemisia tanacetifolia* also grow in the floodplain meadows. Thinking about floodplain meadows as azonal vegetation type, we expected a higher presence of azonal species which are not characteristic to any particular biome. Azonal species like *Inula britannica* form a quarter of the community at Khoper river, and slightly smaller proportions in other meadows apart from Nothern Dvina where, species characteristic to the broad-leaved forest zone were found in proportion similar to the river Thames.

As these diagrams show, the most diverse sets of longitudinal floristic elements appeared at the both extremes of the geographical range: in the most western location at the river Thames and in the most eastern – at Baisa river. Both locations include Euro-American and Eurasian-American species being close to opposite sides of American continent. Euro-Siberian species like *Filipendula vulgaris* and *Ranunculus acris* present in similar proportion in

all five sites where true European species like *Leontodon autumnalis* and *Trifolium pratense* gradually disappear along the longitudinal gradient with only one species *Pulsatilla patens* goes as far as Baisa river. Floristic similarity between each pair of sites was calculated with Jaccard Coefficient at three systematic levels: species, genus, family. This slide presents a summary table where differences between one site and all others were grouped as a range. Most eastern site has the lowest similarity with all other sites at the species level. However, at the genus and family levels similarity coefficients between the sites don't vary very much. From 40 to 50 % of the families are the same in each pair of sites.

### **Conclusion**

*Sanguisorba* meadows can be found on the floodplains across Europe and Asia, from Arctic and Subarctic latitudes down to the south for several thousand kilometres. They represent the species-rich and highly productive plant communities of hay meadows.

*Sanguisorba* meadows can be considered as an azonal vegetation type however, influence of surrounding biomes on the floristic composition is apparent both in latitudinal and longitudinal directions.

Floristic similarity between pairs of sites reaches about 10% at the species level, 20% at the genera level, and up to 50% at the family level.

Plant communities with *Sanguisorba officinalis* are shown to be more species-rich comparing to other parts of the same meadow.

High level of species diversity does not positively correlate with productivity of *Sanguisorba* meadows. The communities with medium number of species appeared to be most productive.

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