The floodplain meadows with Great Burnet

(Sanguisorba officinalis):

a look across geographical gradient

Tatyana Parinova
I am going to talk about:

• Russian floodplains – ideal area to study meadows as intrazonal (azonal) vegetation type

• *Sanguisorba officinalis* – what is special about this meadow forb

• Communities with *Sanguisorba officinalis*:
  ✓ Species richness
  ✓ Productivity
  ✓ Biogeographical diversity of Sanguisorba meadows
With 2,500,000 rivers, the floodplains in Russia cover over 200,000 square kilometres.
Five rivers where long-term monitoring of the meadow vegetation was carried out:

1 – Ugra – 48 years of monitoring
2 – Khoper – about 20 years
3 – Volga – about 20 years
4, 5 – Ob – about 20 years
Five sites where Sanguisorba meadows were studied in 2016.
Floodplain meadows are classified as azonal type of vegetation

- Zonal vegetation reflects climate differences:
  - from tundra in Arctic to the south steppe and deserts in the South
  - From the ocean climate influenced by Atlantics to highly continental climate of Siberia

Meadows are not associated with any particular climate as local factors as floods and hay-making/pasture put much more powerful selective pressure on the plant communities.
*Sanguisorba officinalis* (Great Burnet) is almost a cosmopolitan species occurring from mountains to the floodplains on several continents.

Data from GBIF Portal
On the floodplains, Sanguisiorba meadows can be found on a wide range of soils.
Seedlings of Great Burnet are very weak competitors...

*Sanguisorba officinalis* on the sand river bank, Surgut, Western Siberia, Russia
Photo@Mike Dodd

*Sanguisorba officinalis* on the gravel-sand bar, Kamtchatka, Russia
Photo@Boris Bolshakov
... whereas adult plants persist in the fully-formed communities for a long time
Hypothesis 1: Communities with *Sanguisorba officinalis* are the most species rich among others on the floodplains.
Species richness on the plots with and without Great Burnet on international (A) and British (B) meadows.

**A**

<table>
<thead>
<tr>
<th>Location</th>
<th>With SO</th>
<th>Without SO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baisa</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Vyatka</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Khoper</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Thames</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>N.Dvina</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

**B**

<table>
<thead>
<tr>
<th>Location</th>
<th>Species number per 1 sq m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clattinger Farm</td>
<td>30</td>
</tr>
<tr>
<td>Duckington</td>
<td>25</td>
</tr>
<tr>
<td>East Cottingwith</td>
<td>20</td>
</tr>
<tr>
<td>Mottey</td>
<td>15</td>
</tr>
<tr>
<td>Wheldrake</td>
<td>10</td>
</tr>
<tr>
<td>Portholme</td>
<td>5</td>
</tr>
</tbody>
</table>
Species richness of the communities does not positively correlate either with the biomass of *Sanguisorba officinalis* (A) or with productivity of the communities (B).
Hypothesis 2: Productivity of the meadows with *S. officinalis* is more sustainable comparing to other floodplain communities.
Long-term changes in biomass of *S. officinalis* at the Khoper river (1979-1986)
NMS Analysis of the data using Ellenberg indicator scores

F – soil moisture
N – soil nutrients
T – temperature (climate)
K – continentality of the climate (related to the distance from the sea)

1 – Baisa
2 – Khoper
3 – Northern Dvina
4 – Thames
5 – Vyatka
Floristic latitudinal groups in Sanguisorba meadows:

- **Arctic alpine**
- **Arctic boreal**
- **Boreal (taiga)**
- **Boreal mountain**
- **Subarctic**
- **Forest-steppe**
- **Broad-leaved forest**
- **Azonal**
- **Steppe**

Thames
Khoper
Northern Dvina
Vyatka
Baisa
Floristic longitudinal groups in Sanguisorba meadows:

- Thames
- Khoper
- Northern Dvina
- Vyatka
- Baisa
Floristic similarity of Sanguisorba meadows at three taxonomical levels (ranges of Jaccard Coefficient (%) between the sites)

<table>
<thead>
<tr>
<th></th>
<th>Thames</th>
<th>Khoper</th>
<th>Vyatka</th>
<th>Northern Dvina</th>
<th>Baisa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td>8-15</td>
<td>8-20</td>
<td>9-11</td>
<td>8-11</td>
<td>3-8</td>
</tr>
<tr>
<td><strong>Genera</strong></td>
<td>17-27</td>
<td>17-38</td>
<td>17-25</td>
<td>17-27</td>
<td>17-18</td>
</tr>
<tr>
<td><strong>Families</strong></td>
<td>43-50</td>
<td>39-50</td>
<td>47-57</td>
<td>50-52</td>
<td>40-52</td>
</tr>
</tbody>
</table>
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.
Acknowledgements

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