

Animal Species Diversity Monitoring of SRC Plantations - Beetles and Butterflies

R. Lasák¹, V. Šefferová Stanová¹, J. Šeffeř¹, T. Olšovský¹

About the project

Dendromass4Europe (D4EU; 2017 – 2022) aims at establishing sustainable, Short Rotation Coppice (SRC)-based, regional cropping systems for woody biomass (dendromass) production on marginal agricultural land. The dendromass produced in SRC (lignous biomass, bark and wood) is supplied to dedicated bio-based value chains that create additional income and job opportunities in rural areas. The supply chains will be tailored for optimum efficiency of supply logistics and for reducing CO₂ emissions. Innovative bio-based materials will help to replace fossil-based materials.



| Reference monitoring | Number of localities | | | | Number of records | | | | number of species in SRC (and in control sites) | | | |
|----------------------|----------------------|-------|-------|-------|-------------------|------|------|------|---|-------|-------|-------|
| | 2018 | 2019 | 2020 | 2021 | 2018 | 2019 | 2020 | 2021 | 2018 | 2019 | 2020 | 2021 |
| Birds | 11 | 12 | 13 | 14 | 1171 | 1247 | 2030 | 1724 | 34 | 37 | 49 | 37 |
| | (67) | (61) | (74) | (71) | | | | | (67) | (61) | (74) | (71) |
| Amphibians | 8 | 9 | 10 | 11 | 145 | 247 | 514 | 566 | 6 | 6 | 8 | 10 |
| | (4) | (4) | (5) | (5) | | | | | (4) | (4) | (5) | (5) |
| Butterflies | 8 | 9 | 10 | 11 | 380 | 431 | 310 | 359 | 29 | 37 | 29 | 29 |
| | (37) | (38) | (41) | (41) | | | | | (37) | (38) | (41) | (41) |
| Beetles | 8 | 9 | 10 | 11 | 978 | 1326 | 2254 | 3159 | 161 | 207 | 237 | 231 |
| | (194) | (208) | (233) | (228) | | | | | (194) | (208) | (233) | (228) |

Tab.1: Collected data - overview

Introduction, Task and Challenges

Fast-growing trees are more competitive than native plants. This led to increasing concerns regarding their effects on biodiversity. Since the specific impacts of SRC on biodiversity need to be elaborated, this impact assessment is based on the data collected at the D4EU SRC (see fig.1).

The status of the biodiversity is the key factor needed for understanding the impact of SRC on nature. It can be evaluated on landscape level or on species level. In the scope of the present project, the species level is used because it offers detailed information needed for such dynamic ecosystem like fast-growing tree plantations.

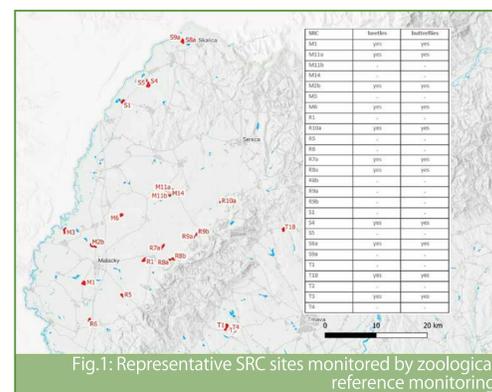


Fig.1: Representative SRC sites monitored by zoological reference monitoring

Methodology

Monitoring of birds, amphibians, beetles and butterflies species was done during four years on 26 SRC sites (see tab.1 and fig.1), representatively selected according to presence of neighbouring habitats, soil conditions and specific needs of different animal species groups.

Each selected site was visited minimally three times per year. The species were recorded within the SRC site and its adjacent biotopes (as a control sample).

All data was kept in the information system developed specifically for this task. Part of it is available on <http://daphne.sk/d4eu/>.

Results

Beetles

In total, 267 different species of beetles were found during 2018 - 2021 in all eleven sites, 254 of them were recorded at SRC sites and 247 at reference habitats (agricultural fields: 54 species; grasslands: 247 species) (see fig.6). 20 species were found solely on SRC sites. Eight beetle species (*Carabus scheidleri*, *Carabus ulrichii*, *Carabus coriaceus*, *Diachromus germanus*, *Dolichus halensis*, *Panageus bipustulatus*, *Pterostichus macer*, *Pterostichus cylindricus*) are very sensitive to agro-chemicals (pesticides, herbicides) in soils. In every field observation, it was verified whether these species were present on the site. It became evident that there was no record of any of these species in conventional agricultural sites, but they occurred both in all grassland sites and in all SRC sites (see fig.3).

Butterflies

In total, 45 different butterfly species were recorded during all four monitoring seasons. 39 of them occurred in SRC sites and 43 at control transect biotopes (fields: 7; shrubs: 32; grasslands: 42) (see fig.2). Comparing the species diversity of daytime butterfly species in areas of planted short rotation poplar coppices with intensively used arable land, there was an increase in the species diversity on SRC.

However, the diversity in SRC sites gradually declined due to the canopy growth of planted trees and associated shading by the poplars. This was found at all monitored sites except two – M11a and S4. At site M11a, the canopy of planted poplars is very sparse. At site S4, the decline in species diversity has not (yet) manifested significantly. This is due to the orientation of the SRC planting (north-south direction). Furthermore, in the vicinity of the site, there is no space for suitable non-forest habitats. Hence, the S4 site seems to be a refugium for butterfly species.

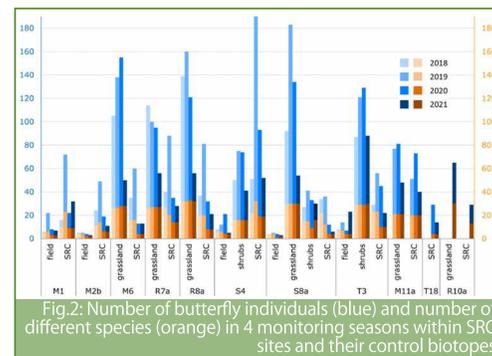


Fig.2: Number of butterfly individuals (blue) and number of different species (orange) in 4 monitoring seasons within SRC sites and their control biotopes

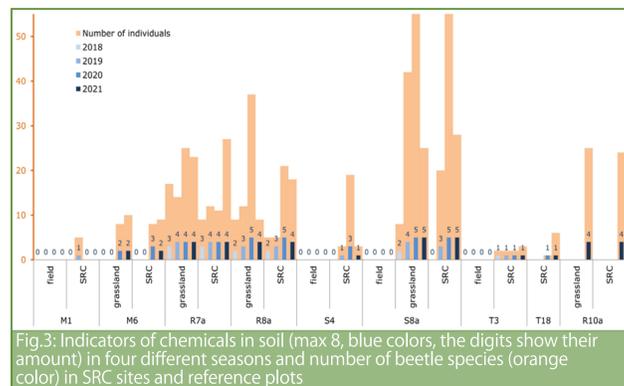


Fig.3: Indicators of chemicals in soil (max 8, blue colors, the digits show their amount) in SRC sites and reference plots

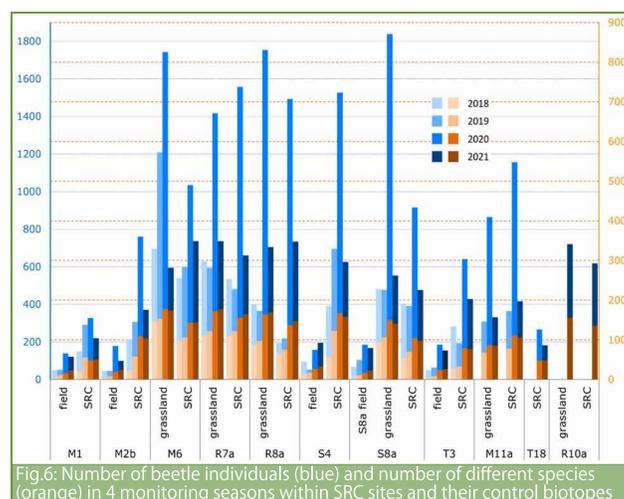


Fig.6: Number of beetle individuals (blue) and number of different species (orange) in 4 monitoring seasons within SRC sites and their control biotopes

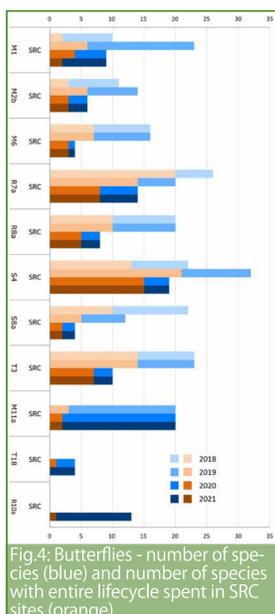


Fig.4: Butterflies - number of species (blue) and number of species with entire life cycle spent in SRC sites (orange)



Fig.5: *Onthophagus vacca*, one of the coprophagous species of site M6, and *Melanargia galathea*, founded in SRC sites M11a and S4 in seasons 2019, 2020 and 2021

Conclusions

As an overall conclusion regarding Coleoptera, it can be confirmed that SRC sites are suitable habitats for beetle species. When SRC were established on arable land, the biodiversity of this species group increases.

These results show that short rotation poplar coppices established on previous arable fields become an important refugium for different species groups, and they can increase the biodiversity value of the respective part of the landscape.

In contrast, SRC established on former grasslands, wetlands or other rather natural non-forest biotopes decrease former biodiversity value. Disking, which is an important non-chemical weeding measure, can have positive but also adverse effects, depending on the respective animal species and on the timing within the growing season.

Establishing a mosaic of different tree age classes within one SRC site can increase its biodiversity and habitat values for several species of fauna and flora.

To support the diversity of butterfly species, it would be appropriate to keep meadow corridors (north-south direction) with a minimum width of 5 to 10 m every 50 m in the poplar stands. These corridors should be sown with a suitable meadow mixture of bee pasture species and should be mowed once in the growing season. At the same time, in the case of wetter habitats, it would be appropriate to create wetlands without poplar planting, which would also be mowed once per year until the end of the growing season.

Inside many short rotation plantation sites there are small areas with unfavorable conditions for intensive poplar production. The reasons can be different hydrological conditions (too wet or too dry), unsuitable soil conditions (sandy or rocky) or inaccessible terrain (depressions or hills). These areas could be used as "biodiversity islands", which will be managed for the benefit of wild flora and fauna.

¹ DAPHNE - Institute of Applied Ecology, Bratislava, Slovakia

