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Effects of mowing on biodiversity in parks of Tartu

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ABSTRACT

In 2020 the city of Tartu started a Curated Biodiversity project to make the parks in the city more biodiverse by keeping certain areas unmown for longer periods of time. The purpose of the study was to assess the number of species found in mown and curated (unmown) areas and to analyse whether the habitat needs of the plants found varied in different areas.

10 research areas of 10x10 square metres were chosen: half of them curated and half mown. Plant identification was done with Google Lens and a densiometer was used to measure the coverage of plant species.

With the results of this study, a preliminary assessment to the effectiveness of the project can be made, although for more concrete assessments more studies have to be made over a much longer period of time.

Results show that areas with the curated regime do have a slightly higher number of species. The species growing in curated areas typically grow under low mowing frequency, but other habitat needs, such as amount of light and moisture, do not differ much from species growing in mown areas.

The Curated Biodiversity experiment has made a visual difference in Tartu's vegetation, but so far the impact on plant species is modest. However, the curated areas were dominated by flowers whereas the mown areas had almost no flowers, which are important for pollinators. As the project continues, the study should be repeated after a number of years to determine any further changes in biodiversity.

Keywords:

- Land cover
- Urban parks
- Biodiversity

Research Questions and Hypotheses

1) Question: Which mowing regime hosts more species: mown or curated?

Hypothesis 1: The curated regime hosts more species because of lesser disturbance to both the soil and plants themselves. This allows the growth of species more sensitive to disturbances.

2) Question: Does the curated regime host species with specific habitat needs?

Hypothesis 2: The curated regime hosts more species which are sensitive to disturbances since species that do not tolerate mowing can only grow in the curated areas.

Hypothesis 3: The curated regime hosts more shade-tolerant and moisture-demanding species. This is due to the taller grasses offering shade and keeping in more moisture.

Introduction

This study was done to assess the biodiversity of the parks in Tartu in the Ülejõe area (see also Figure 1). The city council started a Curated Biodiversity project in 2020 in order to increase the biodiversity of the city's parks (Tartu 2024, n.d). The project started in relation to the city of Tartu becoming the Capital of Culture in 2024, but reportedly, will continue afterwards. The data used for this study was collected in August 2023. Areas not touched by the project, which followed regular mowing schedules, were usually mown every week in the summertime. However, due to the dry conditions, those areas had been last mown in June. The curated areas related to the project were only mown once a year during the summer and had not yet been mown during the data collection for this study.

This project to diversify the parks of Tartu is of great importance to help avoid the city becoming a heat island. The heat island effect describes an urbanised area which experiences higher temperatures than surrounding areas, due to the lack of natural landscapes (epa.gov, n.d). Thus assessing the potency of the ongoing project is a necessary insight for the future of the city and its environment.

Materials and Methods

List of tools and resources used:

- Tape measures
- Small flags
- Densiometer
- Google Lens program
- The GLOBE Observer app (recording data)
- Pen and Paper (recording data)
- GLOBE Biosphere Land Cover Protocols
 - Sample Site Selection and Set-Up
 - Investigation Instruments: Densiometer
 - Investigation Instruments: Pacing
 - Investigation Instruments: Tape Measure
- Database 1: Tichý et al. 2023 J. Veg. Sci. database
- Database 2: Midolo et al. 2023 Global Ecol. Biogeogr. database
- Microsoft Office program Excel

Measurements were taken in 2 parks: Ülejõe park and Tartu Central park. 10 by 10 metre squares away from the canopy were chosen as research areas, 5 of them mown and 5 curated.

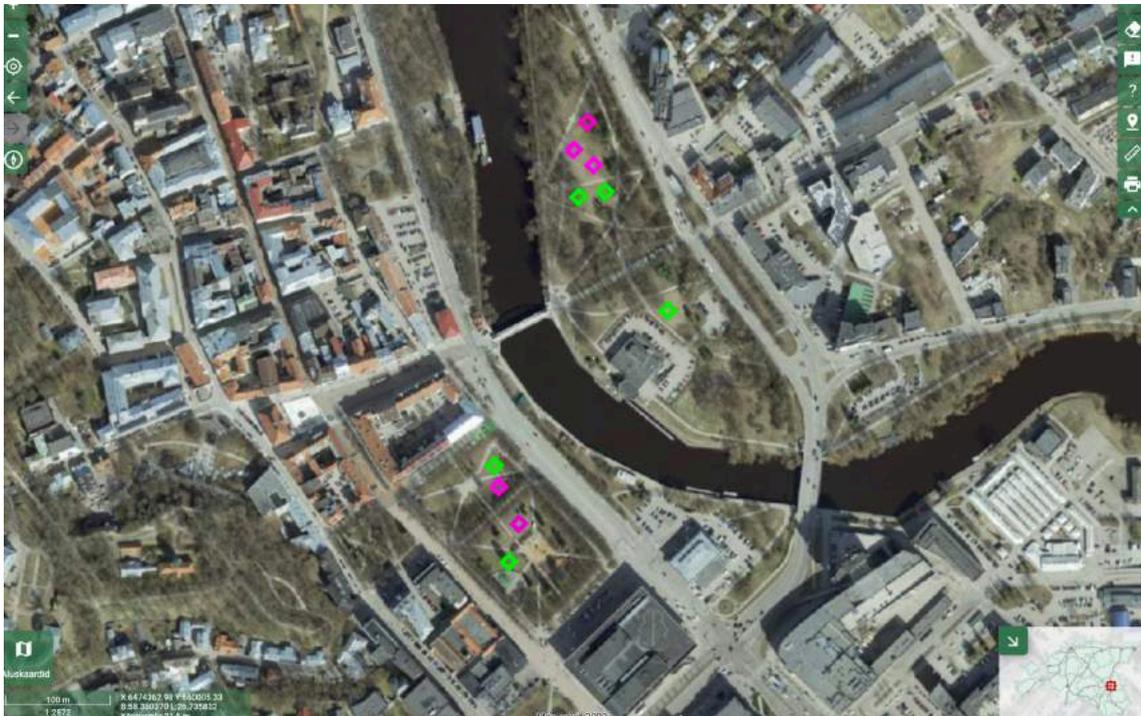


Figure 1. Orthophoto marked with research areas, green for mown and pink for curated. Basemap: Estonian Land Board



Figure 2. Example of a mown area



Figure 3. Example of a curated area

Tape measures and flags were used to mark the size of the squares and Google Lens was used for the identification of found plants. A densiometer was used to measure the coverage of the plant species in every square. The data was recorded via pen and paper and the GLOBE Observer app, following the GLOBE land cover protocols. From the field research findings, the coverage percentage of plants was calculated and compared in the mown and curated areas. Exclusive species to both area types were marked down. For analysing found data, 2 databases were used. The first database was Tichý et al. 2023 J. Veg. Sci. database for finding the Ellenberg-type environmental niche values of plant species, and the second was Midolo et al. 2023 Global Ecol. Biogeogr. database for researching disturbance tolerance values of plant species.

Results

Comparison of mowing regimes:

The mown regime hosted 17 different plant species, 5 of which were exclusive to the regime. The exclusive species were the following: *Ranunculus repens*, *Prunella vulgaris*, *Stellaria graminea*, *Plantago lanceolata*, *Knautia arvensis*.

The curated regime hosted 20 plant species, 8 of which were exclusive to the regime. The exclusive species were the following: *Veronica persica*, *Campanula latifolia*, *Matricaria chamomilla*, *Juglans sp.*, *Populus sp.*, *Capsella bursa-pastoris*, *Medicago lupulina*, *Tragopogon pratensis*.

The mown regime has shown to generally host less species and host less exclusive species than the curated regime, although the difference is not remarkable.

	<i>Achillea millefolium</i> %	<i>Alchemilla vulgaris</i> %	<i>Bromus inermis</i> %	<i>Poa pratensis</i> %	<i>Taraxacum sp.</i> %	<i>Trifolium repens</i> %
curated	22.3	0	27.5	29.6	18.0	2.6
mown	21.0	5.6	0	29.4	23.1	21.7

Table 1. Coverage of dominant species (>5%)

Table 1 shows the coverage percentage of dominant plant species, which covered over 5% of the research squares of the mown or curated regimes. The data was measured with a densiometer. Some species, like the *Achillea millefolium* and *Poa pratensis* share a near identical percentage of coverage in both areas. Others, like the *Alchemilla vulgaris* and *Bromus inermis*, are completely exclusive to either mown or curated areas.

	<i>Ranunculus repens</i> 	<i>Prunella vulgaris</i> 	<i>Veronica persica</i> 	<i>Campanula latifolia</i> 	<i>Matricaria chamomilla</i> 	<i>Juglans sp.</i> 
mown	2	2	1	0	0	0
not mown	0	0	3	1	1	2

Table 2. Number of squares with non-dominant species (<5%)

Table 2 shows the number of squares in each regime, in which the selection of non-dominant species were found. Non-dominant species make up less than 5% of the measured area's coverage. Only one of these species had an overlap, growing in both curated and mown regimes – *Veronica persica*.

Discussion

This research shows that the curated regime is more biodiverse than mown as had been hypothesised, which means that having regimes that are mown less frequently would make the city's wildlife more biodiverse, mostly in the plant and bug area. Continuing this project would also mean less maintenance, therefore less money and other resources going into mowing the city's parks and more resources would be available for other needs in this sector. The parks would also decrease the aforementioned heat island effect (epa.gov, n.d.), because without them the city would need to make lighter-coloured roofs and use a lighter shade of concrete so it would not get too hot.

All of the posed hypotheses were correct.

With the help of research found on the internet, the hypothesis posed for the first research question was that the curated regime would host more species. From the results of this field research, this hypothesis turned out to be true. All the species in the regimes were noted down and results showed there were more plant species in curated regimes than in mown regimes. There were 20 species in curated areas and 17 in mown.

For the second research question, the hypothesis was that the curated regime hosts more species that normally grow in areas of low mowing frequencies according to the environmental niches in the Tichý et al. 2023 J. Veg. Sci. database. This turned out to be true and in addition, 2 growing tree saplings were found in the curated areas.

The final hypothesis that regimes host species with similar light and moisture needs, also turned out to be true. The curated regimes host species with similar needs in terms of light and moisture that might not be met in the mown regime and mown areas host species that have such light and moisture needs, which may not be met in curated regimes.

The Curated Biodiversity experiment has made a visual difference in Tartu's vegetation and biodiversity. The curated regimes hold more flowers, meanwhile the mown ones barely had any. Having more curated regimes would do much good to pollinators, who are extremely important to plant life all around.

Conclusions

All posed hypotheses were correct. The curated regime hosts a greater number of plant species and allows the growth of the species, which are more sensitive to disturbances or demand higher levels of moisture or lower levels of light.

The research shows that the Tartu 2024 project to not mow the parks as often should last and expand throughout the city, since it has had an effect on expanding the biodiversity of the city's parks. Although the differences between areas was slight, this was to be expected since the project only recently launched. The slight differences still showcase the effectiveness of the project and encourage continuity of the project.

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