Visual Exploration of Edible Wild Flora: A Foraging-Oriented Map Tool

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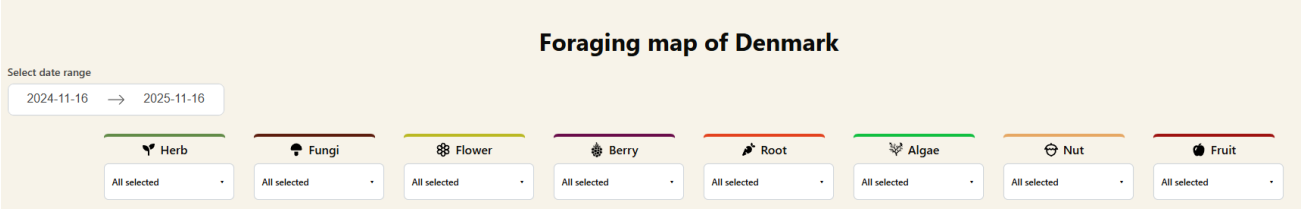
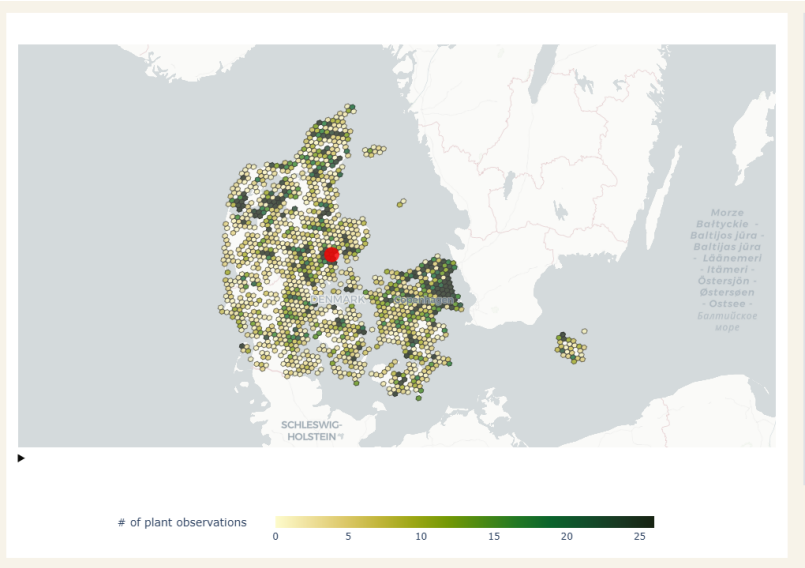
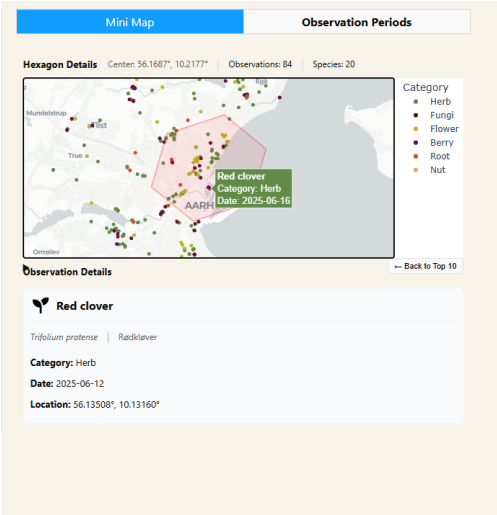


(a) Time period selector and plant category filters.



(b) Foraging map of Denmark with number of observations within the time period.



(c) Mini map of the selected hexagon showing details of a selected observation.

Figure 1: Dashboard of the Foraging Map of Denmark.

Abstract

Foraging for edible plants offers both health and educational benefits, yet access is often limited by lack of knowledge and information on where species can be found. We present a dashboard for exploring observations of edible plants in Denmark, using data from the Global Biodiversity Information Facility (GBIF) filtered to a curated list of edible species. Unlike existing platforms, our tool focuses on planning foraging activities, providing an easy-to-use interface for both novices and experienced users. The dashboard integrates a geospatial overview of Denmark, detailed regional mini maps, observation period histograms, and category filters, supporting exploration of temporal, spatial, and species-level patterns. Our dashboard facilitates informed planning of foraging activities while maintaining potential for expansion to include additional species, hazards, or other types of natural resource collection.

1. Introduction

Nature and visiting the great outdoors have always been an integral part of Danish life. A report from Copenhagen University examined the relationship between nature and the Danish population across the past 30 years. They found that the majority of Danes visit nature at least once a year (97.2 % in 2024), and that Danes visit nature more frequently than previously with 62.0 % visiting nature within the past week in 1994 compared to 71.4 % in 2024. Participants were also asked what activities they spent time on during their latest visit. In 1994, 8.2 % stated that they had collected berries, mushrooms, etc. This number decreased to just 4.3 % in 2024 [LJKO25].

Meanwhile, foraging has a number of documented health benefits, whether it is a primary lifestyle or a recreational activity. Foraging can help reduce food costs, and it has been linked to nutritional and fitness benefits [SM26]. Foraging is also considered a powerful tool for connecting people to nature, and it can also help educate people about nature and local flora [FK20]. A systematic review from 2023 of foraging practices in Europe found that younger generations often lack foraging knowledge, while older generations who possess this knowledge may no longer have the energy to pass it on. This means that there may be opportunities to forge stronger connections across generations, while also reaping the benefits of being physically active and spending time in nature [MSPL23].

Unfortunately, barriers exist that make foraging seem inaccessible for people. One such issue is a lack of knowledge and not knowing where to look [SM26]. Therefore, we set out to build a map of Denmark showing locations where different edible plant species have been previously observed.

2. Related Work

Existing platforms address related aspects of mapping edible or biological species. iNaturalist provides a large database based on user submissions, but is not focused on edible species [iNa26]. Falling Fruit also relies on user-submitted data and targets urban harvesting, but offers limited coverage in Denmark and includes non-relevant entries such as trash containers [Fal26]. VILD MAD focuses explicitly on edible species and is tailored to a Danish audience, but is available only as a mobile app and provides limited transparency regarding its underlying data sources [VIL26]. Our work focuses on creating an easy-to-use dashboard centered on edible species, intended primarily as a planning tool for foraging.

3. Data

The dataset used in this work was obtained from the Global Biodiversity Information Facility (GBIF) [GBI26]. We extracted observations for a list of edible species, using geographic coordinates and dates to map occurrences [GBI25]. The observation period spans from 1 January 2023 to 16 November 2025. Observations within this interval were extracted for the present analysis. This time window may be adjusted in future implementations, for example by updating the database on a daily basis. The list of edible species was created using information from Naturstyrelsen [Nat26]. All species in our list were manually categorized into eight groups: Herb, Fungi, Flower, Berry, Root, Algae, Nut, and Fruit. Each record contains additional metadata, such as observer, institution, and occurrence details. These metadata could be incorporated in future iterations to enhance the dashboard. As part of the data cleaning process, only observations distributed under licenses permitting reuse were retained. This structured dataset provides a reliable foundation for analysis and visualization while allowing for further expansion and refinement over time.

4. Design

The visualization tool supports exploratory discovery of edible plant species in Denmark by using spatial, temporal, and categorical features in the dataset. The tool is aimed at users who are either experienced in gathering edible plant species or have recently started exploring the hobby. It supports both orientation and more focused exploration, allowing users to gain an overview of edible plant observations in Denmark as well as investigating specific species in more detail. Furthermore, our tool follows the Visual Information Mantra [Shn96], starting with a geospatial overview of Denmark, followed by zooming in on hexagonal regions and filtering by categories and time period, and finally providing details-on-demand through the minimap and observation periods views.

The tool consists of the following features/views:

4.1. Map of Denmark

The choropleth map (Figure 1b) allows for initial exploration of edible plant observations. Since individual observations are too numerous to be meaningfully interpreted, we decided to aggregate the observations into spatial regions, using hexagons. Each hexagon represents observation density using sequential color scale. Using sequential color scale on the map, gives the user a quick interpretation of where observations are concentrated and where data is sparse across regions. In addition, it helps the user to decide which areas to explore further. Selecting a hexagon triggers the display of a mini map with detailed information within the selected region, enabling a smooth transition from overview to detailed inspection.

4.2. Mini map

While the choropleth map supports high-level spatial exploration, the mini map (Figure 1c) provides a detailed local exploration of a selected region. The purpose of the mini map is to allow users to inspect individual observations within a selected hexagon. By highlighting the selected hexagonal region in the mini map, we can distinguish observations within the hexagon from the surrounding observations. The mini map uses point markers to represent individual observations. The categories are encoded using categorical colors which is consistent with the category filter menu, allowing users to distinguish categories at local scale. The mini map supports details-on-demand by allowing users to hover over or select individual observations to see species information and observation dates. Finally, placing the mini map next to the map of Denmark, we allow users to see the individual observations while maintaining awareness of the selected region in the broader spatial context.

4.3. Observation per period

The observation period visualization (Figure 2) is designed to help users understand when observations occur. While the geospatial view shows where observations are concentrated, they do not convey temporal patterns such as seasonality. The "Observation Periods" view allows users to identify periods with higher or lower observation activity across years, months, and days. Observations are aggregated by their categories and into time bins using a stacked histogram. Time is encoded along the x-axis, while the number of observation is encoded along the y-axis. Plant categories are distinguished using categorical colors, consistent with the rest of the visualization. Users can select a specific time period (stacked bar) to access more detailed views, enabling a drill-down from monthly to daily observations.

4.4. Time period selection

The time period selector (Figure 1a) defines the temporal scope of the tool. Observation data spans from 2023-01-01 to 2025-11-16. By filtering the time period, the users can interpret the plant observations within a temporal context. The time period filter is applied globally across the tool, ensuring that all visualizations update simultaneously and remain temporally consistent.

4.5. Filter menu for category

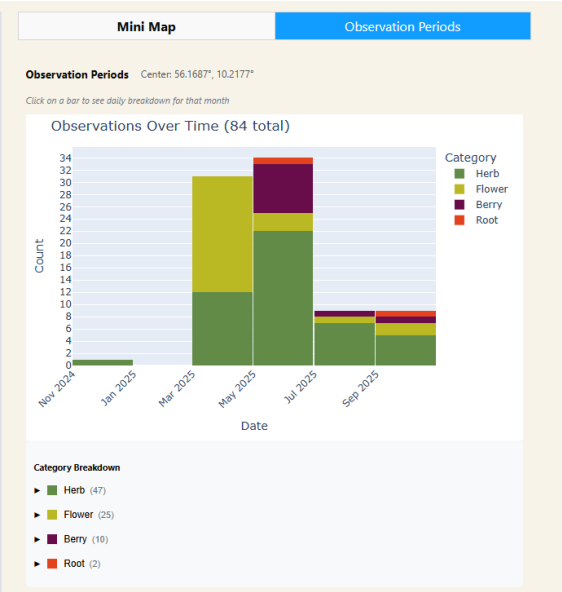
The category filter (Figure 1a) menu supports focused exploration of the dataset by allowing users to select or deselect entire plant categories or individual species. This enables users to explore subsets of the data relevant to their interest. Filter selections are applied consistently across all views and can be adjusted continuously, supporting an exploratory workflow.

5. Results

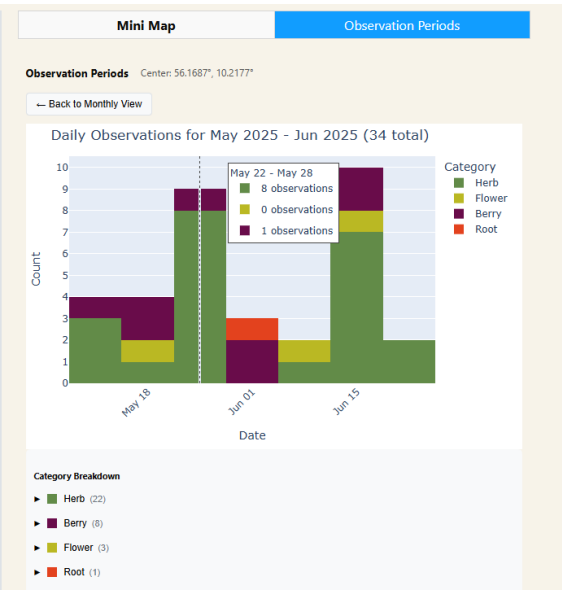
The resulting dashboard consists of a number of elements. At the top of the dashboard, there is a time period selector and filter for plant categories, which can be seen in Figure 1a. The plant filter includes a dropdown menu for each plant category, where it is possible to select specific plant species. Based on the selected time period and plant species, a map of Denmark is generated with hexagons to group observations, which can be seen in Figure 1b. As one's cursor moves across the map, a hover box appears containing the observations by category in the selected hexagon and the total number of observations. When a hexagon is selected, a red circle appears to highlight the area selected.

Once a hexagon has been selected, a mini map is generated to show the area in greater detail, as shown in Figure 1c. It is possible to hover over the different observations and see the English name of the plant observed along with its category and the date of the observation. When an observation on the mini map is selected, a number of details show up, which include the English, Latin, and Danish names, the date of the observation, and the specific coordinates.

It is also possible to switch to the "Observation Periods" tab, where a histogram is generated based on the selected time period, plant categories, and hexagon from the foraging map. Figure 2a shows the spread of observations in the hexagon. There is also a dropdown menu, which shows the specific plant species that were observed. If more details are needed, it is also possible to select a bin on the histogram. If one is selected, a new histogram is generated, which shows the observations of the selected bin in greater detail. This can be seen in Figure 2b. It is possible to go back to the previous histogram.



(a) Histogram of observations made within the hexagon selected for the chosen time period.



(b) Histogram containing greater observation details for a shorter time period.

Figure 2: Observation period tab for the selected hexagon of the foraging map.

The purpose of the dashboard is to be simple and easy to use, regardless of one's proficiency with technology. It allows for a quick overview of where plants are observed in Denmark, and which categories these observations belong to. As one becomes more acquainted with the dashboard, it is possible to become more specific and get more details of the observations. The colors of the plant categories are kept consistent throughout all elements of the dashboard. Finally, the colors were tested to ensure that they would also be differentiable by people with colorblindness.

6. Future Work

While the dashboard works as intended and contains the elements, we wanted, there is still room for improvement. One potential improvement would be to include a feature to select one's favorite species, so it is not necessary to make the same selection each time. It would also be useful for the users to share the mini map, enabling access to the information, while being out foraging. Since the dashboard is targeted at both novices and experienced foragers, it would also be convenient to include information on any poisonous species that look like the species being foraged for, as well as guidance on pests such as ticks or mosquitos. The foraging map could also be expanded further to include fishing or hunting grounds, which would enable users to become even more self-sufficient. Finally, conducting user testing and collecting feedback from users could help validate design choices and identify improvements to the interface.

7. Conclusion

The goal of this project was to create a tool that would be useful for foragers, both beginners and experienced. The resulting dashboard has met this goal in a user-friendly and visually appealing way. The dashboard has also been constructed using the Information Seeking Mantra and with considerations being made for those that are colorblind. There are still possible improvements that could be made, either to expand the scope of the map or to enhance the user experience.

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