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Conference Abstract

A multi-faceted assessment of the condition of ecosystems affected by the invasion of North American goldenrods (*Solidago* spp.)

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Abstract

North American goldenrod species *Solidago gigantea* and *S. canadensis* were introduced to Poland in the second half of the 19th century as ornamental plants and nectar sources for honey production. However, only in recent decades – mainly as a result of land-use changes and the abandonment of agricultural land – have they begun to spread on a large scale. Nowadays, they are considered highly invasive, as they are rapidly expanding and outcompeting native species, and pose a serious threat to the proper functioning of entire ecosystems. One of the objectives of the SolidES project (*Countrywide mapping of goldenrod invasion and assessing its impact on ecosystems and human well-being*) is to assess the impact of goldenrod invasion on habitat conditions, biodiversity and ecosystem functioning across trophic levels.

In 2025, we carried out a multi-faceted assessment of ecosystem condition in 20 randomly selected, at least one-hectare patches of abandoned arable land affected by goldenrod invasion in the Masovian voivodeship, Poland. We investigated soil properties, plant biomass production, and the diversity of plants and animals (i.e., insects

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and earthworms). Comparative studies were carried out in adjacent, similar ecosystems not affected by the invasion. Fieldwork was conducted twice during the growing season: before flowering (June) and during goldenrod flowering (August), to take into account seasonal differences. The research included:

1. collection of phytosociological relevés,
2. direct extraction of plant biomass separated into above- and below-ground fractions,
3. collection of mixed soil samples to examine their physical and chemical properties, and soil enzymatic activity,
4. measurement of soil CO_2 flux,
5. sampling of soil fauna (earthworms) – abundance and biomass measurement and functional group identification,
6. sampling of plant-related invertebrates by sweep-netting – counting and functional group identification,
7. monitoring of flying pollinators (bumblebees by the route method) – counting and species identification,
8. sampling of epigeic fauna using pitfall traps.

We observed significant differences in plant species richness and diversity as well as in the plant biomass between invaded by goldenrods and non-invaded plots. Results of soil properties were more ambiguous. For instance, actual moisture, capillary porosity and soil air capacity varied significantly, while organic matter content, CO_2 flux and several chemical properties show no significant differences between plot types. No clear trends were observed for invertebrates either. Earthworms' abundance and biomass do not differ between invaded by goldenrods and non-invaded plots. In turn, wild pollinators' abundance was significantly higher in June in the reference plots than in the plots with goldenrods, while in August this difference was not statistically significant. Our results identify drivers of goldenrod invasion success, and highlight the ecosystem components and functions most strongly affected by its spread.

Keywords

ecosystem functioning, invasion impact, invertebrates, plants, *Solidago* spp., soil properties, trophic levels.

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Conflicts of interest

The authors have declared that no competing interests exist.