ARPHA Conference Abstracts 9: e201641
doi: 10.3897/aca.9.e201641

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Conference Abstract

From drivers to feedbacks: synthesis of *Solidago* invasion across ecosystems

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Received: 28 May 2026 | Published: 28 May 2026

Citation: Regulska E, Kołaczkowska E, Kowalska A, Zarzycka MA, Jabs-Sobocińska Z, Obidziński A, Omeliańska B, Wolski J, Affek AN (2026) From drivers to feedbacks: synthesis of *Solidago* invasion across ecosystems. ARPHA Conference Abstracts 9: e201641. https://doi.org/10.3897/aca.9.e201641

Abstract

Biological invasions are complex processes involving multiple interacting factors rather than simple cause–effect relationships. In this study, we present a synthetic framework linking three key components of invasion ecology: drivers of invasion, ecological impacts, and feedback mechanisms. Our synthesis of ecological studies on invasive *Solidago* species, reflects current empirical knowledge across diverse ecosystems.

Based on a systematic review of over 200 empirical studies, we analyse how invasion success depends on the interaction among species traits (e.g. dispersal ability, phenotypic plasticity), environmental conditions (e.g. resource availability, disturbance), and propagule pressure. We synthesise the ecological impacts of *Solidago*, including changes in plant community composition, reductions in native biodiversity, alterations in soil properties and nutrient cycling. These effects often extend across trophic levels and may lead to long-term changes in ecosystem structure and functioning. We show that disturbances and human-mediated pathways play a major role in facilitating the spread of *Solidago*, while biotic resistance of ecosystem can limit invasion under certain conditions. We highlight the role of feedback mechanisms, especially plant–soil interactions, which can reinforce invasive species dominance. By modifying soil conditions, microbial communities, and resource availability, *Solidago* can create conditions that favour its own persistence and further spread.

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Our synthesis shows that drivers, impacts, and feedbacks are strongly interconnected and context-dependent. Considering these components together provides a more complete understanding of *Solidago* invasion dynamics than analysing them separately. We also identify key knowledge gaps, particularly regarding causal relationships and the role of environmental context. This integrative perspective may improve predictions of invasion outcomes and support more effective management strategies for invasive species.

Keywords

goldenrod, ecological synthesis, invasion drivers, environmental impacts, feedback mechanisms

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Presented at

Neobiota 2026, the 14th International Conference on Biological Invasions

Funding program

Science for the Society (grant no. NdS-II/SP/0216/2024/01)

Grant title

Countrywide mapping of goldenrod invasion and assessing its impact on ecosystems and human well-being

Conflicts of interest

The authors have declared that no competing interests exist.